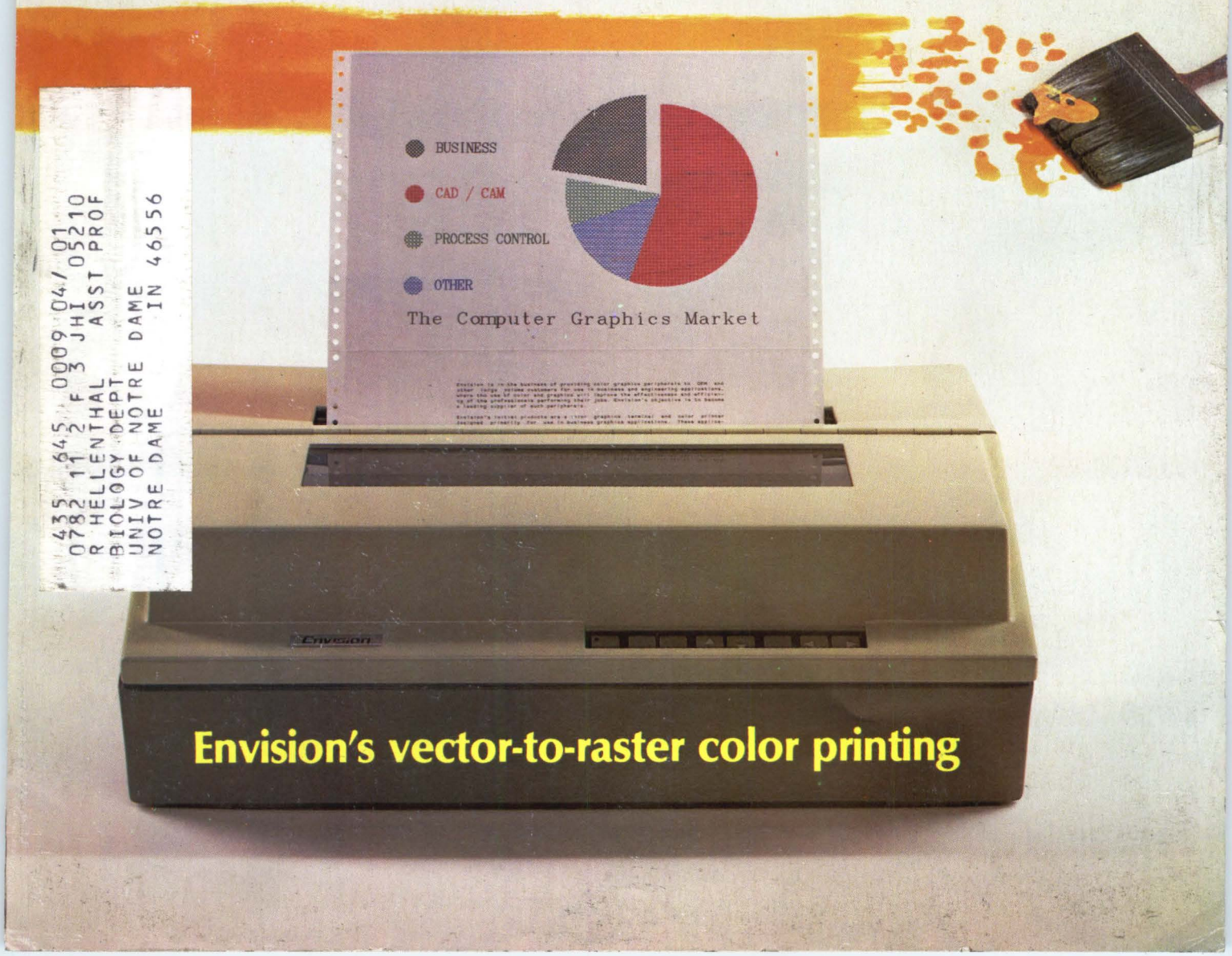
Mini-Micro Systems

A CAHNERS PUBLICATION

JANUARY 1983

PRINTERS:

- **Matrix nears daisy quality**
- **Laying the dots perpendicularly**



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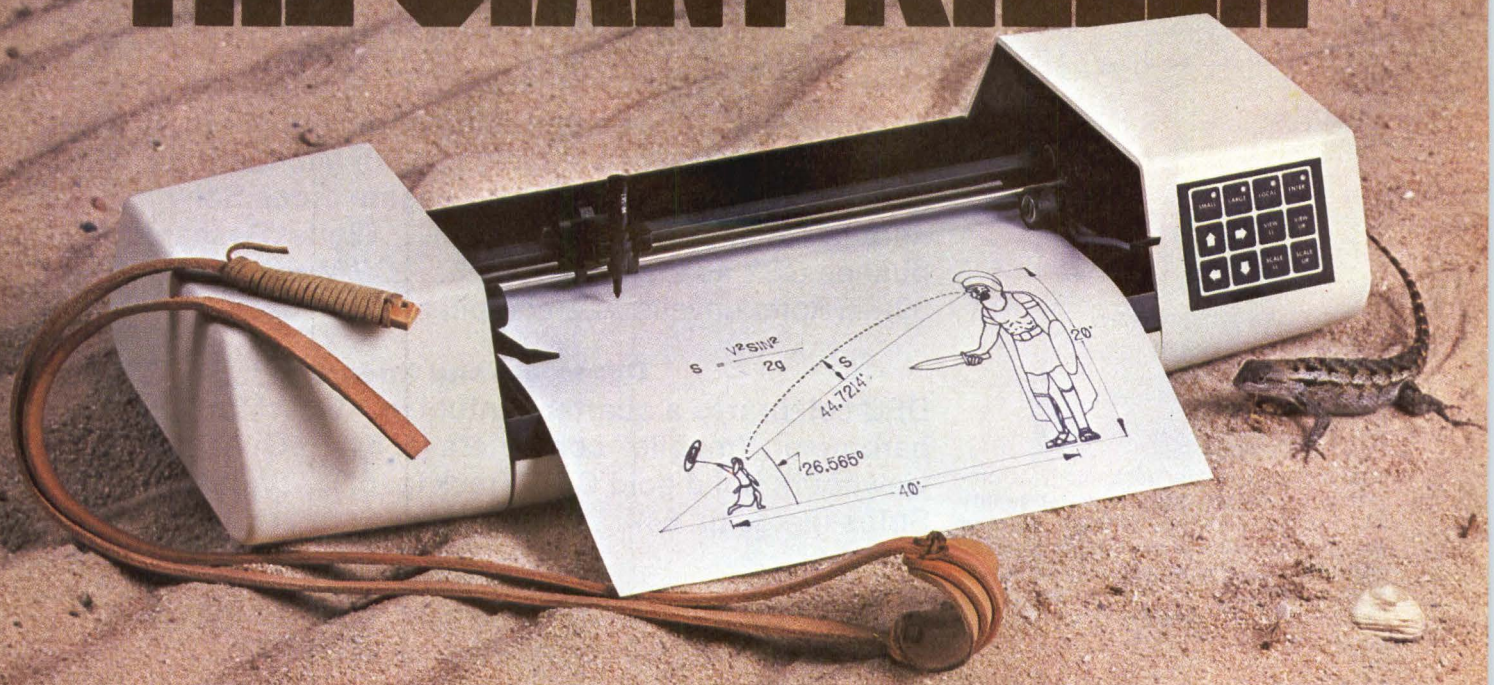

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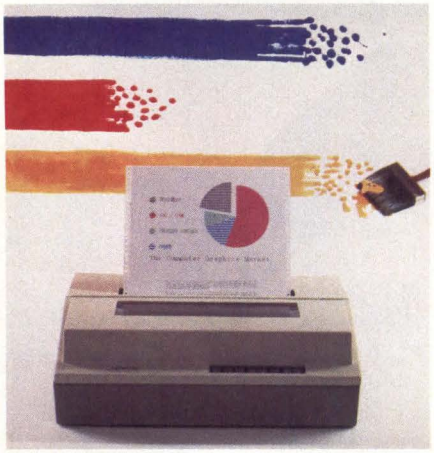
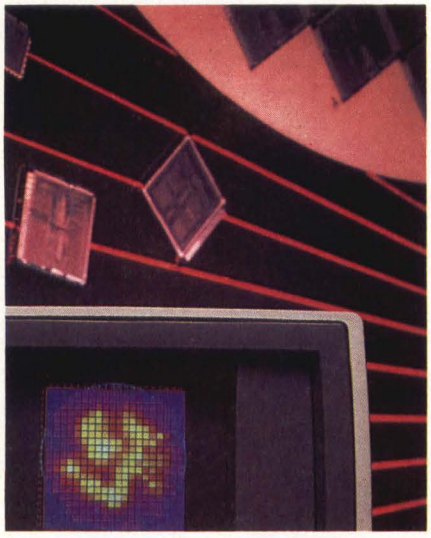
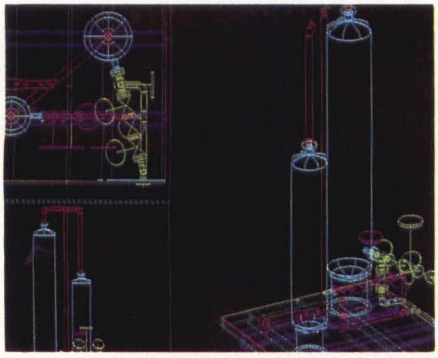
Mini-Micro Systems



Impact-matrix printer technology is providing characters close to letter-quality while at the same time offering improved graphics—in color. One example of this is detailed in the article beginning on P. 145. Photography by Light Language, San Francisco; Courtesy of Envision Technology Inc.



P. 21 . . . . . HP uses its own 32-bit chip



P. 113 . Calma expands CAD market thrust

MINI-MICRO WORLD

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International

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SYSTEMS IN MANUFACTURING

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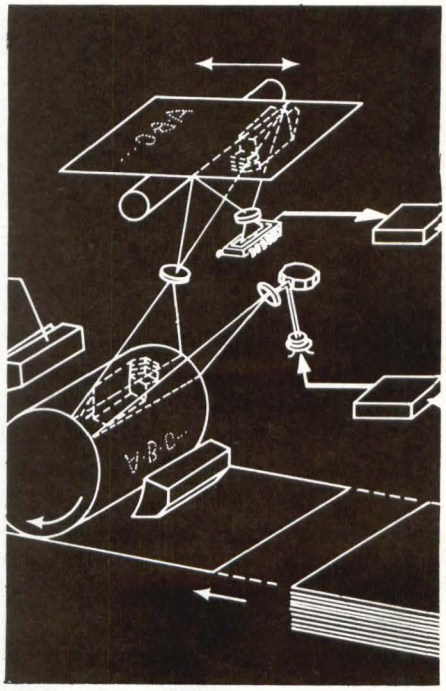
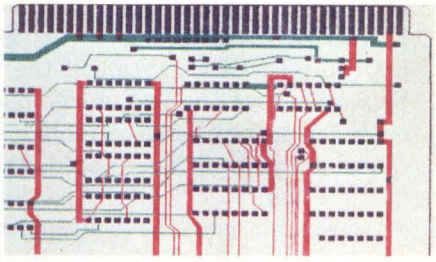
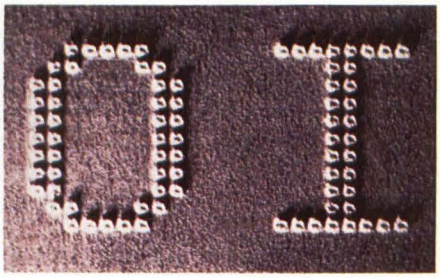


P. 131 ..... Minicomputer line printers



P. 161 . . Plotter interface for matrix printer



P. 169 ..... High-speed magnetic printing

DEPARTMENTS

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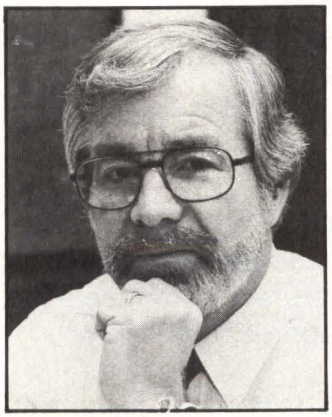
Editorial

Technology pool revisited



Three months ago, I editorialized about a need for a U.S. technology pool (MMS, October, 1982, p. 133). I didn't know then that one such vehicle has been established, at least for semiconductor research: the Semiconductor Research Cooperative, a subsidiary of the Semiconductor Industry Association.

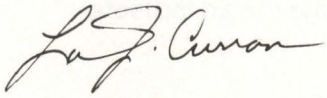
The SRC is a consortium of 12 companies* that hope eventually to provide about $50 million a year to three to six U.S. universities to be used for concentrated long-term research projects. SRC is planned as a nonprofit corporation, governed by a board of directors, and is looking for more members. A third of that board will be elected by and be members of the parent SIA. The remaining board members will come from participating companies and academia. Importantly, there is to be no government support or participation.

I think the computer industry would be wise to monitor and encourage the efforts of SRC in any way it can because semiconductor and computer technology are so closely intertwined. I agree with Erich Bloch, vice president for technical personnel development at IBM Corp., and chairman of the SRC. Writing in the book *Global Stakes*** about the SRC, Bloch opines that semiconductor and computer technology "are so highly interdependent that cause and effect can no longer be differentiated. Progress in one depends on progress in the other." In fact, the charter SRC members have feet firmly entrenched in both the semiconductor and computer camps.

SRC member fees will be based on revenues. Bloch says the goal for this year is to raise $10 million to $15 million, and that current estimates foresee a doubling of yearly support by the semiconductor and computer industry to university research.

SRC membership is open to all companies that manufacture semiconductors in the U.S. SRC and member companies will own patent rights "and other intellectual property," which can be licensed to nonmember companies for an appropriate fee.

Further details about the consortium can be obtained by writing to Larry Sumney, executive director, SRC, P.O. Box 12053, Research Triangle Park, N.C. 27709.



Lawrence J. Curran
Editor-in-chief

*Members as of late November were: Advanced Micro Devices, Inc.; Control Data Corp.; Digital Equipment Corp.; General Instrument Corp.; Hewlett-Packard Co.; Honeywell, Inc.; IBM Corp.; Intel Corp.; Monolithic Memories, Inc.; Motorola, Inc.; National Semiconductor Corp.; Silicon Systems, Inc.

**by James Botkin, Dan Dimancescu and Ray Stata, with John McClellan. Ballinger Publishing Co., Cambridge, Mass.

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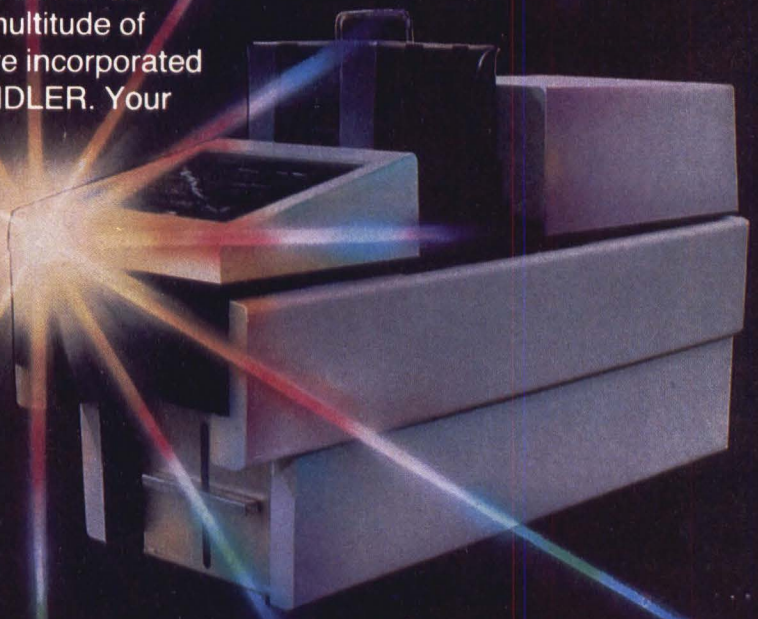

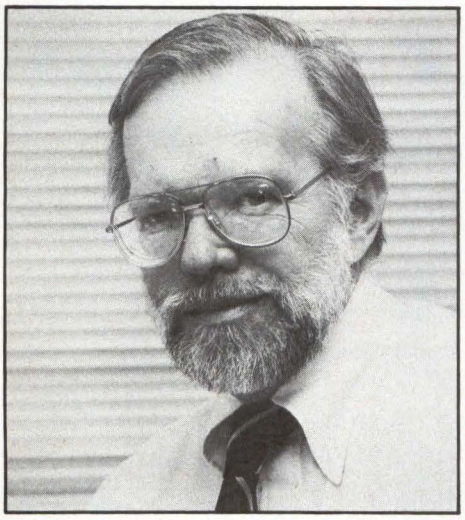

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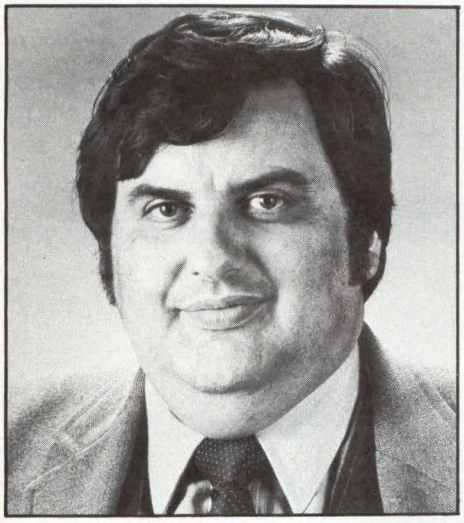

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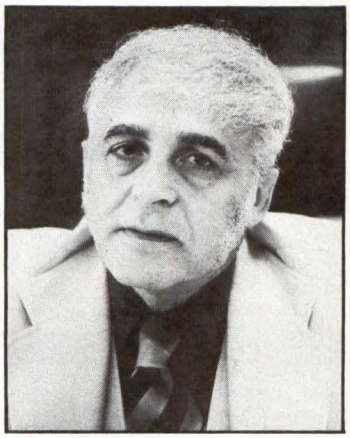
Strengthening the staff



Sacks

Three recent additions to the *Mini-Micro Systems* editorial staff will strengthen us in important staff positions. They are George Bond, Bob Sehr and Linda Bachmanm. George is managing editor, Bob is San Jose correspondent, and Linda is an associate editor. George and Linda are in the Boston headquarters.

George is a journalist with more than 20 years of newspaper and magazine experience. He comes to us from *Electronic Business*, another Cahners magazine, where he was managing editor for 14 months. It is George's responsibility to make sure that the myriad tasks required to produce this publication each month take place in an orderly fashion. The managing editor establishes and enforces copy deadlines and, on the *MMS* staff, supervises the copy desk and production editor. In addition, all section editors report to the managing editor.

We also expect George to contribute articles because of his experience as a small system user and writer on high-technology topics. Before joining *Electronic Business*, George spent some 12 years at *The Washington Star* as a high-tech writer and was a news editor for the newspaper for several years. He held a variety of newspaper staff positions during the '50s and '60s, including a term as managing editor of the *Northern Virginia Sun* in 1968-1969. George also taught English and electronics in the Somali Republic as a Peace Corps volunteer from 1962 to 1964. He has a B.S. in journalism from Temple University.

Bob Sehr succeeds John Trifari in covering the disk drive beat from the San Jose office. He joined *MMS* in November, and is quite familiar with the industry, having spent the last two years as West Coast editor of *Computer Systems News*, the OEM computer newspaper. At *CSN*, Bob concentrated on software issues, including the emergence of the retail market, software piracy and the continuing struggle toward operating-system stan-

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SYSTEM SPECIFICATION

Microprocessors: Concurrent 16-bit 8088 plus 8-bit 8085
RAM Memory: 256 kbytes expandable to 1 Mbyte
Integral Disk Storage: 19-Mbyte Winchester drive plus 1-Mbyte floppy drive
Storage Options: Up to 4 add-on Winchester drives plus streaming tape backup
Communications: 4 workstation ports (RS-422-compatible), plus 2 synchronous/asynchronous programmable RS-232 ports

WORKSTATIONS

Keyboard: Ergonomic, low-profile, 83 keys, 10 programmable function keys, 10-key numeric keypad (with cursor/editing functions)
Color Display: High-resolution, 80 characters x 25 lines, upper and lower case, 8 programmable foreground/background colors
Printer: Bidirectional, 80 characters-per-second, friction and tractor feed

SOFTWARE

Operating System: User-friendly, multi-tasking, CP/M, MP/M, PC-DOS compatible
Languages: BASIC, COBOL, Pascal
Applications: Spreadsheet, Database, Text Processing Communications

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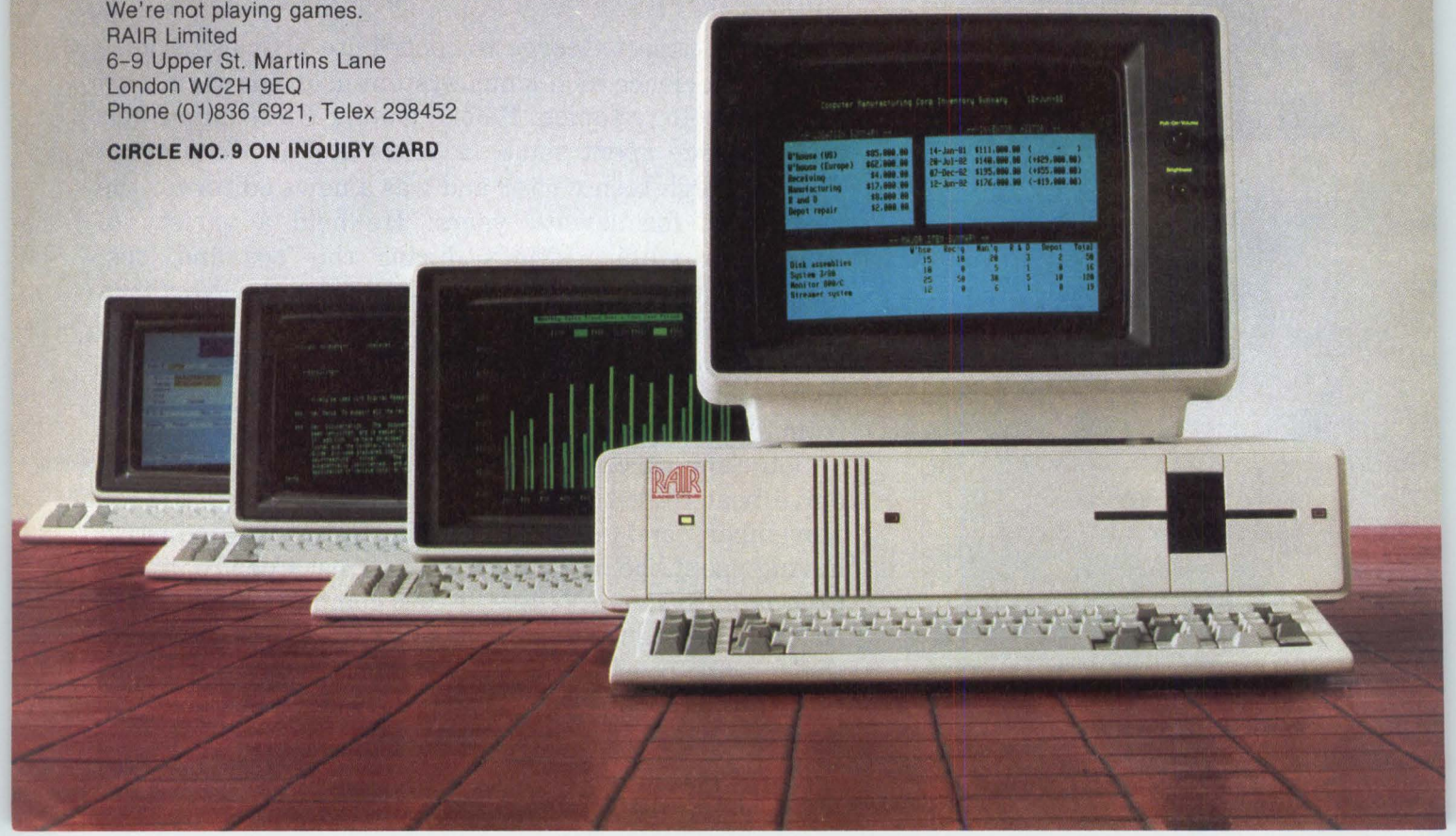

dards for 16-bit microcomputers. His *CSN* experience also includes coverage of the increasing number of major lawsuits in the computer industry.

Bob's career in journalism began 13 years ago when he was hired as a copy messenger for the *Houston Chronicle*. He quickly progressed to various editing and reporting assignments there, and then to the *Los Angeles Herald-Examiner*, the *Oxnard Press Courier* and the *Vallejo Times-Herald*. The latter is a newspaper in Northern California, where he covered state and local politics.

Linda Bachmann comes to us from Manhattan, where she covered new product development and edited and wrote feature articles on a range of communications topics for *Data Communications*, a McGraw-Hill magazine. Linda assists Alan Kaplan, *MMS* executive editor, in soliciting and editing contributed feature articles from industry authorities.

Before joining *Data Communications*, Linda held positions as an editor of technical and medical books for McGraw-Hill Book Co. and as editor of a regional magazine in Springfield, Mass. She has a B.A. in English and German from St. Lawrence University in Canton, N.Y., and has taken courses in computer science.

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Breakpoints

APOLLO ADDS VIRTUAL MEMORY SYSTEM AT HALF OF ITS CURRENT LINE PRICE

A virtual memory version of Apollo Computer Inc.'s Domain distributed system is scheduled for release at the end of this month. The system incorporates Motorola's virtual memory 68010 chip in place of the two MC68000s used on earlier Domain versions, and will be about half the price of the earlier versions. Apollo officials declined to specify a price at press time. The new system is a desktop unit instead of a separate free-standing cabinet. Targeted at technical professionals, the system includes 16M bytes of virtual address space per process performed, up to 15 of which can be run concurrently by each user. Also standard is ½M to 1½M bytes of memory, a 12M bit/sec. token passing baseband local area network, an object oriented virtual memory operating system called Aegis (a UNIX System III shell is available) and 1024 × 800 pixel bit-mapped graphics on a 17-in. display. The new system shares peripherals so that each system does not require its own disk nearby.

DIGITAL RESEARCH PLANS PRODUCT ROLLOUTS AT CP/M '83

Digital Research, Inc., plans to enliven its CP/M '83 show—which is expected to draw more than 20,000 buyers, developers and retailers of CP/M compatible products to Moscone Center in San Francisco from Jan. 19 to 23—with several announcements. Foremost is the expected formal unveiling of CP/M-68K for Motorola's MC68000, which will include DRI's new C compiler, for the basic licensing fee of $75,000. CP/M-68K may help end the dearth of UNIX application software, since it will run as a task under UNIX. DRI will expand its push in graphics with two new products developed jointly with Graphics Software Systems, Inc., Wilsonville, Ore.—GSS Graph and GSS Draw, menu-driven systems for presentation graphics and "freehand" graphics, respectively. Both packages will retail for $500 and will include extensive tutorial material. DRI also is expected to announce a LOGO compiler that has been the pet project of DRI founder Gary Kildall. Although a new subsidiary being established to handle LOGO is aimed at the retail and educational markets, DRI thinks LOGO may become important in mainstream commercial applications as artificial intelligence gains acceptance. To that end a symbolic debugger and other programming aids for the compiler are under development. Finally, DRI is expected to enhance product support, including the establishment of an electronic bulletin board for end users.

START-UP EXCELAN OFFERS FRONT-END PROCESSOR FOR ETHERNET

Excelan, a San Jose networking start-up, this month will introduce its first products, front-end processors optimized to run higher-level communications protocols. The company's EXOS/101 products contain an 8088-based board and an operating system core optimized to run communications protocols. Excelan customers can port protocols out of a host's operating system onto EXOS, which increases performance and allows better scheduling of memory management resources, claims company vice president of marketing Dale W. Way. The front-end processor controllers are Multibus compatible and can run as either non-intelligent Ethernet controllers that have 60K of memory available for buffering or as front-end processors that act as processors on a bus after protocols are downloaded from the host into the EXOS memory. Excelan expects to support the International Standards Organization layers over the next several years, beginning later this year with layer 4, the transport layer. Higher-level protocol software is expected to be offered through Excelan or third party remarketers later this year. No protocols will be offered by Excelan initially. The front-end processor and operating system core available this month come in two configurations: EXOS/101 model 1 with 64K memory is priced at about $800 in quantities of 500 or more, while model 2 with 128K memory is priced at about $900 in similar quantities.

Breakpoints

DESK-TOP VERSION PLANNED FOR PIXEL LINE

The Pixel division of Instrumentation Laboratory, Inc. is getting ready to add a desk-top model to its line of Motorola MC68000-based systems in the second quarter of this year. The 50/AP will start at less than $5000 with a Winchester disk, 512K bytes of RAM and a separate MC68000 processor for I/O management. The system is designed to use SyQuest Winchester cartridge disks and 256K-bit RAM chips, Pixel officials say, and will include UNIX and an Ethernet interface. Like the earlier 100/AP, the system will be marketed to OEMs, but because of its low price may also be made available through distributors. In the first quarter of this year, the company plans to introduce the 80/AP, which will include 5¼-in. peripherals rather than the 8-in. ones used in the 100/AP, and will sell for about $14,000 list. The company plans to use Motorola's 68010 virtual memory processor across the AP line, as well as to move toward supporting Bell's forthcoming System V UNIX.

HIGH-END SYSTEM BASED ON MC68000 EXPECTED FROM ONYX

Onyx Systems, Inc., the San Jose supplier of Zilog Z8000-based systems running the UNIX operating system,is getting ready to extend its line upward with a 12-MHz Motorola MC68000-based system. Said to offer performance in the Digital Equipment Corp. PDP 11/70 or VAX range, the "Ultra Micro" line is expected to emerge next month with a starting price of $30,000. Using SMD-type disk interfaces and dual Z8000 I/O controllers, the system is aimed at outperforming systems from Plexus Computers, a UNIX rival which recently landed an OEM contract with Interactive Systems of Santa Monica, a long-time Onyx customer. The Onyx system, which can be configured to support as many as 48 users and is being designed to accommodate both virtual memory and full 32-bit addressing as they are made available with Motorola parts, may also be the first system on the market to offer UNIX System V. The company is doing its own System III port, but may switch to the updated package if shipments from Western Electric begin soon enough. Onyx officials claim the new UNIX release is already running on Onyx hardware within AT&T.

HARRIS TO CHALLENGE DEC's VAX WITH TWO NEW 800 MINIS

Harris Corp. intends to take a more aggressive stance against Digital Equipment Corp.'s VAX-11/780 superminicomputer this month by adding two top-of-the-line models to its 800 Series minicomputers. The H800-2B and H800-2BP incorporate a new single-board memory called the integrated-memory subsystem, which includes the timing and control functions previously allocated to a separate board. The IMS can hold as much as 1.5M bytes of memory and has a typical access time of 250 nanosec. and a cycle time of 335 nanosec. for 48 bits of data. The H800-2BP is priced to compete directly against the VAX, but offers 30% more performance, Harris officials claim. The H800-2B is positioned to equal the performance of the VAX, but at a lower price. The H800-2B is priced from $139,000 and the H800-2BP from $164,000.

HONEYWELL MICROCOMPUTER TO BE AIMED AT DEALER CHANNELS

Nordata, Inc., a Mountain Lakes, N.J., Honeywell, Inc., reseller that last year signed a three-year contract for $20 million in DPS/6 and Level 6 minicomputers, plans to be in the vanguard of resellers handling Honeywell's long-anticipated microcomputer. The system, developed under the code name Hercules, is expected to emerge early this year in desktop and floor-standing models that will start at under $5000. While Honeywell plans to sell the system directly to high-volume end users and remains undecided about retail outlets, its Dealer Sales Operations Group is expected to be the primary channel for Hercules. Nordata and other DSO firms were given a sneak preview of the system at the fall Comdex show, but final pricing and distributor terms were not complete. In addition to running Honeywell's GCOS/6 Mod 200 and 400 operating systems, the micros are

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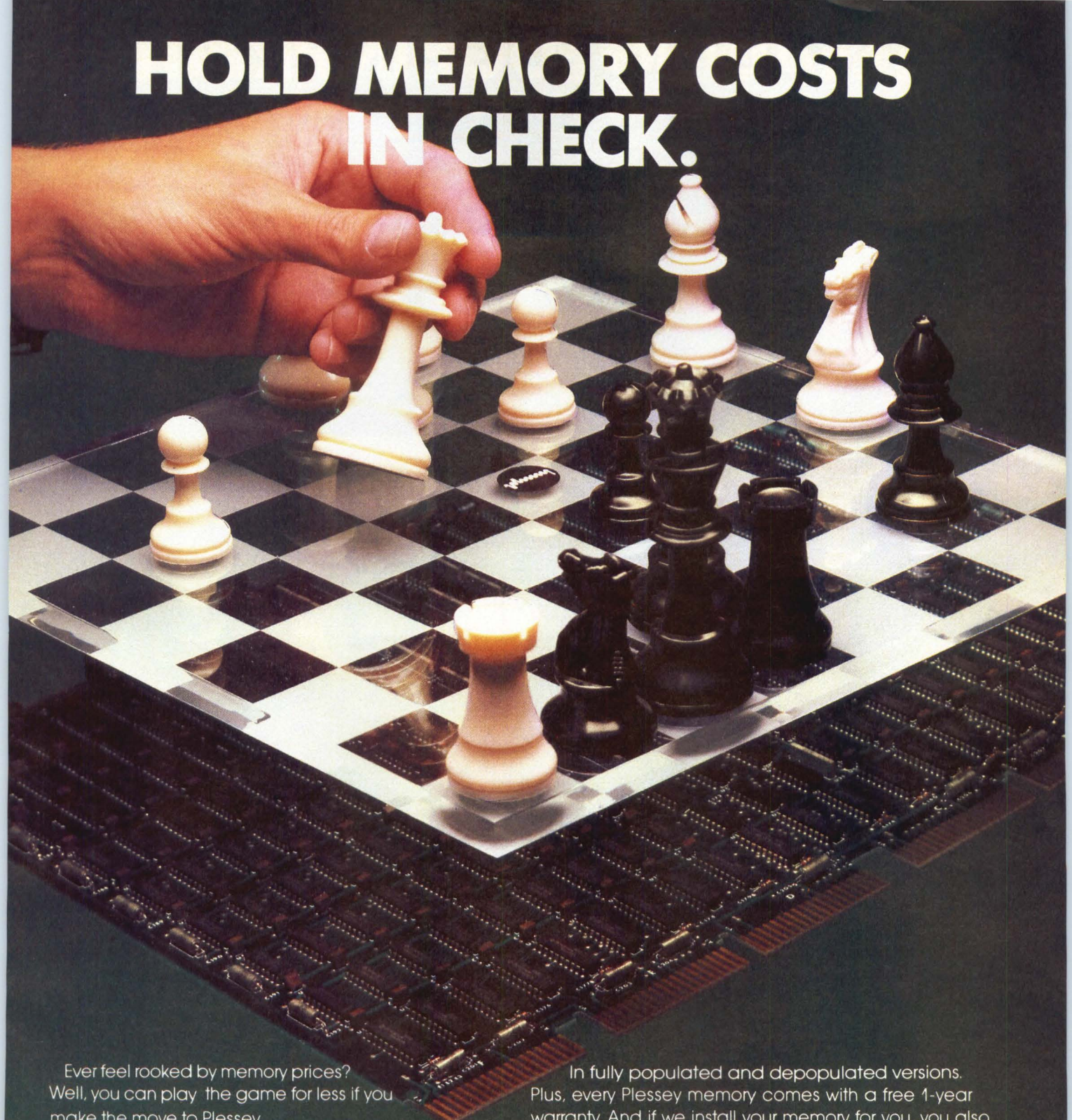

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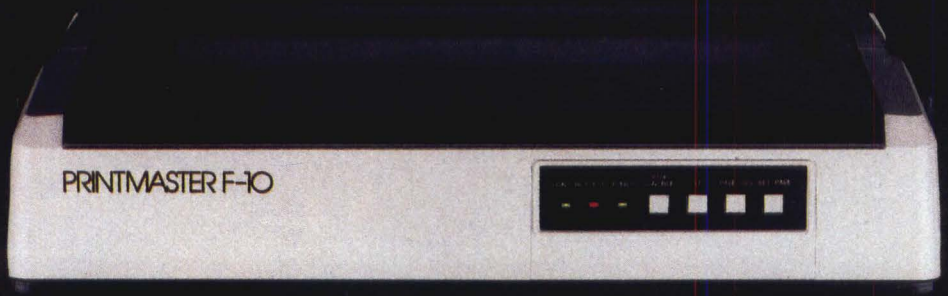

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CIRCLE NO. 12 ON INQUIRY CARD

expected to have an empty card slot to accept an industry standard co-processor and operating system such as a Z80-CP/M combination or an 8088-MS/DOS package. Nordata, a former Data General OEM, perceiving an opportunity in DG's ailing enterprise program, is hoping to expand beyond its base of Honeywell dealers, with a conversion program that will put DG BASIC packages on the Honeywell machine.

DURANGO PLANS MICROCOMPUTER SYSTEMS UPGRADES

Durango Systems, Inc., the San Jose desktop computing pioneer, is planning to breathe new life into its four-year-old Intel 8085-based product line. The company, whose founder and chairman George Comstock recently handed over the presidency to Memorex veteran James Simpson, is planning an upgrade to an undetermined 16-bit processor that will require the exchange of two boards in existing systems. In addition, the company is reportedly looking at UNIX or Microsoft Xenix to replace the proprietary DX85M operating system.

MC68000-BASED PUBLISHING SYSTEM TO COME FROM MASS. START-UP

An MC68000-based documentation publishing system is targeted for introduction in April by Woburn, Mass., start-up Xyvision. The product is a production tool for documentation and is aimed at commercial printers and typesetters or in-house technical publications departments. Components of the distributed system include the 68000, the UNIX operating system, C, Xyview screens that are black and white and can show five document pages in five windows simultaneously, input editing terminals similar to word-processing terminals, 8-in. Winchester disk storage and a laser printer. Storage of 35M, 70M, or 105M bytes is available. The laser printer incorporates Canon's LBP-10 engine, but Xyvision has added a raster image processor. The company estimates it is addressing $9 billion market for technical documentation tools in 1990, and will offer the systems for $50,000 to $100,000 to end users.

TECHFILES: A QUICK LOOK AT INDUSTRY DEVELOPMENTS

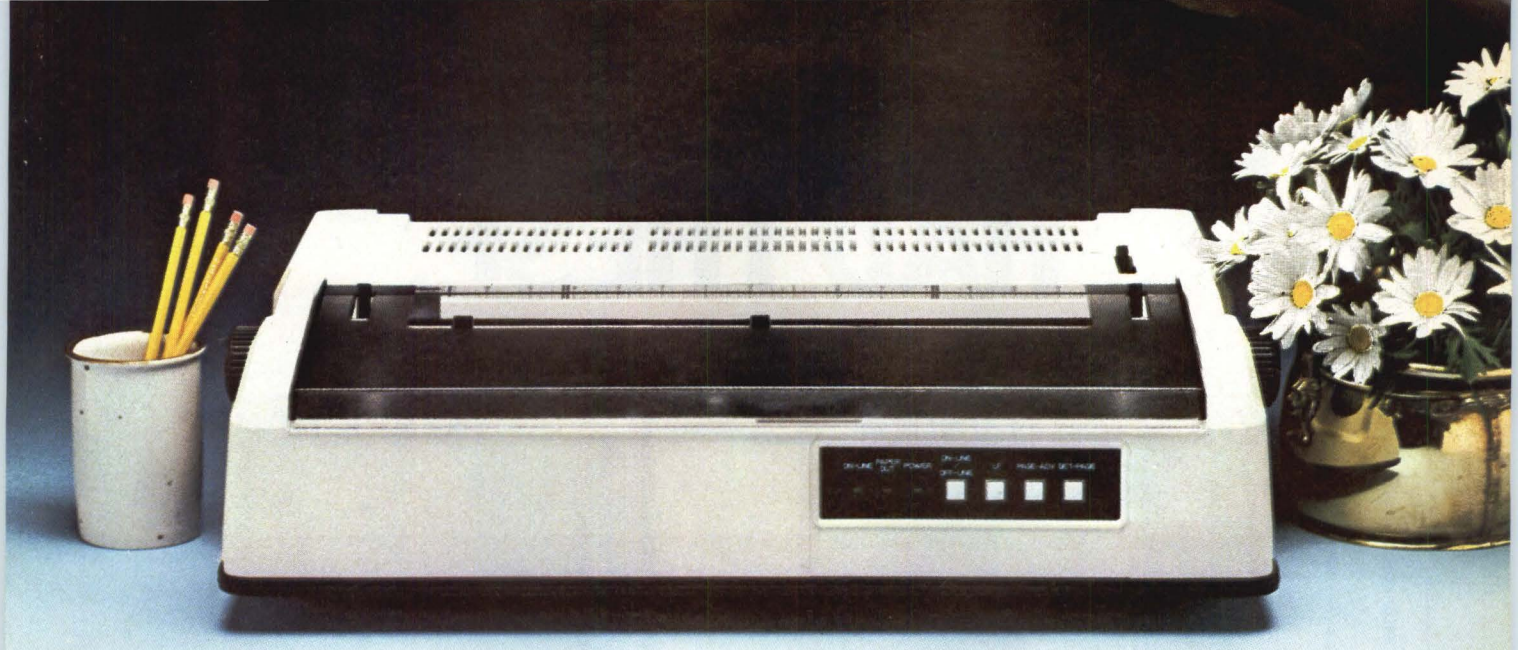
Random Disk Files: While **Seagate Technology** stunned the industry with the decision to drop its evaluation of the **Sony** 3.5-inch floppy drive in favor of a licensing agreement with Westford, Mass., startup **Tabor Corp.,** it is going ahead with a 3.5 in. Winchester that is likely to be announced by NCC. The new Winchester will measure 4 inches wide, 1.6 inches high, and will fit nicely in the form factor used by the Sony floppy spurned by Seagate. The 5M-byte drive was shown privately at a Seagate reception during last fall's Comdex show. The first customer for the Winchester is likely to be current Seagate customer **Hewlett-Packard,** which is already shipping desktop units containing 3.5-inch Sony floppies...**Tabor Corp.** meanwhile is ramping up its new 30,000-square-foot production facility to begin shipping its 3.25-inch floppies by late April. Sources say the company was prepared for any eventuality in the controversy surrounding sub-4-inch floppies. The company filed its business plan a year ago to support 3⅝-inch media. It also has a design for a 4-inch drive should **IBM** go ahead with plans for its rumored microfloppy that now appears far larger than everyone elses. Tabor defends its soft jacket envelope, saying that it is the only real standard that now exists and is accepted by all media manufacturers."Other companies are talking about establishing a standard, but the soft jacket has been a standard for about 10 years," says Tabor's president Mike Hanley. Tabor, which was for a time part of a standards committee led by **Shugart Associates** and **Verbatim Corp.,** said it dropped out because the committee asked the company to wait for a standard while Tabor already had customers for its drive. The first evaluation customer for the Tabor drive is believed to be **Olivetti Research** in Cupertino, Calif. The R&D arm of the giant international firm may be using the microfloppies in a new generation of electronic typewriters...Sony, jilted by Seagate, has been embraced by Shugart Associates after the Japanese firm decided to modify its media in conformance

with the industry standards committee. Shugart executives are busy playing shuttle diplomacy to convince Sony and its chief rival **Matsushita Electric Corp. of America (Panasonic)** to make up and agree on the committee standard. Should MECA, which is now advancing a 3-inch floppy along with **Maxell** and **Hitachi** agree on the committee standard, it would leave Tabor and Seagate by themselves. However, prospects for a compromise between the two Japanese giants are slim since the two have been bitter rivals since they went their separate ways—Beta and VHS—in the manufacture of video tape recorders...Sirjang Lal "Jugi" Tandon has become director of what is essentially a research-and-development operation set up as a stock incentive for **Tandon** engineers, in Campbell, Calif. Called **MicroTek,** the subsidiary is chartered with producing an unspecified new product that will be manufactured by Tandon. The president of the new company is J. Brent Nilson. The company is 80 percent owned by Tandon Corp., while the rest is owned by MicroTek engineers.

Terminal Files: That sleek new terminal in **Altos Corp.**'s ads is its own, an ANSI X3.64 compatible unit scheduled to be available in June for $995 list... Rumors are flying that **Digital Equipment Corp.**'s next generation video display terminal, the VT-200, will be introduced during the first quarter. The terminal is expected to offer bit-mapped graphics at 768 × 480 resolution in a box patterned after the Professional Series display and keyboard. Protocols for text are said to be identical to the VT-100's, while the graphics mode uses the REGIS (REmote Graphics Instruction Set) protocol developed originally for DEC's VT125 graphics terminal. Sources disagree on whether the unit will have a true graphics overlay capability but agree that pricing will be in the $2000 range. A DEC spokesman had no comment.

Micro Files: Business was booming at the fall Comdex show in Las Vegas. **Callan Data Systems** claims to have rung up $4 million in orders for its Motorola MC68000-based Unistar systems, while fellow UNIX/MC68000 supplier **CIE Systems** claims to have racked up $3 million in orders...At the same time, **Corona Data Systems**, which unveiled its IBM Personal Computer look-alikes at the show (MMS, Dec. p. 8) signed up 12 distributors in the U.S. and Canada and has commitments for almost 60,000 units, which president Daniel R. Carter says would amount to a $95 million sales year. However, he says sales will fall short of that because the company is not beginning production of its desk-top model until this month and does not expect to have the portable version ready before April...Comdex also was the setting for the low-key debut of what is bound to be the lowest-priced IBM PC-compatible portable on the market—at least temporarily. The system is called Chameleon and includes a Z80A CPU running CP/M as well as an 8088 running MS/DOS. With a nine-inch screen, dual floppies, operating systems, PerfectWriter and PerfectCalc it lists for $1995. It is the first end-user system to be marketed by **Seequa Computer Corp.** of Annapolis, Md., which previously built S-100 bus microcomputers under contract with Martin Marietta Corp., among other OEMs. The single-board system has no internal card slot, but is said to have 80 percent of the features which IBM customers order including 640 × 200 or 320 × 200 graphics.

Printer Files: Japan's **Seiko Group**, which has been ushering in a series of products from its different subgroups into the U.S., including a microcomputer from **Sci-Com**, and a color printer from **Seiko Instruments U.S.A.**, is reorganizing its operations. While most products fell under Seiko's two watch group subsidiaries, a new division within Seiko will be set up to handle the industrial products, such as computers and peripherals. The new group will have the same profit and loss responsibility as the watch group, thus emphasizing Seiko's commitment to high technology products...**General Electric** previewed multi-color printing for its GE 3000 matrix printers at Comdex. The color versions, which will add about $600 to the price of GE's line, will be available in production quantities in March.



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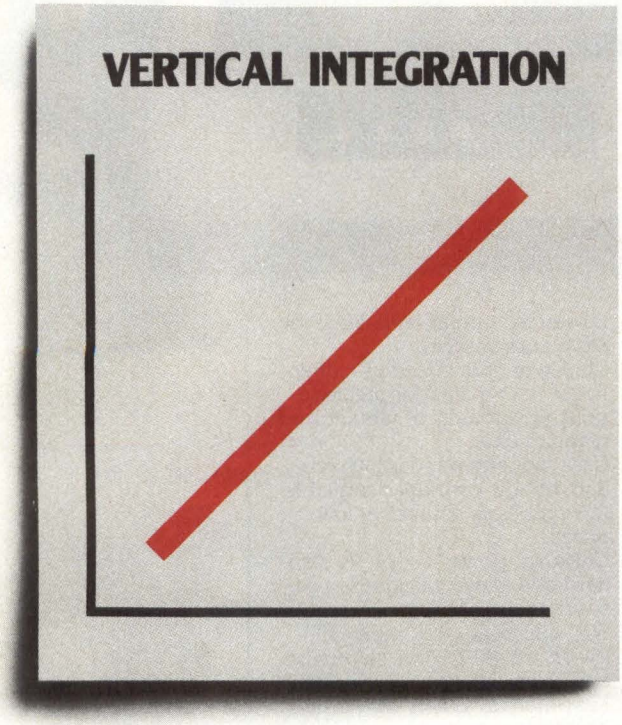

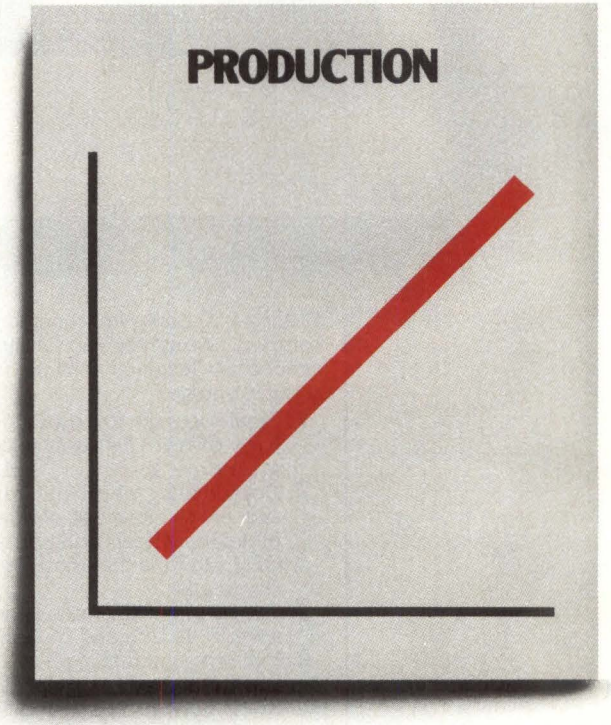

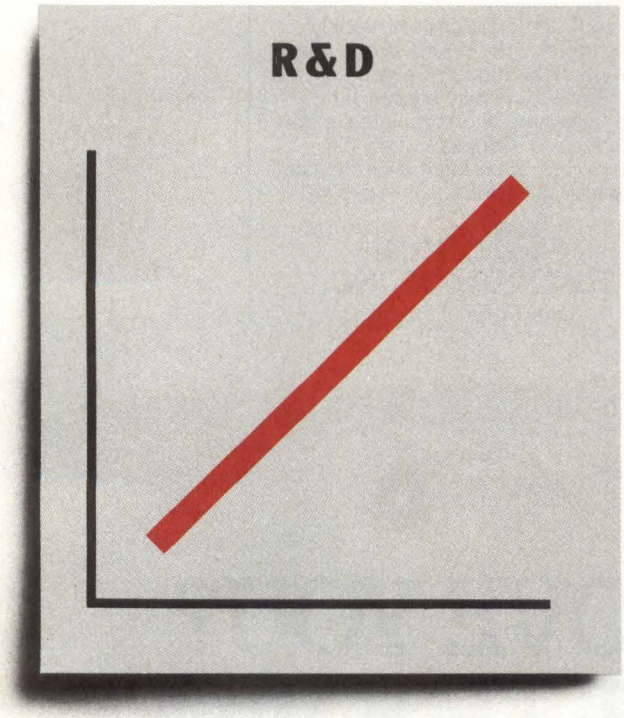

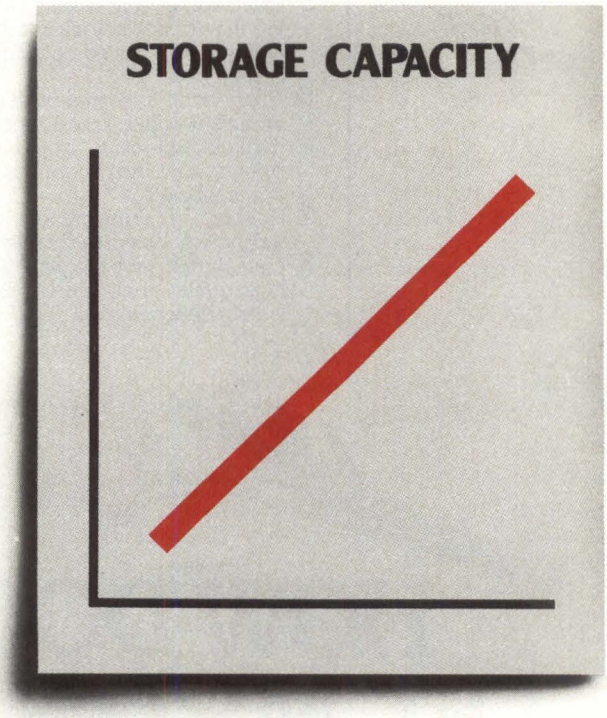

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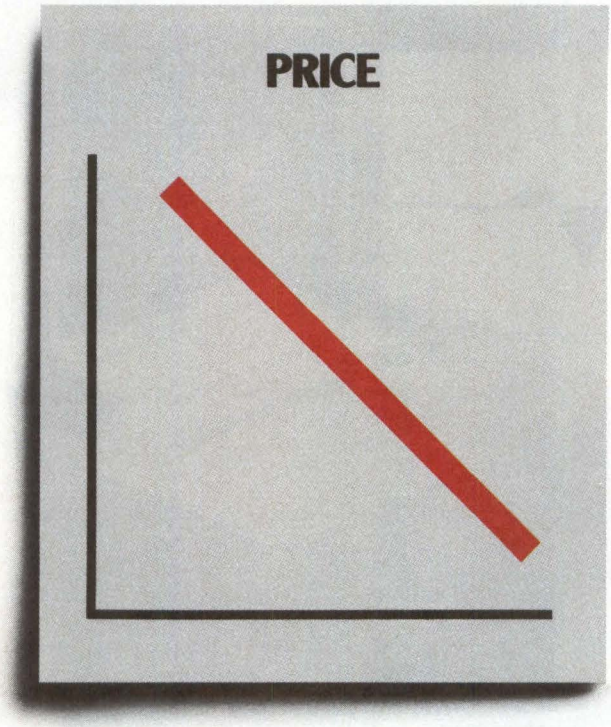

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CIRCLE NO. 46 ON INQUIRY CARD

HP uses proprietary chips in single-, multi-user systems

Hewlett-Packard Co. has introduced its long-anticipated 32-bit computer family, which marks the company's first use of Ethernet networking. It comes as no surprise that the Palo Alto, Calif., company has built the hardware around the five-chip set that attracted so much attention at the past two International Solid-State Circuits Conferences. At the same time, the company has formed a new organization within its Technical Computer Group called the Engineering Systems Division, in Fort Collins, Colo., to manufacture and market the new machines and all follow-on products for the scientific and engineering markets.

Called the HP9000 family, the systems are aimed primarily at the computer-aided engineering market, which HP has cultivated with its Desktop Computer Division's 9800 series machines for more than five years. There are three members of the HP9000 family: the series 500 with one CPU, the series 600 with two CPUs and the series 700 with three CPUs. Each series is available in a desk-top workstation, rack-mount or cabinet version for a variety of single- and multi-user configurations. HP9000 competition includes Digital Equipment Corp.'s VAX family, Apollo Computer, Inc.'s Domain and Fortune Systems Corp.'s 32:16.

Key to the HP9000 is the memory/processor module, so-called because it houses the boards containing the five-chip set: CPU, I/O processor with eight direct-memory-access channels, 128K bytes of RAM, memory controller and 18-MHz clock. The CPU, memory and I/O processor communicate over a 36M-byte-per-sec. backplane bus. The CPU has a 55-nsec. cycle time that company officials say results in performance of 1 million instructions per sec. and a 6M-byte-per-sec. I/O rate. Memory cycle time is 110 nsec.

Preliminary benchmarks from HP pitting the HP9000 against its chief competition show the machine running double-precision Whetstones, in some cases, six times faster than comparably configured hardware. HP officials say the B1 Whetstone was used because it represents the most computer-bound applications in scientific and engineering markets.

An HP9000 series 500 model 20 desk-top workstation with one CPU, for instance, performed 340,000 instructions per sec. In benchmarks against HP's own hardware, the HP9000 was found to be more than a match for the HP1000 A600, 700 and 900 minicomputers introduced last year. These systems, however, are targeted for real-time industrial markets. The stand-alone series 500 outperforms the HP9845 top-of-the-

line desk-top computer. Company officials expect the workstation version of the series 500 to replace the HP9845 in the future.

Two operating systems are available for the HP9000 family: HP-UX, the company's version of Bell Laboratories' UNIX, and HP's enhanced BASIC. HP-UX is a single- or multi-user, time-shared system with virtual-memory capabilities. It supports FORTRAN, Pascal and C compilers, and includes a 3270 emulator, Ethernet compatibility and HP's Shared Resource Manager to connect HP9000s with each other or with HP9800 series machines. HP-UX also supports the Image/9000 database-management software and the Graphics/9000 2D and 3D graphics package.

HP's BASIC is a single-user operating system that includes a run-time compiled BASIC, embedded 2D and 3D graphics, plus Image DBMS, Query, a 3270 emulator and Shared Resource Manager software.

Application software will come from HP, OEMs and independent software houses, company officials say. Plans call for introducing several proprietary packages this year, with emphasis on electrical and mechancal engineering applications. HP currently is offering HPSPICE, a circuit emulation package; FE II, a general-purpose, single-element finite-analysis system; and HP Design, an engineering-drawing package. Company executives expect a large quantity of software to be available through HP's third-party software program, HP Plus. Several major software houses delivering packages for 32-bit systems have signed agreements or are in discussions with HP to make their packages available for the HP9000.

Among those third-party software vendors that have already signed licensing agreements with HP are Softool Corp. and MARC Software International Corp. Softool will supply a FORTRAN programming environment, Change and Configruation Control and transportation tools for FORTRAN programs now on IBM Corp. or DEC systems. MARC will supply MUSE, a

From chip set to workstation and in between: *the heart of the HP9000 is the module (center), which houses the boards containing HP's proprietary NMOS-III five-chip set. The workstation version of the HP9000 family can include a built-in thermal printer and 270K bytes of floppy disk storage. Monochromatic or color displays can be interchanged. The basic model 500 can be upgraded with additional CPUs.*

FIVE-CHIP SET IS THE HEART OF HP HARDWARE

From the start, Hewlett-Packard Co. executives knew the five-chip set being developed at HP's Fort Collins, Colo., facility would be used in the company's 32-bit system. Code-named Focus, the devices were introduced in papers presented by HP engineers at the past two International Solid-State Circuits Conferences. No mention was made of Dawn, however, the project that would become the HP9000, and speculation grew as to when the company would unveil a 32-bit system to face those from Digital Equipment Corp., Data General Corp., Perkin-Elmer Corp. and Prime Computer, Inc.

Unlike its competitors, though, when HP did roll out its 32-bitter, it took the shape of a desk-top workstation rather than that of a mainframe, to carry out HP's "one engineer, one computer" philosophy. What makes that desk-top workstation package possible is the VLSI at the heart of the hardware.

The five devices that make up the HP9000 are built with HP's NMOS-III, a very high-density semiconductor process that uses 1.5-micron line and 1-micron spacing design rules. One result of this process is very dense devices, such as HP's 128K-byte RAM that has about 600,000 transistors on chip. Another is that the company can build a machine with 1M byte of memory using 98 chips; with more conventional LSI components, the same system would require more than 800 devices. Mainframes need nearly 5000 chips.

HP's chip set includes:

- A CPU with 32-bit data and address buses with pipelined data transfers at 36M bytes per sec., a 55-nsec. cycle time, 230 instructions such as IEEE math formats and 9K 38-bit words of resident control store.
- An I/O processor with eight DMA channels and 4.5K 38-bit words of control store.
- A 128K-byte RAM with 165-nsec. access time and 110-nsec. cycle time.
- A memory controller with 256 bytes of RAM; single-bit error correction and double-bit error detection; and byte, half-word, word and semaphore operations.
- A clock chip that generates two overlapping 18-MHz signals.

technical word-processing package.

Statistical software from McMasters University, including SPSS, SCSS, BMDP and Minitab, will be available through HP Plus, as will Comsat General Integrated System's logic-simulation software, TEGAS-5, and microwave design program Super Compact.

Networking is available through Ethernet, making the HP9000 the first HP product to incorporate the LAN scheme. HP will also support the IEEE's 802 LAN standard when it is specified.

Prices for an HP9000 series 500 single-CPU workstation start at $28,250 for the model 20 and include the workstation with CPU, 912K bytes of RAM, 270K bytes of floppy disk storage and a black-and-white display. The same configuration with a color display sells for $39,855. Increasing RAM to 1M byte and adding 10M bytes of hard disk storage, a thermal printer, BASIC and HP-UX operating systems and languages boost the price to $49,945. With a color display, the price goes to $64,565.

A rack-mount model 30 sells for $23,105 and includes a single CPU and 512K bytes of RAM. In a cabinet as the model 40, the same setup sells for $24,115. A model 40 with 1M byte of RAM, IEEE 488 interface, an eight-channel multiplexer, HP-UX, BASIC, FORTRAN and graphics sells for $44,900.

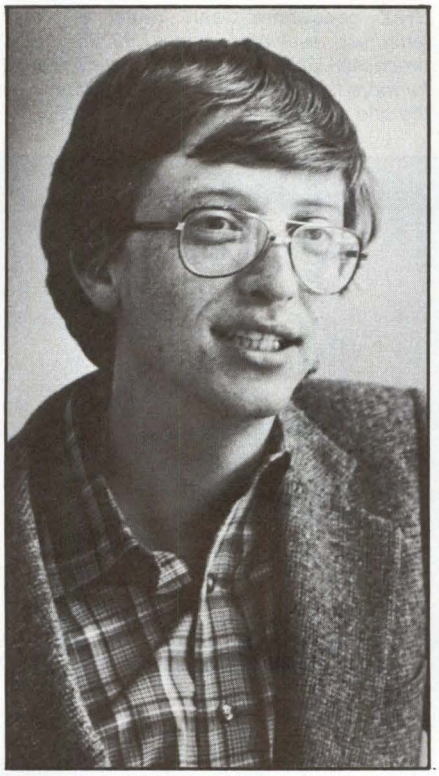
Prices for the two-CPU series 600 and three-CPU series 700 have not been set. —*Larry Lettieri*

Intel teams up with Microsoft, pushes hardware/software for UNIX OEMs

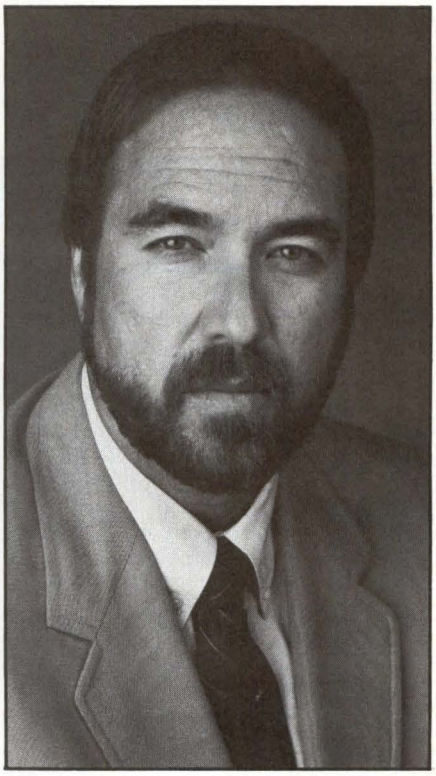
Several months after Motorola, Inc., teamed with Alcyon to support the UNIX-like Regulus operating system (see "Assessing Intel's eye for UNIX," p. 24), Intel Corp. is bolstering its arrangement with Microsoft, Inc., to offer and support the Xenix operating system for several Intel products. The stakes could be a UNIX market as large as 100,000 licenses—more than $3 billion worth by Xenix pricing standards—or as small as 25,000 licenses by year-end because of the continuing poor economy.

Intel's chances to assume a strong market position look positive. Bill Gates, Microsoft's chairman, claims that 80 percent of the UNIX licenses are units from Microsoft's Xenix license. Gates expects the first three years of his company's contract with Intel to generate $5 million in software license sales.

UNIX consultant Jean Yates of Yates Ventures, who projects the 100,000 units by year-end, shares Gates's enthusiasm. She estimates that Intel's 80286 16-bit processor with Xenix will create a market for more than 200,000 such Intel systems by the end of 1986. Omri Serlin, president of Itom International Co., a Los Altos, Calif., consulting firm, is less optimistic than Yates about the UNIX market, partly because of the poor economy. "I'll be amazed and delighted if the



Microsoft chairman Bill Gates *expects to realize $5 million in Xenix license sales through the first three years of his company's contract with Intel.*



Alan M. Davis, general manager of Intel's Software Distribution and Support Operation, *says, "The UNIX market is so explosive we put our first effort there."*

numbers of (end-user) UNIX installations are 50,000 by the fourth quarter. By the end of the year, 25,000 to 50,000 is more realistic," he says.

Intel was drawn to the multi-user operating system strongly enough to push its availability before that of other Intel projects. "The UNIX market is so explosive we put our first effort there," says Alan M. Davis, general manager of Intel's Software Distribution and Support Operation (SDSO) in Santa Clara. "There is no de-emphasis of MP/M. The most important products to Intel by strategic focus are the database system and the 86/330 system, both of which lend themselves better to Xenix." Davis notes Intel's efforts with Digital Research, Inc., are ongoing. He does not view the two operating systems as competitors because MP/M is for small, fast, real-time systems, and UNIX is for larger multi-user systems that require an easy human interface.

UNIX consultant Jean Yates, *of Yates Ventures, estimates Intel's 80286 16-bit processor running Xenix will create a market for more than 200,000 such Intel systems by the end of 1986.*

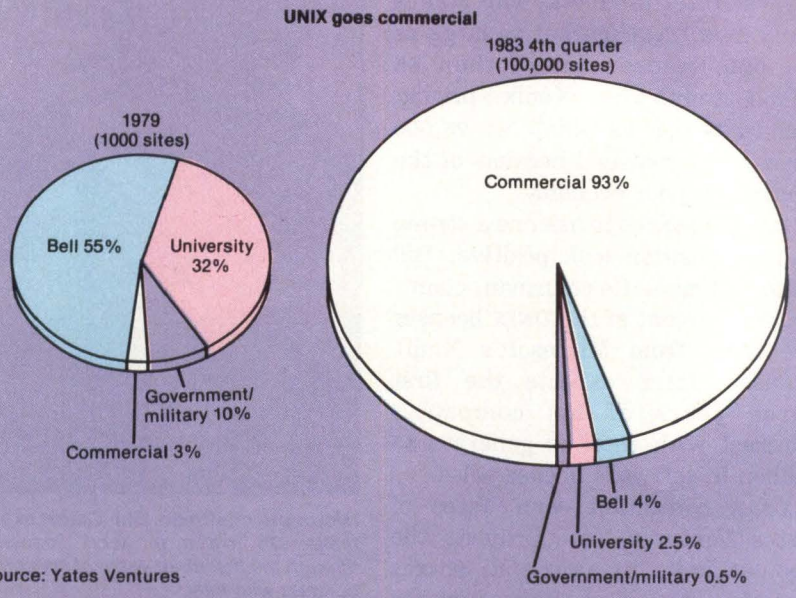
This recent turning point in Intel's efforts to seduce third-party software vendors comes from a market requirement to get products out quickly, and from Intel's wanting not to duplicate efforts made by independent software suppliers. "It takes two years from design to use in the production of a typical LSI component," notes Davis, "and it takes two more years for software to catch up to the new Intel hardware." The company hopes to streamline application software-development efforts and costs by offering an operating system that is compatible in its 16-bit line, and future generations thereof, and thus cut into the two-year development lag. Intel has licenses to many operating systems, including CP/M-86 and MS/DOS.

ASSESSING INTEL'S EYE FOR UNIX

"The one standard in UNIX is how everyone spells UNIX," quips Lovell Chase, vice president of marketing for Alcyon, the company that produces the UNIX-like Regulus operating system recently adopted by Motorola, Inc., for its MC68000 processors.

Intel Corp. faced a host of choices for its UNIX path. The company opted for a Bell Laboratories-licensed version, which narrowed its choices to two: developing UNIX under license from Bell Labs, or adopting Microsoft's Xenix, a licensed version of Bell's that is the only such one with ports to the 8086, says Alan M. Davis general manager of Intel's Software Distribution and Support Operation. Intel chose the latter approach.

Alcyon's Chase believes there are good alternatives to the Bell license, noting that lower cost alternatives are important. Alcyon charges $37,000 for an OEM license to distribute 4000 Regulus copies, which includes one copy of source code. This means $9.25 per copy to OEMs. CIE Systems, Inc., McDonell Douglas's Vitek medi-



The UNIX market is rapidly shifting to commercial versions of the operating system *optimized for end-user sites. In 1979, most Bell license use was by data-processing professionals on minicomputers.*

Intel already supports Xenix system integrations for iAPX-86 family members, and for the 86/300 family systems. Support for 8086 components and board-level products will be available this quarter. Intel's Xenix-86, with a C compiler and debugger, also runs on the 8087 math co-processor. Future Xenix-86 versions will run on the 80286 and the 80287 advanced floating-point co-processor, which gives a growth path for applications developed on the 8086. Intel and Microsoft plan to produce Xenix upgrades jointly. Xenix-86 is one of the first SDSO products.

Xenix-86 for the 86/330 is available under license. Intel's prices range from $3000 to less than $900 for multiple copies. Support for Xenix-86 ranges from $240 to $1950 per year for standard service, which includes newsletters, technical reports, software application exchange, updates, system performance reporting, modifications, fixes and a telephone hot line. The 86/330 is priced between $12,000 and $20,000 to OEMs buying five or six systems. Xenix for the same number of systems is priced at $1000. Davis will not comment on royalties Intel will pay to Microsoft for distributing the operating system.

By this year's National Computer Conference, the 80286 with Xenix will be available in sample quantities. No prices are set for Xenix on the 80286, but Davis expects them to be similar to those of the 86/330's.

—Lori Valigra

INTEL ADDS SINGLE-CHIP 8088

Intel Corp., Santa Clara, Calif., has introduced a single-chip version of its popular 8088 8-16-bit microprocessor. Called the iAPX 188, the device is the latest member of Intel's family of chips that includes the 16-bit iAPX 186 (MMS, August, 1982, p. 19) and virtual memory 286 (MMS, April, 1982, p. 52). Like the 186, the 188 is said to reduce the functions of 15 to 20 chips onto a single component. The 188 includes the 8088 CPU with an 8-bit data bus and a 16-bit address bus, a two-channel DMA, an 8-MHz clock, timers, an interrupt controller, chip-select logic and a ready generator. The 188 operates with Intel's 8087 math co-processor, 8089 I/O processor and 80150 CP/M-in-silicon and 80130 iRMX 86 operating system-in-silicon chips. In quantities of 100, the 188 sells for $50. It will be available during the first quarter of this year.

cal subsidiary, has signed up for Regulus, and Doric, which manufactures an MC68000-based industrial instrument data logger was ready to sign at press time.

Intel's strongest competitor on the semiconductor level, Motorola, has announced a team-up with Regulus supplier Alcyon. Rather than going outside for an operating system, Motorola chose to internalize the project, says Bill Lowery, software marketing manager for Motorola's Microsystems operation in Phoenix. He notes Motorola has made minor modifications to Regulus for performance and for fixing bugs. After next month, the company will be able to offer support for at least eight users on its EXORmacs development system, which Lowery says is UNIX Version 7 compatible. Price for the Regulus version, called Unidos, on EXORmacs, will be about $3000 in single-unit quantities, including utilities. OEM pricing will be aggressive, says Lowery, which is one reason Motorola chose Regulus.

UNIX has gained more popularity since license prices were dropped on System III more than a year ago. Western Electric Co. dropped licensing fees by about half, to a flat rate of $25,000 for a System III license, plus $100 per processor for single-user systems and $250 per processor for systems that supported more users. For very large-volume customers, the UNIX price can drop as low as $40 per user.

Microsoft chairman Bill Gates was hurt by the license price drop because he did not receive credit under the Version 7 license. Gates estimated that cost him $750,000, and he is still working on getting credit.

The team effort still may require fine tuning by Intel. "The Intel and Microsoft deal makes sense in that Intel is getting into the systems game with UNIX systems," says Heinz Lycklama, chairman of the /USR/ Group Standards Committee, which was scheduled to meet at the recent Comdex show to adopt a standard that will conform closely with System III. Members of the group include Fortune Systems Corp., Microsoft, Digital Equipment Corp., Ryan-McFarland Corp. and the Mark Williams Co.

One drawback to the Intel/Microsoft arrangement, Lycklama notes, is that Intel depends on Microsoft somewhat for the operating system.

It will be important for the two companies to work together on updates, especially to consume small shifts in the UNIX market. A new version of UNIX is forthcoming from Bell, but Gates does not believe it will conflict with Xenix enhancements. Microsoft also is doing some shifting. While some Xenix versions now are in Version 7 and are used on Intel 8086 and 86/330 products, Microsoft plans to make all Xenix versions System III compatible. The differences between the two versions are minor, says Gates, who chose System III because it falls under the lower licensing fees from Bell. Gates says the 80286 will have System III-based UNIX. The 8086 and 86/330 will have updates to include System III. Microsoft's Xenix based on System III includes a few more utilities than Version 7, and boosts I/O performance 30 percent, Gates notes.

Confusion abounds as Seagate drops Sony, adopts Tabor microfloppy

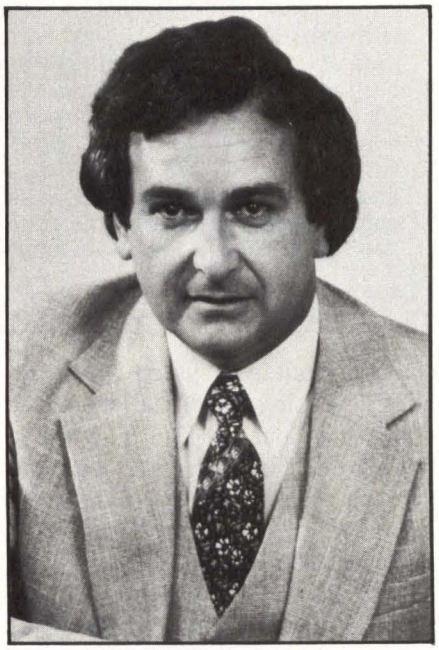
Just when it appeared safe for floppy disk drive manufacturers to return to the assembly line with a quasi-standard for sub-4-in. drives in hand, Seagate Technology reversed itself in mid-course, triggering renewed confusion about media standards for those drives. Industry participants fear a replay of the chaos surrounding the 8-in. Winchester's introduction just three years ago. Those drives came to market lacking a standard interface.

In a move that has stunned many competitors, Seagate has abandoned its evaluation of Sony Corp.'s 3½-in. floppy drive and entered a licensing agreement for a 3¼-in. drive designed by Westford, Mass., start-up Tabor Corp. The Tabor drive features a flexible jacket diskette from Dysan Corp., a track density of 140 tpi and a recording density of 9250 bpi. In comparison, the Sony drive uses a hard jacket media, has a 140-tpi track density and a recording density of 7610 bpi.

"We have made a fair assessment of the availability of the low-priced media," says Seagate's executive vice president Finis Conner, "and we firmly believe that the Dysan product has the best opportunity to be available from a number of alternate sources." Conner does not elaborate on just what alternate sources are available, or if any other licensing agreements had been arranged by Tabor or Dysan.

Conner and Tabor president Mike Hanley firmly deny any pressure from Dysan president Norm Dion to accelerate the deal. Dysan is a minority stockholder in both Seagate and Tabor.

The key to the success of the Tabor/Seagate drive will be the ability of the two companies to convince others to join them in making the 3¼-in. flexible jacket drive a standard. From initial responses in the industry, it appears that job will be difficult. "They have snatched defeat from the jaws of victory," says one executive of a rival disk drive manufacturer, referring to the industry's apparent preference for hard jacket media.



Seagate executive vice president Finis Conner *says Dysan's flexible media microfloppy drive has the best chance of being available from a number of alternate sources, but will not elaborate on what sources are available.*

Most observers agree the confusion created by the lack of a standard interface caused controller manufacturers to hesitate in building controllers for 8-in. Winchesters. Consequently, sales of 8-in. Winchester disks were slowed for the first year until manufacturers agreed on an interface.

Not until Shugart Associates introduced its SA1400 controller could OEMs evaluate the 8-in. hardware. As a result, Shugart's SA1000 interface became a de facto standard for that class of drives. Many now fear a similar hesitance among media manufacturers to introduce products for the sub-4-in. market until a single standard emerges.

While most of the microfloppies make life easier for controller manufacturers by using the 5¼-in. ST506 interface (Sony's is ST506 compatible), the differences in the media form factor may create some problems among system integrators and end users. One independent observer puts the blame for the confusion about the form of the sub-4-in. floppies squarely on the shoulders of the product's pioneer. Raymond C. Freeman of Freeman Associates, a Santa Barbara, Calif., consulting firm, says Sony should have entrenched itself deeper and earlier when it had the market to itself. "The Sony drive would have been the clearly defined standard, had Sony been ramming this marketplace fast and hard," he says.

Freeman recalls Shugart's introduction of the 5¼-in. floppy in 1978. Shugart cornered the market by working with 12 manufacturers of word-processing systems that saw the advantage the smaller drives would give their desk-top units. All 12 participated in evaluating the drive, and there was little space for another manufacturer to take the same idea and reshape it.

Seagate's decision to join Tabor creates a fifth interest group seeking the favor of an ANSI committee (MMS, October, 1982, p. 17). In addition to Sony, another Japanese consortium including Hi-

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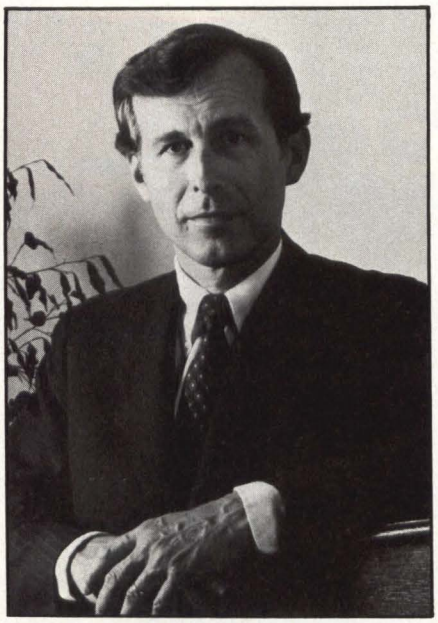
tachi, Hitachi-Maxel and Matsushita is developing a separate sub-4-in. floppy. In the U.S., Tandon Corp. also is competing against the industry drive committee standard with a microfloppy drive that will be compatible with the Sony media (MMS, October, 1982, p. 18).

Seagate officials will not comment on reports that the company has contacted rival Tandon Corp. in Chatsworth, Calif., to interest that company in a product based on the Tabor design. Tandon president Jugi Tandon was not available for comment at press time. An endorsement by Tandon, one of the three largest makers of low-end disk drives, would greatly increase the credibility of the Tabor design. It also would give Seagate a boost in the floppy drive market—a new venture for Seagate.

Charles Payne, manager of business planning for Verbatim Corp. and chairman of the industry committee to formulate a standard, says it was the fear of too many standard contenders that caused the committee to be formed in the first place. Both Dysan and Tabor were originally on the committee, Payne notes, but became disenchanted when the committee failed to adopt a flexible jacket as a standard. "Every survey we ever made showed that both OEMs and end users preferred the hard-cased jacket," Payne says.



"The Sony drive would have been the clearly defined standard, *had Sony been ramming this marketplace fast and hard," says Raymond C. Freeman of counsulting firm Freeman Associates.*

But Tabor's Hanley says one Tabor engineer responsible for the microfloppy drive had worked at Memorex Corp. when it attempted a floppy disk with a hard casing. "It didn't work then for Memorex, and it won't work for us now," Hanley says.

The hard casing also costs more to manufacture, says Seagate's Conner, but members of the industry committee, including Payne, sharply disagree with that assessment. Among those disagreeing is Shugart Associates' George Sollman, executive vice president and general manager of the marketing and sales division, who notes that the flexible jacket cannot provide the media protection required in smaller microfloppies. Because it requires fewer parts, the Tabor drive is likely to reduce Seagate's costs and give the 5¼-in. Winchester pioneer a quick and inexpensive foothold in the emerging microfloppy market. More importantly, the trail will be cleared for Seagate to create a niche for sub-4-in. Winchesters just as 5¼-in. floppies on the market cleared the way for Seagate's hard drives.

Seagate is expected to have evaluation units of its microfloppy available in the second quarter of 1983, with production units available by the third quarter. Tabor is expected to have its production units available in the first quarter of 1983. The Tabor drive, dubbed the TC500, is priced at $315 in single-unit quantities. Neither designation nor price has been set for the Seagate microfloppy.

—Bob Sehr

Digital Research pushes GSX as the micro graphics standard

Digital Research, Inc., hopes to cash in on what chief operating officer John Rowley calls the highest potential growth market in microcomputer software by incorporating Graphics Systems Extension (GSX) on all versions of CP/M and making it available for other operating systems. Rowley hopes GSX will become a de facto industry standard.

"Graphics is becoming the fourth requirement on microcomputers after word processing, a spreadsheet capability and database management," says Future Computing analyst Egil Juliussen. "But a lack of standards is holding back an even more vigorous microcomputer graphics boom." Other observers, such as Okidata Corp.'s vice president of marketing, Chet Baffa, say a dearth of software to drive graphics output devices is the bottleneck. Digital Research, Pacific Grove, Calif., hopes to remedy both complaints with GSX, an operating-system enhancement incorporating the emerging ANSI-standard Virtual Device Interface (VDI), plus drivers for a large number of graphics devices. Moreover, Digital Research will offer GSX in versions compatible with operating systems competing with

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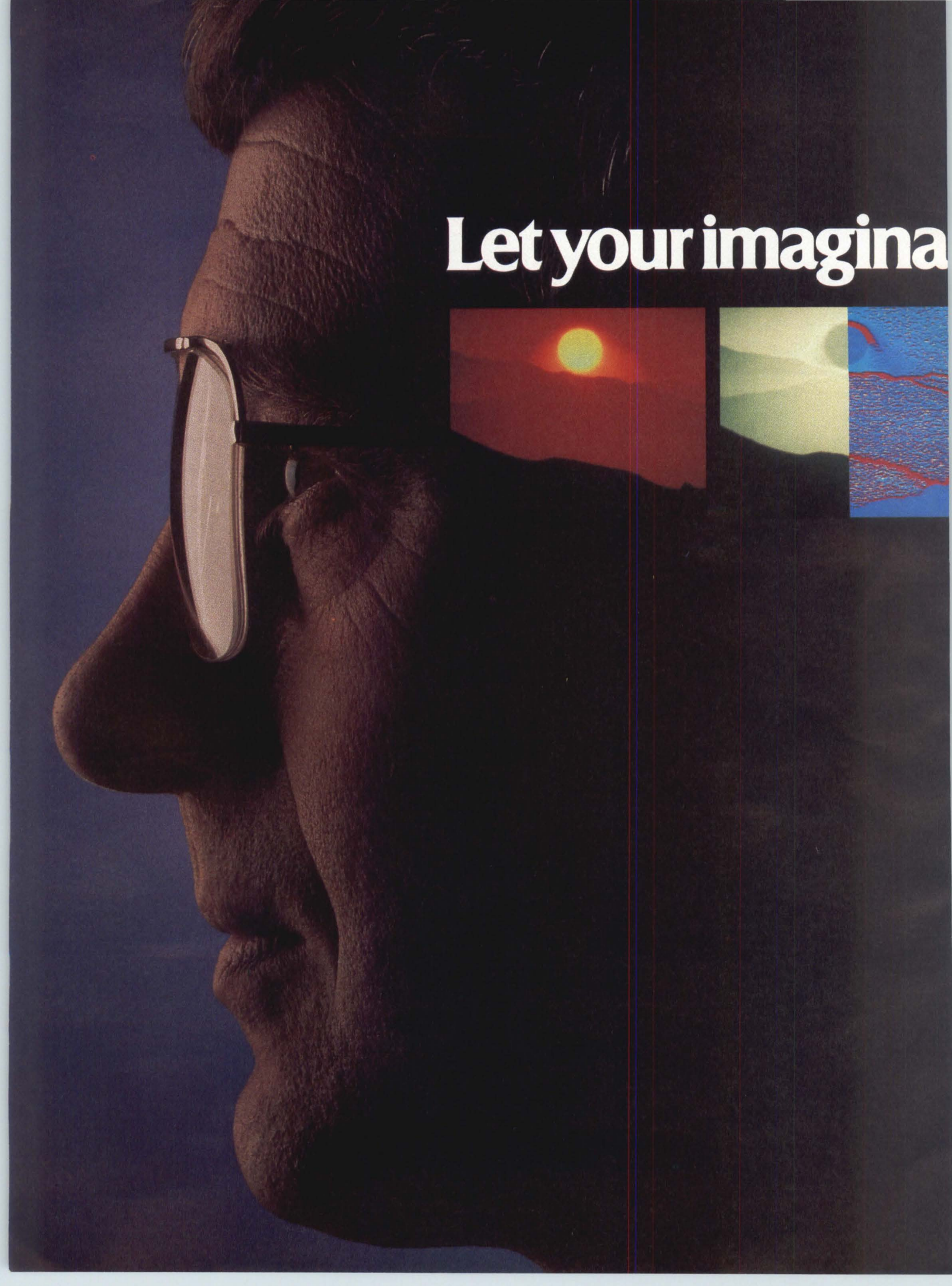
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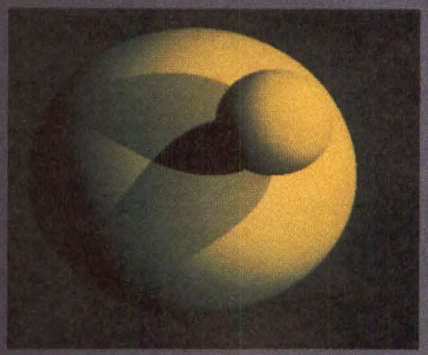
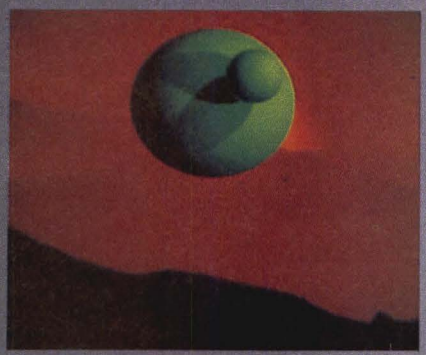


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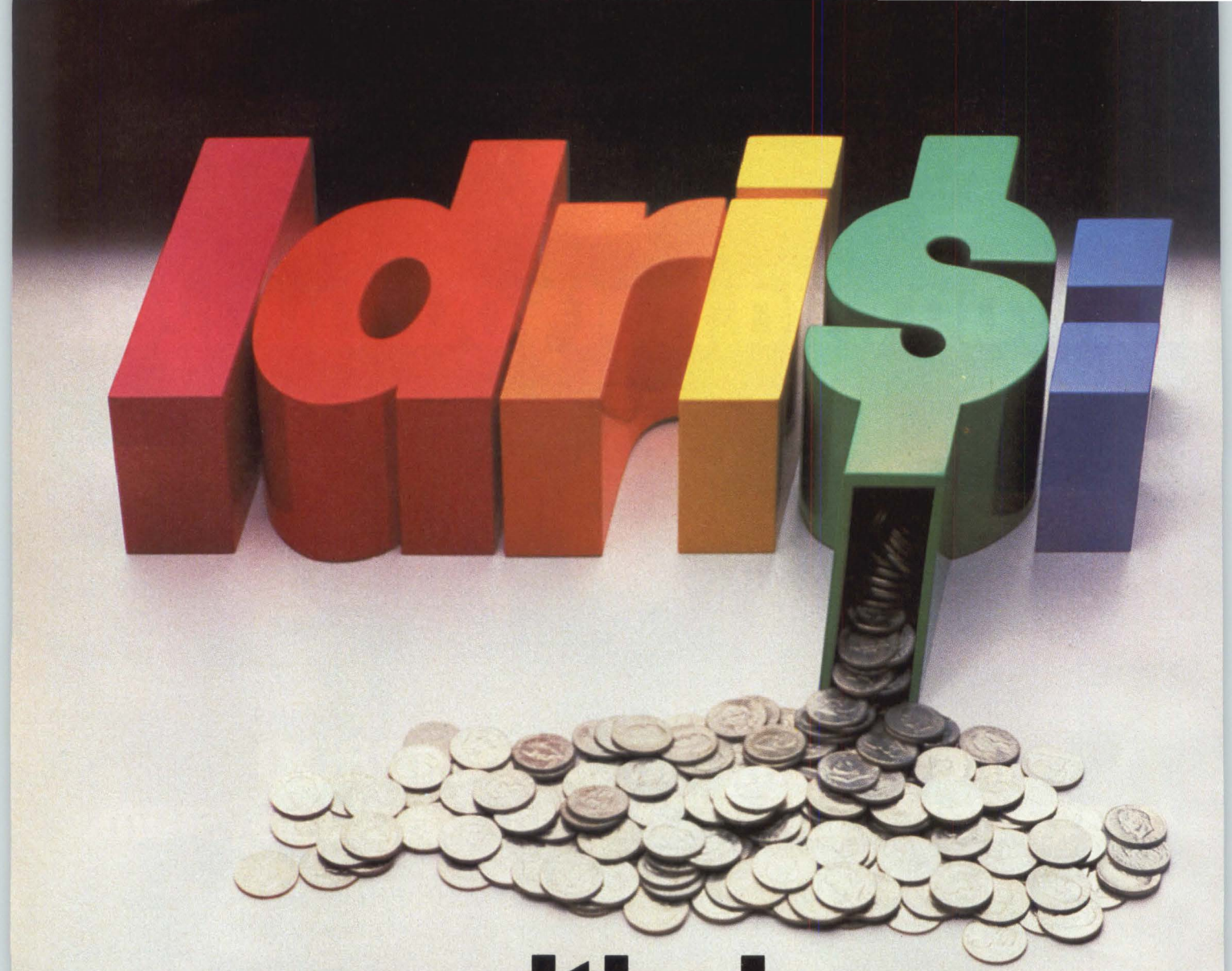

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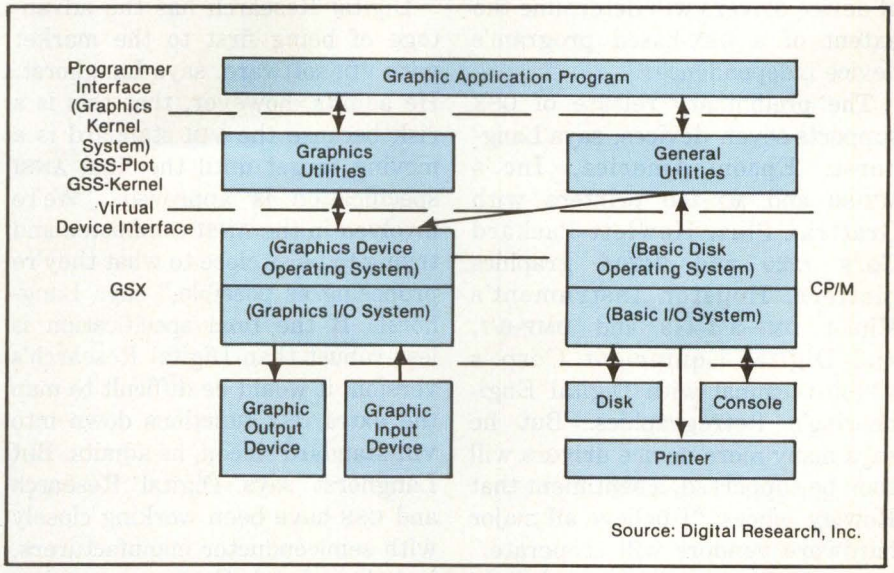
CP/M, including MS/DOS and UNIX.

The key advantage offered by GSX is its device independence. In effect, programmers write their programs to draw in a normalized coordinate system using a standard protocol defined by ANSI's VDI. They need not worry about hardware peculiarities because GSX maps the standard's coordinates and protocol to the hardware coordinates (such as 320 × 240 for the IBM Corp. PC's color raster display) and protocols (such as vector pairs for a plotter). Therefore, an application program accommodates a variety of graphics hardware devices without changing the object code. The same object code runs unchanged on any computer equipped with the same operating system.

For programmers who do not wish to write at the low level defined by GSX's VDI, Digital Research offers two sets of subroutine libraries that are based on the Graphics Kernel System (GKS), the draft international standard. The lower level product, GSS-Kernel, supports Pascal, FORTRAN, PL/1, BASIC and C with standard graphics procedure calls. GSS-Plot, a higher level programming tool, defines plots and graphs with just a few calls from a high-level language. (GSS stands for Graphics Software Systems, Inc., a Wilsonville, Ore., Tektronix, Inc., spin-off, with which Digital Research developed GSX and adapted the subroutine libraries for CP/M.) Both tie to CP/M's underlying GSX and offer a programmer the same device-independence and program portability. Finally, an emulation of the Tektronix 4010/4014 terminal protocols, called GSS-4010, is available to provide compatibility with Plot 10 software.

The most common graphics devices in microcomputers are an internal raster-scan monitor, a printer or a plotter and perhaps an analog input device such as a mouse.



GSX is an extension of CP/M and its components GDOS and GIOS, *which correspond roughly to BDOS and BIOS. GDOS interfaces to the normal BDOS calling sequence by trapping all calls to BDOS and examining the function code. If the code is 115 (73 Hex), the call is a graphics request and is serviced by GDOS. All other codes are passed to BDOS and serviced as normal CP/M I/O. (Source: Digital Research, Inc.)*

A number of such devices can be supported under GSX within an application. A memory-resident file called Graphics Device Operating System (GDOS) loads the appropriate device driver off the disk when a device is requested by the application program, overlaying the previous driver. Memory is conserved because only one driver is resident at a time.

The library of device drivers is called Graphics I/O System (GIOS). Each driver communicates with the graphics device to perform basic drawing commands. In some cases, the device driver emulates standard GDOS capability not provided by the graphics hardware. For example, the device driver may simulate dashed lines with a series of short vectors.

To interest graphics hardware vendors in cooperating in writing such device drivers, a large installed base is necessary. Therefore, says Digital Research's Rowley, GSX's pricing is intended to make it nearly ubiquitous. Digital Research initially considered charging OEMs $25,000 up front and $25,000 more after 10,000 copies were distributed, but opted instead to charge $2.50 a copy for the first 10,000 and $1.25 a copy thereafter. "An OEM would be foolhardy not to design it in at those prices," says Rowley. Independent software vendors, meanwhile, pay $500 to base applications on GSX's capabilities. GSS-Plot and GSS-Kernel are also available for $500 per copy.

The success of GSX will depend in large part on the number of device drivers offered. Ironically, the need for such device drivers eventually will disappear. Intel Corp. will produce VLSI devices that will allow graphics vendors to provide the standard VDI in hardware. But such chips are probably 18 months from production and much further from design into a new generation of graphics devices, says the director of Digital Research's Graphics Product Group, Fred Langhorst. For at least several years, therefore, the extent of the GIOS library

of device drivers will determine the extent of a GSX-based program's device independence.

The preliminary release of GSX supports seven devices, says Langhorst: Epson America, Inc.'s MX-80 and MX-100 printers with Graftrax Plus, Hewlett-Packard Co.'s 7220 and 7470A graphics plotters, Houston Instrument's Hiplot DMP-3/4-443 and DMP-6/7, and Digital Equipment Corp.'s VT100 terminal with Digital Engineering's Retrographics. But he says many more device drivers will soon be supported, a sentiment that Rowley echoes: "I believe all major hardware vendors will cooperate," he says. "Because we have close to 1000 OEMs and 1 million CP/M users, the hardware people want us to support their graphics devices."

Another factor favoring acceptance of GSX, says Langhorst, is its inherent ability to tailor output to the characteristics of a device. "You need that for good quality using the device-independent approach," he says, and adds it was the chief reason for Digital Research's choice of VDI as GSX's indigenous base over the roughly equivalent, North American Presentation Level Protocol Syntax (NAPLPS) draft standard. "VDI was designed to be an interactive workstation interface," he says, "while NAPLPS is a one-way dump." Under VDI, an application program can inquire about the capabilities of a device; if color is available on a CRT, for example, the device driver would automatically use it instead of gray shading. Area fill might be in color if available; otherwise, the application program could provide cross-hatching. NAPLPS provides no such adjustments and offers limited resolution. "Yet there will be a demand for NAPLPS," says Langhorst, "so it's available under GSX via a mapping routine." NAPLPS is intended primarily for videotex terminals.

Digital Research has the advantage of being first to the market with VDI software, says Langhorst. He admits, however, that this is a risk because the VDI standard is a moving target until the final ANSI specification is approved. "We're involved in the ANSI committee and trying to be as close to what they're proposing as possible," says Langhorst. If the final specification is less robust than Digital Research's version, it would be difficult to map the extra GSX functions down into VDI-standard silicon, he admits. But Langhorst says Digital Research and GSS have been working closely with semiconductor manufacturers, including Intel Corp., the prime mover behind the VDI push. "If discrepancies crop up, I think the Digital Research version would be as influential as the standard," he says, because of an early lead in the market.

Even before the question of whether GSX will be an official or a de facto standard has been answered, Digital Research's independent software vendors that have graphics applications under development or on the market are leaning toward the GSX approach.

Al Dynarski, president of DataGraph, Arnold, Calif., says, "Using GSX would greatly simplify our job." DataGraph's Accuchart, which is offered under OEM agreement by Vector Graphic, Inc., supports only Diablo Systems, Inc., protocol daisy-wheel printers for output, although DataGraph has several other device drivers under development. "But it would be nice if we could interface to anything without having to buy one of each hardware device," he says. And Micro Focus, a vendor of productivity tools designed to aid the creation of business applications, says it has already committed to GSX.

Meanwhile, support from Digital Research's computer OEMs is swelling. Digital Research confirms it has commitments to license GSX from TeleVideo, Inc., NEC Information Systems, Inc., NCR Corp., DEC, Xerox Corp., Ontel Corp., Otrona Corp. and others.

Other major operating-system software vendors have taken different approaches and have no plans to jump on the GSX bandwagon. "We've put graphics capabilities into the 16-bit BASIC that comes as part of the OASIS-16 operating system package," says Howard Sedorski, president of Phase One, Inc., Oakland, Calif. "Because it's a true complied BASIC, you can use the commands in programs written in other languages," he says. Phase One has written device drivers for a number of color raster-scan CRT displays, including that of the IBM PC, with support for such output devices as Epson printers, HP plotters and "whatever else there's a demand for" soon to follow, Sedorski says. "Putting graphics into a language rather than the operating system makes it easy for the programmer," Sedorski claims, "and that's what it's all about."

Microsoft has taken a similar approach. Its new release of GW BASIC (Version 2) incorporates additional graphics commands into the language, but only screen raster graphics are supported. Microsoft's operating system MS/DOS may add graphics capabilities eventually as well, but a company spokesman declines to comment about that addition.

Although it is not clear that GSX will become a standard for other operating systems as Digital Research hopes, a recent study from Frost & Sullivan, Inc., says the drive for graphics software will increase the use of the GSX-enhanced CP/M operating system.

—Kevin Strehlo

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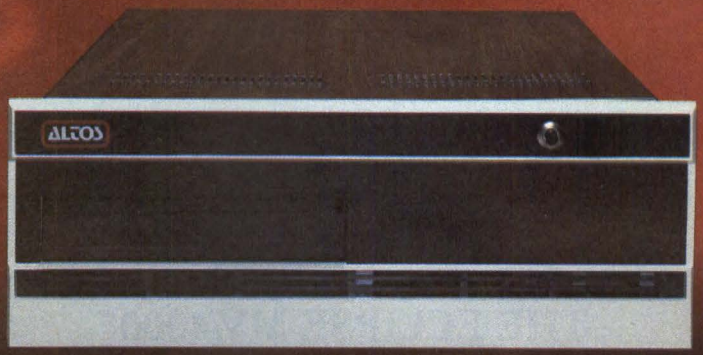

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CIRCLE NO. 21 ON INQUIRY CARD

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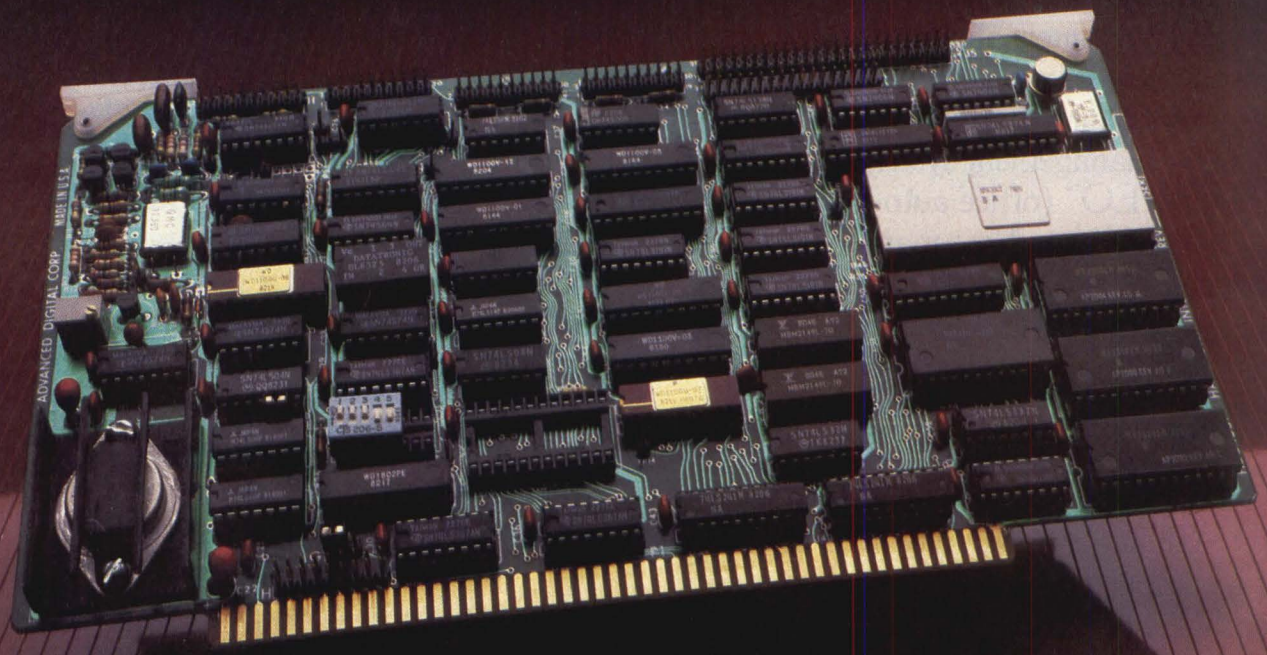

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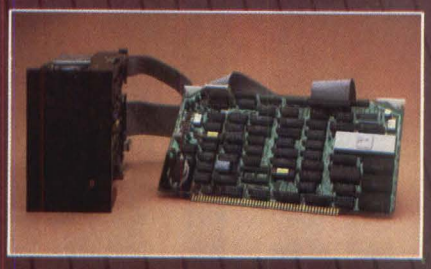

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CIRCLE NO. 22 ON INQUIRY CARD

CP/M update has help feature, addresses bank-switched memory

Digital Research, Inc., has released CP/M 3.0, the latest update of the popular 8-bit microcomputer operating system, which the company has dubbed CP/M Plus and which it claims brings CP/M users a high-performance option.

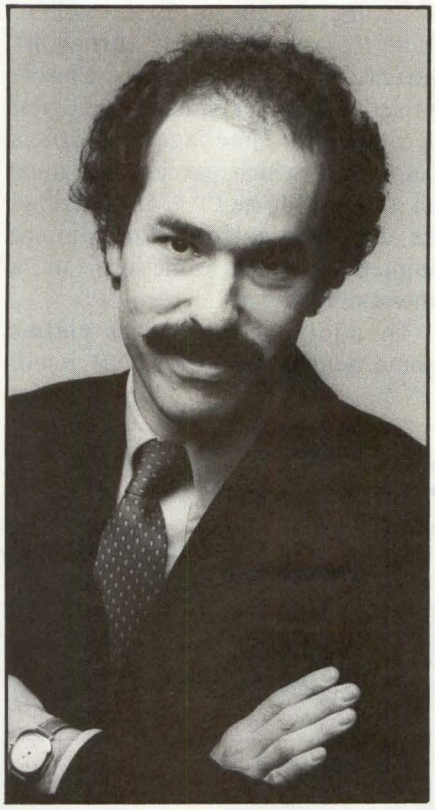
Among the major enhancements to the package are the ability to address multiple 64K-byte banks of memory on Z80- and 8085-based systems and a help facility that presents users with an explanation of system commands and their use. In addition, the new version has an optional file time- and date-stamping feature, error trapping and recovery, automatic disk log-in, hashed directory access, record buffering and multiple-sector I/O.

Harold R. Elgie, product marketing manager for 8-bit operating-systems marketing, says the updated CP/M package performs two to four times better than release 2.2 in standard applications, but adds that no formal benchmarks have been conducted. He denies that Version 3 is an effort to solve alleged problems with Version 2.2, but says, "It is based on input from 2.2 users."

The new system is now in use at 55 test sites and has been ordered by three large minicomputer/mainframe vendors as well as several high-volume software suppliers, Elgie points out, but declines to name the customers.

Commercial shipments were scheduled to commence last month with an evaluation copy price of $350. The price includes the symbolic instruction debugger, relocatable macroassembler, link and other utilities.

Elgie says the operating system consumes about 10K bytes of memory without data buffering or about 4K bytes more than Version 2.2. He says the system can now address as much as 512M bytes per drive on as many as 16 disk drives. Version 2.2 supports as many drives with a maximum of 8M bytes per drive.



Harold R. Elgie, *product marketing manager for 8-bit operating systems at Digital Research, says the new CP/M Plus performs two to four times faster than its predecessor, Version 2.2.*

The features of CP/M Plus said to provide more sophisticated operating-system functions are hashed directory access, LRU (least recently used) record buffering and multisector I/O. Hash sectoring is designed to provide quick access to files by creating a numerical index to disk files in RAM so that the file can be located without searching through an entire disk. LRU buffering provides a buffer for directory and data entries that automatically drops the least recently used entry when the buffer is filled. Multisector I/O can speed loading and writing a file.

User interface improvements to the operating system include the error-trapping routine that allows application programs to detect systems errors and issues English messages instructing users how to correct them. Automatic disk log-in eliminates the need to reset the disk every time a disk is changed. A user facility lets end users store frequently used programs under the User 0 directory division, while allowing access to the program from any of 16 directory divisions, a capability unavailable on Version 2.2.

The help function, which gives English language explanations of system functions, is not seen as a user-friendly shell—at least not by Taurus Software Corp., San Francisco, purveyor of CP+. Taurus president John Simpson notes the CP/M Plus help function is similar to the CP+ user-friendly shell and acknowledges use of the name CP/M Plus may be more than a coincidence, but adds, "I wouldn't go as far as to say we have influenced them."

Simpson explains that the $150 CP+ program is not intended to replace the CP/M operating system, but replaces the command console program commands used by Digital Research with a set of English prompts. He describes CP+ as a series of transient programs designed to do "98 percent of what most people want to do with the operating system." For example, he

says, CP+ takes the programmer or operator through a series of prompted procedures to erase files, compiling a list of files to be erased and verifying each selection before the erasure is completed.

Simpson says CP+ is being ordered by OEMs including Epson America, Inc., Seiko, Vector Graphic, Inc., Toshiba, Four-Phase Systems, Inc., and Xerox Corp. He says Taurus plans to update CP+ for CP/M Plus and says he is not concerned about CP/M Plus's help routines. "It makes it a little easier for programmers to use, but it's not really a user-friendly shell as far as I've seen."

However, Taurus competitor Epic Computer Systems, San Diego, takes a different view. "I think it's our impetus," says Epic software developer Bruce Allen. Like Taurus, Epic has turned its attention to the command-console program portion of the Digital Research package. Epic's Supervyz, which carries the same $150 price tag as CP+, is described as an application program to implement CP/M functions in a menu-driven way.

In addition, Supervyz claims some advantages over CP/M itself. For example, Allen says, Supervyz enables users to implement a submit from the default disk, while CP/M Version 2.2 supports submits only from the A disk. Elgie says CP/M Plus offers the same submit capability as Supervyz. Supervyz also supports nested submits and the ability to tailor output formats to the specifications of various printers and display terminals.

While Epic is working on a new version of Supervyz and improved user manuals, Allen says there are no plans to do CP/M Plus extensions for the program.

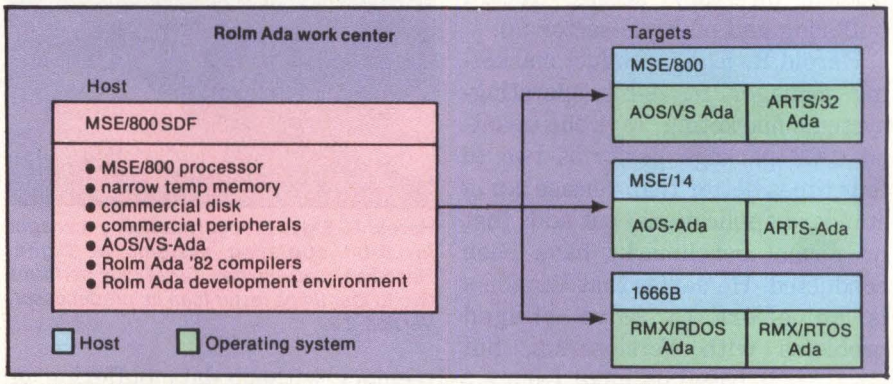
—Geoff Lewis

Rolm unveils Ada compiler, hopes to get jump on competitors

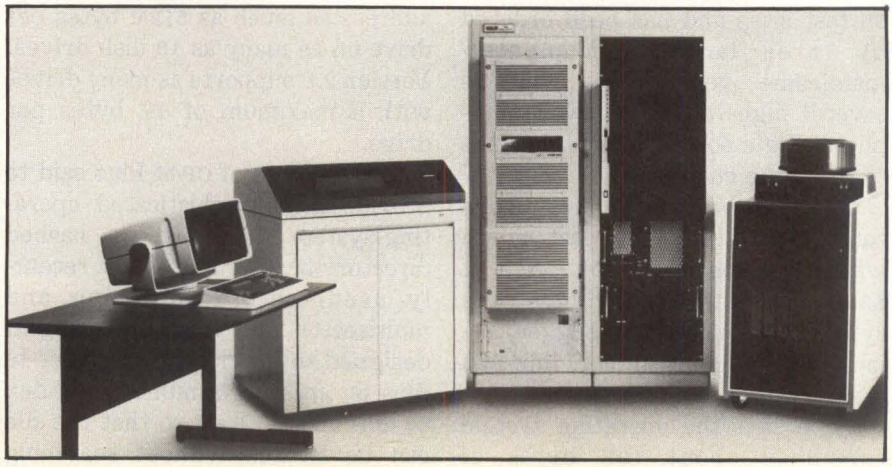
Hoping for at least a six-month jump on competitors eyeing government markets, Rolm Corp. has unveiled an Ada compiler that the company says fully implements Department of Defense specifications for the Ada development language.

However, DOD specifications for Ada were not submitted to the American National Standards Institute for final approval until the end of last year. Rolm is gambling that its new compiler will pass final DOD validation testing.

The Ada compiler is the software portion of the new Rolm Ada work center, an integrated package of hardware, software and technical support for development of Ada language applications. The hardware segment of the system is built



The three target computers for native-code generation from the Ada compiler *are the MSE/800, MSE/14 and the 1666B, which run under the operating systems designated.*



Rolm's Ada work center *includes the ANSI 1982 standard ADA compiler that is said to comply with forthcoming Department of Defense specifications, eight to 128 Ada development terminals, a 32-bit processor and support for three target processors.*

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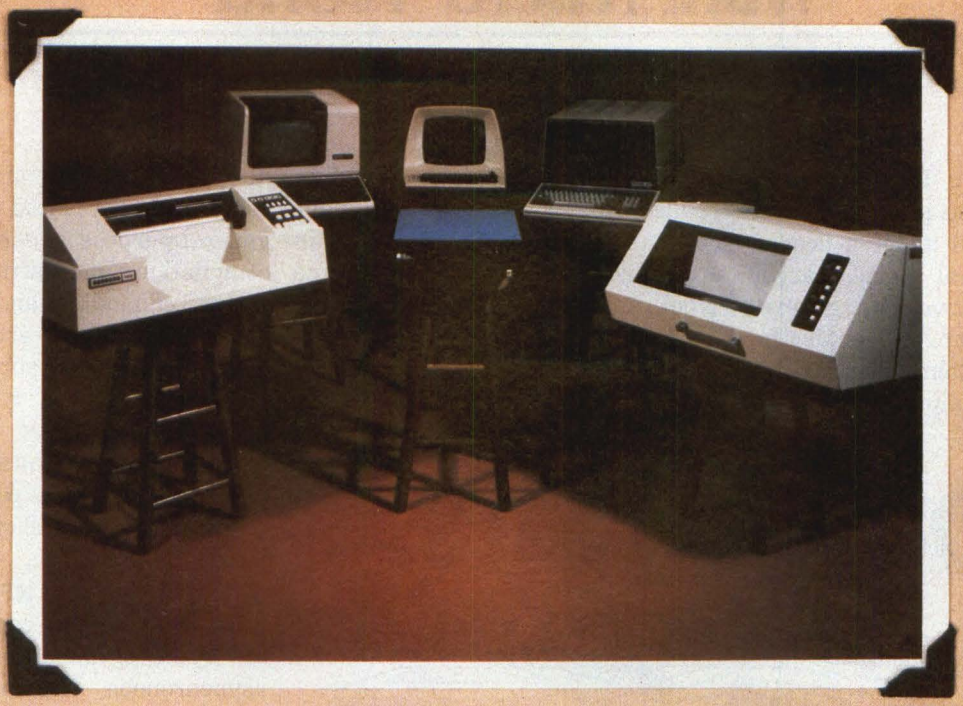

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CIRCLE NO. 23 ON INQUIRY CARD

around the 32-bit Rolm MSE/800 host processor, the archeticture of which was created under a license from Data General Corp. Target computers for native-code generation from the compiler include the MSE/800 and the Rolm 16-bit MSE/14 and 1666/B minicomputers.

The work center is designed to reduce Ada software-development costs and make people productive in Ada programming, says Bruce Noel, Rolm's Ada product manager.

The work center can support as many as 128 simultaneous users for Ada program design, application development and training. The compiler features real-time tasking, general-purpose generics, separate compilation, unconstrained arrays, exception handling and propagation and parameter overloading. The MSE/800 processor suports demand paging, a 4G-byte virtual-address space and a 36.4M byte-per-sec. main-memory bandwidth. Rolm pegs the processor's performance at more than 1.2 million Whetstone instructions per sec.

Supporting the MSE/800 in the basic work-center configuration is 2M bytes of main memory, eight asynchronous terminal lines for connection of Ada development terminals and other peripherals. Optional system components can be added to allow system upgrades and mil-spec operation.

The first shipment of the $463,000 work center to an unidentified defense contractor near Santa Clara is scheduled for January, Noel says. Rolm has targeted defense industries wishing to develop Ada application programs for military agencies as prime customers. The U.S. Army has committed to converting to Ada for all development programs in 1983, followed by the Air Force in 1984 and complete DOD conversion in 1985. By 1986, according to estimates made by Softech, the total market for Ada support software in the military and defense contractors will total approximately $800 million.

Rolm envisions a larger market developing for the MSE/800, the MSE/14 and the 1666/B units, the target computers on which the Ada programs are run. "There can be hundreds of follow-on orders for our target machines," Noel estimates. "We have a two-pronged approach to the Ada marketplace: the work center and the three target computers."

Industry reaction to Rolm's claim that it has a fully implemented DOD

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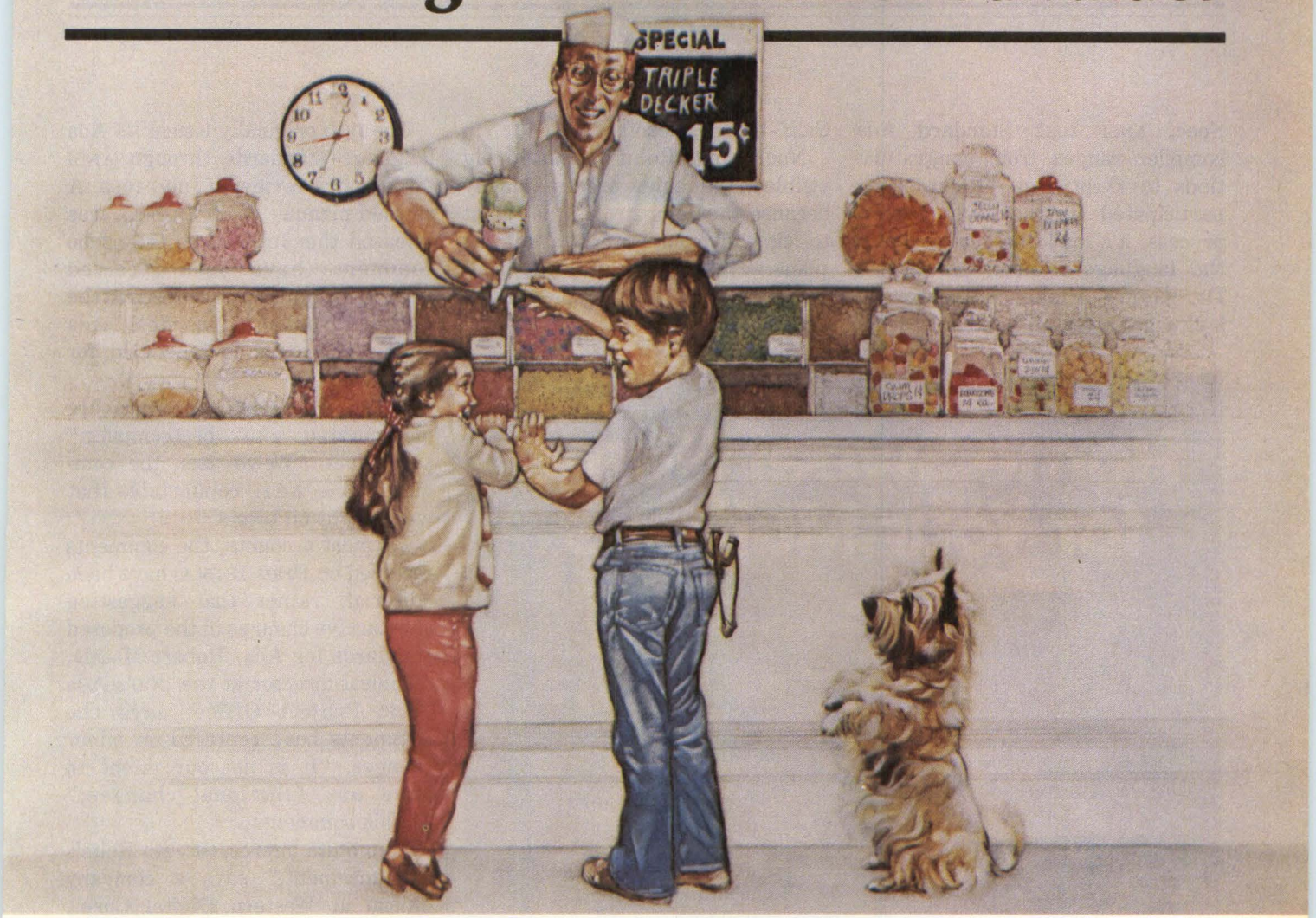

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CIRCLE NO. 26 ON INQUIRY CARD

Spec, ANSI 1982 Standard Ada compiler ranges from congratulations to skepticism. "Rolm hasn't participated in the ANSI review process; it's made no comments on the language manual," comments Dr. Gerry Fisher, director of language research at San Diego, Calif.-based Telesoft.

Noel admits Rolm was not highly visible in the review process, mainly because the company did not want to tip off competitors about its plans. He says Rolm has been involved with key people in the review cycle.

The DOD originally issued its Ada language standards through ANSI for industry review in July, 1980. A revised manual, Draft 1815(A), was released this July. More than 3000 comments have been received suggesting additional changes in the revised manual. The final Ada language manual is scheduled for release now.

"The July, 1982, standards are incorporated into the compiler," says Noel. "We've seen the comments, and we're comfortable that we're right on target."

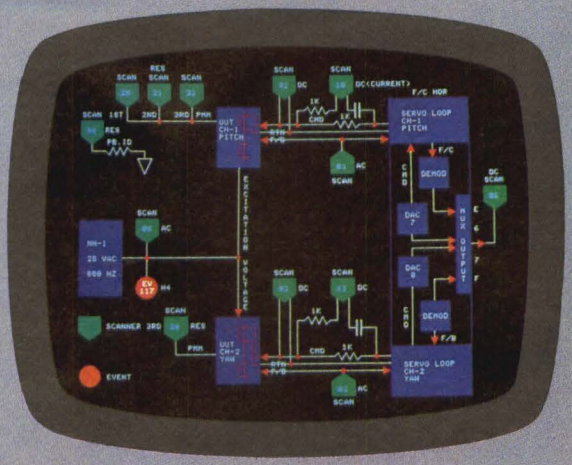
By most accounts, the comments received on Draft 1815(A) have been editorial, rather that suggesting substantive changes in the proposed standards for Ada. Robert Mathis, technical director at the DOD's Ada Joint Project Office, says the comments have centered on minor changes. "It is not our intent to have any functional changes," Mathis comments.

"I'm quite impressed with Rolm's announcement," says a company official at Western Digital Corp., who declines to be identified. Western Digital is the only company that the Ada Joint Project Office says has formally requested to schedule the required validation testing on its Ada language compiler, which is still under development. The Western Digital source estimates there are 45 efforts under way in the U.S. for Ada compilers, and 15 to 20 non-U.S. efforts. He adds, "But the bottom line for all of us is who gets through the DOD validation tests." DOD's Mathis concurs. "No compiler is fully DOD-compatible until DOD says it is."

The DOD official expects the first Ada language compiler to be validated in the first quarter of this year. —*Stephen Shaw*

Stephen J. Shaw is a free-lance writer working in Washington, D.C.

THE BEST HAS JUST BECOME THE BEST DEAL.



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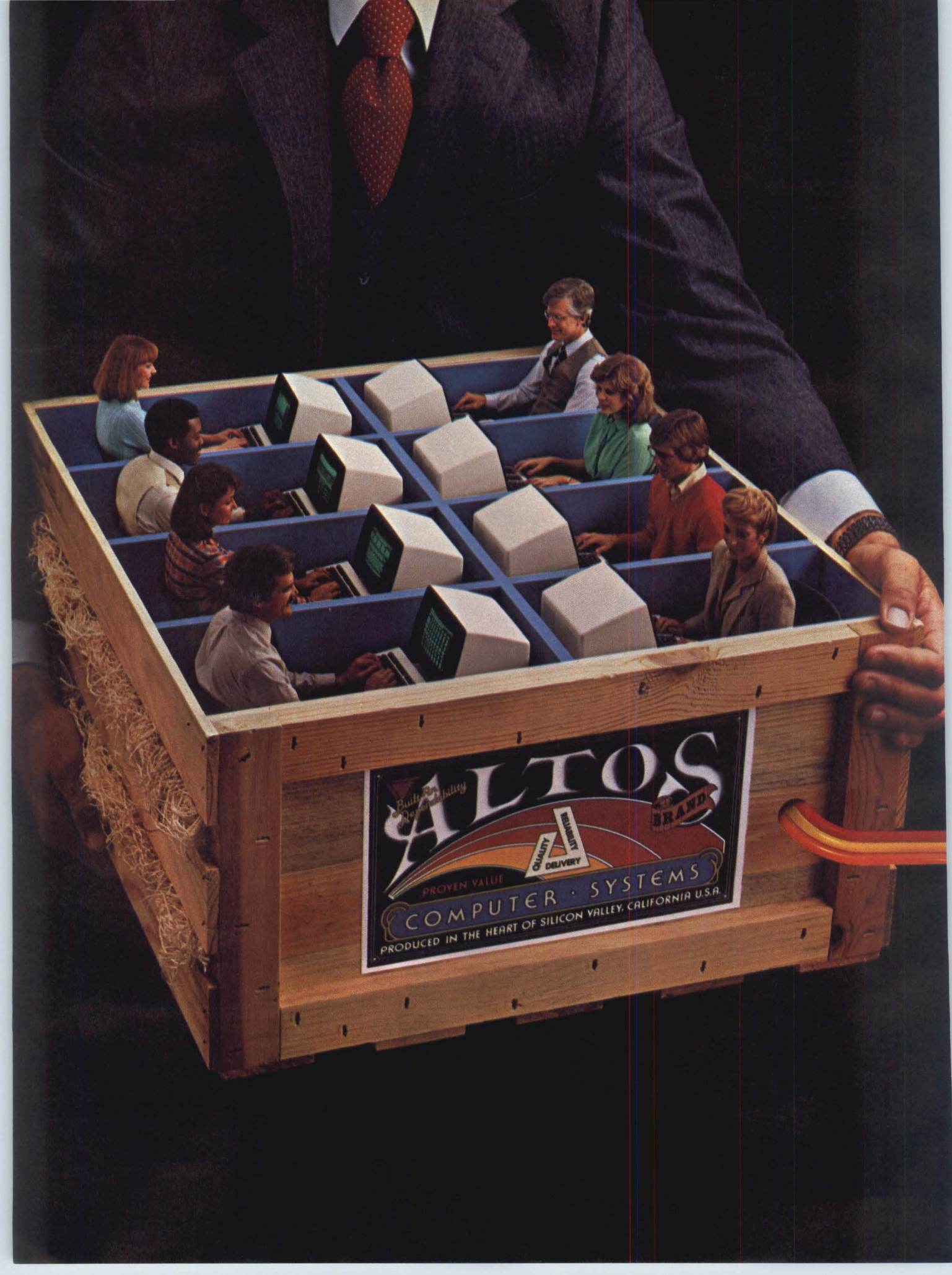
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USER Memory	128K-1 Mbytes	16K-256 Kbytes	?
IBM-PC Compatible Expansions Slots Beyond Professional Configuration[1]	8 Slots	0	?
Resident Floppy Disk Storage	Dual 320K (std)	Dual 160K (Opt) Dual 320K (Opt)	?
Resident Cache Buffer Hard Disk Storage	5M/10M	—	?
OPTIONAL OPERATING SYSTEMS (Supported by Company)[2]			
MS-DOS (PC-DOS)	Yes	Yes	?
CP/M 86	Yes	Yes	?
MP/M 86	Yes	—	?
OASIS-16	Yes	—	?
XENIX	Soon	—	?
OPTIONAL HARDWARE EXPANSION BOARD (Supported by Company)			
RS-232 Communications	Yes	Yes	?
B/W and Color Display Controller	Yes	Yes	?
Expansion Memory	Yes	Yes	?
Z-80 CP/M-80 Board	Yes	—	?
Cache Buffer Hard Disk	Yes	—	?
Time/Calendar Board	Yes	—	?
IEEE Bus Controller	Yes	—	?
8" Floppy Disk System	Yes	—	?
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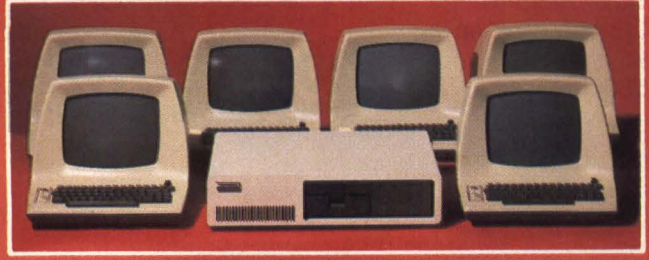
Tape Cartridge System	Yes	—	?

[1]For comparison purposes, typical professional configurations consist of 16-Bit 8088 Processor, 128K RAM with Parity, Dual 320K 5-inch Floppies, DMA and Interrupt Controller, Dual RS-232 Serial Ports, Centronics Parallel Port and Dumb Computer Terminal or Equivalent.

[2]Columbia Data Products also supports CP/M 80® with an optionally available Z-80 CP/M Expansion Board.

*As advertised in BYTE Magazine, August 1982.



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DEC celebrates quarter-century in business amidst lower earnings, hiring freeze

The tone exuded by Digital Equipment Corp. president Kenneth H. Olsen at the company's recent 25th annual meeting prompted a feeling of long-term stability for the nearly $4-billion company. Nonetheless, it is clear the giant Maynard, Mass., computer firm, like other minicomputer companies, is feeling the harsh effects of the worldwide recession.

The gathering followed disconcerting announcements by both DEC and Massachusetts neighbor Honeywell, Inc., just days earlier. Honeywell laid off 800 workers, primarily white-collar workers, as part of a corporate reduction that began last year. DEC had announced results for the first quarter of this year that reflected a 10-percent increase in revenues but a 36-percent decline in earnings over last year's quarter. Olsen expects second-quarter earnings to be down.

"We were isolated for the first one to two years during the recession," says Olsen. He adds that while DEC's OEM business was not affected for a while, it is being hit worse by the recession than other DEC businesses. The reason, he says, is that OEMs usually sell directly to the capital equipment market. Orders in that market have been slow during the spring and summer, and Olsen sees no short-term improvement.

Olsen says DEC's goal last year was to sell to the world's largest corporations, and notes, "Very large companies have canceled projects (for computers) they hadn't expected to cancel." Olsen emphasized DEC has long-term projects with major firms that stretch over changes in the economy, which has helped the company remain somewhat recession-proof until now. "We have a long-term concentration for stability in the future," he says.

Digital Equipment Corp. president Kenneth H. Olsen *spoke optimistically of the company's growth with new products during the recent 25th annual meeting, despite a continuation of a hiring freeze and salary-increase delays.*

Despite the comforting words, Olsen could not designate an end to the hiring freeze. The company also is delaying salary increases. For its fiscal year ending July 3, 1982, revenues were $3.9 billion, compared with $3.2 billion last year. Although DEC's costs were down, product prices were lowered to meet competition and get revenues. Service and other revenues increased from $814 million to $1.1 billion. Net income increased from $343 million to $417 million. Business in Europe hasn't changed much, and was 38 percent of revenues. DEC's revenues were $188 million 10 years ago, while net income was $15 million, and service and other revenues were $21 million. Net income per share was 50¢ in 1972, $6.70 in 1981 and $7.53 in 1982. DEC's 10-year growth in operating revenues is 31 percent. Over the past few years, the firm has moved from position 280 to 137 among the Fortune 500 companies.

For the first quarter, which ended on Oct. 2, 1982, results were not as strong as for the year. Revenues increased 10 percent from $839 million during last year's first quarter to $927 million this quarter. Net income declined 36 percent from last year's first quarter from $89 million to $57 million, partly because of higher research expenditures. Earnings per share declined over the quarters from $1.60 to $1.02. Service and other revenues

Continues on page 63

Digital Equipment Corp. 11 year financial summary

	Equipment sales revenues ($ millions)	Service and other revenues ($ millions)	Total operating revenues ($ millions)	Net income ($ millions)	Net income per share
1982	$2,793.7	$1,087.1	$3,880.8	$417.2	$7.53
1981	$2,384.2	$ 813.9	$3,198.1	$343.3	$6.70
1980	$1,779.4	$ 588.6	$2,368.0	$249.9	$5.45
1979	$1,381.8	$ 422.3	$1,804.1	$178.4	$4.10
1978	$1,128.1	$ 308.5	$1,436.6	$142.2	$3.40
1977	$ 847.5	$ 211.1	$1,058.6	$108.5	$2.78
1976	$ 586.6	$ 149.6	$ 736.3	$ 73.4	$1.98
1975	$ 433.2	$ 100.6	$ 533.8	$ 46.0	$1.28
1974	$ 360.8	$ 61.1	$ 421.9	$ 44.4	$1.27
1973	$ 229.1	$ 36.4	$ 265.5	$ 23.5	$ .72
1972	$ 166.3	$ 21.3	$ 187.6	$ 15.3	$ .50

Source: Digital Equipment Corp.

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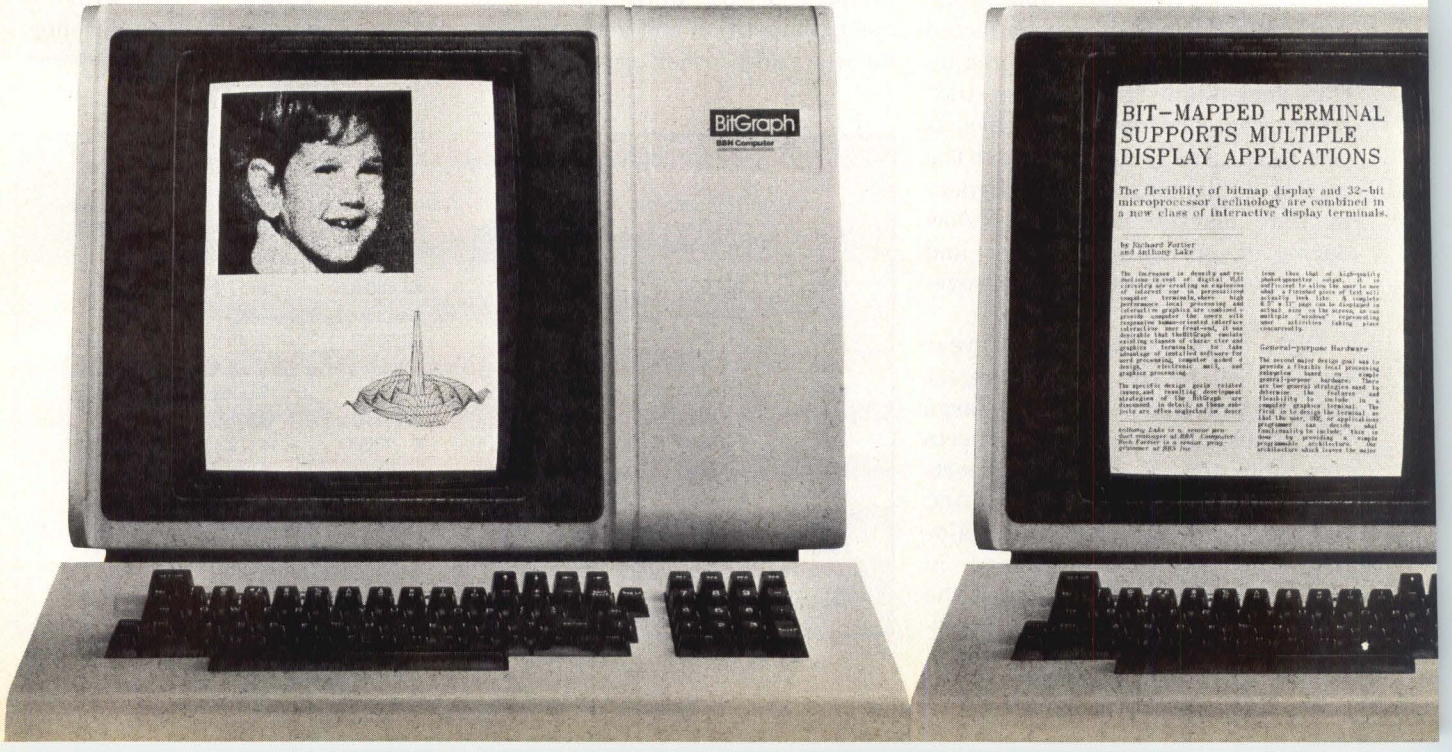

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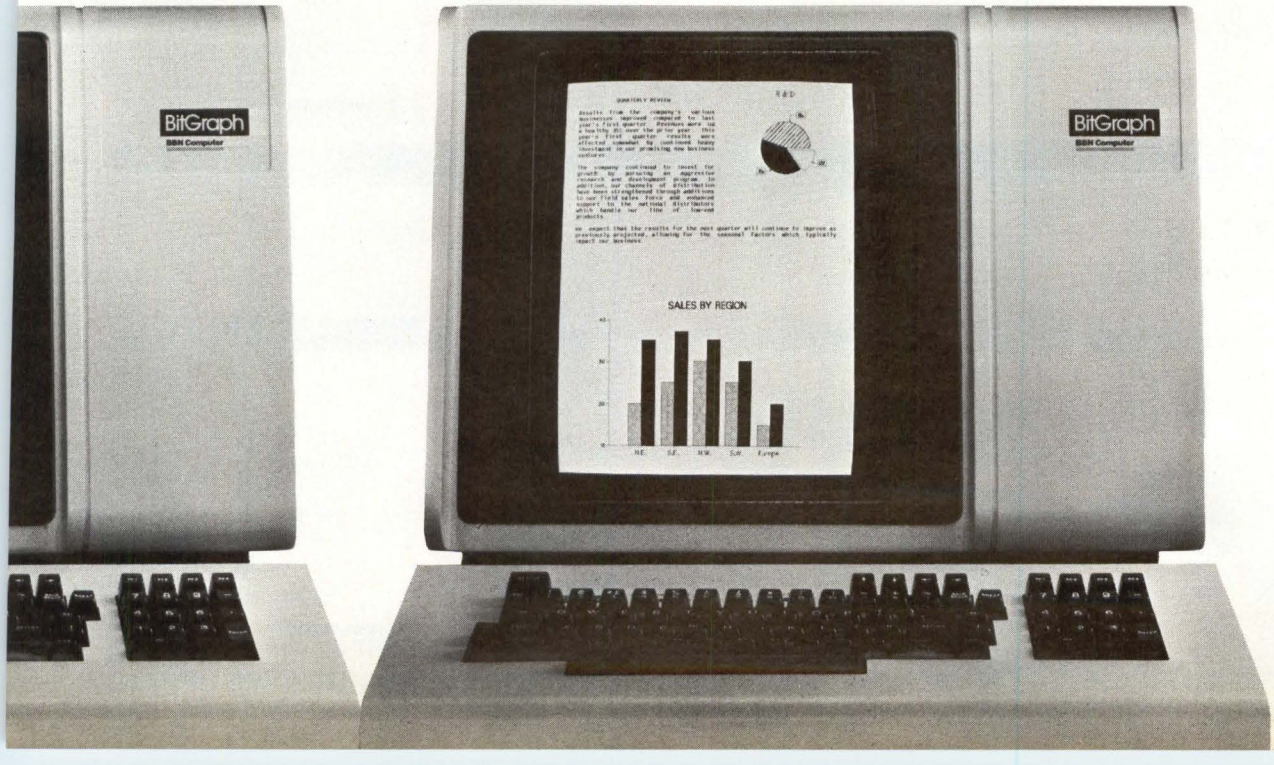

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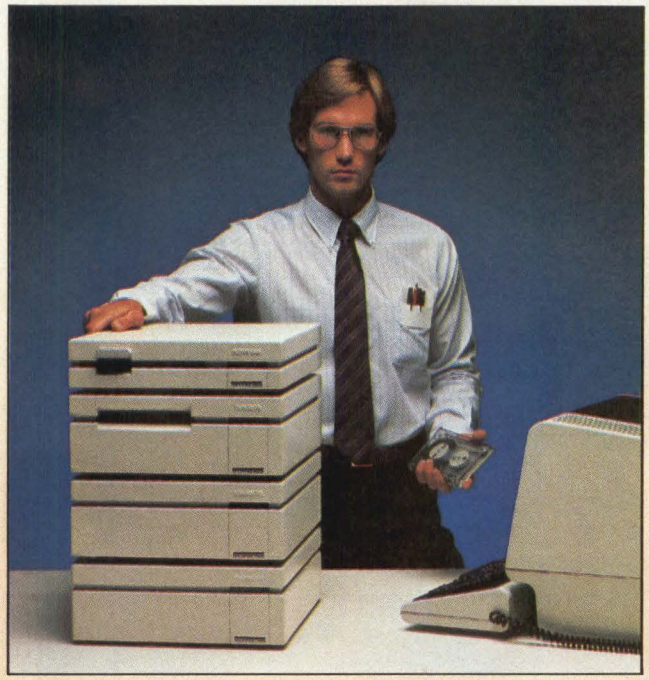

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CIRCLE NO. 33 ON INQUIRY CARD

MARKET BAROMETER

A monthly column devoted to an expert's look at an industry

Mobile computers' special system-integrator challenge

By Richard J. Matlack
Infocorp

The introduction of the Osborne 1 with its carrying case and under-the-airline-seat size began to stimulate the growth of full-capability computers that could be carried conveniently by a user. In the last year, the field has grown dramatically to at least 13 suppliers, which may be joined next year by IBM Corp., Apple Computer, Inc., and Japanese suppliers.

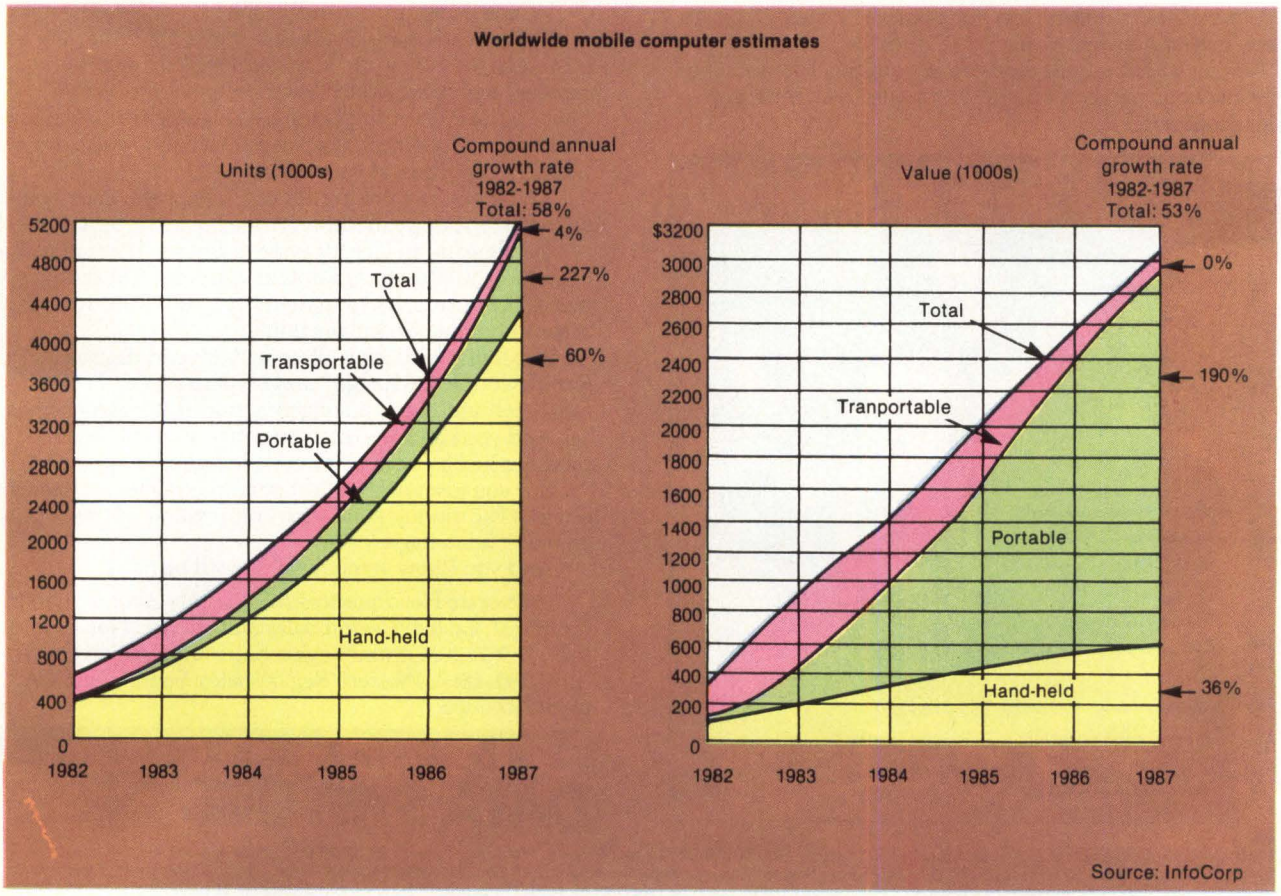
The new class of "mobile" computers—general-purpose computing devices with a keyboard and built-in display and programmable in a high-level language—will attract add-on suppliers, system integrators and other third parties. Because of a requirement for the computers to be conveniently moved, third parties will face some special design considerations. Add-on peripherals must be compact and lightweight, but still fully functional.

Though mobile computers hardly existed a year ago, their sales should grow to 5.1 million units by 1985 (valued at $3.1 billion), from 527,000 units in 1982 (valued at $372 million).

The most rapidly accelerating segment, portable computers, will grow from $11 million last year to $2.3 billion in 1987. The growth in units for the period is 2000 to 750,000. Portable computers such as the Epson HX-20, GRiD Compass and Teleram T-3000 typically are based on 8- or 16-bit, low-power CMOS processors. They have 64K of RAM, and as much as 256K bytes of bubble-memory storage, a four-line × 80-character LCD, a typewriter-style keyboard and remote or plug-in peripherals. Weight ranges from 2 to 25 lbs. Prices range from $500 to $5000.

The second fastest growing segment is hand-held computers, such as the Panasonic LINC and Sharp PC1500. That market will grow from $136 million last year to $630 million in 1987, representing an increase from 400,000 TO 4.2 million units. Hand-held computers typically are based on 8-bit CMOS processors, have ROM storage and about 16K bytes of RAM and contain a 1-line × 80-character LCD. The keyboard is button-like, and peripherals are plug-in. Hand-helds weigh from 8 oz. to 5 lbs., and are priced from $100 to $500. These computers can be programmed in a high-level language.

Continues on page 57



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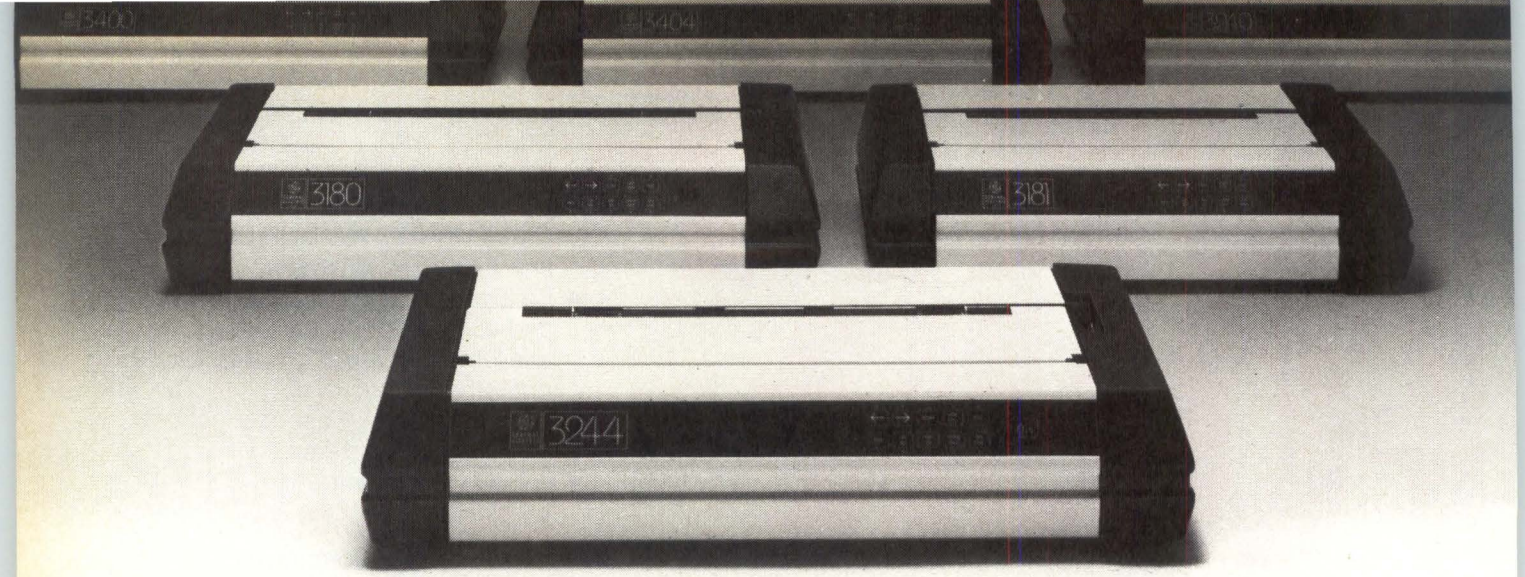

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GENERAL ELECTRIC

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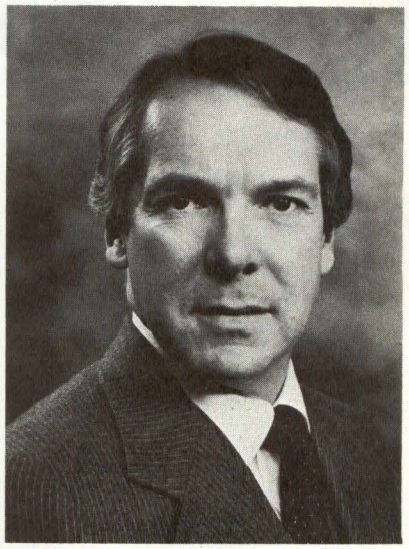
Continues from page 54

The high predicted growth in the hand-held and portable-computer categories will detract from that of transportable computers. These suitcase-sized computers, such as the Osborne 1, Otrona Attache and Dynalogic Hyperion, are growing rapidly in sales now, but we believe this market will peak in 1983 as technological advances allow more portability. While that market was $225 million last year, it will grow to $442 million in 1984, then decrease to $225 million by 1987. Unit growth will rise slightly from 125,000 to 265,000 in 1984 before declining to 150,000 in 1987. Transportable computers generally are based on an 8-bit NMOS processor, have 500K bytes of RAM and 500K bytes of rotating memory and include a 24-line × 80-character CRT display. Peripherals are plug-in, and the keyboard is typewriter style. Weighing 25 lbs. each, they typically are priced at about $1800 to $5000. The rapid pace of both the market and technology growth challenges system integrators to plan ahead. The target system in 1987, as we see it, might include: a 16-bit, high-speed, low-power CMOS processor with multiple 8-bit auxiliary processors; 1M-byte CMOS main memory, 1M-byte bubble memory and 10M to 20M bytes of rotating storage; a full-page, flat, low-power display with full graphics; a typewriter-style keyboard; an 8-hour battery; an integral full-page, plain-paper printer; UNIX, a relational database module, Query language and graphics package; and full communications including links to a local network or standard terminal emulation. All will fit into a standard briefcase weighing less than 20 lbs. The system will offer functions equivalent to a large minicomputer today for less than $3000 to end users.



Richard J. Matlack is president of Infocorp, Cupertino, Calif., a new market research firm.

GUEST FORUM

A monthly column for guest experts to speak out

Solid-gold CADD lack

Dr. Joel N. Orr
Orr Associates, Inc.

There is a rapidly growing need for small computer-aided-design and -drafting systems, representing a significant opportunity for system integrators. The CADD system market, dominated by systems averaging $400,000 for a minicomputer, software and four workstations, grossed some $1.2 billion in 1982. About $70 million of that amount was for "small" systems—those typically selling for less than $100,000, with one or two workstations, and generally limited to 2D drafting, rather than design. It is expected that the market will grow to more than $3.3 billion by the end of 1985, with more than $650 million in less-than-$100,000 systems. And while half the 1982 small systems was sold to the electronics (PC and IC) design and drafting market, that percentage is expected to drop to 25 percent by the end of 1985, yielding first place to architectural systems (35 percent) and second place to mechanical (30 percent). More than 10 percent of the small systems will go to educational institutions in 1985.

There are currently more than 20 small CADD systems on the market; the list is growing at the rate of one to three per month, by my observation. What characterizes a "winner" in this market?

- First, make your system solve a specific set of user problems, in terms meaningful to users. "General-purpose" small CADD systems are not sales leaders.
- Use existing powerful microcomputers, with reliable, flexible operating systems. It does not pay to write special-purpose operating systems for this market.
- Make the system expandable and define a clear growth path.
- Devote most of your energies to creating a system that speaks the user's language. It should also be friendly, reliable and responsive.
- There is little excuse for not using a color display, at least as an option.
- Aim at the architectural and mechanical market, rather than electronics. Go for a narrow market segment, such as space planning or piping in architecture, or mold design in mechanical design.
- Consider "OEMing" a general-purpose CADD package and turning it into a "solution system."

A major pitfall in this market is the tempatation to write your own graphics software. Don't do it! There are many subroutine packages and general systems available, whose authors have shed the requisite volume of tears to make them functional.

Dr. Joel N. Orr is chairman and principal consultant of Orr Associates, Inc., Danbury, Conn. Orr Associates is a large computer graphics consulting firm.

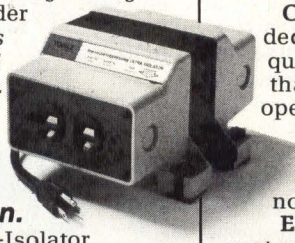
Complete Protection Needed

Dedicated Power Lines Leave Computers Vulnerable.

Power-line noise is a major source of computer problems; it can cause program errors, component malfunction and hardware damage. The many sources of noise include lightning, the switching of power grids and power-factor correction capacitors by utility companies, and the operation of countless electrical devices from elevators to electric pencil sharpeners. Power-line noise is so troublesome that most computer manufacturers recommend that users provide some form of noise protection in order to keep sensitive equipment operating properly.

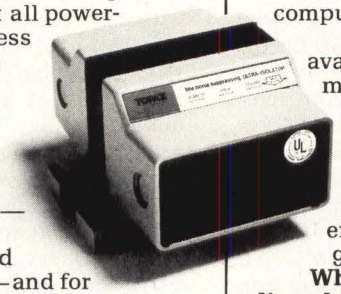
Dedicated Lines are Ineffective Against Most Noise Transients.

Many computer users believe that the best way to provide noise protection is with a dedicated power line. But a dedicated line protects *only* against noise that originates *within* the computer facility. It provides virtually no protection against the majority of noise transients — those which originate outside the facility. This external noise enters the building through the main power feeder *and actually travels down the dedicated line to the computer.*



Ultra-Isolators Provide COMPLETE Noise Protection.

A Topaz Ultra-Isolator installed between the computer and the electrical power source blocks the only path through which noise can pass. This ensures complete protection against all power-line noise regardless of its source. (See table.)



More Ultra-Isolator Advantages.

Distribution— A dedicated line offers only limited noise protection—and for only one piece of equipment. A Topaz Ultra-Isolator offers complete protection and also offers output receptacles for as many as 21 pieces of sensitive electronic equipment. This feature allows users to distribute noise-free AC power to an entire computer system simply by plugging each piece of equipment into the Ultra-Isolator.

Convenience — Installing a dedicated power line often requires building modifications that can disrupt normal facility operations for days. A Topaz Ultra-Isolator typically can be installed in less than one hour — and with practically no inconvenience.

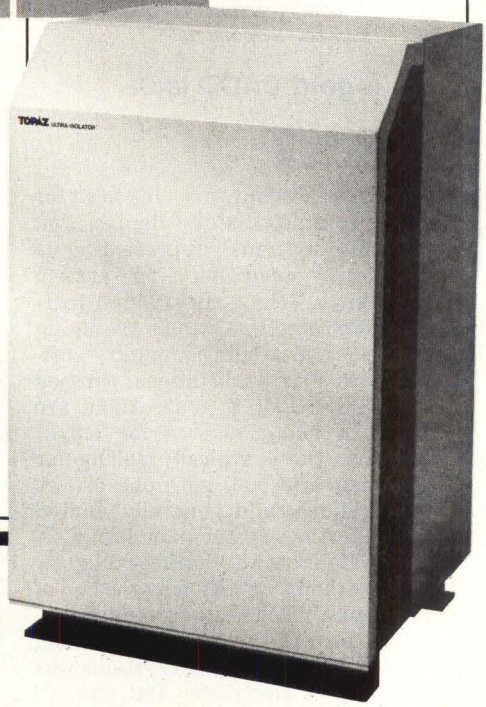
Economy — In most cases, the cost of an Ultra-Isolator will be considerably less than the cost of a dedicated power line. And unlike a dedicated line, a Topaz Ultra-Isolator can be moved if the computer is ever relocated.

Topaz Ultra-Isolators are available in 50 Hz and 60 Hz models and in styles and power ratings to suit virtually any application. Other features include UL listing, attractive computer-room styling, quiet and efficient operation and guaranteed performance.

Why install a dedicated power line when you can provide more protection for more equipment in less time for less money with a Topaz Ultra-Isolator? Contact us today for the **complete** solution to noise-related computer problems.

SOURCES OF NOISE	PROTECTION	
	DEDICATED LINE	*ULTRA-ISOLATOR*
Electrical devices within your facility	YES	YES
Electrical devices in neighboring facilities	NO	YES
Lightning	NO	YES
Power-network switching	NO	YES
Switching of power-factor correction capacitors	NO	YES

Topaz Electronics Division,
3855 Ruffin Road
San Diego, CA 92123
(619) 279-0831
TWX: 910-335-1526

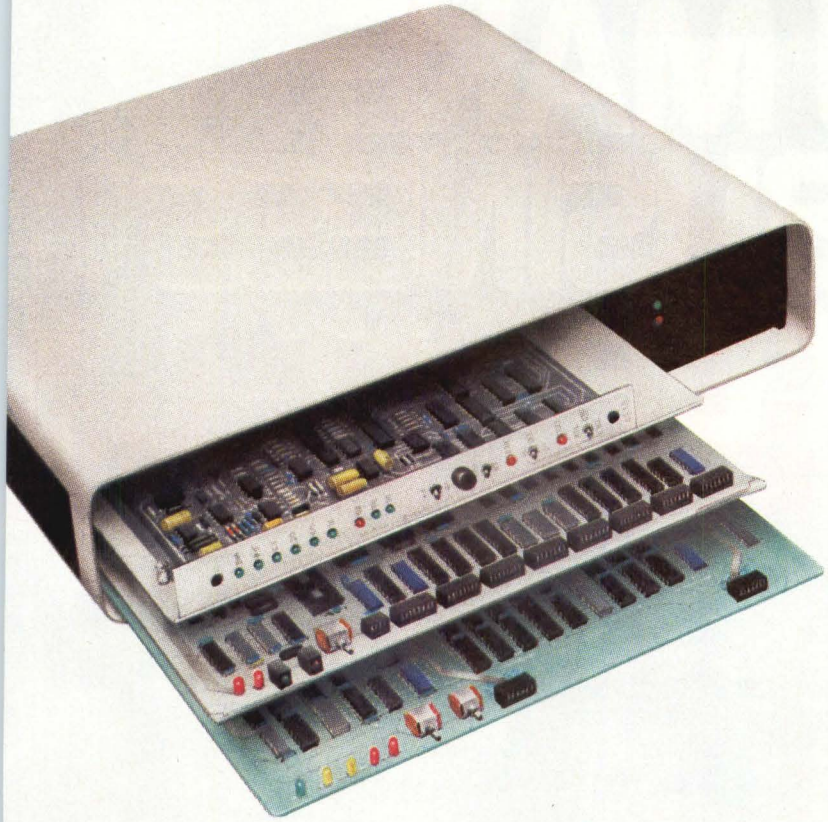


TOPAZ
SOLUTIONS TO POWER PROBLEMS™

CIRCLE NO. 36 ON INQUIRY CARD

Minicomputer users:

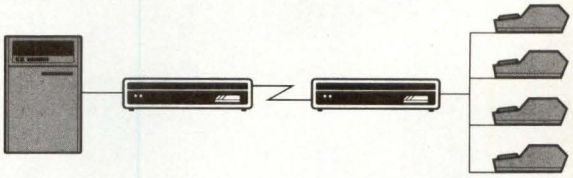
Timeplex offers a one-stop system solution for communicating with multiple remote terminals. Economically.



Asynchronous statistical multiplexer

Synchronous statistical multiplexer

High speed modem



The Timeplex E/SERIES is a complete data concentrator system designed to economically link clusters of remote terminals to your minicomputer.

E/SERIES: Cuts communications costs. Suddenly, saving communications costs by linking several terminals to one shared telephone line becomes easy.

Unlike the competition, the Timeplex E/SERIES simplifies the challenge of point-to-point communications by incorporating three functions in a single compact unit. One system offers you a statistical multiplexer supporting 4 to 16 asynchronous channels, *plus* an optional statistical multiplexer for an additional synchronous channel, *plus* an optional integral high speed modem.

E/SERIES: Puts it all together. Putting three functionally distinct modules in one enclosure eliminates external communications units and bulky, expensive cables. And, a minicomputer interface option further reduces costs. The result: System planning and installation is extremely simple. Reliability is enhanced. Costs are dramatically reduced.

Free step-by-step Guide. This easy-to-understand booklet contains all the facts on how to remote your terminals, simply *and* economically. Just write or call Timeplex for your free copy.

For the name of the E/SERIES stocking distributor nearest you, call 201-368-0736.

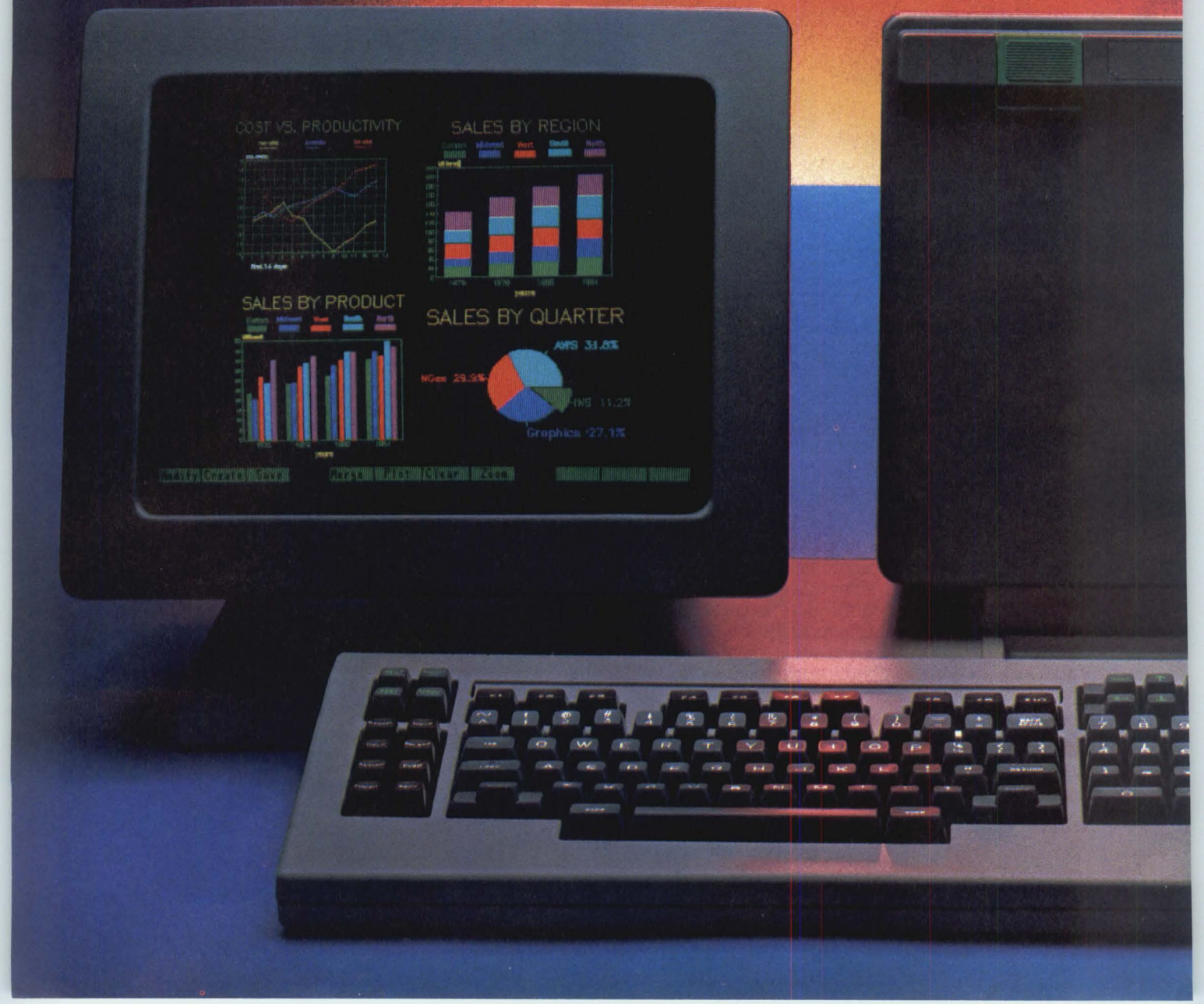
Timeplex, Inc./One Communications Plaza/ Rochelle Park, N.J. 07662.

Timeplex®

The technology leader in data communications

CIRCLE NO. 37 ON INQUIRY CARD

NOW ANYBODY CAN MAKE THEIR BUSINESS LOOK GREAT.

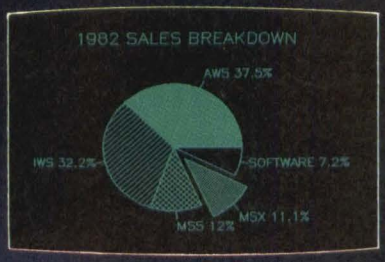


The explosion in business graphics is just getting started.

To help OEM's cash in on the boom, Convergent Technologies now offers spectacular, low-cost graphics hardware, plus revolutionary software that lets even untrained users create sophisticated business graphics.

Picture-perfect hardware.

There are two ways to add great graphics to a Convergent system.



The monochrome option comes on a single Multibus® board that plugs into any IWS™ workstation. Using a dedicated 8MHz 16-bit processor with on-board ROM and RAM, it displays either of two 656 x 510 bit maps on the existing high resolution monitor.

Color comes as an option in our new AWS™ Turbo workstation. Using the same dedicated processor approach, you get dazzling 64-color images with 432 x 319 resolution.

A complete set of graphics primitives gives high-level languages access to all the features of both systems.

Sensational Software.

Now generating business graphs and charts is as simple as using the highly-acclaimed Multiplan™ spreadsheet program.

With Convergent's enhanced Multiplan and our proprietary Business Graphics Package, you just select a range of rows and columns for graphing in any of several standard formats (pie and bar charts, line graphs, etc.)

If you want to get creative, use our unique graphics editor to resize, rescale, move, and combine charts—interactively, right on the screen. Then produce presentation quality hard copy on an inexpensive plotter.

Convergent graphics software is 100% interchangeable between color and monochrome systems; shading and cross-hatching are automatically substituted for color when necessary!

The Convergent OEM revolution continues.

Combine *accessible* graphics power like this with all our other advantages, and it's easy to see why so many OEM's are making major, long-term commitments to Convergent systems.

Shouldn't you get the full story now?

Convergent Technologies

Where great ideas come together.

Call toll-free (800) 538-7560; in Calif. (408) 727-8830 or return this coupon.

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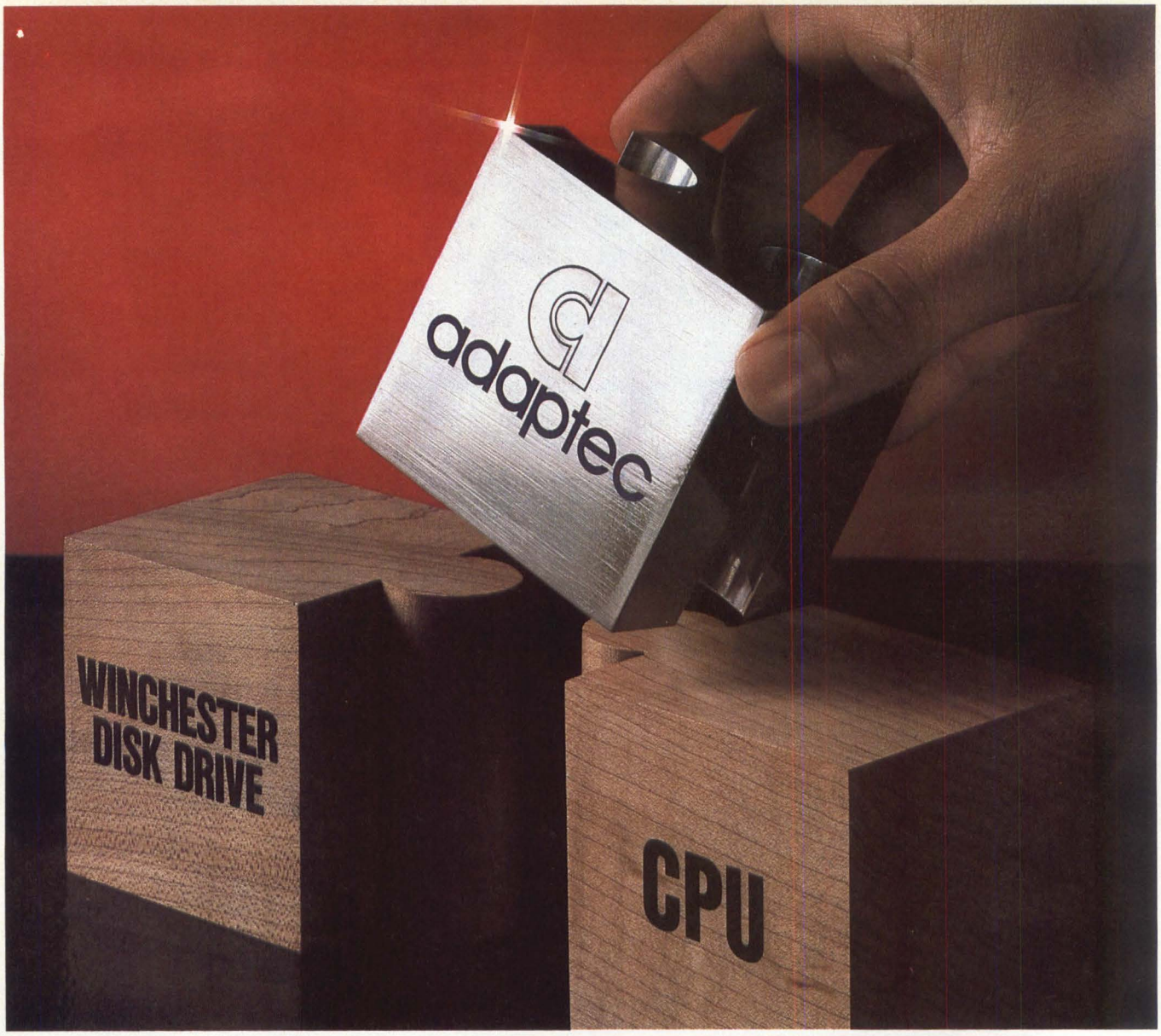

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The Adaptec Connection: Controllers that actually enhance your system's I/O capability. Superior quality and reliability. Detailed attention to customer support. Leader-of-the-pack performance at low cost. Sound like the connection you need for your Winchester? Read on.

The High Performance Connection: Adaptec intelligent ANSI SCSI (SASI) bus controller devices. Fully-featured Adaptec LSI 5000 Series Chip Sets and Controller Boards complete your high performance, multi-tasking system perfectly. Popular ST-506, SA-1000 and Q-2000 drive interface compatibilities assure a tight fit no matter what drives you select. And a range of features allowing complete device independence, logical block addressing, disconnect/reconnect, and a 10Mbit/second transfer rate mean that these low cost controllers won't be a performance bottleneck.

The Very Low Cost Connection: The Winchester Controller Chip™. This device lets you design your own controller board with as few as eleven "glue" chips. You still get powerful features like automatic error correction and software selectable sector sizes. You still get Adaptec reliability and support. But you also get costs (and margins) that let you compete in the personal computer marketplace. Finally, a Winchester controller that costs a fraction of the drive.

Adaptec people are experts in systems, drive and LSI technology. We even provide complete PCB design and manufacturing information for volume chip customers. And since you can build or buy, and choose the right performance level for your needs, you don't waste money. So don't waste time. Call Don Rector, vice president of marketing, at (408) 946-8600. Or write Adaptec, 1625 McCarthy Boulevard, Milpitas, CA 95035.

adaptec, inc.

The best controller connection you can make . . . or buy.

CIRCLE NO. 38 ON INQUIRY CARD

Continues from page 49

rose from $233 million during last year's first quarter to $303 million. Many analysts expect DEC's second-quarter earnings to be down, but this does not concern George R. Balaschak, a DEC follower and vice president at First National Bank of Boston. Balaschak expects earnings per share for the year to be between $6 and $6.50, but to climb to about $8 per share in 1984 because of new products. He notes that DEC experienced flat growth in 1975 during the last recession. He questions whether DEC can make up for lost growth in the second half of this year, but expects the personal-computer line to help.

Besides noting the strength of service during the annual meeting, Olsen stressed long-term emphasis in several product areas, notably its disk business. DEC has manufactured disk drives for several years, and Olsen has considered the company two to three years behind IBM Corp. until now. "We want to become a leader in disks, and now we are equal with IBM, or maybe better," he claims, referring to the cost per bit stored in two rack-mountable storage devices introduced by DEC at last year's National Computer Conference—the RA60 and RA81—a DEC spokesman says. Olsen says DEC has the technology in place to be a leader, but will not elaborate.

In pointing to DEC's heavy investment in technology, and noting that the company's heavy investments in engineering have hurt the financial statement, Olsen focused on other product areas—semiconductors and personal computers. He notes that DEC will make VAX superminicomputers on one or four chips, but says those products are still two to four years away. Research and engineering expenditures for the first quarter were up 39 percent over last year's period to

BOX SCORE OF EARNINGS

This monthly table lists the revenues, net earnings and earnings per share in the periods indicated for companies in the computer and computer-related industries. Parentheses denote losses. Comments are from corporate summaries unless otherwise noted.

Company	Period		Revenues	Earnings	EpS
Ayden Corp.	9 mos	9/25/82	88,012,000	6,892,000	1.47
	9 mos	9/26/81	75,458,000	4,851,000	1.04
Burroughs Corp.	9 mos	9/30/82	3,066,668,000	99,715,000	2.37
Computer Consoles, INC.	9 mos	9/30/82	43,909,312	4,110,192	.73
	9 mos	9/30/81	33,438,378	3,591,300	.64
Computer Sciences Corp.	26 wks	10/1/82	330,960,000	9,369,000	.70
	26 wks	10/2/81	297,632,000	6,912,000	.51
Convergent Technologies, Inc.	9 mos	9/30/82	54,086,000	6,946,000	.40
	9 mos	9/30/81	4,773,000	(741,000)	(.07)
CPT Corp.	3 mos	9/30/82	37,041,000	3,394,000	.21
	3 mos	9/30/81	30,012,000	3,349,000	.21
Cray Research, INC.	9 mos	9/30/82	78,492,000	6,833,000	.50
	9 mos	9/30/81	61,651,000	10,163,000	.74
Genrad, Inc.	9 mos	10/2/82	130,675,000	4,572,000	.54
	9 mos	10/3/82	117,748,000	(1,925,000)	(.25)
Hazeltine Corp.	9 mos	9/30/82	114,562,000	4,108,000	2.00
	9 mos	9/30/81	108,308,000	3,004,000	1.46
Informatics General Corp.	year	9/30/82	165,646,000	6,133,000	1.44
	year	9/30/81	139,409,000	4,426,000	1.27
Lexidata Corp.	year	9/30/82	28,561,600	3,134,300	.58
	year	9/30/81	14,529,100	2,053,300	.50
Logicon, Inc.	6 mos	9/30/82	32,884,000	1,529,000	.76
	6 mos	9/30/81	28,690,000	977,000	.48
NBI Inc.	3 mos	9/30/82	27,168,000	3,123,000	.31
	3 mos	9/30/81	19,273,000	2,235,000	.24
NCR Corp.	9 mos	9/30/82	2,463,825,000	140,440,000	5.26
	9 mos	9/30/81	2,387,892,000	118,077,000	4.37
Rolm Corp.	3 mos	10/1/82	115,000,000	8,300,000	.47
	3 mos	10/1/81	83,000,000	6,700,000	.38
Tandem Computer, Inc.	year	9/30/82	335,899,000	37,283,000	.95
	year	9/30/81	208,397,000	26,549,000	.72
Triad Systems Corp.	year	9/30/82	82,000,000	3,300,000	.47
	year	9/30/81	78,000,000	8,700,000	1.35
Tymshare, Inc.	9 mos	9/30/82	231,719,000	11,117,000	.93
	9 mos	9/30/81	218,875,000	16,115,000	1.37
Visual Technology, Inc.	9 mos	9/30/82	18,305,693	2,031,892	.56
	9 mos	9/30/81	12,336,834	1,286,141	.42

Comments: **Convergent Technologies, Inc.** revenues for the nine-month period represent an 11-fold increase over the same period in 1981. Third-quarter earnings were $3,939,000, up from a loss of $470,000. The company attributed the increases to greater acceptance of its products. **Tandem Computers, Inc.** noted that its seventh straight year of record revenues was the result of a continued commitment to new-product development. The company said it spent $33 million on R & D and $63 million on plants and equipment for the fiscal year. **Triad Systems Corp.** blamed weak economic conditions and high interest rates for its drop in earnings. The company said the fourth-quarter results, while lower than 1981, showed improvement over the previous three quarters. Fourth-quarter earnings were $1.6 million, compared to $3.3 million last year, a loss of 30¢ per share. **Tymshare, Inc.** said the sale of its bank-credit-card-processing business helped third-quarter earnings show only a small decline from $2,813,000 in 1981 to $2,260,000, or 5¢ per share. **Visual Technology, Inc.** said sales for its third quarter were about $1 million below expectations. Revenues for that quarter were 5,800,304 up 18 percent from $4,917,367 in the previous year. The company said the cause was a one-time production problem created by a supplier had been corrected; thereforethe company expects a return to sales growth.

$101 million, or 11 percent of revenues.

The personal computers are being shipped; 1000 are now in test sites, and Olsen expects production to be in full tilt by the end of winter. A DEC spokesman says shipments are on schedule.

—*Lori Valigra*

Victor and Sirius merge under Sirius president Chuck Peddle

In a move to strengthen the Sirius/Victor marketing effort, Sirius Systems Technology, Inc., has merged with Victor Business Products, its exclusive U.S. distributor. The new company, which will be headquartered at Sirius' Scotts Valley, Calif., facility, is headed by Chuck Peddle, founder of Sirius. The merger comes a year after Victor disclosed its distribution plan with Sirius and introduced the Victor 9000 microcomputer.

As of press time, the name of the new entity had not been decided. The original name, Victor, Inc., was not accepted by the State of Delaware, where the company is being incorporated, says Sirius finance vice president David Monroe. He expects the company to emerge as Victor Technology, Inc.

The new company is being established as an independent, privately held corporation, although Kidde, Inc., Victor's parent company, owns a majority share in the enterprise. The transaction creating the company involved the acquisition of Victor Business Products by Sirius, which paid for the Chicago-based calculator and cash-register company by issuing Kidde preferred shares. Kidde had invested $2.5 million in Sirius in return for preferred shares equivalent to 5.4 million common shares, Monroe says. Monroe adds that all outstanding common stock would total 14.5 million shares. Of that, Kidde could hold as much as 67 percent if it exercises all its preferred stock

options, a Kidde spokesman says.

Monroe declines to specify the capitalization of the new firm, citing the company's plans to make a public stock offering this year. A Victor spokesman says the combined company would have 1982 sales of approximately $180 million, including the $80 million Peddle estimates Sirius made in its first year of operation.

The new organization will market the Sirius Intel 8088-based desk-top computer and Victor Business Machines' desk-top calculators and electronic cash registers. The sales, marketing and product-development efforts for all three lines will be centralized at the Scotts Valley facility. With the new entity, the Sirius product is expected to move beyond the 50 Victor branches in the U.S. that have handled the product to date. Victor also has 700 dealers. Peddle says he plans to establish a 1000-outlet dealer network, about half of which will be current Victor dealers.

Chuck Peddle *has been named president of a new unnamed company resulting from the merger of Peddle's Sirius Systems Technology, Inc., and Victor Business Products, Sirius' U.S. distributor.*

Peddle says a particular strength of the new company is Victor's combination of direct and dealer locations. The Victor-owned outlets will continue to concentrate on major end-user sales but will also have responsibility for dealers in their areas, Peddle says.

The Sirius system will still be sold under the Sirius name in Europe, where the company has had the bulk of its worldwide sales to date. The company will be prohibited from using the Sirius name in the U.S. as it had planned to do after 3-year Victor contract ran out. Sirius' rights to the name were lost in a suit settled in October with Sirius Software, Sacramento, Calif.

Ed Carlson, who was president of Victor Business Products, has been named senior marketing vice president of Kidde's Victor United Group. —*Geoff Lewis*

ESPRIT III™

goes TVI-950 one better.

The new Hazeltine Esprit III™ is a plug-to-plug replacement for the TeleVideo TVI-950. Same command set. Same keyboard layout. The same features. Even the same user-PROM capability.

But Esprit III goes TVI-950 one better. And that one important difference is price. Esprit III costs $300 less. In fact, it costs $100 less than TeleVideo's far less capable TVI-925.

Look at the numbers. TVI-950 performance for less than TVI-925 cost. You'll agree. Esprit III is the best one.

	Esprit III	TVI 925*	TVI 950*
Buffered mode	**Yes**	Yes	Yes
Programmable function keys	**Yes**	No	Yes
Line graphics	**Yes**	No	Yes
Page/line transmit	**Yes**	Yes	Yes
Smooth scrolling	**Yes**	No	Yes
Price	**$895**	$995	$1,195

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The new terminal technology.

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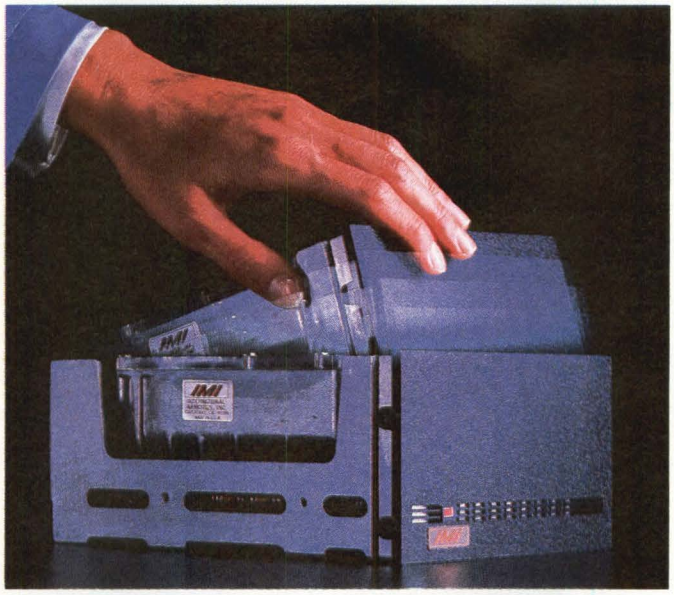
IMI reinvents the 5¼" Winchester. And backs it with a 2-year warranty.



NOW FASTER • ACCESS TIME • 68 MSEC (INCLUDES SETTLING TIME)

If our new 5000H Series drives weren't the most reliable 5¼" Winchesters ever built, we wouldn't give them an unprecedented 2-year warranty.

Don't expect to use it, though.

5000H Series drives are made to withstand the everyday abuse known as "normal system usage." And to give continuously superior performance in even the most demanding applications.

So the overwhelming odds are that the 2-year warranty will expire long before the drive ever does.

THIN-FILM PLATED MEDIA PRESERVES DATA INTEGRITY, INCREASES STORAGE CAPACITY.

To ensure that 5000H drives withstand harsh treatment without sacrificing data integrity, the media is thin-film plated. Thin-film plating is orders of magnitude more shock resistant than ferric oxide coatings and many times harder. Because it's not easily damaged, data is not easily lost, and the drive remains in service.

Thin-film plated media also allows greater bit densities, as much as 10,700 bpi. This has enabled IMI to up the unformatted storage capacity of the 5021H drive, for example, to 21 Mbytes.

And to improve data integrity even further, we've maintained industry standard formats and transfer rates with lower track densities.

NEW 2-PIECE SHOCK-MOUNTED CHASSIS EXTENDS SERVICE LIFE.

To protect the heads and disks, we've recessed the head/disk assembly inside a rigid, die-cast frame enclosure. Integral shock mounts at the center of gravity insulate the head media interface from the environment.

Besides reducing acoustical noise, this 2-piece design minimizes vibration and shock loads transferred to the heads and disks during installation and use. Even the printed circuit boards utilize the shock-mounted design to lessen stress on the components.

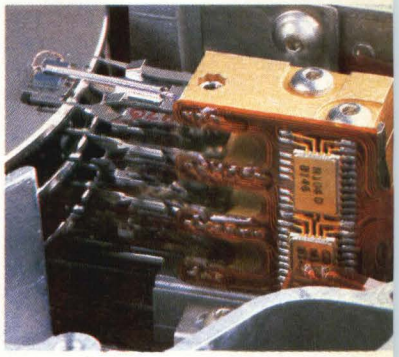
NEW THERMALLY STABLE DESIGN ENSURES OPTIMAL HEAD POSITIONING.

5000H Series drives have a deeply finned die-cast base and cover that increase both the stiffness of the structure and the surface area for heat transfer.

When thermal distortion of the head/disk assembly is minimized, head positioning is optimized. And the combination of temperature stability and lower track densities substantially reduces the potential for off-track errors.

HEAD-MOUNTED PREAMPLIFIER PROVIDES MAXIMUM NOISE IMMUNITY.

Only IMI puts the read/write preamplifier on the head stack, where it greatly reduces EMI/RFI noise susceptibility. This, coupled with the inherently higher signals of plated media (>50%) and the shielding of the all metal frame, yields the best signal to noise ratio in the industry.

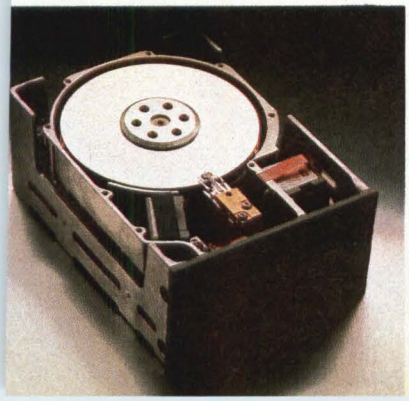


A FULL LINE OF HIGH PERFORMANCE 5¼" WINCHESTERS.

Although the unformatted storage capacity ranges from 6.38 Mbytes to 21 Mbytes, depending upon the drive model and interface, all 5000H Series drives feature:

- 68 msec access time.
- 303 tpi.
- 3600 rpm.

For specification sheets, call or write: International Memories Incorporated, 10381 Bandley Drive, Cupertino, CA 95014. (408) 446-9779. TWX: 910-338-7347



IMI

We're at it again.

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TOWER 1632. IT TOWERS OVER THE MINICOMPUTER. AND FITS UNDER A DESK.

Tower™ 1632.

The power and performance of a minicomputer. At the size and price of a micro.

Only 29 inches tall. Yet it casts its shadow over everything before it. And, upon the system builder with the foresight to sell it, it will confer a truly towering advantage.

This single sleek package conceals as much as two megabytes of memory. Plus 60 megabytes of mass storage. And up to 5 additional add-on modules (each seven inches wide) can boost mass storage to one billion bytes.

Tower 1632's capacity to interface is equally vast. From networking to peripherals, it's as ready for the future as it is right for today.

We enhanced its full-scale UNIX* operating system for maximum software capability and flexibility.

And the NCR name guarantees maximum support, with more than 16,000 field engineers around the world.

But we've barely begun to explore the ground floor. Call us to learn more about this towering achievement.

The OEM price starts under $10,000. The performance never stops.

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*UNIX is a trademark of Bell Laboratories.

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IMAGE PROCESSING: THE FASTEST, LEAST EXPENSIVE WAY TO FIND OIL.

Where to drill? Traditionally, exploring a 25,000 square mile frontier for an answer to that question could take months. And cost over a million dollars for consultant fees and aerial photography.

Today, a DeAnza Image Processing System can narrow the same frontier to a few miles using roughly $100.00 worth of satellite data. *And* help project the final drill site in less than thirty days. Remarkably, the system itself is paid for several times over, exploring just a single frontier.

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Image processing is the *only* way all geological data can be considered *simultaneously:* LANDSAT, SEASAT, radar, magnetic, gravity, topographical, etc. Step-by-step, a DeAnza Image Processing System graphically displays faults, folds and stratigraphic units to pinpoint areas small enough for seismic exploration. Finally, the system enhances seismic data gathered in the field to project final drill sites. And these projections stay completely confidential, because they're done in-house.

Enhanced seismic data of an oil find.

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Gould/DeAnza is one of the world's leading suppliers of image processing systems. For one very good reason. No other supplier offers systems with power, flexibility, and range of operations equal to ours. Nobody. Call or write us today. Let us help you explore the possibilities of image processing. It may be the richest find you make this year.

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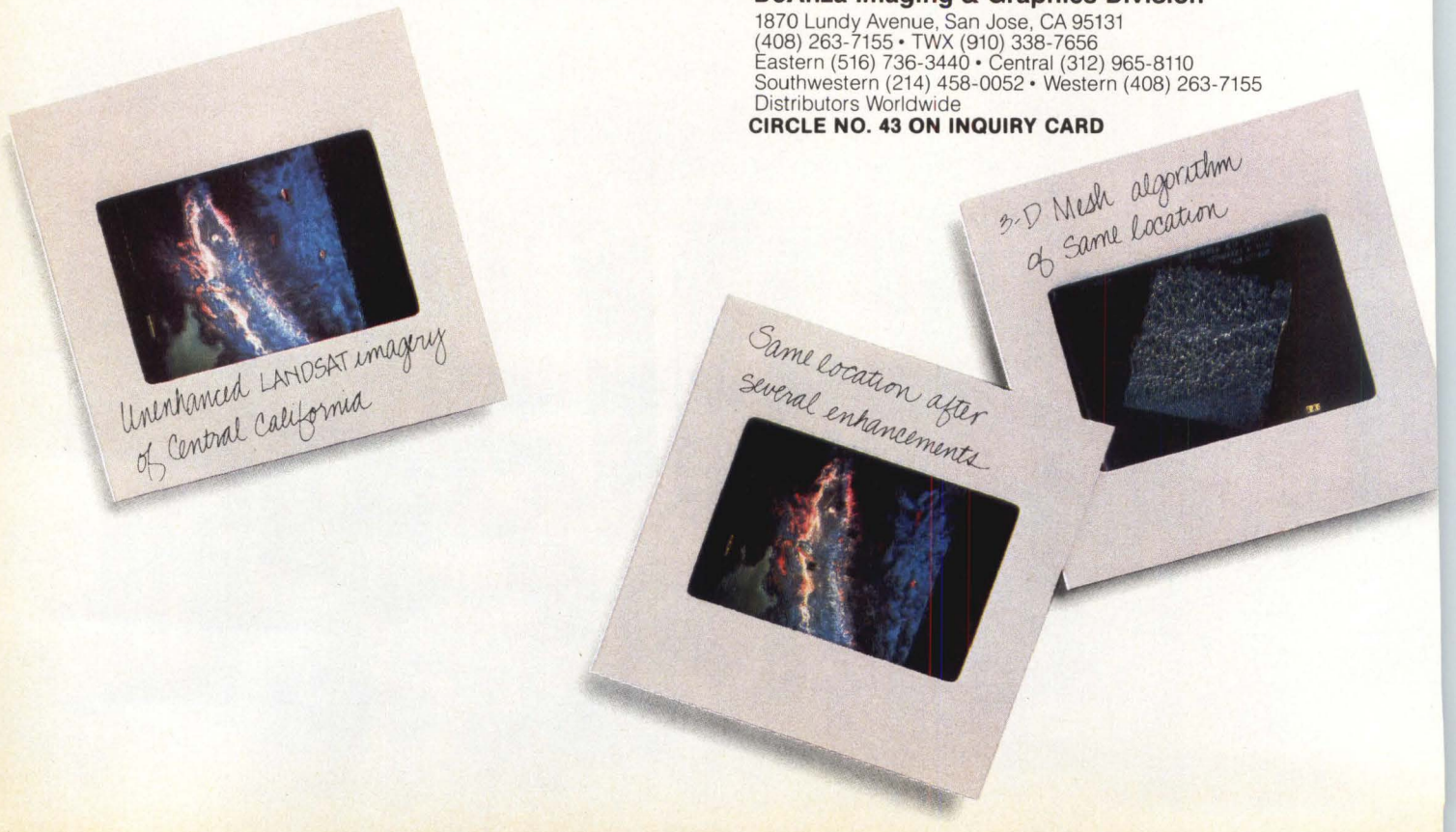

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Comdex Europe's attendance low, but attendees were high-quality

In general, exhibitors at the first Comdex Europe '82—mostly U.S. companies—regarded the quality of attendees at the Amsterdam show as very high and were impressed that they came from all over Europe. But most exhibitors chose the word "quiet" to describe the show's visitor numbers. Peter Young, a spokesman for the Framingham, Mass., Interface Group, the show's sponsor, estimates that more than 4000 who attended fit Interface's profile of an Independent Sales Organization. ISOs are the distributors and retailers that form the main target audience for Comdex events and account for the show's popularity among U.S. exhibitors. The exhibitors at Amsterdam met some first-rate distributors, but found the retailer population fairly thin.

Young estimates that the total ISO universe in Europe numbers 25,000 and points to efforts to attract a much higher proportion of them to Comdex Europe '83, including mailings to attendees after the '82 event to check what periodicals they read. Interface president Sheldon Adelson says that more than 60 percent of exhibitors had signed to appear at Comdex Europe '83 by the end of the '82 show.

Comdex Europe coincides with several major and established European computer shows—notably Sicob in Paris, Compec in London and the biennial Systems Show in Munich, Young acknowledges. The last will probably lure some West German ISOs away from Comdex Europe '83. But Young notes that all those shows—like the National Computer Conference in the U.S.—are aimed at a more diverse audience than Comdex, including end users.

Young also notes that the '82 Amsterdam show was no more "quiet" than the first Comdex events staged in the U.S. Young's view is supported by Robert Kresek, worldwide third-party marketing manager with Hewlett-Packard Co., one of the largest exhibitors at the Amsterdam event. "Comdex Europe compares well with the early Comdex exhibitions in Las Vegas, and HP will probably go ahead with a booth at the 1983 Amsterdam show," Kresek declared at the show.

Kresek regards Comdex Europe '82 as an appropriate arena in which to announce major enhancements to HP's value-added system supplier program for OEMs. The main new feature is a plan under which an OEM with a software package designed to run on HP machines receives a compensatory payment of as much as 6 percent of the value of HP hardware shipped to an end user if HP supplies the hardware directly. This would deprive an OEM of a markup. "This plan will be costly for HP," Kresek admits, "but it will ensure that existing OEMs stay with HP, and we hope it will convert OEMs to HP that are having problems with their existing hardware suppliers. With this plan, we believe HP is the first vendor to come up with a creative solution to conflicts with OEMs."

Some U.S. companies at the Amsterdam show were not satisifed enough to want to appear at Comdex Europe '83. Tom Reynolds, European marketing vice president for Onyx Systems, notes that his company's European distributor network is in place and that Onyx had hoped to make contact with dealers at Amsterdam. They are needed to work with Onyx's European distributors, who went to the show to meet dealers as well as to discuss business with each other. "But there are not too many dealers here," Reynolds wistfully observed at the show, "so we will not be appearing at Comdex Europe '83."

—Keith Jones

Software gives MUMPS users graphics, multiterminal DEC professional support

MUMPS, the interactive high-level language and operating system with powerful file-handling capabilities, is adopted most widely among the Digital Equipment Corp. user community. Now, two European software houses, both dedicated to MUMPS work, have developed products that should enhance the software's attractiveness for DEC users.

HRD Ltd., Birmingham, England, offers a product that can generate a variety of graphics from MUMPS files, while Structured Data Systems, Newton Stewart, Scotland, has developed a version of MUMPS that supports as many as eight

concurrent terminals on a DEC Professional computer. This is the personal machine intended by DEC for single-user work only.

Bill Davies, sales manager of HRD, says his company is seeking U.S. distributors for its product, Business Graphics Package. Davies stresses potential distributors must have DEC software expertise and, preferably, involvement with DEC Standard MUMPS, DSM. He notes that in Europe, DEC has expressed an interest in adding the product to its DEC Classified Software catalogue. Davies says DEC is attracted by the VAX version of Business Graphics Package.

He stresses that DEC users in the U.S. can buy the product now if they order directly from HRD. User configurations must include one essential hardware ingredient, the VT125 graphics terminal, and run under DSM Version 2.1. Davies quotes about $1200 as the price of a license allowing use on two VT125s hosted by a PDP-11, and about $200 for each extra VT125. The VAX version will sell for about $1520, and Davies says the extra charge is justified by an interface allowing RSX and RSTS files to be transferred to the Business Graphics Package via DSM.

Using HRD Ltd.'s Business Graphics Package, *a DEC VT125 graphics terminal shows bar charts generated from DEC Standard MUMPS files. Shown at the recent U.K. MUMPS User Group meeting in London are Richard Davies (right) managing director, and Bill Davies, sales manager, of the company.*

HRD technical director Steve Rawlinson explains that the Business Graphics Package is designed to reformat MUMPS files so they can be handled by Regis, a microprocessor-hosted executive that resides in the VT125. He stresses that no modifications have been made to Regis.

The graphics package can be driven by an MUMPS application program. Supplied with the necessary file and key information, it can extract the required records and format the data so Regis can generate any of a variety of graphics, notably bar charts and histograms.

Rawlinson says the Business Graphics Package is written in MUMPS so users can easily extend it for their requirements. A user might break the license by copying the package, but Rawlinson says that a user's license would be removed if this happened.

HRD managing director Richard Davies explains that his company's main business is producing general commercial applications using MUMPS. Structured Data Systems has developed its own version of MUMPS called Standard MUMPS Micromachine, which supports language and data structures resembling those of DSM. A version called SMM-11 is available for PDP-11 machines. Now, the DEC Professional models, 325 and 350, can host new implementations called SMMFL and SMMWI.

According to the Structured Data Systems specification for the Professional versions, a theoretical maximum of 40 concurrent tasks can share the I/O devices on a Professional machine, and support for three to eight terminals is achievable. SMMWI needs an RD50C Winchester disk unit, while SMMFL is designed for a 325 with an RX50 floppy drive.

The specification for SMM in general notes that SMM does not provide the features of DSM-11 that are used by larger installations, such as journaling and spooling.

SDS director Mike Davey points to his background with DEC as a European support specialist for DSM.

Davey notes that SMM for the Professional machines will be made available in the U.S. by Computer Technology Inc., Germantown, Tenn., a Memphis suburb. CTI's president, Joe Lerner, says the product will be sold under the name CSM 350, and will retail at prices between $500 and $1000, depending on whether users want it bundled with another SDS product, a word-processing system called SMMWPS. Davey expects DEC in Europe to add the Professional versions of SMM to the DEC Classified Software catalogue.

DCS is similar to the external application software library maintained by DEC in the U.S. Davey explains that DEC in Europe is interested because SMM will enhance the sales prospects of Professional machines in the enormous market for personal computers among doctors. Medicine has always been a major application for MUMPS. —*Keith Jones*


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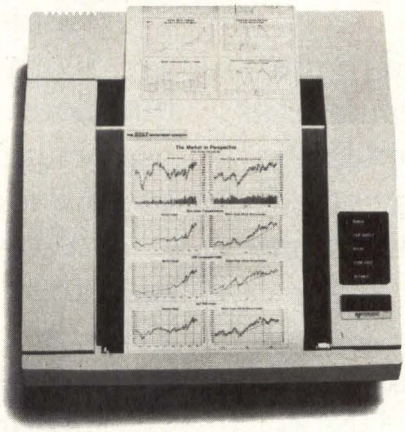

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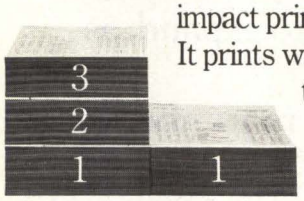

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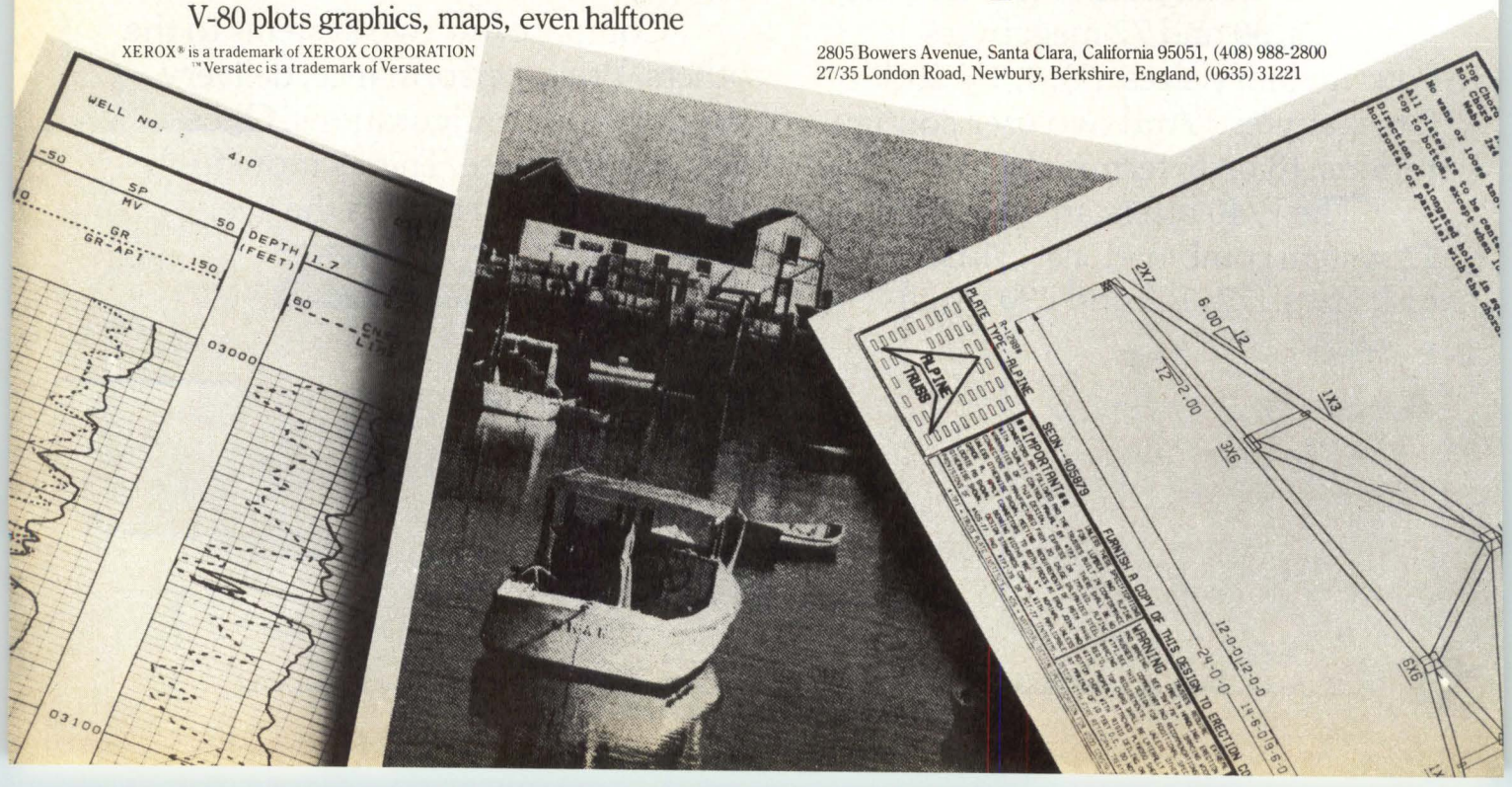


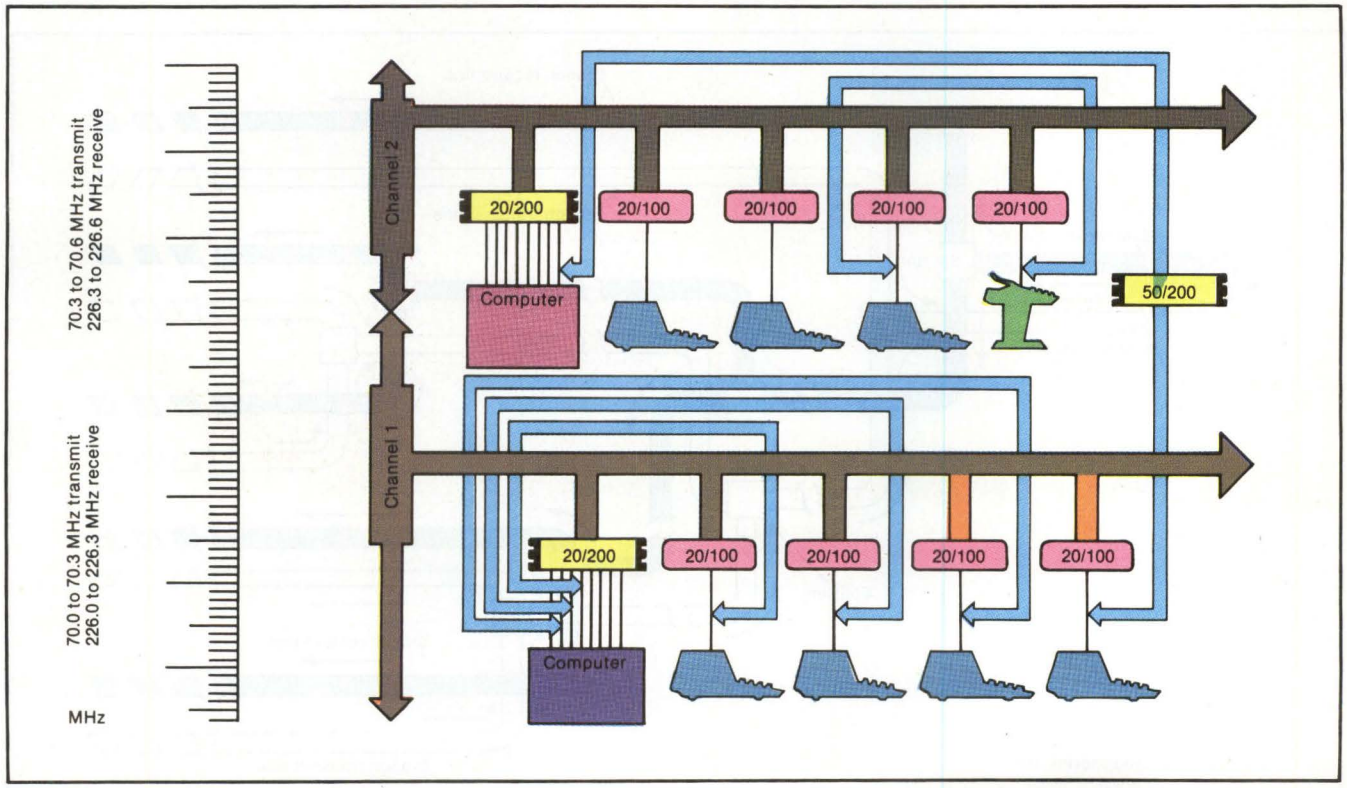
Pioneering vendors attempt to develop infant broadband local net market

By Dwight B. Davis

Just one year ago, the controversy about the relative merits of single-channel baseband networks and multi-channel broadband networks was at its peak. While far from settled, the debate has moderated considerably, with most vendors in each camp admitting that each type of local-area network meets the requirements of certain types of users. The standards issue on the baseband side has also cleared considerably over the past several months (MMS, August, 1982, p. 29), with a slightly modified Ethernet scheme emerging as the single-channel flagship for bus-architecture networks using the carrier sense multiple access with collision detection (CSMA/CD) technique. IBM Corp. will probably soon challenge Ethernet's supremacy by introducing its long-rumored token-passing-ring LAN, but, for now, the Ethernet forces are taking a breather.

Not so for the several vendors selling broadband LANs. Although a truce exists between the baseband and broadband camps, with some vendors selling products of both types, the broadband vendors are increasingly fighting among themselves to gain market acceptance for their LAN solutions (see "CATV foundation breeds diverse broadband networks," p. 88). With many crucial broadband issues still unresolved—or unaddressed—by standards bodies, each LAN vendor hopes to gain enough market share to ensure that its design will succeed.

The broadband LAN market is still limited, with only



Sytek, Inc.'s LocalNet 20's logical layout *illustrates the basic configuration typical of most single-cable broadband LANs. Channels are defined through the use of frequency-division multiplexing, and each channel is split into mirrored transmit and receive sections of the frequency spectrum. Computers with parallel ports or clustered terminal nodes access the network through Sytek's multi-port 20/200 devices, while serial-interface devices access the network through 20/100 packet communications units, which can each support two serial devices. Sytek also sells an inter-channel bridge, the 50/200, which routes packets originating from devices on one frequency channel to devices residing on a different frequency channel.*

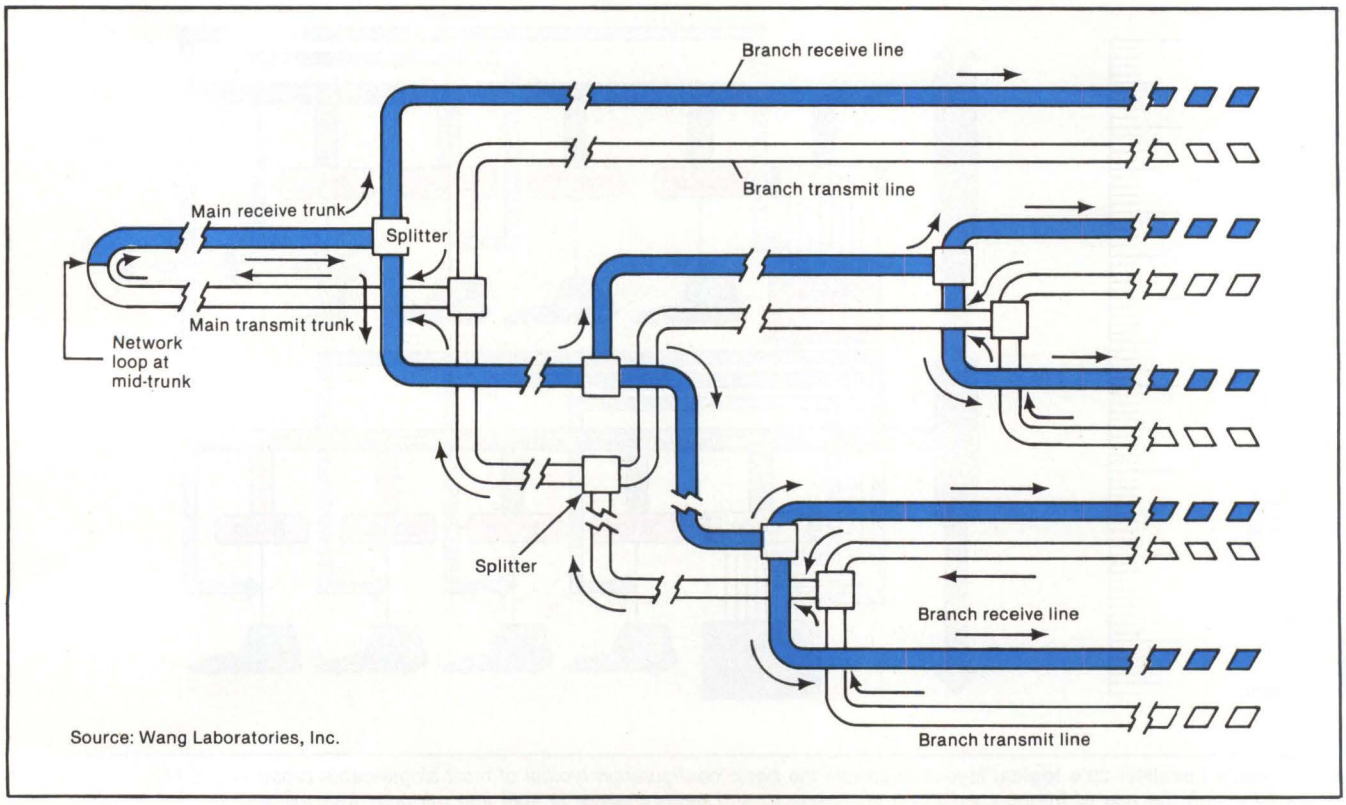
about 720 intra-company networks installed as of 1982, according to figures from Strategic, Inc., San Jose, Calif. By 1986, the market research firm predicts, approximately 7000 broadband nets will be installed. While office-automation applications are expected to account for a large percentage of the future applications, the office market is just a small part of the current broadband market, says Ralph Ungermann, president of Ungermann-Bass, Inc., Santa Clara, Calif. "The market is now mostly CAD/CAM users, R&D laboratories and universities," he says. "People in these settings are working with leading-edge technologies, so they're not afraid to install broadband networks. Also, these people have big communications problems to solve."

As distributed computers and terminals become more commonplace in commercial environments, broadband vendors expect their LANs to add office applications to the existing factory-floor and research-center bases. This migration is especially likely into companies with mixed data- and video-communications needs—traffic that broadband is ideally suited to carry. Broadband coax can also carry voice traffic, but the relatively high expense of broadband voice equipment compared to standard PBX equipment has limited customer demand for this feature so far.

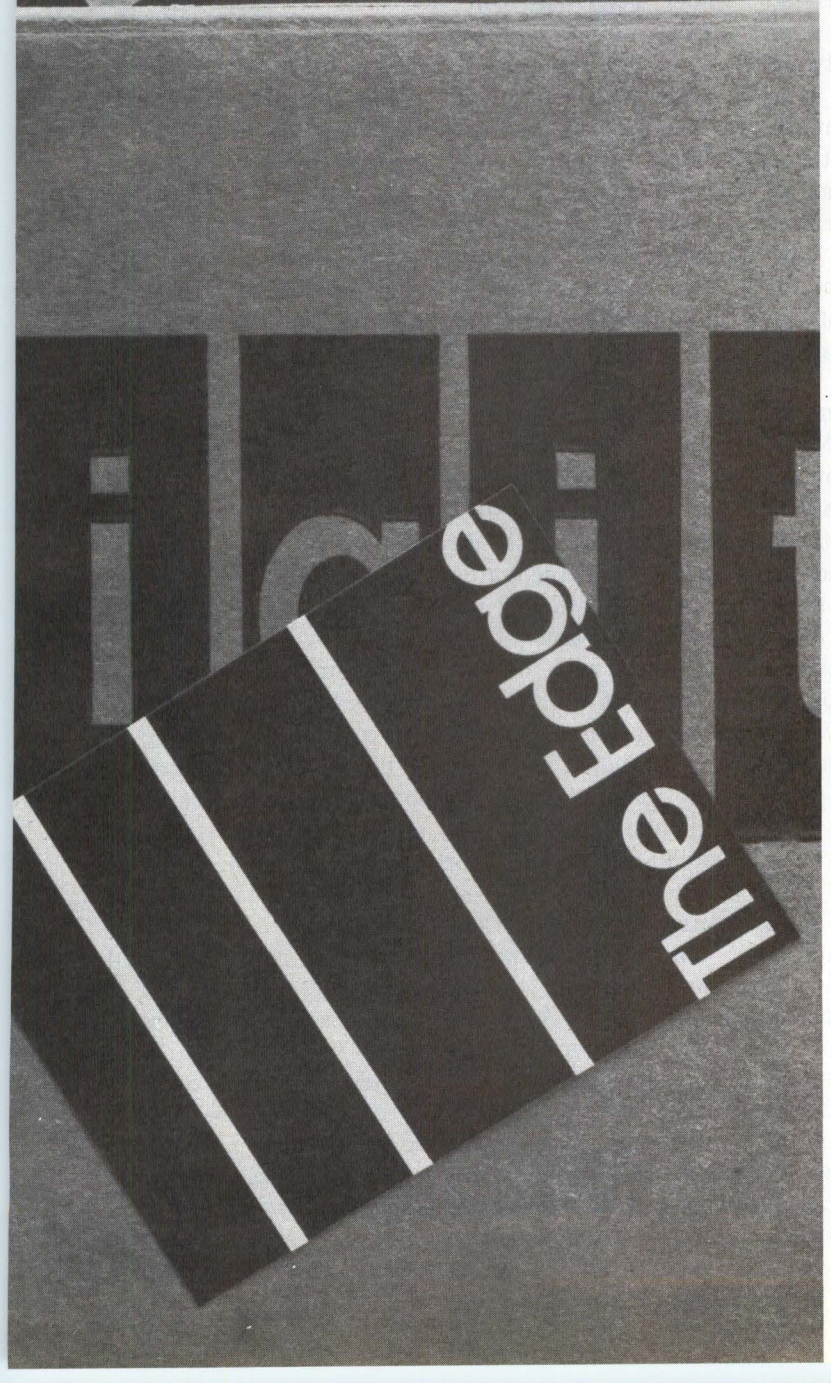
Broadband's capacity to link thousands of communicating devices over longer distances than typically possible with baseband technology is resulting in the formation of two general configuration scenarios into which broadband neatly fits. One consists of fairly large customer installations in which broadband is the sole LAN, with branches of its tree-like trunk traveling to every network node. In the second scenario, a broadband trunk links various baseband (or PBX) networks and serves as the main data highway over which the baseband network devices communicate from network to network. The small baseband networks might serve different floors or departments within a building or might serve entire buildings within a multi-building complex.

Battling for the broadband LAN crown

With fewer than 10 broadband LAN vendors selling to



Wang Laboratories, Inc.'s dual-cable branching-tree WangNet *has a transmit/receive crossover loop at the mid-point of the main coaxial trunk. The cable is divided into a transmit and a receive half, and both halves are folded together. Because network traffic is unidirectional over the entire 10- to 400-MHz bandwidth of the transmit and receive cables, WangNet eliminates the need for head-end frequency translators required by single-cable broadband LANs, which divide the cable into transmit and receive spectrums.*



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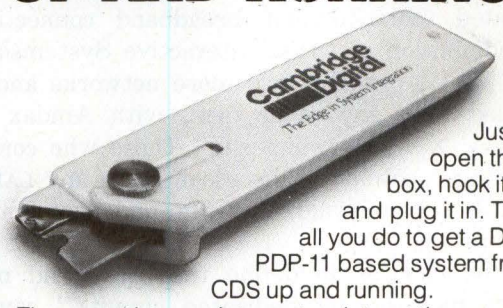

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a still-small market, it might appear simple to determine the relative success of each firm. But each vendor defines the broadband LAN market somewhat differently, which allows each to claim superiority over all other competitors in some way. For those that include dedicated, point-to-point broadband connections in their definition of LANs, Interactive Systems/3M, St. Paul, Minn., probably has more networks and nodes installed than any other firm, with Amdax Corp., Bohemia, N.Y., the runner-up. Those who consider a switching capability to be essential to any LAN place Sytek, Inc., Sunnyvale, Calif., far and away in the lead (see chart, p. 91).

"Sytek chooses to define the broadband network market by ignoring dedicated circuits," says Ivan Socher, president and chief executive officer of Amdax. "I agree that Sytek is the biggest with switched services, but if you take the total number of nodes, dedicated or switched, we're a lot bigger." Socher says that even though "the market is enamored with switching services," he has yet to see a big demand for such capability. "Most terminals, 99 percent of the time, are talking to the same computer and doing the same application," he says.

Mort Fortgang, vice president, operations of ConTel's Information Products Division, Great Neck, N.Y., disagrees with Socher's assessment. The company's ConTelNet broadband LAN—with first installations scheduled to begin last month—provides both switched and virtual-circuit links. "I don't think the need for switching capabilities is overblown," Fortgang says. "Cheap, distributed intelligence is showing up more and more every day, making the switching capability an absolute necessity." Ungermann agrees, noting, "Switching is an absolute requirement in every system we have sold." He adds, "The term LAN has come to mean what we and Sytek are selling, not point-to-point communications."

Sytek jumps to packet-switched lead

Leading the switched-network pack with more than 220 installations, Sytek offers products in three categories. Its first broadband LAN, the single-cable, mid-split LocalNet 20, connects serial interfaced synchronous and asynchronous devices with a network data rate of 128K bps. Designed for higher speed processors and peripherals with parallel interfaces, the 2M-bps LocalNet 40, like LocalNet 20, provides packet switching of data and uses a CSMA/CD scheme to let numerous devices share each frequency channel. Sytek's LocalNet 50 products consist of special function devices such as the 50/50 head-end frequency converter, the 50/100 network-control center and the 50/200 bridge, which routes data to and from frequency channels in the network.

Although it has sold most of its systems to large end users such as universities and government installations, Sytek will also try to pick up some OEM customers such as computer manufacturers, says Michael Pliner, Sytek's president. "The networks will get better support and more software if computer vendors market them with their products," he says. Broadband networks are best suited for medium to large installations, Pliner believes. "Our networks are not very cost-effective for small users," he says.

A key direction for Sytek is to move beyond the LAN installations into wider range broadband networks called metropolitan-area networks. Working with its affiliate, General Instruments, Sytek is moving to implement its MetroNet MAN, which will combine Sytek's local networking expertise with GI's CATV products and skills to build city-wide networks that serve both business and residential users. Standards for such MANs are embryonic, and some in the industry question Sytek's MetroNet approach.

Despite Sytek's claims that MetroNet will serve both business and residential applications, Socher at Amdax believes the product is focused more at home users. If so, Socher questions the viability of an expanded LAN approach, which is designed to carry an equal amount of traffic in both directions. "In the commercial environment, the traffic tends to be somewhat balanced in both directions," he says. "In the home, there's a tremendous amount of information being sent to the residence with only a small amount coming out." Because of the unevenness of residential information flow, Socher suggests that a network serving this market should have a much higher outbound data rate than inbound, and he notes the reliability of the outbound information is not as critical a factor as it would be in business communications. "The techniques are completely different for home versus commercial metropolitan networks," he concludes.

For its existing local network, Sytek provides communications protocols through level six of the International Standards Organizations's seven-layer networking model, according to Pliner. However, because no protocols are well-defined above level two, the functions provided by Sytek's higher level protocols differ from those performed by the higher protocols of some other broadband vendors. Such protocols provide more of a total networking solution than available from some broadband networks, which essentially provide standard physical and data-link interfaces and proto-

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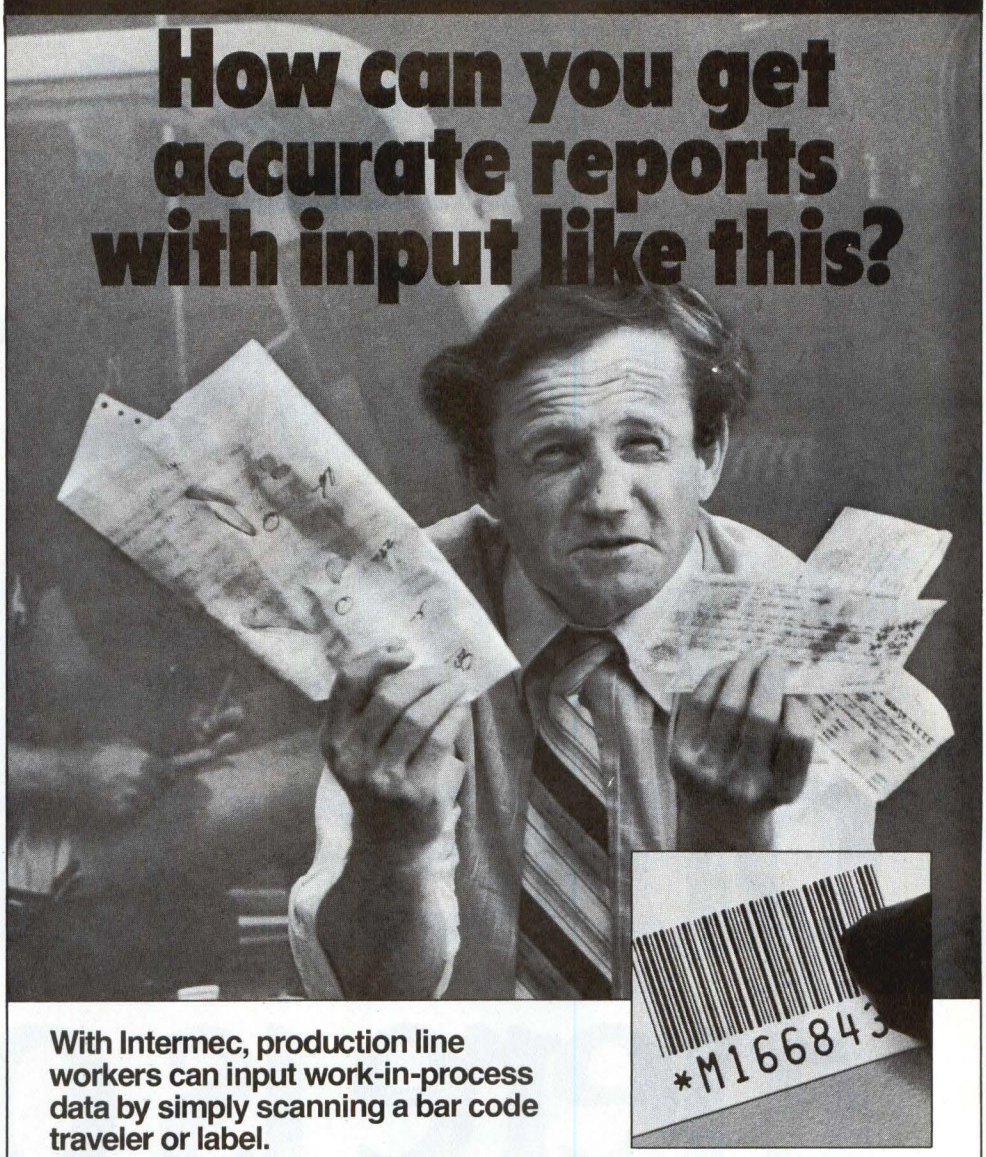

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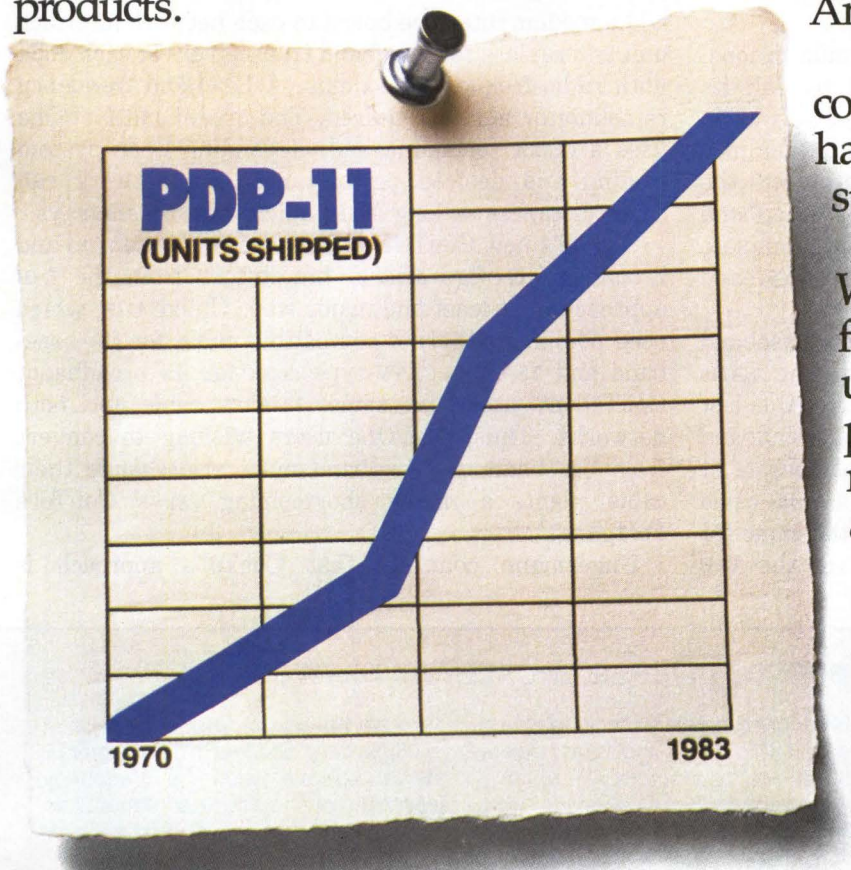

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CIRCLE NO. 50 ON INQUIRY CARD

cols, leaving higher level communications tasks to the devices attached to the network.

Playing both sides of the fence

Sytek, in conjunction with Bridge Communications, Inc., plans to offer a gateway product to link its broadband LocalNets to baseband Ethernet networks. While Sytek will offer bridges to baseband LANs, Pliner says, "I don't really see my company getting into the baseband side of the business." Two other broadband vendors, however, are trying to cover the complete market by offering both baseband and broadband versions of their products.

Ungermann-Bass established itself as a baseband vendor with its Ethernet-compatible Net/One LANs before announcing a broadband version of Net/One last year, (MMS, March, 1982, p. 75). The broadband Net/One provides five 6-MHz channels that operate at 5M bps in a mid-split, single-cable or a dual-cable configuration. Net/One software remains the same for both baseband and broadband versions of the U-B networks and includes protocols that provide some level seven ISO functions, according to Ungermann. To shift from a baseband to a broadband configuration, users add a modem interface board to each network interface unit and replace the baseband transceivers at each node with radio-frequency modems. A head-end frequency remodulator is also required. The broadband Net/One uses a CSMA technique and, depending upon system loading and desired performance, the network can cover distances as long as 10 miles, Ungermann says.

ConTel's new ConTelNet also comes in baseband and broadband configurations, but differs from the U-B approach in at least one major way. Unlike U-B, which uses 50-ohm, Ethernet-compatible cable for its baseband and 75-ohm, CATV-type coax for its broadband, ConTelNet uses the same 75-ohm cable for both networks. Thus, Net/One users wishing to convert from baseband to broadband must also change their cable plant, a major shortcoming, says ConTel's Fortgang.

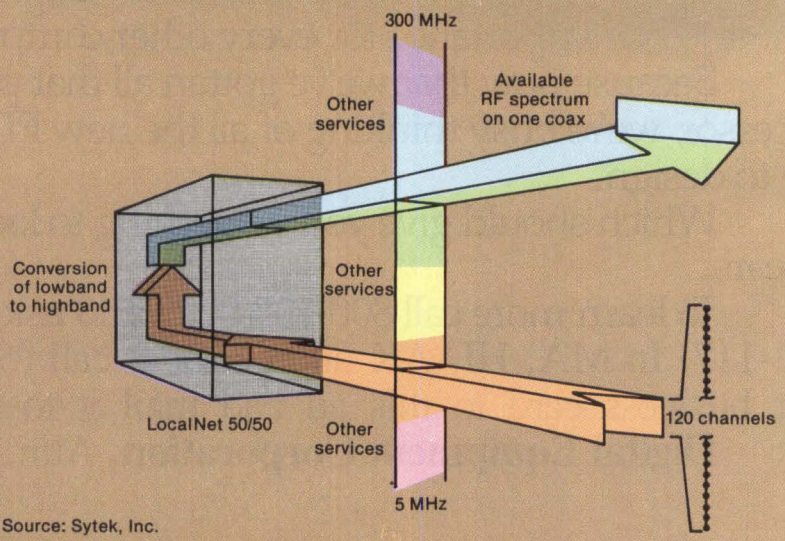
Ungermann counters that ConTel's approach is

CATV FOUNDATION BREEDS DIVERSE BROADBAND NETWORKS

Broadband local-area networks trace their roots to the Community Antenna TV systems that first appeared in 1949 and now serve more than 20 million subscribers. But designers of broadband LANs have had to improve on the technology associated with CATV, which typically carries one-way video traffic (although this is changing) over relatively long distances. The enhancements developed by broadband designers have resulted in several LAN configurations that have little in common other than the very basic CATV equipment upon which the networks are built.

The standard CATV transmission medium used in every broadband LAN is coaxial cable with a 75-ohm impedance. The cable and the various devices attached to it cause signal attenuation and loss, which, if uncorrected, would result in an unacceptable signal degradation at nodes distant from the transmission's point of origin. Amplifiers spaced as required along the cable solve this problem and ensure that every network node receives a signal of virtually the same strength. Other standard CATV components common to broadband networks include filters, directional couplers, multitaps, power supplies and connectors.

A single broadband cable can carry numerous transmission channels through the use of frequency-division multiplexing. Standard CATV components operate within a frequency spectrum of 0 to 300 MHz (some LANs stretch this to 400 MHz), and each TV



Source: Sytek, Inc.

Shifting low-frequency inbound signals into high-frequency outbound signals, a head-end frequency converter—*in this case a Sytek LocalNet 50/50—sets up receive and transmit channel paths over single-cable broadband networks. The Sytek network channels take up a just fraction of the available 300-MHz bandwidth, permitting the cable to carry additional services on other sections of the frequency spectrum.*

flawed because it ignores the Ethernet baseband standard. "I don't see a market for a baseband network using 75-ohm cable," he says. "People are picking up on Ethernet because they want to have a baseband industry standard." Ungermann says a company might buy a baseband Net/One simply to get a network up and running while it waits the several months required to install a broadband cable plant. "But it's very unlikely a customer will go in and install a total Ethernet system and then decide he wants to go broadband," he says. "Broadband will usually be a trunk between buildings or floors, and the baseband nets are spurs off of that." U-B sells a bridge product that connects Net/One networks of any type and combination.

ConTelNet, which will eventually have an Ethernet gateway, uses a single, mid-split cable to support five 6-MHz paths at speeds of 2M, 5M or 10M bps. A single channel can support 255 nodes with as many as 64 virtual circuits per node, for a total of 8160 point-to-point connections. The network uses CSMA/CD and runs under the firms TICOS operating system, which provides functions through level three of the ISO model, Fortgang says. The network's bus interface units incorporate Multibus backplanes, permitting direct network access for Multibus-compatible devices Each BIU also has four RS232C ports and one parallel port.

Because ConTel is a division of a major telephone company, Fortgang says, "We will obviously provide interfaces to wider networks. But," he notes, "our primary focus is the local network." And, despite ConTelNet's phone-company association, "Voice is a very low priority on our development schedule," Fortgang says. "With the investment in voice equipment that already exists, it doesn't make sense to force an interrelationship between voice and data at this point." This sentiment apparently is shared by most broadband vendors and their customers.

Broadband data net pioneers

Long before debates over LAN definitions came to the forefront, Interactive Systems was using broadband technology to solve factory communications problems.

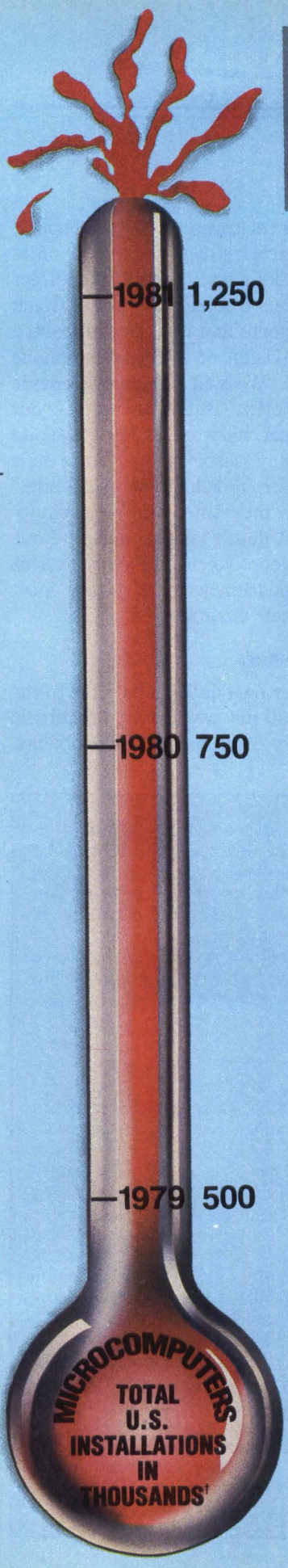
video signal requires a bandwidth of just 6 MHz. Data transmissions require considerably less bandwidth per channel than video signals and, through the use of RF modems LAN designers can configure hundreds of data channels, each at a different frequency within the available spectrum. The RF modems are set to operate over a single frequency or, if they are frequency-agile modems, can alter the frequency of their transmissions under software control to access different channels and their devices.

Beyond the use of similar CATV components and FDM splitting of the bandwidth, broadband LANs go their separate ways. Different channels can be allocated for data, video and voice traffic; data rates, modulation techniques and access schemes can vary from channel to channel; channels can carry self-contained datagram messages, can operate as point-to-point virtual circuits or can carry combinations of both services; and channels can be designated as dedicated, switched or shared. Dedicated channels link pairs of communicating devices, switched channels alternate the communicating devices on a request basis, and shared channels connect numerous devices that must use either a contention or a time-division technique to access the channel. The combinations of configurations are myriad, and with few standards to direct them, vendors in the young broadband LAN market are offering products that vary widely in their design and operation.

Even the fundamental cable architecture is not immune to variation. Most vendors use a single cable to carry traffic in both directions, but a few companies offer dual-cable designs, with one cable carrying transmit data and the other carrying receive data. Single-cable broadband LANs must split (typically mid-split) the cable's bandwidth into dedicated transmit and receive spectrums, with each transmit channel having a corresponding receive channel offset from it by a specific bandwidth jump (see illustration, p. 88).

Single-cable vendors, which often offer dual-cable options, point to the media compatibility of their networks with the single-cable CATV approach and claim dual-cable systems require twice as much cable and twice as many amplifiers and taps, which results in higher costs, less reliability and greater complexity. Dual-cable proponents emphasize their networks' ability to offer almost twice the bandwidth possible with split-frequency single-cable networks. They also claim the simplicity of one-way components coupled with the absence of a head-end translator —needed by single-cable networks to split the bandwidth—improves network reliability and cuts costs.

As the broadband LAN market becomes more crowded, the variations on the CATV theme are bound to grow, and the task of choosing a LAN will become even more confusing. Robert Shatzer presented a list of LAN selection criteria at a recent broadband LAN conference sponsored by Sytek, Inc. The list illustrates points buyers should evaluate and also indicates some ways in which broadband LANs differ. The criteria include: topology, connectivity, control mechanisms, protocols, data rate, error rate, interface/device support, internetworking concerns, services, network management, user transparency, standards issues, performance, reliability, life-cycle cost, ease of installation, maintainability, failure-recovery mechanisms, expandability, safety issues and vendor issues.



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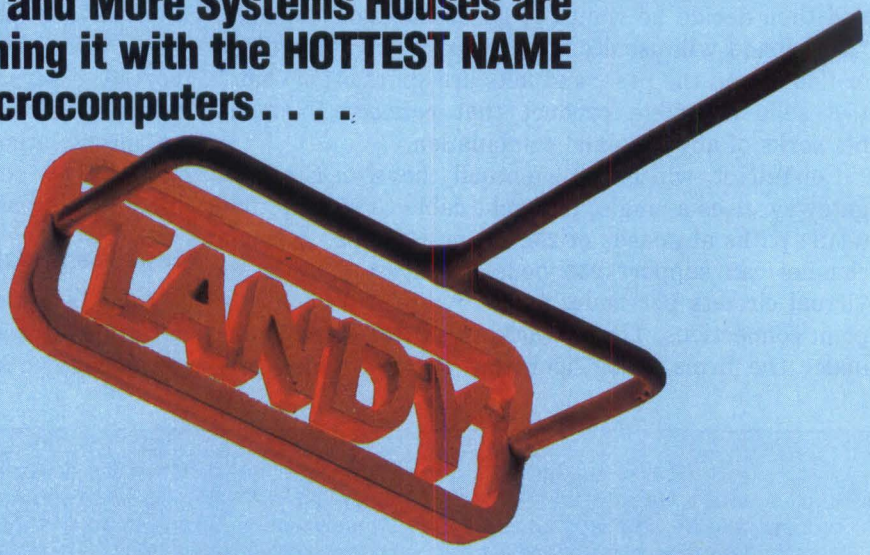

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In 1972, the company introduced its Videodata network, which placed hundreds of point-to-point channels on a single coaxial cable. 3M acquired the company in 1979 and broadened its focus beyond the factory into commercial applications. "Videodata was the first commercial broadband network," says Allan Edwin, business unit manager for IS/3M. Early this year, Edwin says, 3M will begin beta tests on a new 2.5M-bps, token-passing LAN, which will provide more flexibility than the aging point-to-point-oriented Videodata systems.

The Videodata nets function almost like a utility service, providing dedicated communications between pairs of devices, but little in the way of higher level communications protocols. Several Videodata product families exist: 9600-bps point-to-point and multidrop modems, which can be configured 75 to a single 6-MHz channel; 100K-bps point-to-point or time-division-multiplexing modems (as many as 248 terminals per channel in TDM mode); a 2.1M-bps OEM modem; and a 5M-bps OEM modem, still in beta test. Protocols supported include RS232 synchronous and asynchronous, SDLC and bisynchronous.

Other companies are following IS/3M's long-standing lead into factory applications, including the major broadband vendors, which view factory networking as an important segment of their target markets. At least two companies that sell factory equipment have also entered the broadband LAN fray—Gould's Modicon division with its Modway network and General Electric Co., with its GENET (MMS, June, 1982, p. 177).

The LAN company that's not a LAN company

Like IS/3M, Amdax was an early entry in the broadband market, selling point-to-point dedicated modems. In June, 1981, the company unveiled what it described as its CableNet local-area communications network, a 7M- or 14M-bps network said to be targeted largely at IBM Systems Network Architecture environments. CableNet uses a time-division multiple-access technique and supports asynchronous, bisynchronous or SDLC/HDLC communications protocols. While some competitors point to the unusual TDMA as a system flaw, Socher argues that TDMA has three major advantages over CSMA/CD.

"First and most important," he says, "is distance. Contention systems are limited to about 15 miles, and we're at 50 miles. Secondly, we believe the local networks in the market we're after will interlink via satellites, which transmit using TDMA. Finally, we believe that in the long term, TDMA will be a much better way than contention of implementing switched voice over broadband."

If it seems that Socher's concern for the ability to

	Amdax CableNet	ConTel ConTelNet	IS/3M Videodata	Sytek LocalNet 20; 40	Ungermann-Bass Net/One	Wang WangNet
Number of Installations (nodes)	15 (1000)	Beta Sites	300 + (10,000 +)	220 (12,000)	Below 10 (100)	Beta Sites
Standard Network Architecture	Single-cable mid-split	Single-cable mid-split	Single-cable mid-split	Single-cable mid-split	Single-cable mid-split	Dual-cable unidirectional
Channel Access Technique	FDM; TDMA reservation	FDM; CSMA/CD	FDM; TDM (AutoPoll)	FDM; CSMA/CD	FDM; CSMA	FDM; CSMA/CD
Channel Data Rates	7M, 14M bps	2M, 5M, 10M bps	100K, 2.1M 5M bps	128K bps (L20); 2M bps (L40)	5M bps	64K, 12M bps
Data Device Interfaces	RS232; RS449	RS232; 32-bit parallel Multibus	RS232; 16-bit parallel; IBM 3274/3278	RS232	RS232; 32-bit parallel; 8-bit TTL; IEEE 488	RS232; RS449 RS336
Protocols Supported	Sync; Async Bisync; SDLC/HDLC	Sync; Async; TTY; X.25	Sync; Async; TTL	Sync; Async; HDLC derivative	Async; 3270/2780 Bisync; IEEE 488; 8/16-bit parallel DEC DR-11B/W	Sync; Async HDLC
Modulation Technique	Vestigal Sideband Amplitude; Bi-Phase Shift Keyed	Frequency Shift Keyed; Amplitude Modulation	Frequency Shift Keyed	Frequency Shift Keyed; Phase Coherent Frequency Mod.	Vestigal Sideband Amplitude	
Network	Software that runs on IBM PC, other processors	Network Control Center	Network monitor	Network Control Center	NIU-resident software	DataSwitch based; More comprehensive system planned

transmit as far as 50 miles removes CableNet from the realm of LANs, there's a good reason. Socher claims that CableNet's initial description as a LAN was largely for marketing clout, and says the true direction for the network is the metropolitan broad-area market. "We're not really a LAN," he now says, "and we're not trying to sell to single buildings. It isn't clear to us that broadband was the way to go in the local environment. Twisted pair or baseband might be a better approach."

Socher expects to see two new players enter the broadband networking market in a big way—CATV franchises and the divested Bell Operating Companies. "We've tried to position ourselves to become vendors to both the cable franchise industry and to the BOCs," he says. "The BOCs are not allowed to manufacture (by regulation), so they will become our customers and provide all the support and service. It will be the greatest thing that ever happened to Amdax."

Socher thinks the service provided by the cable and telephone companies will prove to be a crucial factor that most broadband vendors have not properly addressed. "All the broadband people claim to have these big service organizations calling on their customers and doing cable maintenance," he says, pointing out that the cable runs up elevator shafts, through air ducts and in underground tunnels. "You ask your first IBM-type service guy with his three-piece suit to go shimmying up an elevator shaft, and he'll turn around and say, 'I quit.' The only guys that can handle that cable maintenance are Bell and cable guys and electrical contractors."

Welcome to Wangland

Unlike the other broadband LAN vendors, Wang Laboratories, Inc., Lowell, Mass., is first and foremost an office-automation vendor that also sells the processing equipment it wants to network. Also unlike the others, Wang uses proprietary cable components and bases its network on a dual-cable networking architecture. Just one other network—Mitre Corp.'s MitreNet, sold under different names by several companies that license the technology—pushes the dual-cable approach. And even Mitre's approach uses more standard equipment and techniques than Wang's (MMS, October, 1981, p. 34). "I think Wang made an incredible error," says Ungermann. "They're the only company that's really trying to go totally proprietary."

Tony Bolton, senior product manager for networking at Wang, points out that the company will probably open some of its proprietary technology to other vendors once broadband standards become better resolved. "It's a new technology, and we want to see how things pan out before we decide what portions of WangNet we will license and how we will license it," Bolton says. And, while the IEEE 802 committee broadband standard focuses on a mid-split, single-cable approach, "We think that two-cable will become part of a draft and may become part of a standard at some point," he notes.

WangNet is divided into four major service bands—the Interconnect Band, the Utility Band, the Peripheral Band and the Wang Band (MMS, August, 1981, p. 26). The Interconnect Band has three channel groups: 16 dedicated-frequency channels that connect RS449 devices at data rates of 64K bps, 32 dedicated-frequency channels that connect RS232C devices at data rates of 9600 bps and 256 switched-frequency channels that connect as many as 512 RS232 devices at data rates of 9600 bps. The Utility Band carries seven standard CATV video channels in the 174- to 216-MHz portion of the bandwidth. The Peripheral Band contains six channels that can each support 32 logical connections between Wang serial devices and Wang VS, OIS or Alliance systems. The Wang Band connects various Wang processors over virtual circuits at data rates of 12M bps. Devices connect to the Wang Band through a cable interface unit, which performs functions such as packet assembly/disassembly, flow control and CSMA/CD operations.

While Socher questions the viability of broadband for intra-building communications applications, Bolton questions the technology's place in wide-area communications. "We see the advantage of broadband within a building," Bolton says, "and we see other means of transmission as possibly more viable than broadband outside the building. There are many products and devices that can serve for wide-area networking, including microwave and satellite technologies. We're looking at everything because we don't think broadband will be the only solution to networking problems." □

NEXT MONTH IN MMS

The February issue of Mini-Micro Systems will feature disk drives. Topics covered will include small and large Winchester systems and floppy-disk drives and how technology and market forces are affecting them. Some Highlights:

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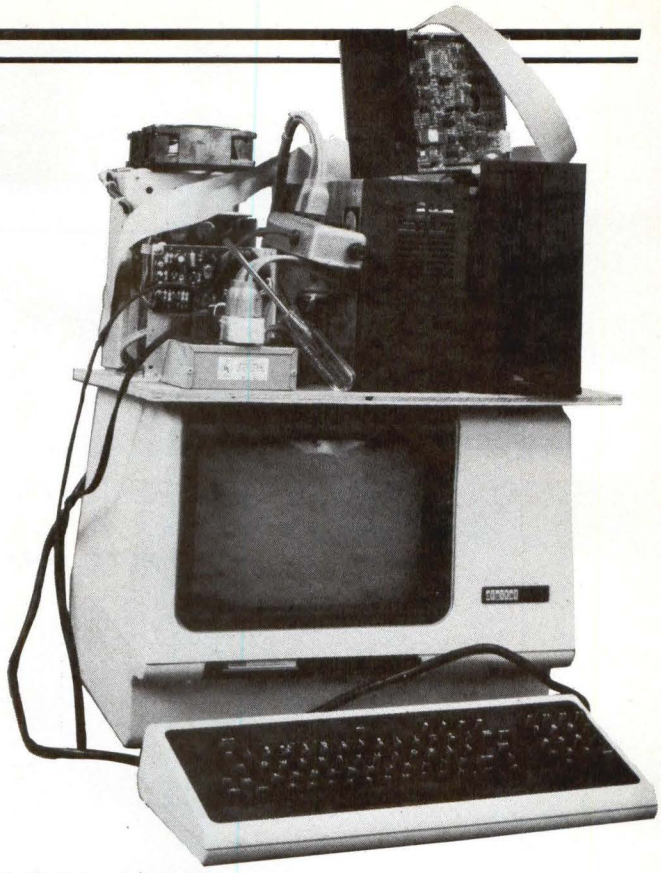

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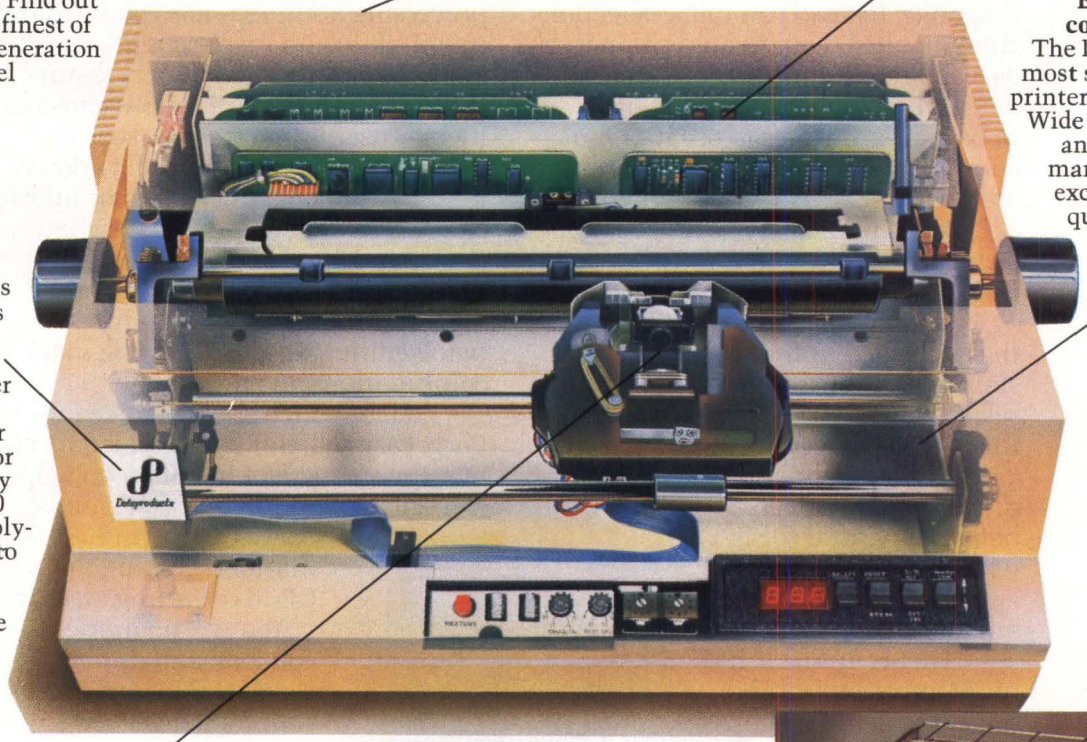

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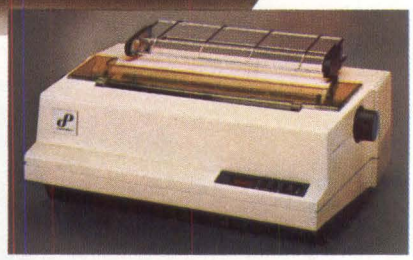

DP-55 DAISYWHEEL PRINTER

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CIRCLE NO. 54 ON INQUIRY CARD

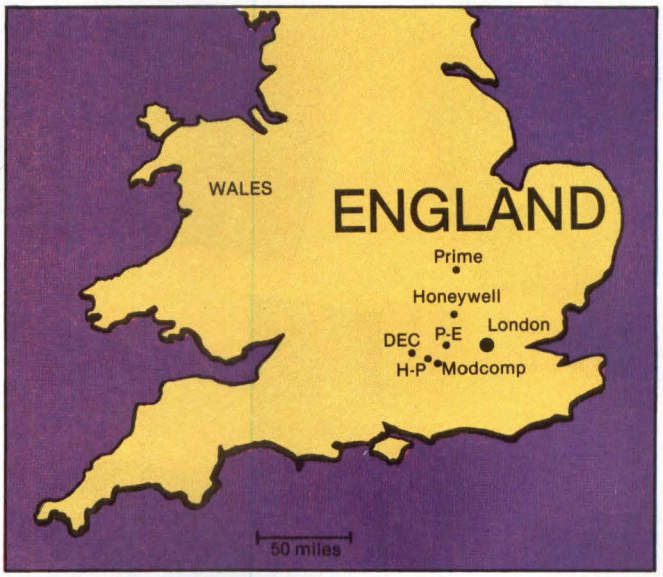
U.S. mini manufacturers base software development in Britain

By Keith Jones
European Editor

Hardware technology development continues to be led by U.S.-based computer companies and spearheaded by their U.S.-based personnel. But U.S. firms are increasingly placing key software-development operations on foreign shores—primarily in the U.K. and Europe and with a heavy concentration in the London area. U.S minicomputer manufacturers that maintain software-development teams near London include Digital Equipment Corp., Hewlett-Packard Co., Modular Computer Systems, Inc. (Modcomp), Honeywell Information Systems, Inc., Perkin-Elmer Corp. and Prime Computer, Inc.

The development of fundamental systems software, notably operating systems, remains in the hands of U.S. staff. But software to handle functions between system-control programs and end-user application packages is appearing in substantial quantities from Old World locations. Products include sophisticated software for jobs such as transaction processing, database management, electronic mail, videotex and packet-switched communications.

European-based software-development branches of U.S. computer companies apparently have grown and flourished because they can tackle certain software technologies more effectively than U.S.-based operations. Some European software teams actually originated independent of their U.S. parents to develop software for requirements specific to the European markets.



Several U.S. minicomputer manufacturers have established London-area software-development centers. *These include Digital Equipment Corp., Reading; Hewlett-Packard Co. and Modular Computer Systems, Inc., both in Wokingham; Perkin-Elmer Corp., Slough; Honeywell Information Systems, Hemel Hempstead; and Prime Computer, Inc., Bedford.*

First projects: bits and pieces

DEC set up its European engineering operation 10 years ago, initially sending U.S. staff to the offices of its British subsidiary in Reading, England. European engineering manager Dick Davies, a Briton who heads the operation, says the aim at the time was mainly to hand over "bits and pieces" of software development that engineering in the U.S. was not keen to tackle. This included projects involving the European real-time languages Coral and Pearl.

"The engineering team at Reading was built up to 60 or 70 people without a clear charter or purpose," Davies notes. But the Reading operation, based in DEC Park, the new headquarters of DEC Ltd., has established itself as a major center for office automation and distributed-system software development. Davies points to his team's development of X.25 software that enables DEC equipment to communicate via packet-switched networks such as Telenet. The European team handled this project because "the development of packet switching in Europe has been forced by the high cost of communications, a result of the monopoly position of the common carriers here," Davies explains. His team also has worldwide responsibility for the continuing development of DEC Mail, the electronic-mail facility sold as part of DEC's Office Plus product group.

Davies supports the European development of office automation and other products for end users, claiming, "We are more conscious of the diversity of users in Europe." He points to the need to cater to different languages, currencies and conventions—the formatting of dates, for example. Davies doubts whether a U.S-based development team could implement foreign-

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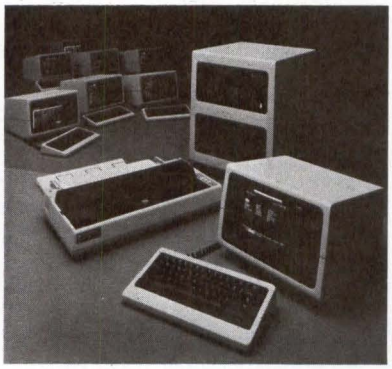

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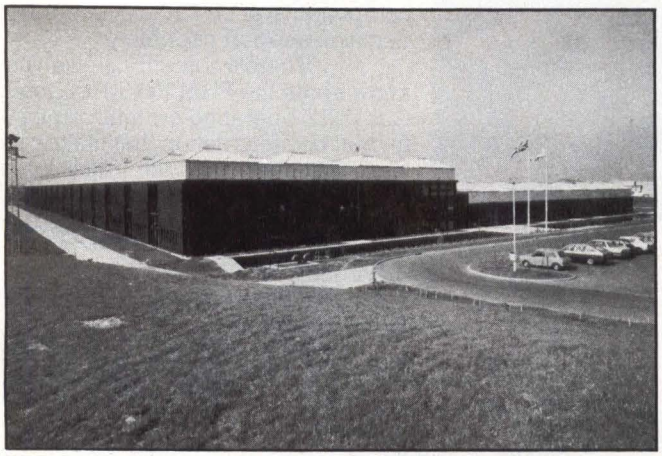
language versions of office products. At the same time, he feels confident that his team at Reading, staffed almost entirely with British personnel, can cater adequately to the needs of U.S. users. "I spend about a quarter of my time with DEC in the U.S. and make six to eight visits a year," Davies says. "There are six or seven other people here at Reading who go there as much as I do, and 20 or 30 others who also travel a lot. We're good news for the airlines."

Touching home base

Davies notes that most of his time in the U.S. is spent at DEC locations in the Boston area. "We need to visit DEC in Boston to get clear, well-understood decisions and to find out what engineering is doing there," Davies explains. He points to his team's need to understand what is happening to fundamental software products such as VAX/VMS, so the team can create workable interfaces in its products. He adds, "There is a lot of misunderstanding at the moment, especially in office-automation technology, which is changing quickly and is ill-defined." Davies says he also has to play company politics. "There is a danger that a European project may wither on the branch unless a key U.S. person can be persuaded to take it under his umbrella and commit himself to its success." It's Davies's job to do the persuading.

He identifies the problems at Reading as the need to find enough fresh and challenging work to make the talented members of his team feel that they are making progress in their careers. The European engineering group at Reading numbers about 170, but Davies believes it is still not big enough to provide a varied long-term career.



DEC Ltd.'s headquarters at DEC Park in Reading *houses a software-development operation that handles some of the office-automation software, including DEC Mail, that is sold worldwide to the company's user base.*

Although Davies and his team work mainly with the U.S. engineering group, they are funded by the British company, DEC Ltd., which receives no payments or royalties from any other parts of DEC. Explaining this arrangement, Davies notes that DEC Ltd. is the biggest DEC subsidiary in Europe and benefits from the presence of a significant software engineering operation. He also points to the benefits DEC Ltd. realizes from products developed by DEC's U.S. engineering teams.

HP's team self financing

Like DEC, HP's British subsidiary also initially funded its rapidly growing software-development team. But Dave Townsend, marketing manager for commercial systems within HP Ltd., says the British software operation is now self financing because it bills worldwide HP sales offices that sell its main product offering, HPMail (MMS, April, 1982, p. 60). The overall charter of HP's British software group also embraces word-processing and telex/teletex products for worldwide use.

Like DEC's European engineering group, HP's British software team shares the company's British headquarters, located in Wokingham, just a few miles from DEC Park. Called Pinewood, the new 100,000-sq.-ft. building will eventually be taken over completely by the software-development team, Townsend says. "We have 50 people in software-product development at the moment, but we are growing at 100 percent a year," he says.

As for staffing requirements, Townsend says, "It is easier to get good computer-science graduates in Britain than in the U.S. We have to compete for them against other computer companies and software houses, but Britain has some of the world's best computer science departments." He lists the Universities of Strathclyde, Manchester, Aston, Loughborough and Cambridge as among the best. Townsend also acknowledges that the salaries of British graduates tend to be lower than their U.S. equivalents—starting as low as £6000 (about $10,000). However, he stresses that overall employment costs equal those in the U.S. because overhead costs such as office accommodations are higher in Britain.

The Pinewood team was established two years ago and is now one of five worldwide development groups. One other group is located outside the U.S., in Beoblingen near Stuttgart, West Germany. Its activities complement Pinewood, concentrating on financial

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CIRCLE NO. 56 ON INQUIRY CARD

The Interpreter

H-P Ltd.'s Dave Townsend *says software such as HPMail that is developed in England must complement the products developed at HP's four other software facilities. Three of these are in the U.S., and one is in Beoblingen, West Germany.*

applications such as multi-currency accounting, an ideal project for a European-based team.

Complementary U.S. software

Townsend explains that the Pinewood team works most closely with HP's Cupertino, Calif., Office Systems Group, whose products also complement those emanating from Pinewood. The U.S. products cover personal-decision-support functions such as business graphics and spread-sheet generation. Townsend says both the Pinewood and Cupertino teams report to HP's information networks division manager, André Schwager. All products must work together; for example, business graphics generated by Cupertino software can be disseminated by Pinewood's HPMail.

Underlining the importance of coordinated activity with HP, Townsend notes that the development of software systems by all the company's groups must now be executed in Pascal. "This is an HP edict," Townsend explains. "We used HP's Systems Programming Language to develop HPMail, but if we had started six months later, we would have used Pascal."

Outlining the history of HPMail development, Townsend explains, "Our own people went over to the U.S. during the early design stages and talked to a lot of HP customers—members of HP's Partner Program. Later, we sent them a prototype users' manual." He says some "subtle" changes in the users' interface were made at the alpha test phase, although these will not be implemented until the second release of HPMail next year.

Continuing work includes the transfer of some HPmail functions from the HP 3000 host to the HP 125 personal computer that acts as a terminal. The Pinewood team is also implementing an interface enabling HPMail to support document communication conforming with the teletex standard—the "super telex" technology now at a more advanced stage of development in Europe than in the U.S.

Videotex's European roots

Videotex is another European-dominated technology, and ModComp has its European Special Systems Department to thank for the videotex software it now sells in the U.S. The U.S. market for private videotex systems was recently boosted by IBM Corp.'s decision to make its videotex software (developed by its British subsidiary) available in the U.S. on Series/1 minicomputers (MMS, September, 1982, p. 145). IBM's choice of a system functionally compatible with the Prestel standard pioneered by common carrier British Telecom will also help Modcomp because its ViewMax product is a powerful superset of Prestel.

ViewMax sprang from the success of a videotex-like system, Topic, developed by the London Stock Exchange on ModComp Classic computers. John Linford, a technical field consultant at Modcomp's European headquarters, explains, "Modcomp was chosen by the Stock Exchange because of the communications capability of the Classic family. We had to present Modcomp in the U.S. with a proposal before going ahead with ViewMax, but the impetus definitely came from Britain. Videotex has been peculiarly British until now."

Modcomp's international marketing manager for communications products, Dick Howe, notes that Modcomp staffers from the U.S. visit Britain "in a continuous stream" to familiarize themselves with ViewMax and related products. He says Modcomp employees also exchange ViewMax product information across the Atlantic using ViewMax's electronic-mail facilities. Underlining the importance of these exchange activities, Howe anticipates that the U.S. personnel may have to modify ViewMax in a few years if non-Prestel videotex standards, such as AT&T's PLP, are widely adopted, despite IBM's backing of Prestel. But Howe stresses that Modcomp's U.S. staff will not have to rewrite ViewMax from the ground up. "ViewMax is highly modular so they will be able to plagiarize it extensively," he says.

Honeywell transaction processing

Users of Honeywell DPS-6 minicomputers who run transaction processing under TPS-6 are entrusting their transaction work load to a software product conceived,

Continues on page 108

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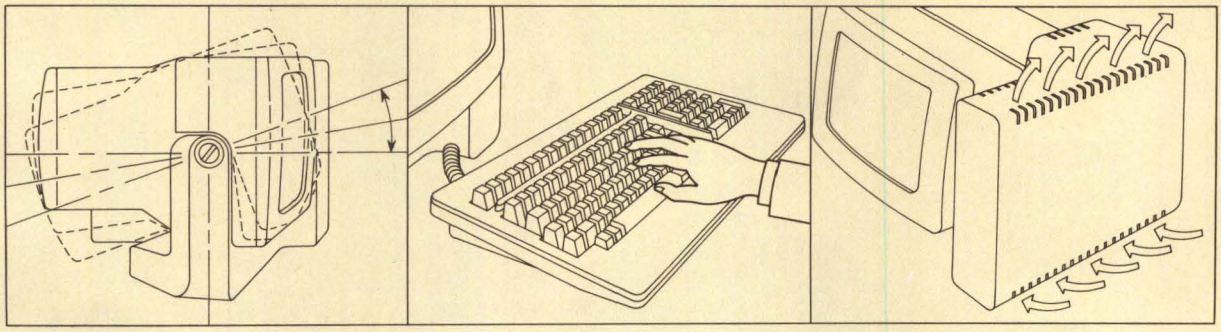

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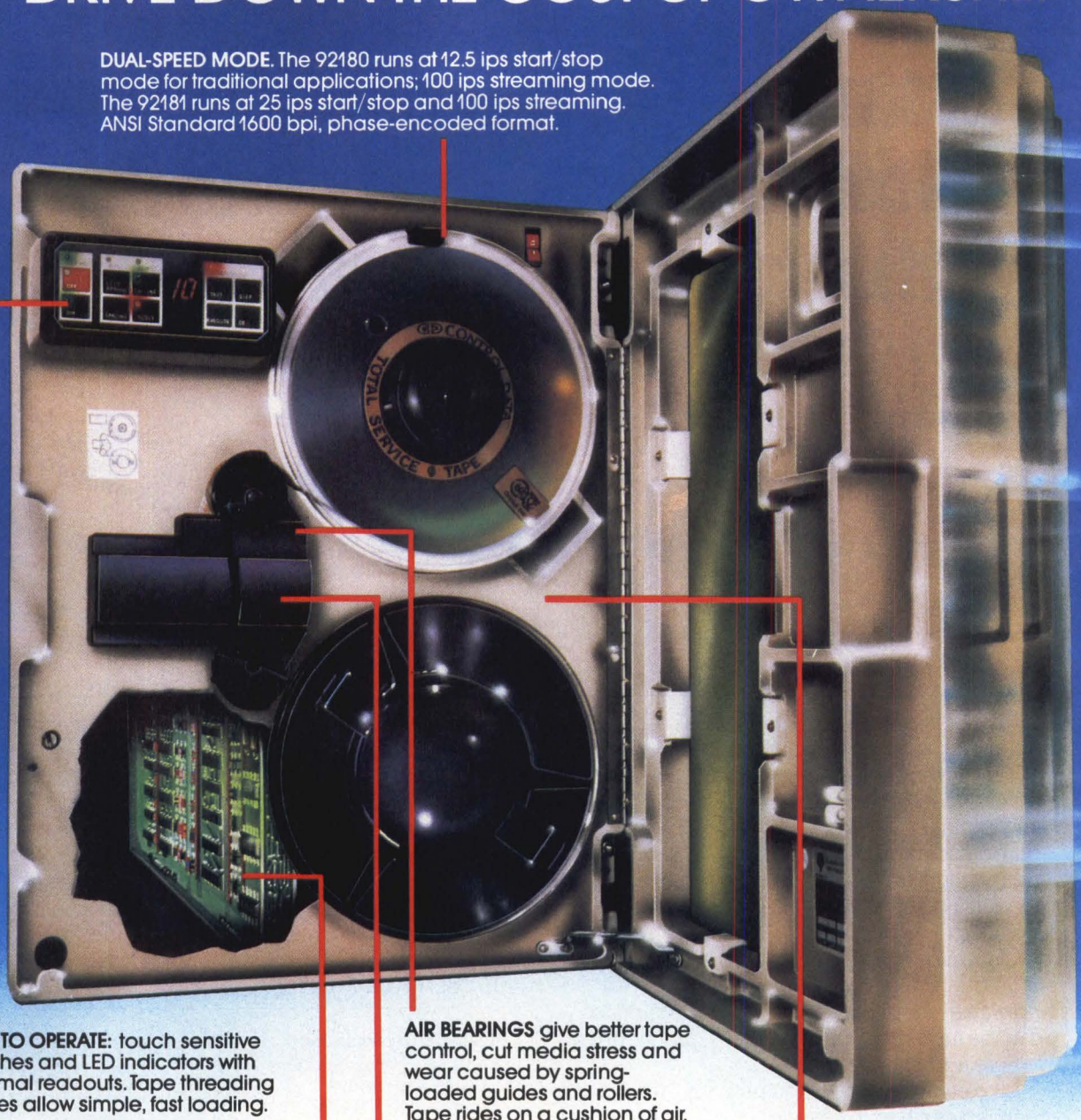

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The Interpreter

Continues from page 102

designed, written and tested at the General Systems Division center of Honeywell Information Systems Ltd., Hemel Hempstead, just north of London. TPS-6 was the result of an initiative by the Hemel center, encouraged by the experience it acquired in the late 1960s and early 1970s implementing transaction-processing applications for European users of the earlier Honeywell Series 16 minicomputer.

Tony Hutchinson, development director at Hemel, explains, "We proposed the TP project to HIS corporate when DPS-6 was announced as Level 6 in 1976 because we saw TPS-6 as a necessary weapon in our armory in Britain. The project was funded by HIS Ltd., not by HIS corporate. But, by 1980, TPS-6 was adopted by the engineering center in Billerica, Mass., as a worldwide product. By then it was already adopted by U.S. marketing."

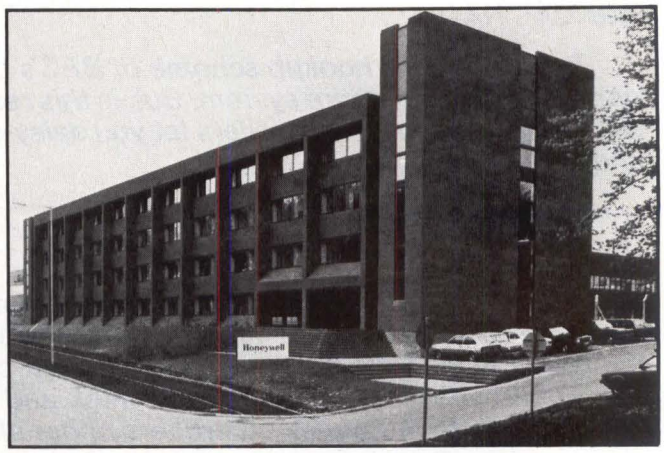
Malcolm Murdoch, manager of the minicomputer software group at Hemel, adds, "TPS-6 is so important now that any new release of the DPS-6 operating system, MOD 400, must support it." Looking at further developments for TPS-6, Murdoch points to application generators and local-area networking as two important enhancements. On the question of keeping in touch with U.S. needs, Murdoch declares, "We go to Boston frequently, and we talk to the marketing people in Waltham as well as the engineering people in Billerica. But Boston does not tell us what to do. We work jointly and have quite a say these days in software development in general, including operating-system evolution. We also attend TPS-6 user meetings in the U.S. and gather remarks, mainly detailed, about the product."

HIS in Boston now formally coordinates the worldwide marketing plan for TPS-6, but product development continues to be based in Hemel. Hutchinson estimates that 200 man years of effort have gone into TPS-6, and notes that about 30 of the 300 professional staffers at the Hemel center are directly involved with the continuing product development.

Funding from home

Two major U.S. minicomputer suppliers, Prime and P-E, maintain software-development centers in England that are funded entirely by the U.S. parent rather than by the company's British subsidiary or European sales office.

Prime's center in Bedford, 50 miles north of London, was set up with 12 staff members in 1979 to develop emulators for various remote-job-entry terminals. "But having won our spurs, we are now working on transaction-processing monitors and other commercial systems software," says Jim Foy, senior manager in Bedford. He notes that the operation's staff now numbers 95.



Honeywell Information Systems Ltd.'s 112,000-sq.-ft. headquarters *in Hemel Hempstead houses a software group that conceived, designed and produced the company's TPS-6 transaction-processing system.*

Like his British-based competitors, Foy is well aware of the vital importance of effective communication between the European staff and the U.S. engineering and marketing people. He explains that Prime's proprietary networking system, Primenet, carries heavy electronic-mail traffic between the British and U.S. facilities. The company uses the Telenet public packet-switching network to achieve the transatlantic link between Bedford and Boston. "From Bedford, we can log onto development systems in Boston, and we employ a sophisticated file-transfer system," Foy says. "Everyone at Bedford has a terminal." Foy also says, "I make around six trips to Boston a year, and so do the other senior managers at Bedford. We also have people from Boston here every month."

P-E's software center at Slough, just west of London, has been in operation since the mid-'70s and develops most of P-E's commercial system software. One major project produced by the Slough team was the Reliance transaction-processing system (MMS, October, 1982, p. 116). Established seven years ago by Interdata before its acquisition by P-E, the Slough center now employs a team of 75. □

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Microprocessors & Systems	35.2%

*NOTE: Figures (from survey commissioned by *DataCommunications Magazine*) reflect equipment INTERFACE '82 audience plans to purchase/lease before December 1983.

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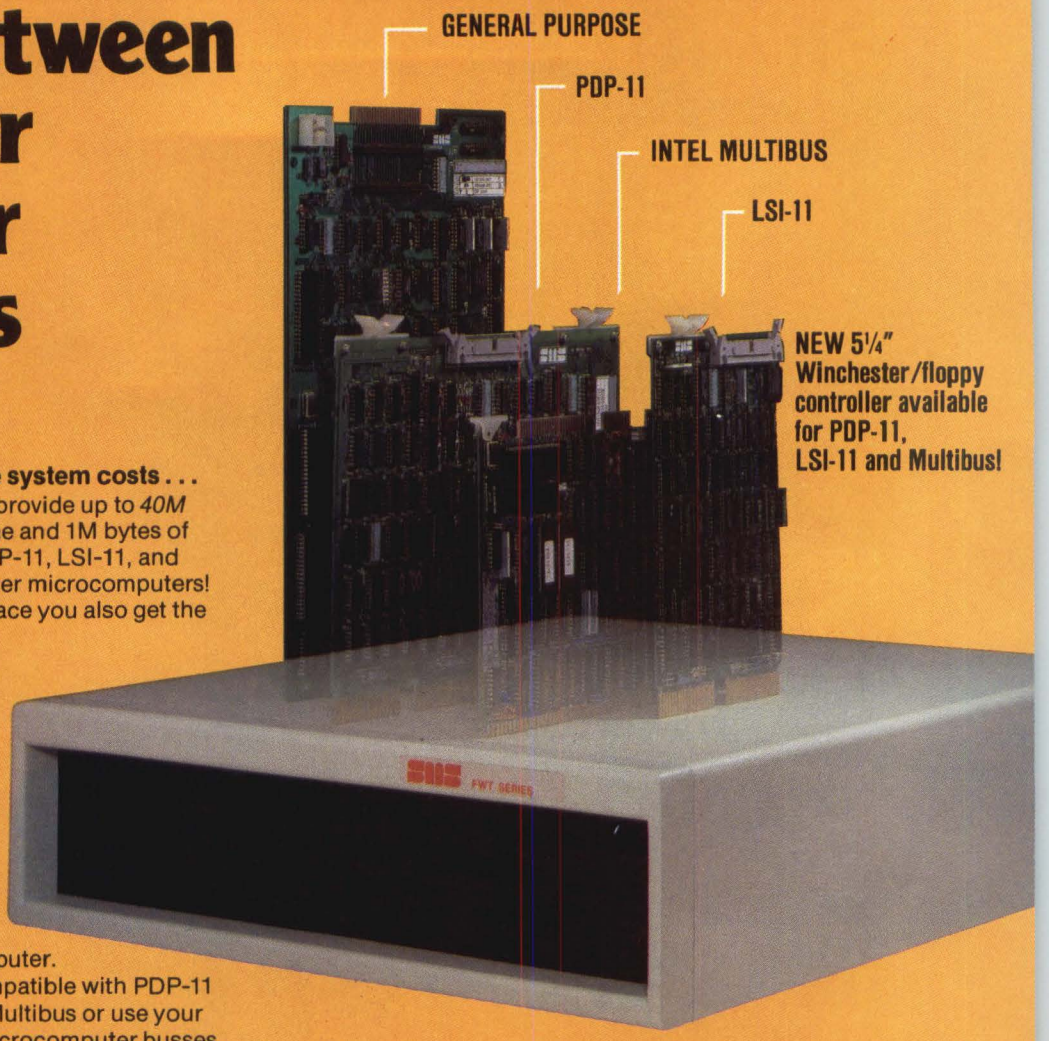

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CIRCLE NO. 62 ON INQUIRY CARD

Calma expands CAD market thrust, product line with support from parent GE

By Sarah Glazer

In the two years since General Electric Co. acquired Calma Co., Santa Clara, Calif., GE's influence on the supplier of turnkey CAD systems has become apparent. Most striking is the expansion of Calma's market beyond its traditional electronic circuit design base and into 3D mechanical design applications. Calma has also introduced new systems in the past six months at both the low and high ends of its product line. The high-end system is its first to be based on Digital Equipment Corp.'s VAX machines rather than on Data General Corp.'s processors.

Two years ago, 90 percent of Calma's revenues were from systems sold to the electronics industry and only 10 percent from those sold to mechanical design customers, says Calma president Robert Benders. He puts the mix this year at 50 percent electronics and 50 percent mechanical. He estimates that in 1983, when projected revenues are $190 million (up from more than $130 million in 1982), 60 percent will be mechanical.

"There are a lot more businesses that are candidates for mechanical CAD systems than for ICS or electronics," Benders explains. He defines the mechanical market as manufacturers of "piece parts" and those running other 3D applications such as architectural-engineering and construction. In contrast, he describes electronics design applications as basically schematic preparations that require less complex software than 3D applications.

Merrill Lynch Pierce Fenner & Smith estimates that 38 percent of the $1.1-billion worldwide market for turnkey CAD/CAM business in 1982 is mechanical, and another 17 percent is architectural-engineering and construction. In contrast, the electronics market accounts for only 26 percent, and other 2D applications account for another 13 percent.

GE's corporate emphasis on the "factory of the future" was also a factor on Calma's shift to mechanical. James A. Baker, GE's executive vice president in charge of factory automation, says, "Besides providing capital backing and engineering resources, GE's sales force has aggressively pushed Calma systems on our machine-tool customers."

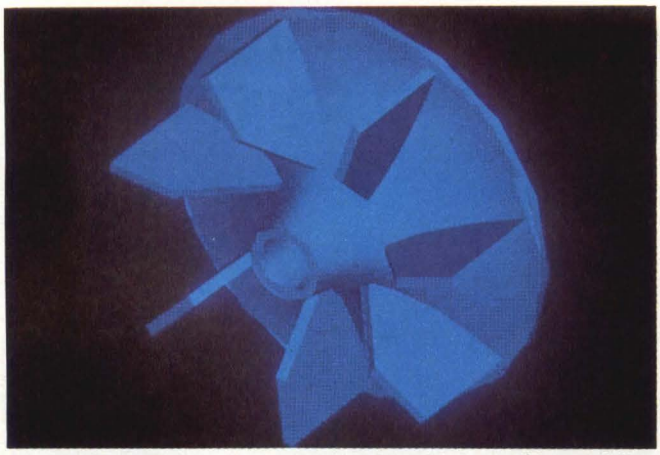
Benders says Calma had decided to move into the mechanical area before GE bought the company, but he admits GE has helped Calma in this area, especially with marketing. "The main reason," he says, "is that GE is offering a more comprehensive product than just CAD/CAM." Baker explains the relationship from GE's standpoint, saying, "Calma, a CAD vendor, gave GE a new product line that is indispensable for a company moving into the factory marketplace. If you don't have CAD at the front end of a manufacturing process, the process can't be automated further on."

Robert Benders, president of Calma Co., *says, "Our value added is software."*

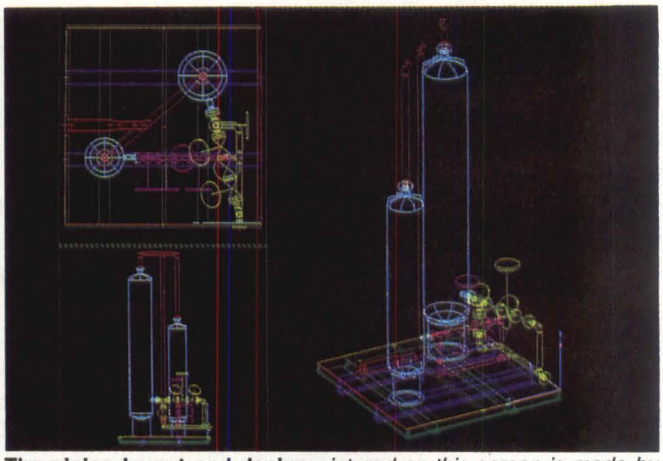
CAD is also an important factory-automation component in GE's push to automate its own plant operations. Benders says Calma has developed software for GE applications in a number of joint efforts with its sister subsidiaries. For example, Calma's new solids-modeling package grew out of a project with Computer Aided Engineering International, a joint venture of GE and Milford, Ohio-based Structural Dynamics Research Corp.

"We are the world's largest user of CAD systems," Baker says of GE, "so it made sense for us to acquire a CAD company." However, Calma's management makes it clear that the company will not become a captive supplier for GE. "Last year, about 11 or 12 percent of our revenues were from internal GE sources," Benders says. "This year it's going to be less—about 8 percent."

In addition to supplying Calma with marketing help, GE has financed extensive R&D efforts. These expenditures offset the dramatic rise in Calma's revenues from $62 million in 1980 to Benders' estimate of more than $130 million in 1982, says Tom Kurlak of Merrill Lynch. "GE has given a lot of money for R&D," he explains. "Because it has developed a lot of new products, the company has shown a small loss since it was acquired."



An impeller design that was made with a solids-modeling package. *Rather than using traditional graphics techniques of making 3D figures out of lines and surfaces, this package uses more lifelike shaded graphics.*



The piping layout and design *pictured on this screen is made by using 3D design software. This is a typical application in architectural engineering and construction.*

Benders refuses to comment on his company's profits over the last few years. However, GE's Baker lends credence to Kurlak's analysis, saying, "We're putting a lot of money into Calma, such as equipping the systems with VAX computers, with the idea of sacrificing short-term profits for long-term market share."

The expanding product line

The results of GE's investment are new products at both the high and low ends of Calma's product line. The most recent addition, announced at Autofact '82 in late November, is a new high-end offering, the Calma 7000 series (see "Calma's new VAX-based system," p. 120).

Unlike almost all of Calma's previous products, which run on Data General Corp. 16-bit Eclipse computers, the 7000 series runs on Digital Equipment Corp.'s 32-bit VAX machines. The decision to switch to the VAX, rather than use DG's MV/8000 32-bit CPU, says Benders, was closely tied to the company's desire to penetrate the mechanical CAD market. "We've discovered over the past couple of years that the mechanical engineering community is enamored with the VAX, and I think justifiably so," Benders says. "It's a better machine for the engineering applications."

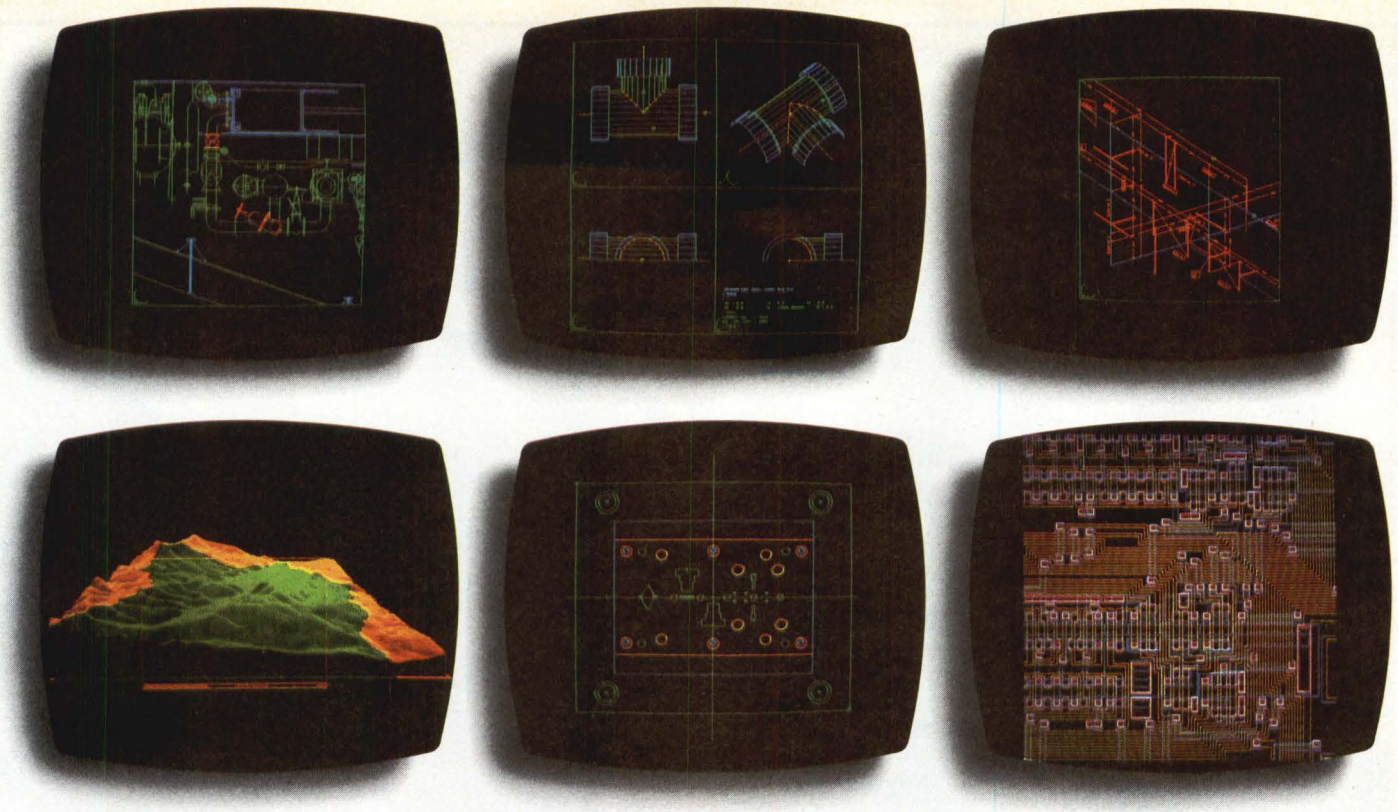
Sherm Rutherford, Calma's director of industrial marketing, adds, "DEC has very effectively managed to become the de facto standard of the engineering industry with the VAX product line." However, he admits that supporting two computer lines will cause initial problems for Calma. For example, Calma had to reformat its existing mechanical design and architectural-engineering and construction software for the 7000 series. "Obviously, it would have been easier from a technical standpoint to go with DG," Rutherford concedes. "But how many university engineering departments are raving about the MV/8000?"

Kurlak of Merrill Lynch agrees that the new VAX-based system will open doors to users of mechanical CAD systems. "It will be very costly to support two systems initially, but Calma has made the right decision ultimately," he concludes. Benders also admits that supporting both DEC and DG computers will be expensive. "Even though there is a short-term pain financially," he says, "in the long term, keeping reasonable options open pays off."

One way it may pay off is to improve Calma's competitive stance against the CAD system market leader, Computervision Corp., Bedford, Mass. Ken Anderson, a Simi Valley, Calif., consultant and publisher of a newsletter about computer graphics, says, "For mechanical and other applications outside electronics, people want the VAX. I think it's going to give Calma a competitive edge, not only on Computervision, but on other CAD companies that do not offer VAX."

Anderson ranks Computervision number one in the CAD/CAM market and IBM Corp. (which, unlike other turnkey vendors, sells its hardware with software developed by third parties) number two. He ranks Calma running neck and neck for third place with Huntsville, Ala., Intergraph Corp., another company that has introduced equipment using the VAX.

Despite its choice of VAX technology for its high-end system, Calma has no plans to abandon its DG-based systems, Benders stresses. "The electronics industry is perfectly happy with the DG Eclipse," says consultant Anderson. "The DEC VAX is just a factor in the



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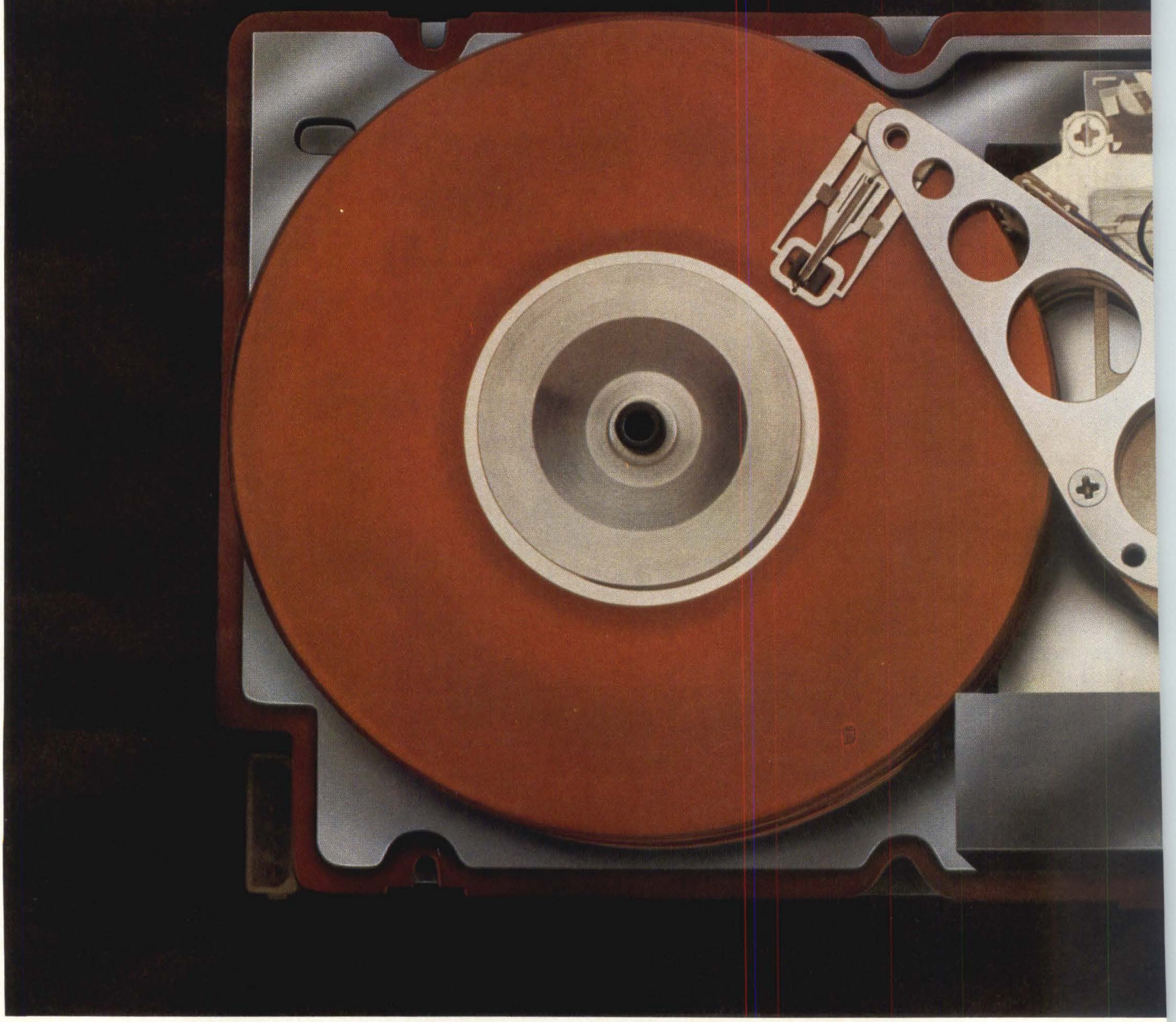

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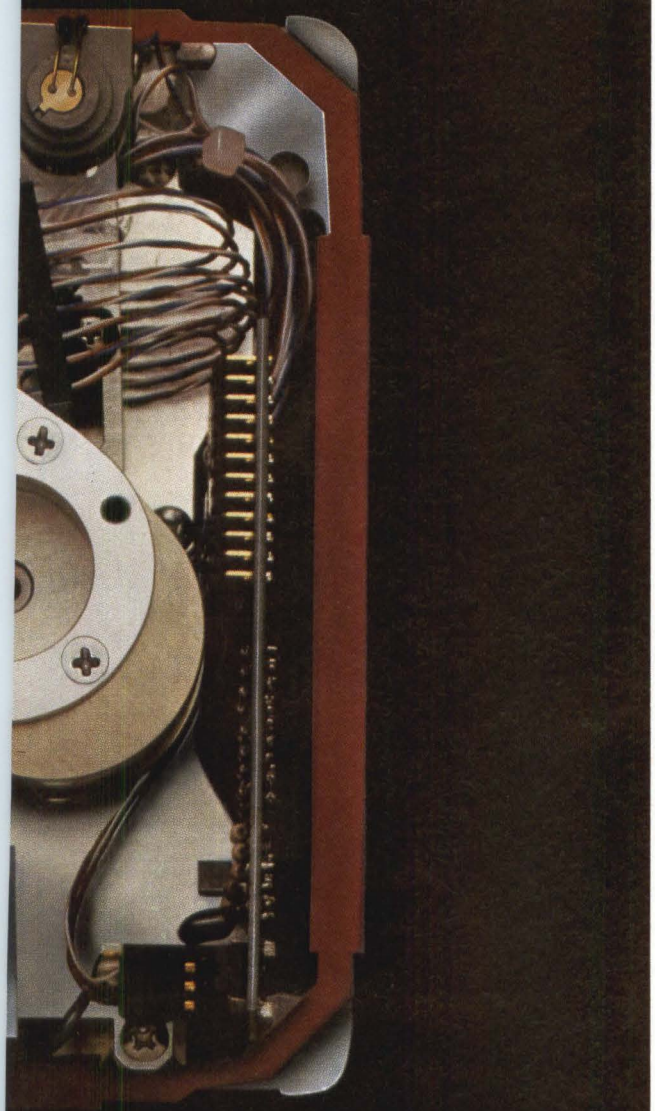

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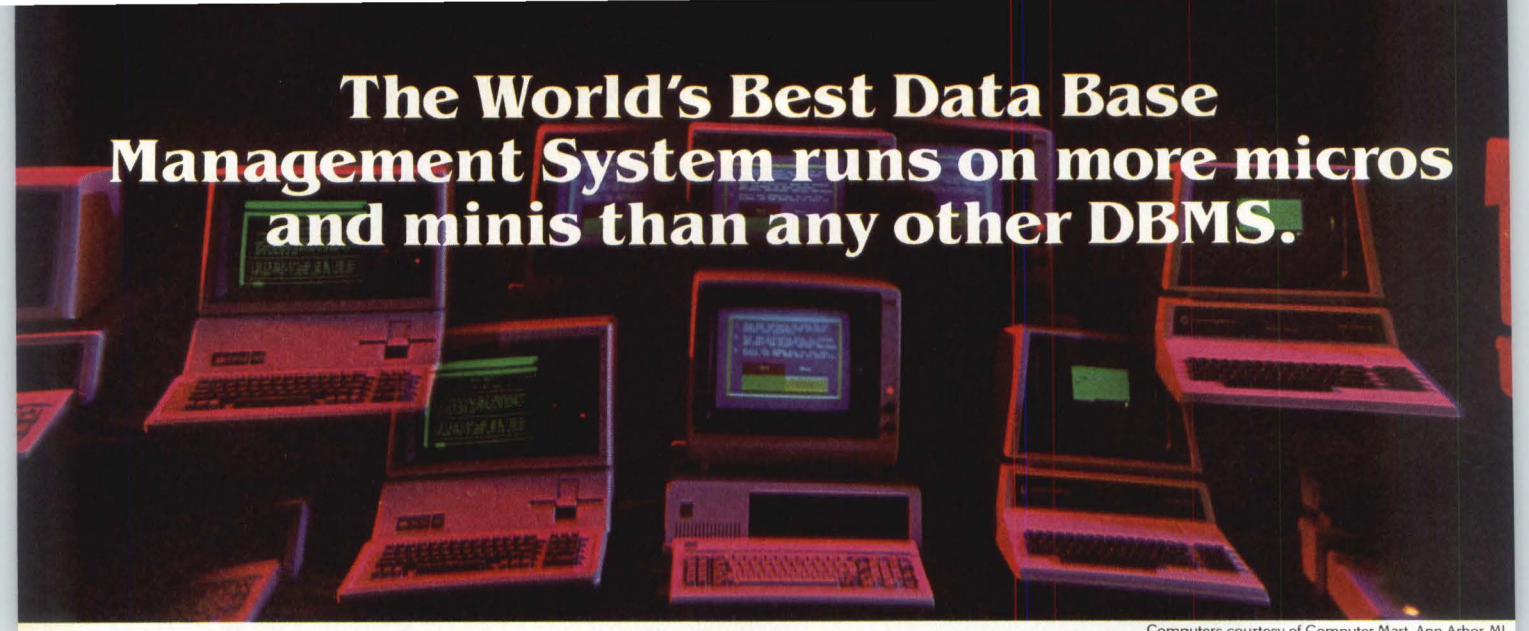

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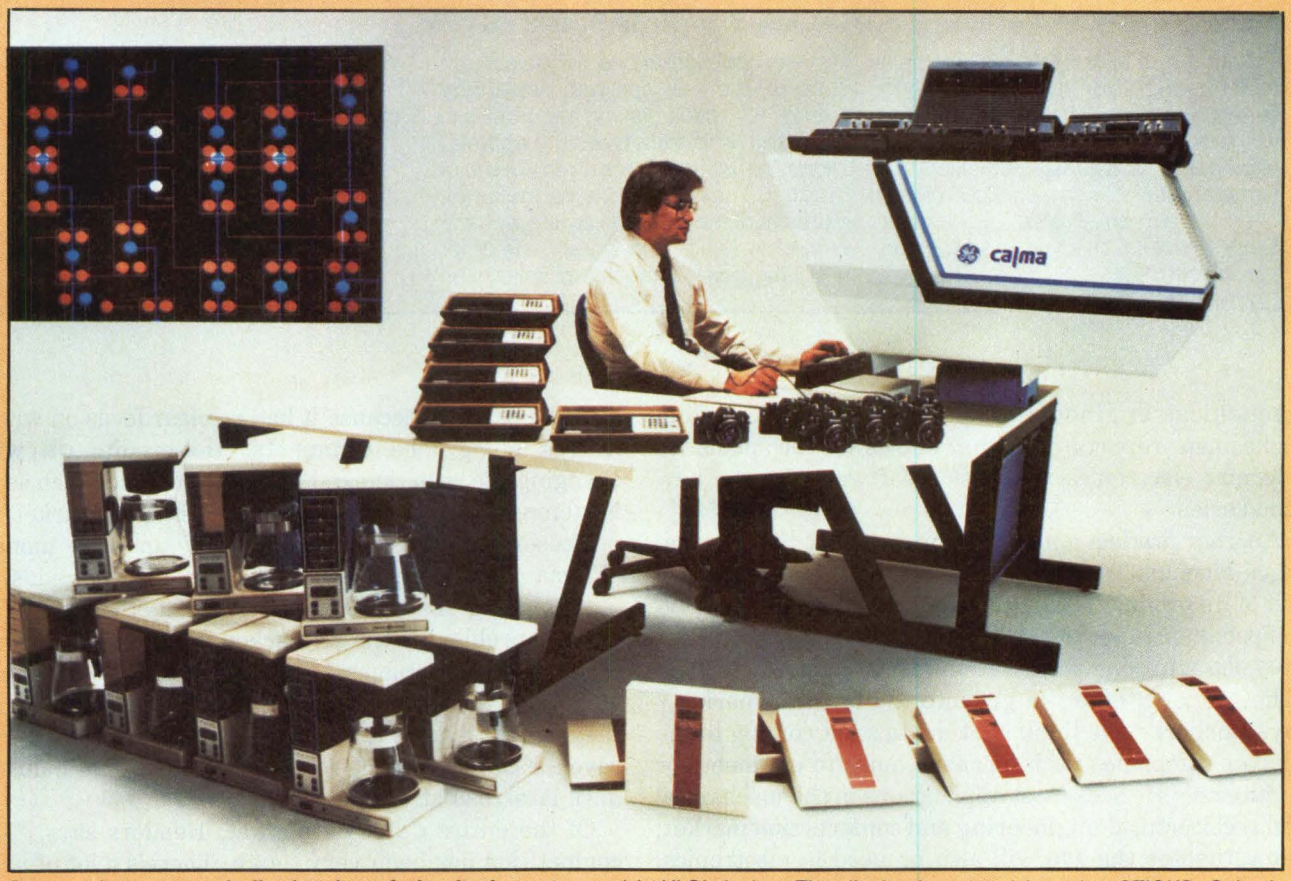

Screen shows a symbolic drawing of circuit elements *used in VLSI design. The display is created by using STICKS, Calma's symbolic IC-design system.*

CALMA SYSTEMS SPEED GATE-ARRAY DESIGN

A big selling point touted by gate-array semiconductor chip suppliers is that their semi-custom-designed chips reduce the time it takes customers to get IC-based products to market. Intersil, a newly acquired subsidiary of General Electric Co. and a manufacturer of CMOS gate-array ICs, claims that by designing its chips using Calma Co. CAD systems, the company can cut design and implementation time even further. "Calma provides us with quick turnaround time for customers," says Jerry Zis, a product marketing manager at Intersil. "We can complete most designs and have prototypes to customers in six to eight weeks."

John Dosio, a senior software engineer at Intersil, says circuit diagrams that once took three weeks to a month to accomplish manually now take only three days using Calma systems. Although Intersil employees may be biased in their assessments because Intersil and Calma are sister GE subsidiaries, Dosio says that in his 20 years of experience with CAD systems supplied by Calma competitors, Calma is the leader in his opinion. "I like the GPL operating system used by Calma as well as the STICKS software package," he says. "The software can be easily tailored by a customer for his application." STICKS provides designers with the basic logic symbols such as rectangles, squares and triangles that are used in IC design.

Intersil uses eight GDS 2 Calma workstations equipped with Data General Corp. Eclipse processors. The GDS 2 is Calma's top-of-the-line system intended for IC-design applications. A VAX 11/780 computer contains the system software and the design database, and performs the routing function—the final step in gate-array design. Logic, circuit and master designs are performed locally at the Calma workstations, and design data are then transferred to the VAX via paper tape. Dosio notes that the Calma systems will eventually be linked directly to the VAX using Calma's new networking scheme. All application software involved in the system was designed at Intersil using the STICKS package as a building block.

James Baker, executive vice president of GE's Technical System Division, the group responsible for GE's factory-automation effort, says Intersil's gate-array application software will be marketed commercially through Calma. Two of the eight Calma workstations at Intersil are dedicated to such software development.

—Frank Catalano

CALMA'S VAX-BASED SYSTEM

Announced at Autofact '82, Calma's new top-of-the-line system, the 7000 series, contains software packages for mechanical and architectural engineering and construction applications. It comes in two configurations, one based on Digital Equipment Corp.'s VAX-11/750 and the other on the VAX 11/780.

Both configurations also contain DEC tape drives and DEC 300M-byte removable-pack disk drives. Both can be used with four types of workstations, all of which have resolution of 1280 × 1024 pixels. Calma manufactures two: the RC-1000 (color) and the RB-1000 (black and white). The other two, the CDS-70 (black and white) and the CDS-80 (color) contain firmware made by Calma and hardware made by Lexidata Corp., Billerica, Mass. The VAX-11/750-based system supports as many as six workstations, and the 11/780-based system suports as many as 12, says a Calma spokesman.

mechanical engineering environment." A Calma spokesman reports that he knows of no plans to reformat electronics application software for the new 7000 series.

Another product announced by Calma at the International Machine Tool Show in September falls at the low end of its product line. The Calma 170, based on the DG Eclipse, can support two terminals and sells for about $100,000 with one workstation and $140,000 with two. "The 170 is an effort to get into the broader market," says Benders. "We think it's time to start coming to the smaller companies with, perhaps, only 10 engineers or architects." He sees most applications in the mechanical and architectural-engineering and construction market, but estimates the 170 will also be used in electronics, especially in PC-board applications.

Another product, introduced in late November, is Calmanet, the company's broadband communications network. A Calma official explains that Calmanet allows Calma systems to communicate with each other and to share a database. Benders says that Calmanet was developed closely with GEnet, GE's communication network for the factory environment, and it is compatible with other networking products as well. "Calmanet is essentially a software protocol that allows you to use various communication systems products," says Benders.

A healthy outlook

With an expanded product line and its new focus on mechanical applications, Calma is in a strong position in the CAD/CAM market, says consultant Anderson. "Calma is going to be one of the survivors," he asserts. "I don't think there's any doubt of that." He also forecasts a bigger market share for Calma, predicting that the company will be the first- or second-ranked supplier of turnkey CAD/CAM systems by 1990.

Kurlak of Merrill Lynch also sees a brightening picture for Calma. "Calma was losing market share for a couple of years because it had no clear focus on where it was going," he comments. He credits GE with changing the situation and points to specifics such as its hastening Calma's entry into the mechanical market, its professional style of management and its money. "Calma is gaining market share now," Kurlak adds.

In making his own forecasts, Benders says, "Our biggest problem is the IC market. It's been experiencing terrible problems." He explains, "We have a 70-percent market share in the IC market, and when they stop buying, it has a significant effect on our revenues." He predicts no recovery for the IC industry until late 1983 at the earliest.

Of the entire CAD/CAM market, Benders says, "The competition has been very tough. There's a lot of price cutting, and Computervision has put up a good fight to keep us out of the mechanical market." He claims Computervision has cut prices by as much as 50 percent, and believes its total vertical integration (Computervision makes all the components for its systems) allows it the profit margins to make such large price cuts.

Computervision's vice president and general manager of the North America division, Robert Gothie, denies his company has made such deep price cuts. "Historically, Computervision has enjoyed the highest gross margins in the CAD/CAM industry," he says. "Those margins are public facts. And you can't have them at 50-percent discounts."

However, Glen Palmer, vice president of engineering at Productivity International, a Connecticut-based consulting firm, thinks Computervision may have reason to worry about Calma's move into the mechanical market. "Calma's got an advantage over Computervision by use of vendor-supplied hardware," he says. He believes Calma is well-positioned for the future, adding, "Now that they've got the bugs out, I think Calma's going to be one of the big contenders in the marketplace." □

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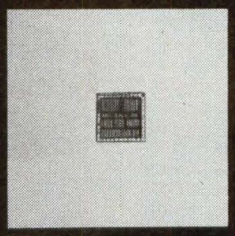

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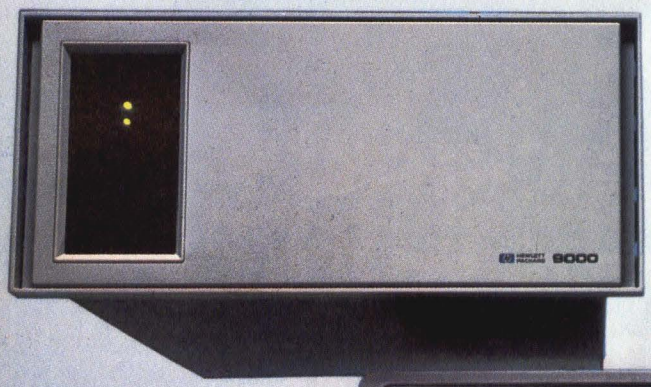

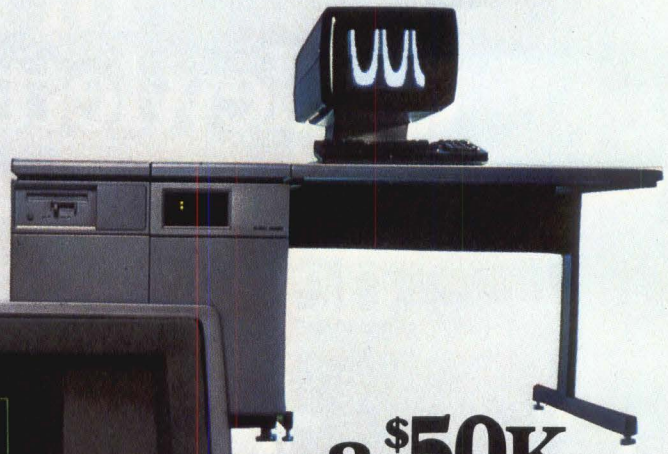

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Our tiny ¼" square CPU contains 450,000 transistors. So there's nothing small about the 32-bit power it gives our new HP 9000 family of technical computers. Even our $20K model gives you the performance of a mainframe computer costing up to four times as much.

And now you can have all this power in a configuration that really fits your application. The densities of the CPU and surrounding 'super chips' allow you the choice of a rack-mountable box; an integrated workstation; and a mini-cabinet suitable for a variety of single and multi-user applications.

Of course, the benefits of one-micron geometry don't stop there. This new technology has also let us develop a multi-CPU architecture that offers you three levels of processing power. Each configuration described above can take one, two or three CPUs. So you can almost double or triple the computer's capacity without adding to its size. Whether you order it that way or add the extra power later, it's transparent to the user.

32-bits, every bit of it.

The HP 9000 family has 32-bit internal and external data paths, 32- and 64-bit math (IEEE floating point format), and virtual memory addressing of up to 500 Mbytes.

And it is fast! The system will handle a million instructions per second. The 18 MHz clock permits the execution of a micro-instruction every 55 nanoseconds. The I/O rate can reach 6 Mbytes per second for every I/O slot. And the memory cycle time is a lightning-quick 110 nanoseconds.

There's also lots of program space, with up to 2.5 Mbytes of main memory. A flexible disc drive and optional 10 Mbyte Winchester are built right into the integrated workstation.

Each memory board has a Memory Controller Chip that provides automatic error detection/correction, memory mapping and 'healing.' Every time you power up, this chip actually maps out single-bit memory error locations, and assigns a back-up memory location in place of the old one—without slowing the access time or reducing memory capacity.

We've also made the CPU more efficient by assigning many of its time-consuming tasks to our Input/Output Processors. And to give you even more speed, the HP 9000 has a backplane bandwidth of 36 Mbytes/second. That's enough to support all three CPUs, each backed up by its own IOP. You can imagine the effect that has on throughput!

All the benefits of a UNIX® operating system. And then some.

Our HP-UX is an enhanced version of this increasingly popular operating system. It supports FORTRAN 77, Pascal and C language. And lets you take advantage of the many programs and utilities already available for UNIX. In addition, HP-UX offers significant extensions like 3-D graphics, virtual memory, IMAGE Data Base Management, a variety of data communication products and enhanced file capability.

The integrated HP 9000 workstation also supports our highly evolved, high-performance Enhanced BASIC, augmented by 3-D graphics. Its run-time compile feature provides the friendliness and interactive capabilities of an interpreter with the speed of a compiler.

Powerful networking made easy.

Even our stand-alone models won't have to work alone. Each can be part of a network of powerful, dedicated, interactive workstations. They'll support several different networking options, including Ethernet.™ And in late 1983, LANs based on the industry-standard IEEE-802. So you can share peripherals and data files locally.

With HP's broad range of peripherals and instruments to choose from, it isn't hard to build precisely the system you need. Once your HP 9000s are up and running, we can make sure they stay that way. Our service is good enough to be rated Number One in Datapro surveys for the past two years.

We've also developed two special marketing programs that could mean extra sales for you. If you're a software supplier, there's our HP PLUS program, which we designed to open new doors for you. And if you're a hardware OEM, our volume discount schedules and third-party support program make the HP 9000 even more intriguing.

To get a close look at the way our new computer has changed the 32-bit world, phone your nearest HP office listed in the White Pages. Ask a Technical Computer Specialist to give you a hands-on demonstration. Or write for complete information to Pete Hamilton, Dept. 08149, Hewlett-Packard, 3404 East Harmony Road, Fort Collins, CO 80525.

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TCG-206

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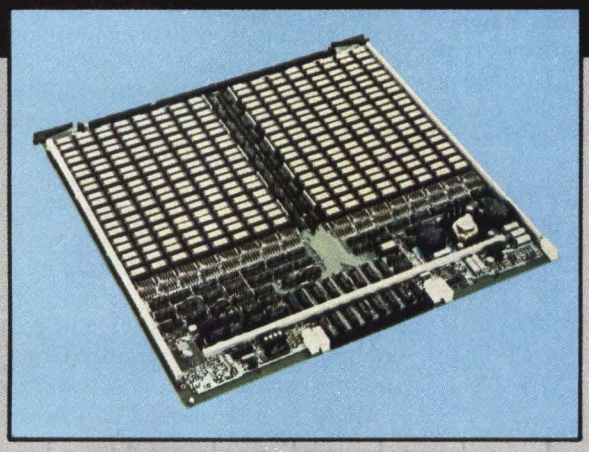

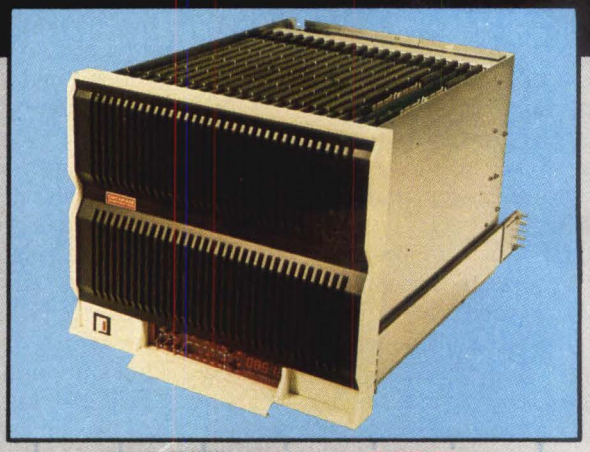

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Both feature speed, capacity, reliability, performance...and low price. Features you won't find in memory from any other Perkin-Elmer memory supplier. Products such as high-performance BULK SEMI that are available only from Dataram. All good reasons why Perkin-Elmer users should look to Dataram when they're looking to perk up their 3200 Series computers.

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Solid-state speed enables the BULK SEMI to run at the full SELCH rate of 4.0MB/sec. More than that, solid-state technology means high reliability, further enhanced by standard Dataram features like error correcting and off-line test capability.

And when you talk about capability, you'll talk about the BS-702's unique dual-port operation that allows you to bring your image processing, array processing, or data acquisition input in on one port and off-load to your 3200 on the other.

CIRCLE NO. 68 ON INQUIRY CARD

DATARAM CORPORATION

Two products link HP computers to factory-floor operations

By Frank Catalano and Dwight B. Davis

As part of its drive into the factory-automation market, Hewlett-Packard Co. is starting to take orders this month for a process monitoring and control (PMC) system, as well as an interface that links HP hardware to networks of Allen-Bradley Co. programmable controllers. The PMC/1000 software package and the Programmable Controller Link/1000-AB interface each run on HP 1000 series computers.

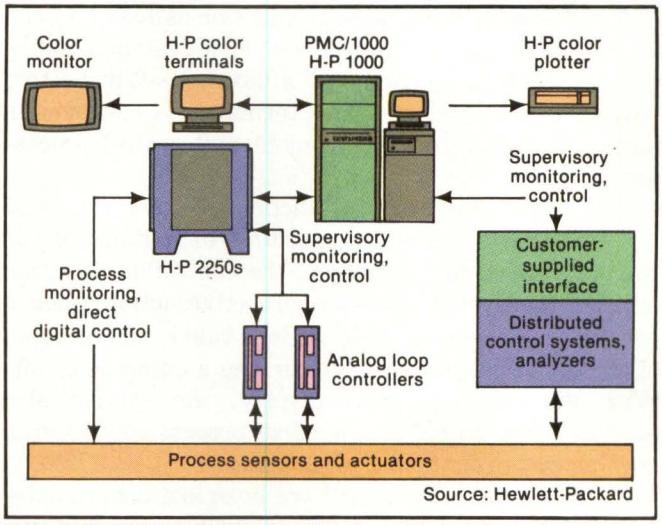
Both products are equipped with what Jim Olsen, applications manager at HP, terms "generic software" that gives end users and system integrators building blocks upon which to structure higher level application packages.

The systems are among the first products offered by HP as part of the company's Manufacturing Planning Network strategy of providing linked computer solutions in the industrial areas of administrative and office services, operational planning and control, computer-aided engineering and factory and plant automation.

By providing its HP 1000 computers with generic software, HP hopes to tap what Olsen calls a "wide-open" market for factory-oriented application software. "There's a lot of money to be made in software and services," he says, "so we're setting up separate software groups within our organization specifically dedicated to factory applications."

John Myers, president of Tech Tran Corp., a Naperville, Ill., market research and consulting firm that specializes in factory automation, says the move by computer vendors such as HP to provide systems with software runs parallel to such vendors' strategies in the office-automation market. "Some of the most successful business-application software on the market has come from hardware-oriented vendors like HP or Digital Equipment Corp.," says Myers. "That only makes sense because such vendors know their computer systems, their operating systems and their computing capabilities. Now, with all the interest in factory systems, we're starting to see DEC and HP come out with factory-oriented application packages."

Olsen notes, however, that by providing software with its systems, the company will not be competing with system integrators specializing in narrow factory applications. Instead, says Olsen, HP will be helping those vendors. "Our application software is not tailored to any specific application, but covers a broad range of industries," says Olsen. "We recognize that every manufacturer has a different application from the next one and that our software will have to be tailored for those different applications. That's where system integrators come in. We want to help them, as well as end-users, start with something rather than build the software from scratch." Olsen adds that, later, HP will tap its own factory experience and start offering more application-specific packages aimed at discrete manufacturers.



HP's PMC/1000 system *can directly control and monitor process sensors and actuators on a factory floor through the 2250 measurement and control processor or can perform supervisory monitoring and control of a distributed-control system through a customer-supplied interface. That interface could range from a standard RS232 port to a more sophisticated parallel interface.*

Process monitoring and control

The new PMC package, which runs on the HP 1000 F-series minicomputer, is intended primarily for small- to medium-scale continuous-process and discrete-manufacturing environments. Olsen describes the target processes as those that involve 200 to 300 control points such as temperature and pressure.

With a base price of $130,000, the PMC/1000 system includes the HP 1000 16-bit computer with the RTE 6/VM real-time operating system and 1M byte of memory, an HP color graphics terminal, a dot-matrix printer, a Winchester disk drive with 28M bytes of storage and an HP 2250 measurement and control processor. The HP 2250 provides a direct link between the PMC/1000

system and process sensors and actuators on the factory floor. Besides the process control and monitoring software, the package also includes color graphics software (see diagram, p. 125).

A high-end system, able to montior as many as 500 process points, sells for $280,000. That system includes another 1M byte of memory, a 65M-byte Winchester, two additional color graphics terminals, a line printer and additional 2250 measurement and control processors.

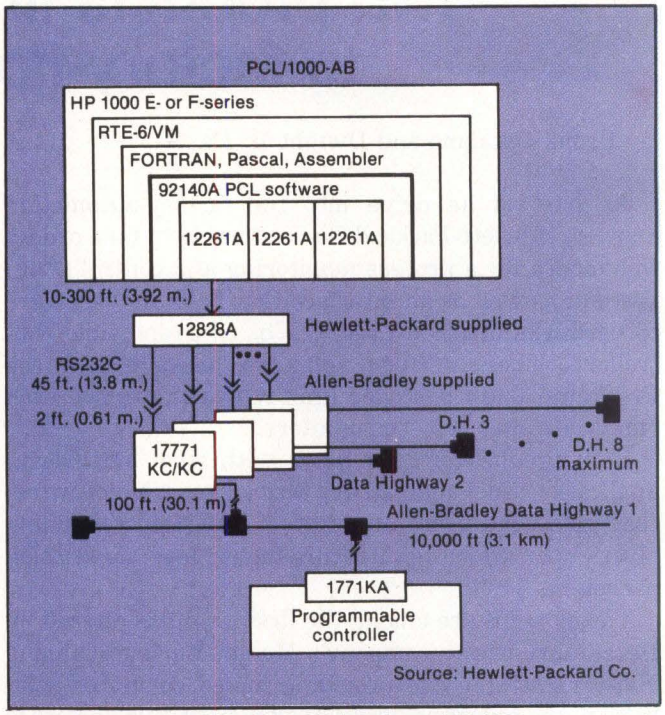
While the monitoring function of the PMC/1000 system consists of alerting operators to malfunctions or breakdowns within processes, the controlling function enables the system to take corrective action when a breakdown occurs. Such action could range from opening or closing a valve to turning a pump on or off. With the color graphics display, the system also enables users to log and analyze process-control data such as cycle counts and error rates.

Three PMC/1000 systems have been installed to date. One monitors and controls an ore-crushing and -separation operation at an Australian mining firm, a second manages a film-coating process for a Belgian photographic filmmaker, and a third manages a wastewater treatment operation at HP's Sunnyvale, Calif., PC-board facility. Olsen says HP's in-house installation cut a year from the time it took to get the Sunnyvale facility up and running and is saving the company an average of $100,000 a year through proper wastewater treatment.

"Our primary market thrust with the PMC/1000 will be to discrete manufacturers, like ourselves, who have embedded processes, such as wastewater treatment or furnace control, which are part of their overall manufacturing operation," he says. "Most discrete manufacturers don't have the budget to purchase a complete turnkey process-control system from a process-control vendor, nor do they have the engineering resources to develop a complete system themselves. Our customers are telling us that they want something in between. We feel the PMC/1000 fills that gap."

Programmable controller link

HP's second new product, the PCL/1000-AB, serves as a hardware and protocol interface between HP 1000 computers and Allen-Bradley's Data Highway networks of programmable controllers. A single HP 1000 computer can support three interfaces, which can each control eight Data Highways. Because as many as 32 programmable controllers can reside on each Data Highway, a single computer can theoretically supervise 1512 controllers, but CPU response time would suffer at the upper limits of this range.



Hewlett-Packard's PCL/1000-AB *interfaces HP 1000 computers to Allen-Bradley's Data Highways networks of programmable controllers. Elements in the diagram specific to the interface are the 92140A PCL software, the 12261A eight-channel multiplexer interface cards (as many as three per computer) and the 12828A multiplexer panel. The permissible cable lengths between the components are indicated.*

Although HP was the sole developer of PCL/1000-AB, Allen-Bradley, Highland Heights, Ohio, did cooperate with the HP program. "We were very supportive of the HP effort," says Al Fink, Allen Bradley product manager, "and we provided technical capability, test equipment and some of our software for evaluation purposes."

HP is the first computer vendor to develop an interface between its own computers and the Data Highways independently. Until now, the only option Data Highway users had for adding supervisory computers to the network were DEC PDP-11 minicomputers, connected to the networks through an Allen-Bradley-supplied interface.

The PCL/1000-AB link consists of three main elements —an HP 92140A software package, an HP 12261A multiplexer interface card and an HP 12828A multiplexer panel. These connect to an Allen-Bradley 1771-KC/KD communications controller interface (see diagram, above). The Z80-based HP 12261 interface card performs buffering, retries, checksums and protocol specifics.

"With the PCL/1000-AB and the database-management and networking capabilities of an HP 1000

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computer, a manufacturer can get both immediate status reports and historical trend information showing exactly what's happening on the factory floor at any time," Olsen says. He admits, however, that the interface is just a foundation upon which to build higher level supervisory and monitoring software. Such application-specific packages must be provided by a user or by a third-party system integrator. On the programmable controller side, Fink points out, certain Allen-Bradley PCs already provide some support for higher level software, for example, by offering sophisticated report-generation capabilities.

Permitting full-duplex, 9600-bit-per-sec. operation, the PCL/1000-AB lets FORTRAN-77, Pascal/1000 or Macro Assembler progams monitor PC status, down-load commands and programs and send information to and from any Data Highway device. A user interface isolates the PCL/1000-AB from the computer's RTE 6/VM operating system and automatically handles error conditions.

HP plans to offer interfaces between its computers and other manufacturers' programmable controller networks, Olsen says, and the company will probably announce three such links within a year. While Olsen won't comment on which vendor's PCs HP has targeted for interfaces, likely candidates include Gould Inc., General Electric Co. and Texas Instruments Inc.

A single PCL/1000-AB—including software for as many as three interfaces, an interface card, a multiplexer panel and cabling for connection to an Allen-Bradley 1771-KC/KD communications controller—carries a U.S. list price of $7200. Quantity discounts are available. □

NEXT MONTH IN MMS

The February issue of Mini-Micro Systems will feature disk drives. Topics covered will include small and large Winchester systems and floppy-disk drives and how technology and market forces are affecting them. Some Highlights:

- **Multiple-megabyte Winchester disk drives.**
- **A profile of the floppy-disk drive market.**
- **A profile of the small Winchester system market.**
- **Thin-film technology and its implications.**
- **Large disk drives.**

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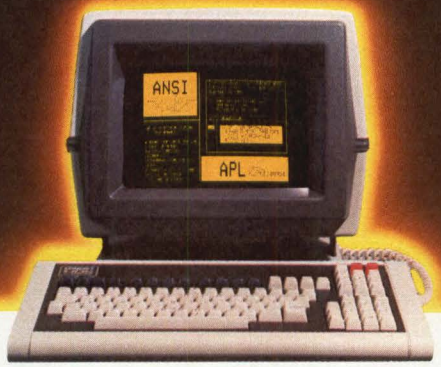

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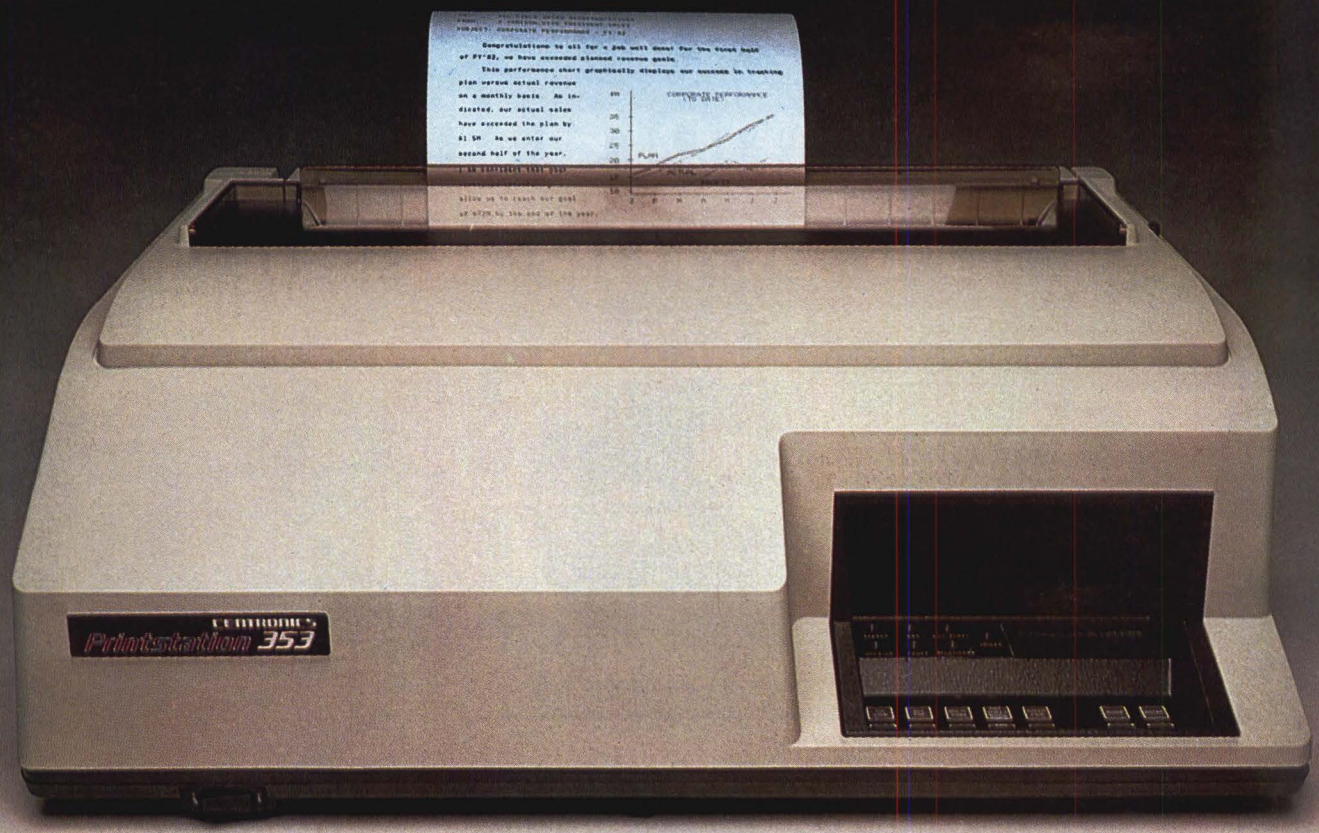

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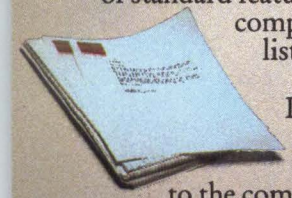

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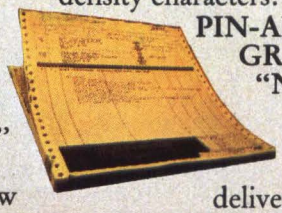

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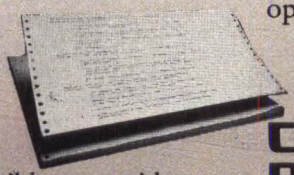

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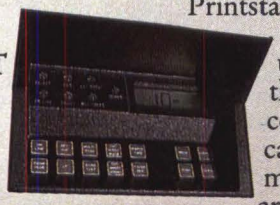

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CIRCLE NO. 72 ON INQUIRY CARD

Market overview: minicomputer line printers

PATRICK KENEALY, Associate Editor

Non-impact printers come off the drawing boards to threaten today's dominant technologies

Users of general-purpose minicomputers and small-business systems have always relied on line-printer technology they "inherited" from their supercomputer and mainframe brethren. While this has brought them ever faster, cheaper and more reliable impact printers, they've been waiting for non-impact units designed and priced with them in mind. The structure of the line-printer industry and the high cost of both impact and non-impact printer design and manufacturing have made their wait long, but a number of 1982 developments indicate that the wait should be over this year.

A stable industry

Four kinds of vendors still control the line-printer industry: data-processing-system manufacturers, plug-compatible manufacturers, printer integrators and leasing companies. The computer and minicomputer systems manufacturers such as IBM Corp. and Digital Equipment Corp. make and sell printers to their captive customers. The system manufacturers sell more dollars worth of printers than any other kind of vendor. Independent printer manufacturers such as Data Printer Corp. and Dataproducts Corp. operate as OEMs and sell their printers to other vendors that, in turn, resell to end users under their own labels. Independents sometimes function as plug-compatible manufacturers and sell directly to end users. Printer integrators such as Digital Associates Corp. and Southern Systems, Inc., buy OEM printers and add software, interfacing, packaging and marketing expertise before selling them to end users, often with maintenance support (Fig. 1). The last group of line-printer vendors is the third-party leasing companies that buy printers for lease or resale with little, if any, value added.

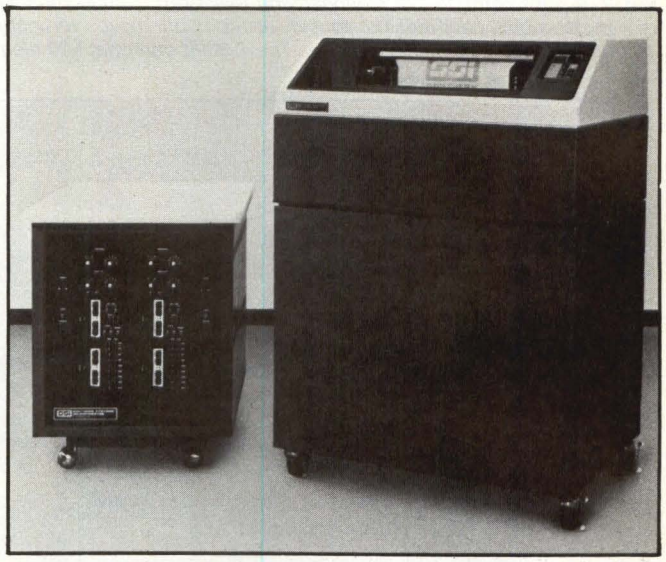


Fig. 1. An IBM 3203-5 printer replacement system *from Southern Systems, Inc. By combining its 32/5 controller with a 1130-lpm OEM band printer from Control Data Corp., Southern Systems can offer a less-than-$20,000 printer system—less than half the price of its plug-compatible IBM counterpart. Southern Systems and its competitors also offer replacement printers for DEC, DG, HP, Burroughs Corp. and Texas Instruments, Inc.*

Line printers can still be divided into three basic speed ranges, but the advent of super-fast non-impact units has broadened the ranges. Low-speed line printers are the first step above fast serial printers and print from 125 to 500 or so lines per min. They can sell for well under $10,000 and use matrix and other impact printing methods. Medium-speed line printers print between 600 and 1500 lpm and use traditional electromechanical belt, band, chain and train mechanisms. They sell to end users from $10,000 to $70,000 and are the most popular minicomputer line printers. High-

speed line (or page) printers use non-impact laser, magnetic, thermal, electrostatic and ion-deposition technologies to print 4000 to 45,000 lpm (70 to more than 700 pages per min.). High-speed line printer prices have recently fallen below $100,000, but most units still are priced between $150,000 and $350,000.

Line-printer applications have changed very little. Superminicomputer systems have the power to generate as much output as older mainframes and are usually equipped with medium- to high-speed line printers. Multi-user traditional minicomputers used for general-purpose, business and educational applications are still the biggest users of medium-speed line printers. The new 16- and 16-/32-bit, multi-user microcomputer systems are voracious consumers of low-speed line

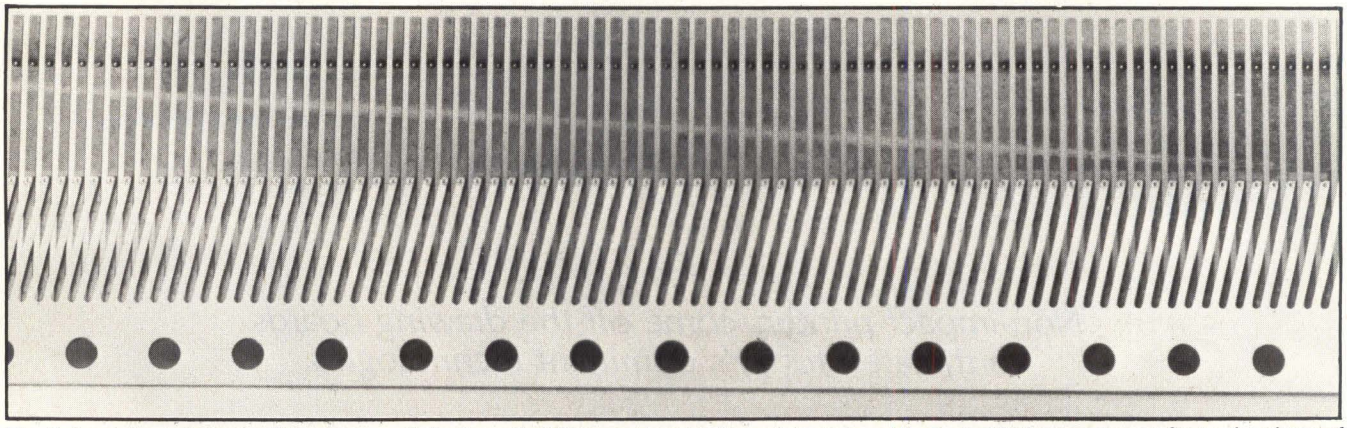
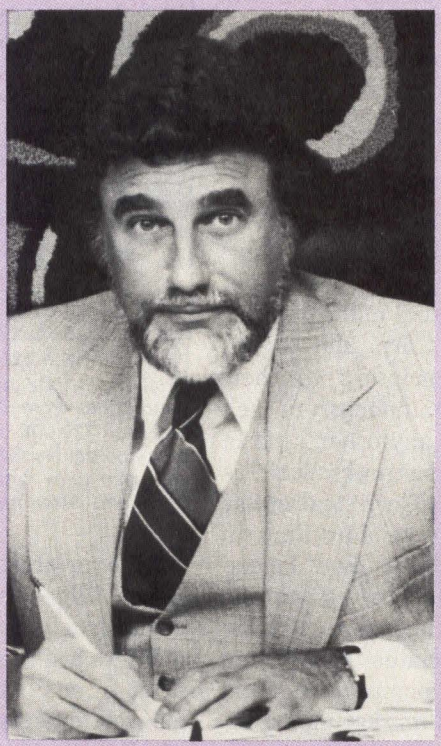


Fig. 2. A print comb *from a Mannesmann Tally Corp. T-3000 impact matrix line printer (above) features 132 hammers, one for each column of output. The comb oscillates horizontally as the paper moves vertically, yielding 7 × 7, 7 × 9, 7 × 11, 7 × 13 or 7 × 16 dot characters in any of 10 standard and optional languages. The T-3000 can print 600 element character sets at a true 300 lpm.*

WHAT ARE END USERS BUYING?

Digital Associates Corp. is a value-added supplier of line-printer systems, primarily to the minicomputer-based end-user community. The Stamford, Conn., company was the first to develop a plug-compatible line-printer system for minicomputer applications in 1971, and has grown to be the largest organization of its type in the industry. Its product line encompasses 27 models in band, chain train, belt, drum and matrix technologies as well as a complete line of printer controllers/interfaces and communications interfaces for a broad range of CPUs. All of the company's products are supported by a nationwide, centrally dispatched service network.

"As a major printer supplier in the end-user marketplace, we have noticed some interesting trends in configuration requirements," says company founder and president Thomas Loucas. "Speed requirements are on the increase; the driving force behind this phenomenon seems to be the growth in the superminicomputer marketplace. Bands have replaced the venerable drum as the predominant printing technology purchased by today's users. The reasons for this are lower price, better print quality, ease of print-font changes and built-in user friendliness.



Thomas Loucas, *Digital Associates Corp. president, comments on trends in configuration requirements.*

"The increasing popularity of the band printer has also reduced the average printer system sale. Two years ago, it was a bit over $12,000; this year, it's pegged at approximately $11,000. Nearly all band printers manufactured today incorporate diagnostic, LED status displays to aid operator convenience and ease of maintenance. Requirements for vertical format control have also changed in the past few years. Forms length selector switches and/or direct access vertical format units are requested on nearly all of our printers. The paper-tape VFU is no longer a popular item. One thing that seems to remain constant is character-set requirements. The large majority of our printers are still shipped with 64-character, upper-case sets. However, some of our band printer customers are ordering an extra 96-character upper-/lower-case band after purchasing their printers with a 64-character band."

printers and have the software and processing power to drive medium-speed units.

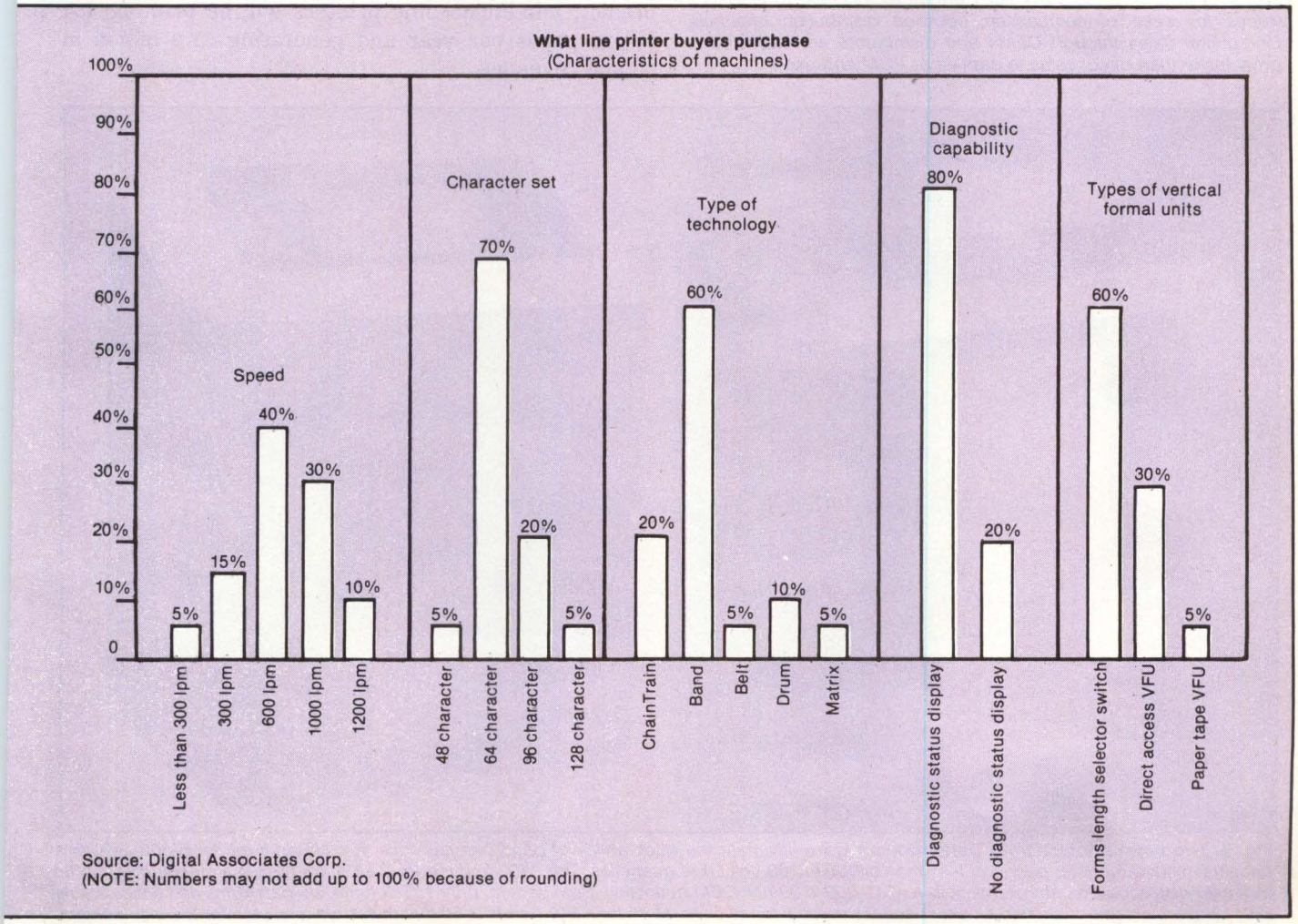
The stability of line printer distribution channels, performance ranges and applications has not affected the slow but steady pace of technical innovation in line-printer design and manufacturing. Low-speed units are becoming faster, medium-speed units are becoming more reliable, and high-speed units are becoming more affordable. Fine tuning of impact technologies has been matched by basic research in non-impact technologies. Non-impact page printers have proven their reliability in mainframe applications, and minicomputer users covet their multiple speeds and forms and font flexibility. The technologies available this year will not radically differ from last year's, but the market shares they hold should change noticeably during 1983.

Impact technologies

The biggest impact line-printer news of 1982 was a discontinuation rather than an announcement. In September, having sold more than 75,000 units, Dataproducts announced it would no longer accept orders for its 2200 series drum line printers. Drum printers had topped 1200 lpm, but their drums were expensive and difficult to change, and their hammer assemblies needed frequent adjusting. Dataproducts had been selling both drum and band line printers for the past few years, and its decision to drop drum units is testimony to the technical and marketing superiority of band technologies.

Chain and train line printers such as those made by IBM and Data Printer are the fastest impact line printers, reaching speeds of 1500 to 3000 lpm. They are expensive, and their character sets are hard to change, but they are reliable and print multiple copies with high-quality print.

Impact matrix line printers offer multiple fonts, bar codes, graphics and multi-copy capability at various resolutions. Printronix, Inc., Hewlett-Packard Co., Tally, Okidata Corp. and IBM offer units priced between $3000 and $10,000 that print from 125 to 600 lpm (Fig. 2). A number of 200- to 500-character-per-sec. bidirectional impact *serial* printer technologies compete in low-speed line-printer markets. Matrix printer resolution (typcially 9 × 7 dots per character) is inversely proportional to speed, and both are inversely proportional to price. Many matrix line printers feature fast printing of draft-quality characters and slower printing of near-letter-quality characters, but fast printing of high-resolution characters is still beyond matrix technology. In the long and short runs, matrix



Source: Digital Associates Corp.
(NOTE: Numbers may not add up to 100% because of rounding)

line printers will be very popular in single-printer systems in which cost and flexibility are the most important printer attributes.

Band printers are the darlings of the impact line-printer market (Fig. 3). They are mechanically simpler and hence less expensive and more reliable than chain and train printers. They use inexpensive, easily changed print bands along with proven inking and paper-handling mechanisms. It's not surprising they've forced drum printers off the market and are outselling chain and train printers that run in their speed ranges.

Eight companies now manufacture band printers, and every major minicomputer-system vendor offers one or more band printers. Most band printers have end-user prices between $5000 and $20,000 and print between 300 and 1500 lpm. Control Data Corp., Dataproducts, General Electric Co., Data Printer, Centronics Data Computer Corp. and Teletype Corp. all offer band or similar belt-type units. Because of their speed and flexibility, one band printer can often replace several other types of printer.

1981 IMPACT LINE PRINTER MARKET BY TECHNOLOGY AND DISTRIBUTION

Fully formed characters

Captive:	OEM/distributor:	End user:
$1050 million (EU)	$690 million (EU)	$60 million (EU)
35,000 units	60,000 units	1000 units
8% unit growth	20% unit growth	15% unit growth

Dot matrix

Captive:	OEM/distributor:
$24 million (EU)	$184 million (EU)
2,000 units	23,000 units
20% unit growth	20% unit growth

Source: Datek Information Services, Inc.

Impact line-printer shipments *topped $2 billion and 121,000 units in 1981, according to Datek Information Services, Inc., a Newtonville, Mass., printer research and publishing company. The tables above are Datek's breakdowns of worldwide line-printer shipments by U.S.-based companies and foreign companies with a significant U.S. presence in printers. Dollar values are all expresssed as end-user values for ease of comparison between distribution channels. Line-printer sales through OEMs and distributors are expected to grow faster than direct sales to captive or PCM end users.*

Non-impact technologies

Demand for increased speed, low noise levels and character-set versatility has inspired a dozen vendors to develop electro-optical, thermal, electrostatic, ink-jet, magnetic and ion-deposition technologies (MMS, January, 1982, p. 157). Frost & Sullivan estimates that non-impact line printers will increase their share of the total number of computer printers sold from today's 1 percent to roughly 4 percent in 1985, when, they predict, non-impact line printers will be printing 454 billion pages per year and generating $7.2 billion in annual revenues.

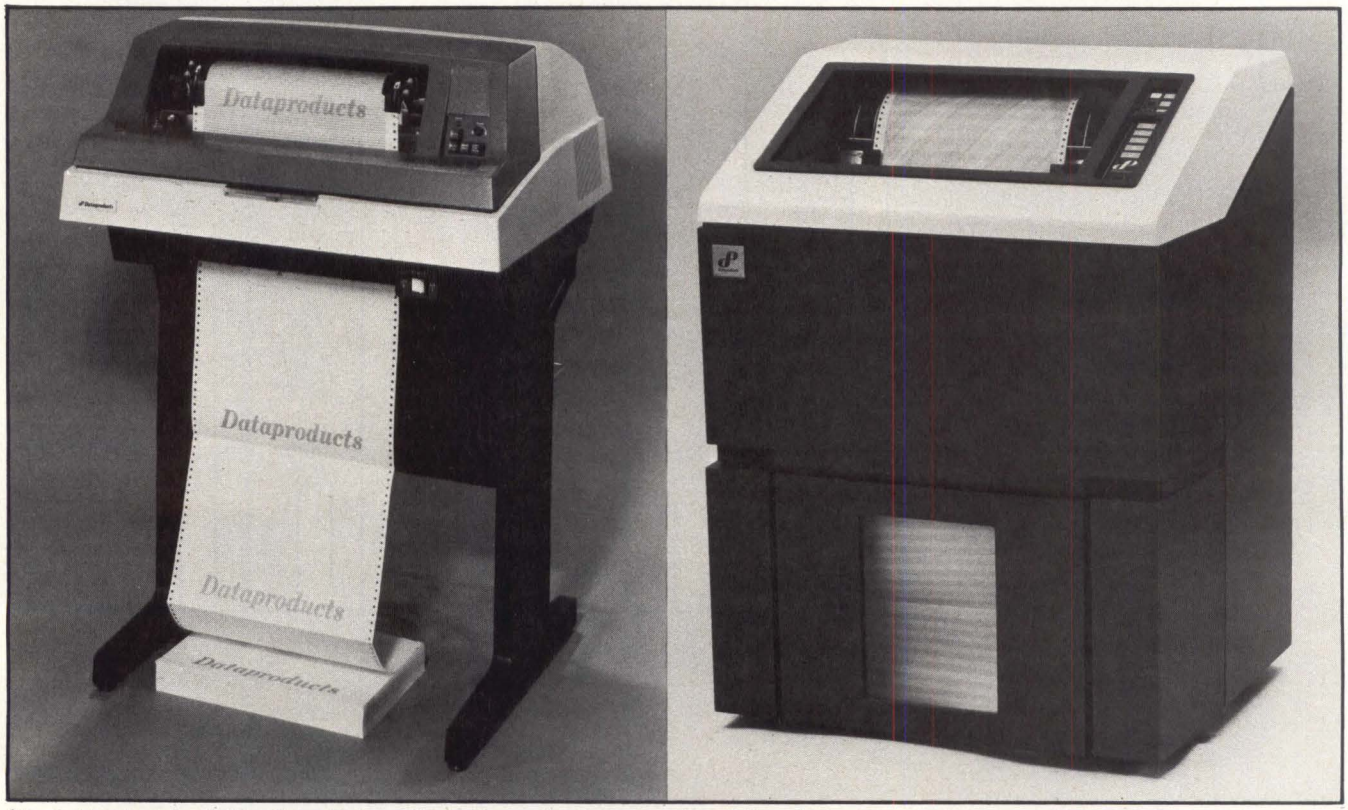
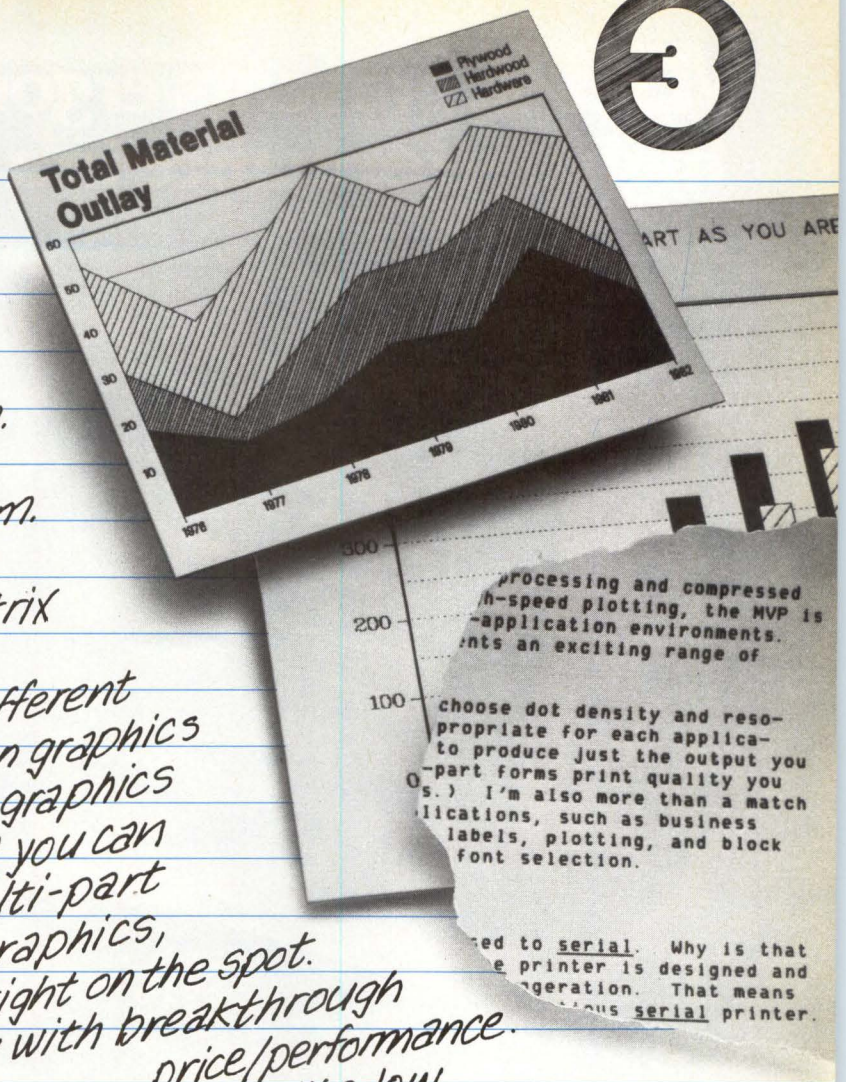


Fig. 3. Two band printers from Dataproducts Corp. *illustrate the adaptability of band mechanisms. The 300-lpm model B-300 (left) is a pedestal-mounted printer priced at less than $4000 in 100-unit OEM quantities. The 1500-lpm model B-1500 (right) is a floor-standing model with a 60-dBa acoustic cabinet that sells for $11,300 in 50-unit OEM quantities. Both printers print 132-column, six-part forms and are available with 12-channel tape-controlled or direct-access vertical forms units. More than 250 bands in 50 font styles are available for B series printers.*

For different needs, different speeds.



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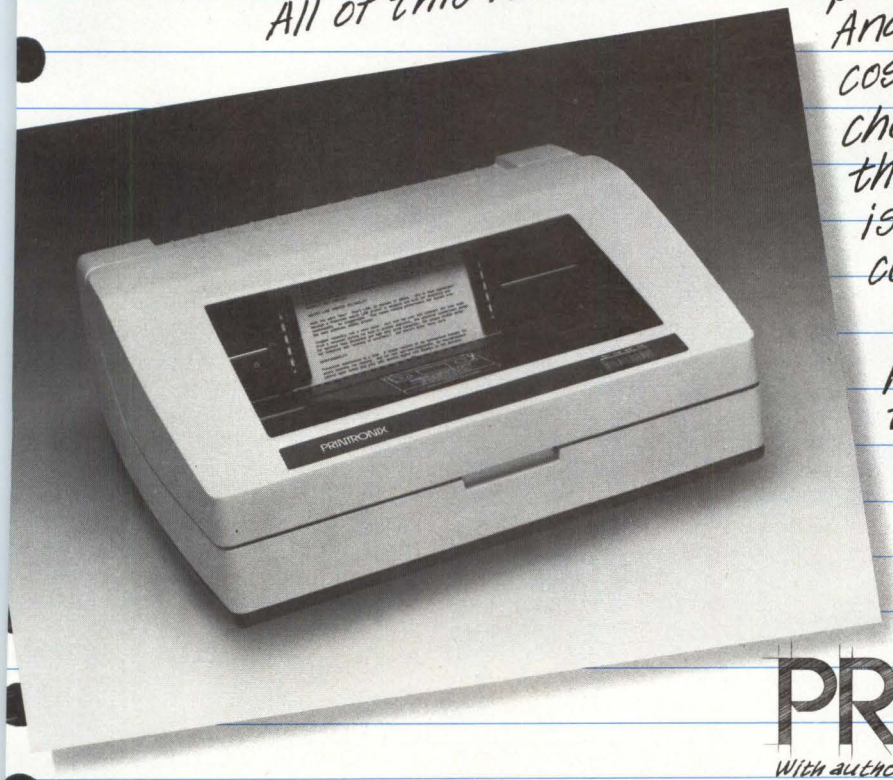

Graphics shown courtesy of ISSCO.

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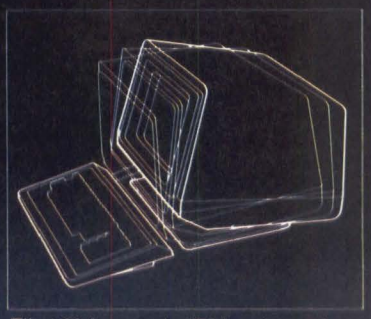
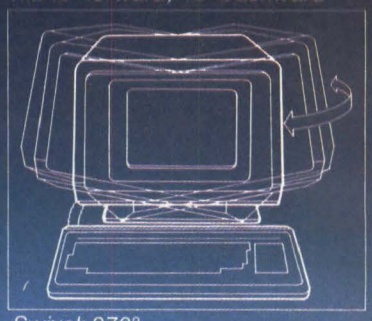


Tilt: 10° forward, 15° backward



Swivel: 270°

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Another distinctive feature of the VISUAL 50 is its emulation capability. VISUAL 50 is code-for-code compatible with the Hazeltine Esprit,™ ADDS Viewpoint,™ Lear Siegler ADM-3A™ and DEC VT-52.® Menu driven set-up modes in non-volatile memory allow easy selection of terminal parameters.

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FEATURE COMPARISON CHART

FEATURE	VISUAL 50	Hazeltine Esprit	ADDS Viewpoint	Lear Siegler ADM-5	Televideo 910
Tilt and Swivel	YES	NO	NO	NO	NO
Detached Keyboard	YES	NO	YES	NO	NO
N-Key Rollover	YES	NO	YES	NO	NO
Audible Key Click	YES	YES	NO	NO	NO
Menu Set-Up Mode	YES	NO	NO	NO	NO
Status Line	YES	NO	NO	NO	NO
Full 5 Attribute Selection	YES	NO	NO	NO	YES
Smooth Scroll	YES	NO	NO	NO	NO
Line Drawing Character Set	YES	NO	NO	NO	NO
Block Mode	YES	YES	NO	NO	YES
Insert/Delete Line	YES	YES	NO	NO	YES
Bi-Directional Aux Port	YES	YES	NO	YES	NO
Columnar Tabbing	YES	YES	NO	NO	YES
Independent RCV/TX Rates	YES	NO	NO	NO	NO
Answerback User Programmable	YES	NO	NO	OPT.	NO

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CIRCLE NO. 74 ON INQUIRY CARD

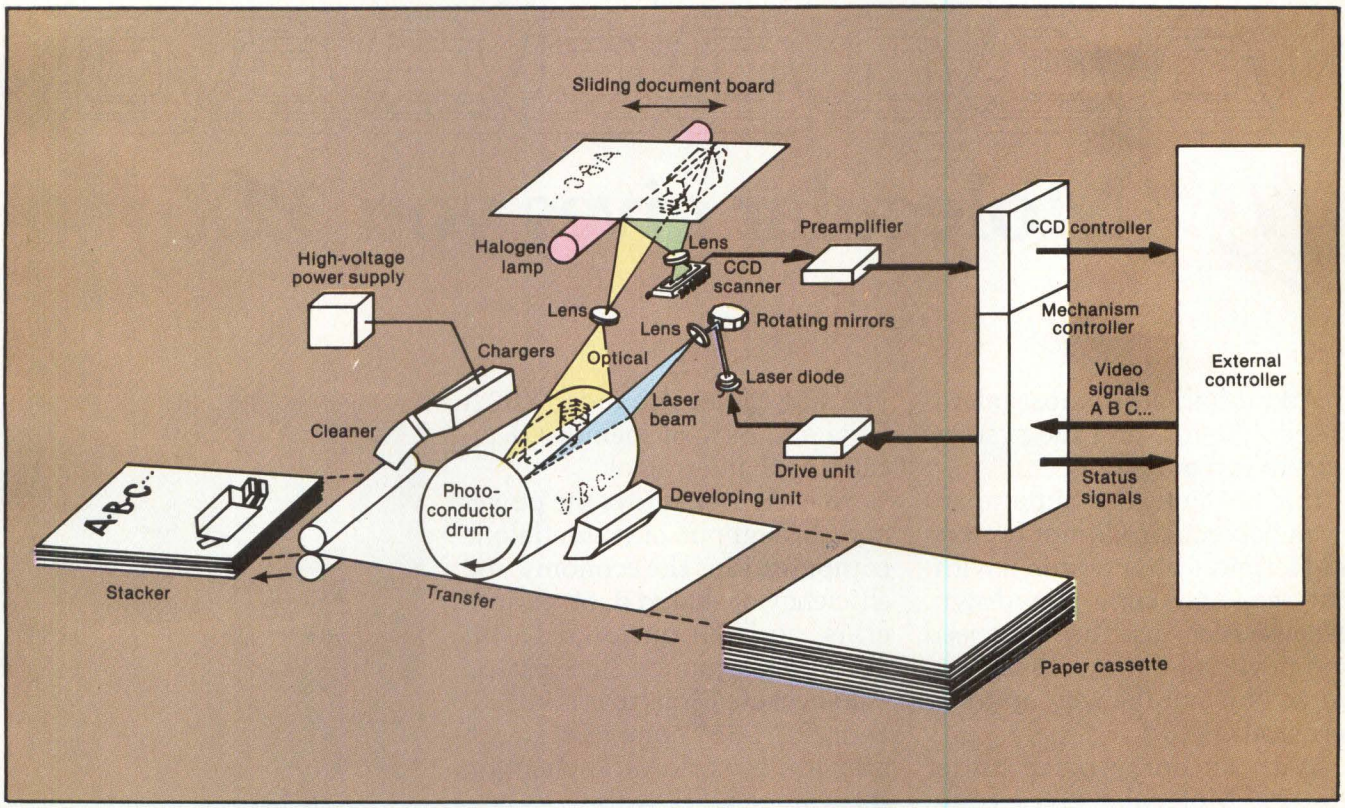
Xerox Corp., Honeywell Information Systems, Inc., IBM, Wang Laboratories, Inc., Canon USA, Inc., HP and Siemens Corp. pioneered non-impact page printing in the 1970s, and they are still the market-share leaders. Roughly a dozen companies market about two dozen non-impact page printers in the U.S. today. Xerography is used in IBM, Honeywell and Xerox printers and is likely to remain the dominant high-speed non-impact page-printing technology for some time. This method is used in all the fastest page printers and, as new office-copier-based print engines become available, it should dominate the low-end non-impact market as well.

Xerographic printers (Fig. 4) print from 5000 TO 50,000 lpm and sell for less than $100,000 to more than $350,000. They store multiple fonts and forms overlays, print graphics with or without text and print enlarged and reduced pages. Although xerographic printers cannot print multipart forms, they often print more than six times as fast as printers that can print six-part forms. The xerographic units save money by using less expensive single-thickness paper and by eliminating the use of expensive forms-bursting hardware.

A number of non-xerographic, non-impact technologies made it to market during 1982. The 5280-lpm Delphax Systems ion-deposition print engine was offered to end users in the Southern Systems Mercurion 1 at the Info '82 conference in New York in October. The unit sells for about $60,000, stores eight type fonts and features a resolution of 240 × 240 dots per in.

Magnetic or magnetographic printers use magnetic-tape recording technology to write magnetic images that attract toner that is transferred to paper roughly the same way as in other non-impact page printers. AM International and the Cynthia Peripheral Corp. division of Cii Honeywell Bull offer magnetic printers, and GE and others are said to be pursuing this technology.

Electrostatic and thermal line printers have their



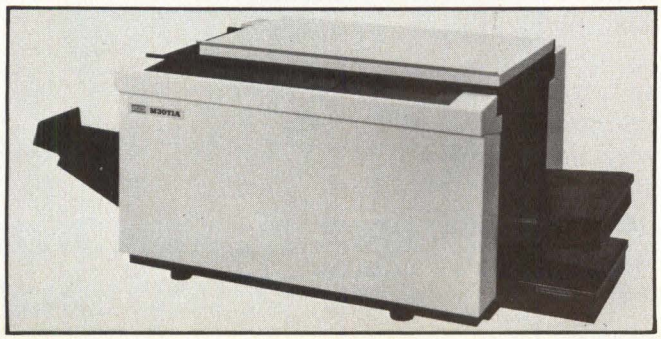


Fig. 4. The Fujitsu M3071A OEM integrated printer module *(left) is a 12-page-per-min. line printer, photocopier and document scanner in one. The desk-top unit is offered as a non-impact computer printer but can be configured to make photocopies, to combine photocopy and computer input and to scan documents for facismile and OCR applications. The innards of the 3071A (above), like those of most non-impact line printers, are based around a modified office-copier engine. Light beams from the laser optics system (in printing) or the halogen lamp optics system (in copying) generate sharp images on the photoconductor drum. These images are developed and transferred onto a printing or copying paper and fixed by pressure. In image scanning, a charge-coupled device in the image scanner reads information from a document to send video signals to the host computer via the external controller.*

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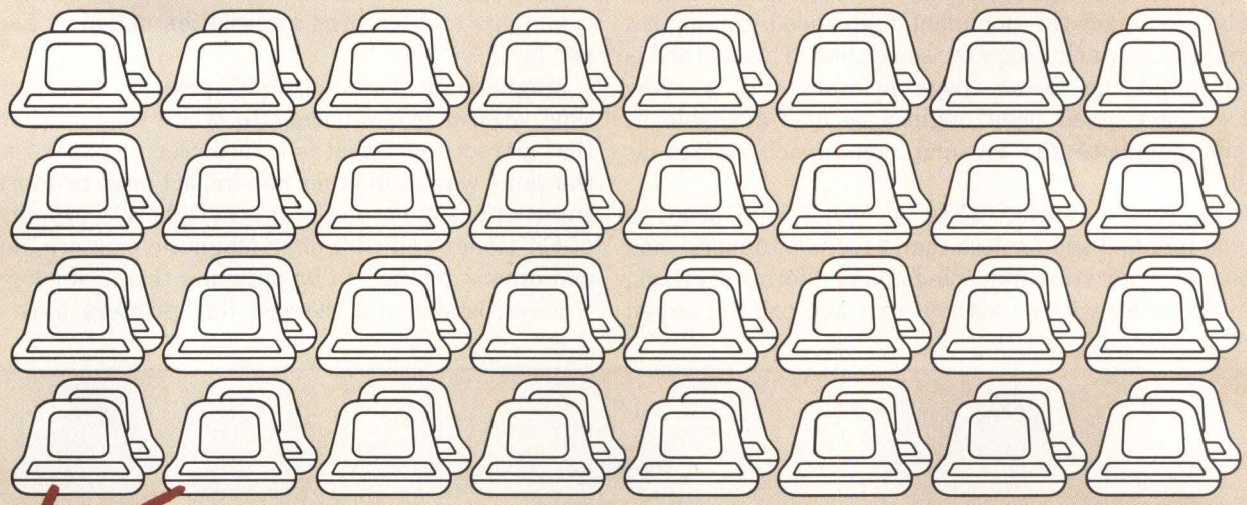

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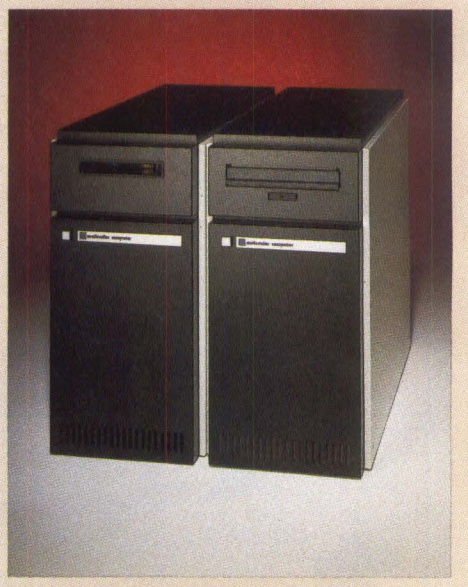

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origins in the printer/plotter industry. They use selectively charged comb-like electrostatic and thermal matrix print elements to write matrix images on specially coated paper. Printing speeds vary from 250 to 3000 lpm and are related to resolution and price as in any matrix printer. Versatic, Inc., Houston Instrument, Olivetti Corp. and HP manufacture these kinds of printers.

Ink-jet printers are for the most part serial rather than line printers. Like fast impact matrix serial printers, they compete against low-speed line printers. Most ink-jet printers run at between 200 and 500 cps, but Mead Digital Systems' Dijit uses multiple jets to spray ink onto a moving web of paper at speeds as high as 60,000 lpm.

A faster future

The structure of the line-printer industry and the technologies that serve it should remain relatively unchanged over the next five years. The market shares held by non-impact line printers should grow enormously as xerographic line printers based around mass-produced office-copier engines are offered in speed and price ranges attractive to supermini, mini and even supermicro users. Combination printer/copier/facsimile machines will become key parts of automated offices offering flexibility, speed and silence not possible with band or matrix printers. Page printers have overcome many actual and perceived reliability problems and are now arguably as reliable as their impact competitors.

Band printers should dominate medium-speed line-printing applications until non-impact units become price competitive, and they should become more reliable and easier to use as electromechanical refinements are made. Vertical forms units are gaining sophistication, and most printer parameters can be set both remotely and from comprehensive operator/diagnostic panels. Band-printer manufacturers have very capable service staffs and national and even international maintenance programs that vendors of high- and low-end non-impact line printers would do well to imitate.

	LINE PRINTER TECHNOLOGY									
Vendor	band	belt	chain	chain/train	drum	electrostatic matrix	impact matrix	laser	thermal	train
Burroughs Corp.	•		•					•		•
Canon, U.S.A.								•		
Centronics Data Computer Corp.	•									•
Control Data Corp.	•		•							
Data General Corp.	•									
Data Printer Corp.	•		•							
Dataproducts Corp.	•									
Digital Associates Corp.	•	•		•			•			
Digital Equipment Corp.	•									
Fujitsu Limited		•						•		
General Electric Co.		•								
Harris Corp.	•		•							
Hewlett Packard Co.	•		•			•	•			
Honeywell Information Systems, Inc.	•								•	
IBM Corp.	•		•					•	•	
Mannesmann Tally							•			
NCR Corp.			•						•	
NEC Information Systems Inc.	•									
Okidata							•			
Printer Systems Corp.	•						•			
Printronix, Inc.							•			
Ricoh of America									•	
Siemens Corp.								•		
Sperry Corp.	•	•								
Storage Technology	•									
Teletype Corp.		•								
Trilog, Inc.							•			
Versatec, Inc.						•				
Wang Laboratories, Inc.								•		
Xerox Corp.								•		

Impact matrix technology should dominate low-speed line-printer markets in which flexibility and low cost are most attractive. Price-related and absolute resolution limitations will restrict impact matrix technology's market in the short term, and ink-jet technology could win away its customers in the long term.

While not as dynamic as the disk or serial printer markets, the line-printer industry is keeping up with end-user needs. Much of the recent action has been in line-printer design labs, and much of the action this year will be out in the market. □

LINE PRINTER VENDORS

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Centronics Data Computer Corp.
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Hudson, N.H. 03051
(603) 883-0111

Control Data Corp.
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Data General Corp.
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Data Printer Corp.
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Palo Alto, Calif. 94304
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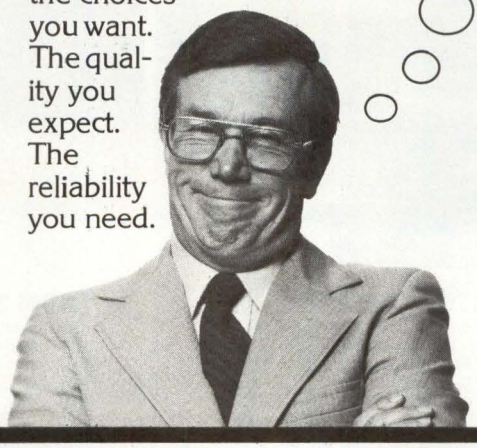

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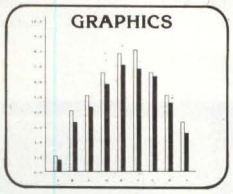

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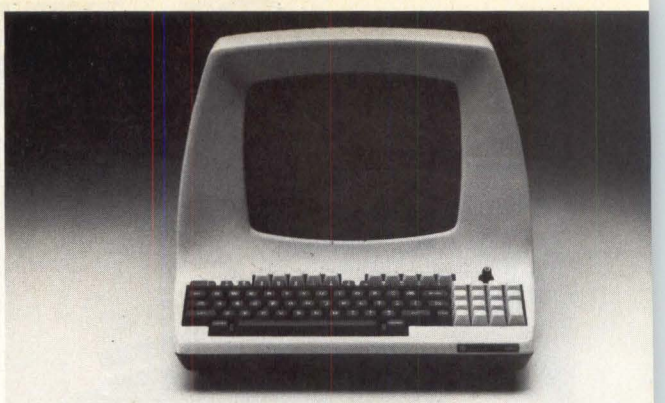

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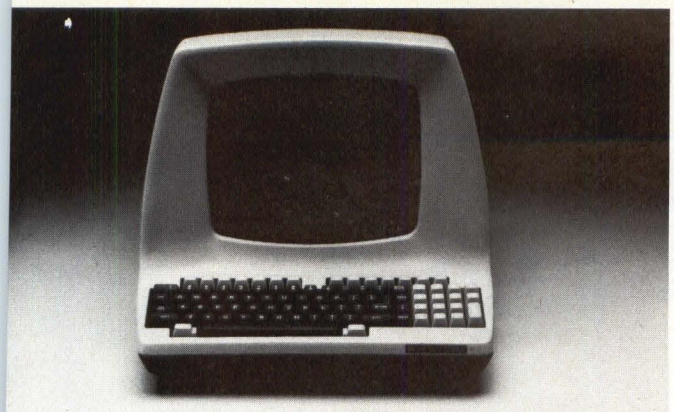

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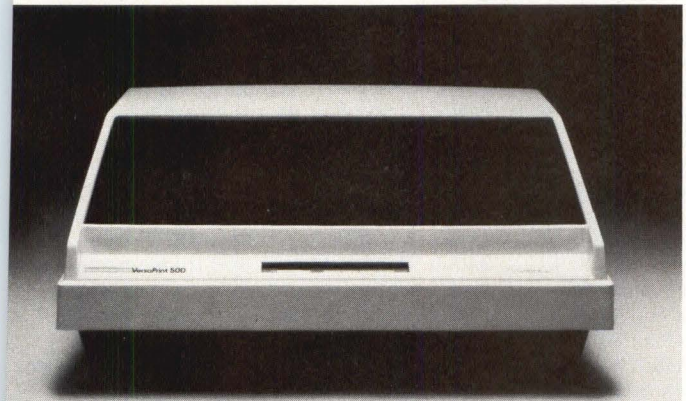

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CIRCLE NO. 78 ON INQUIRY CARD

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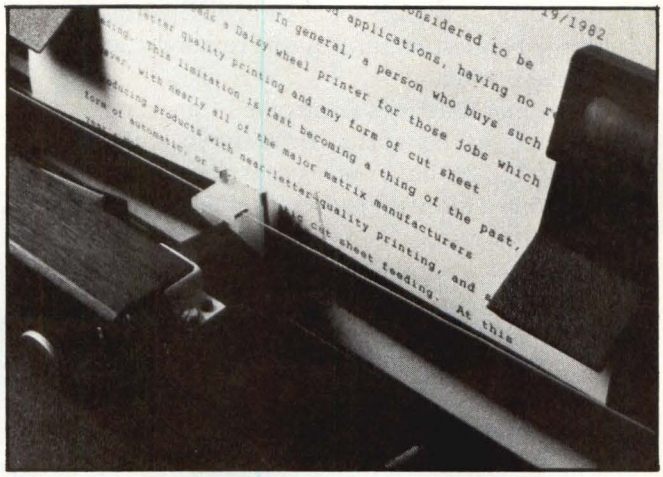
Steady technology advances will adapt these printers to word processing and other applications now claimed by letter-quality printers

Impact dot-matrix printing is usually considered to be limited to rough-draft, medium-speed applications and to have no real future in word processing. Generally, a buyer of such a printer also needs a daisy-wheel printer for jobs that require letter-quality printing and cut-sheet feeding. But these limitations are disappearing. Nearly all major matrix manufacturers are introducing products with near-letter-quality printing and automatic or semiautomatic cut-sheet feeding. With the continuing technical advances in print-head design, carriage motion and control, paper handling, ink-delivery systems, software and electronics and acoustic suppression, a new class of printer is inevitable. The emergence of the ribbonless ink system and high-speed, high-pin-count print heads is making dot-matrix printers suitable for high-speed applications and color graphics as well as for word processing.



The letter-quality print *being output from this dot-matrix printer is visibly close to that of a daisy-wheel printer.*

The print head

Modern matrix impact printers employ the same basic methods they did 10 years ago. By moving the head and paper in a controlled fashion, they can very rapidly place dots just about anywhere on a sheet. However, head design and pin arrangement have evolved to achieve greater speed and better letter quality.

To print dots requires a method of converting electrical energy to mechanical motion, along with a geometry that provides ink in the right place at the right time. The term "solenoid" encompasses a broad range of energy-conversion devices used for matrix printing. Its functional elements usually include a coil and a ferromagnetic mass. When a controlled electrical current is sent through the coil, the two parts move with respect to each other, providing the energy for printing. The earliest matrix print heads used a tubular solenoid to create dots (Fig. 1). This original solenoid approach has some serious technical drawbacks. First, tubular solenoids are inefficient. To deliver adequate energy to the pin, 20 to 50 times as much energy must be delivered to the coil. This causes the head to run very hot and requires a large power supply and high current drivers. Second, this design is critical of head-to-paper distance and needs readjustment for each new form thickness. This head will operate only in a high-precision printer, making the head expensive to use. Something better than tubular solenoids was needed.

Hydra was one of the first companies to produce a clapper-type solenoid print head. This head still uses a

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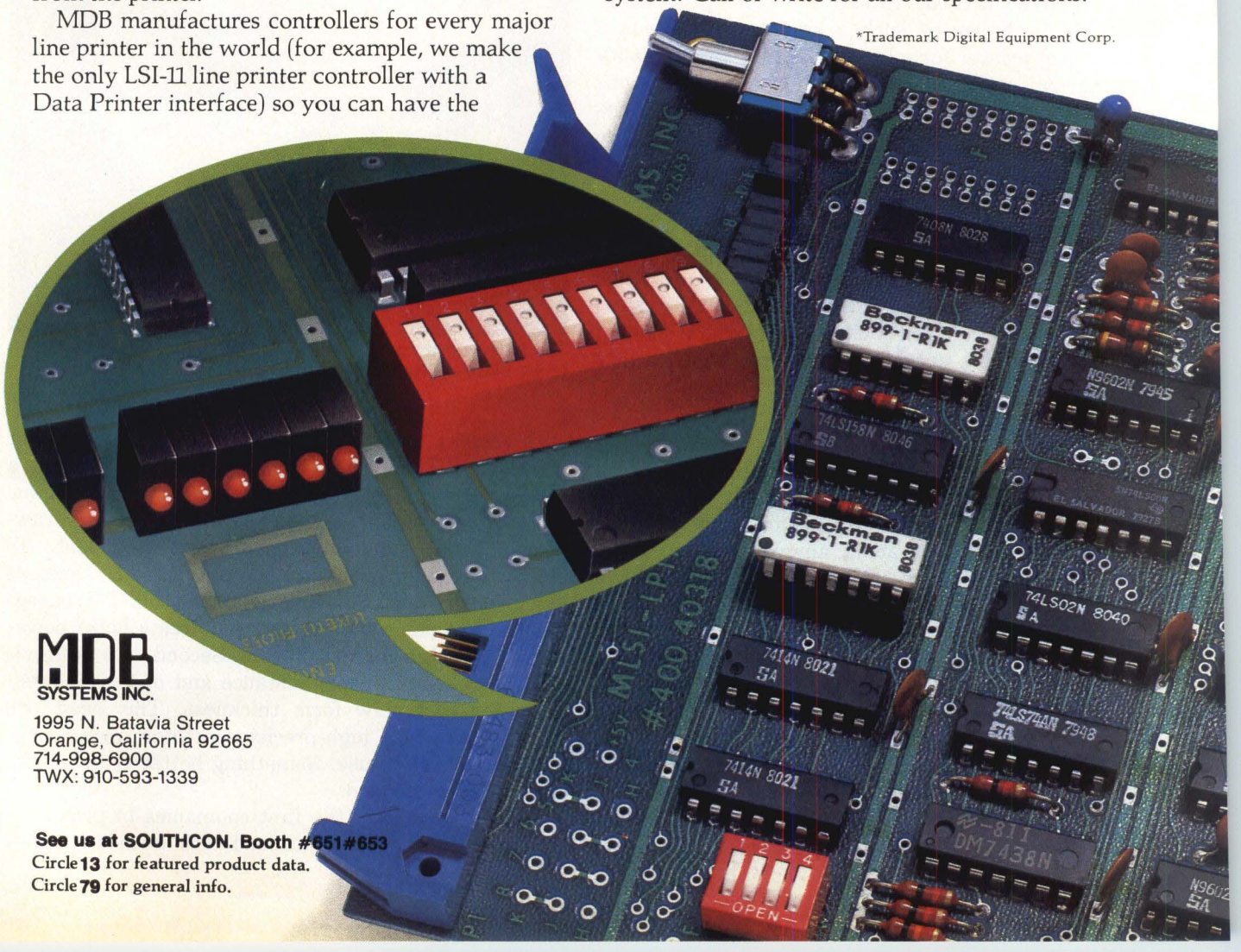

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coil to form the magnetic field, but the field now attracts an armature or clapper, rather than a ferrite slug as in the tubular design. This configuration allows the print wires to be much straighter and closer together and reduces the side forces within the head. It is also substantially more energy efficient because of the geometry of the magnetic path. The tubular solenoid is about 4 percent efficient, and the clapper style is as high as 10 percent efficient. Consequently, the clapper head has quickly become the industry standard.

In many clapper heads, known as free-flight, or ballistic heads, the pin is not attached to the armature (Fig. 2). Advantages of this head is that it may not need re-gapping when going from multipart to single-part forms. It is also more tolerant of dimensional variations within the printer. In addition, the free-flight head can provide much improved high-speed performance through proper balancing of spring forces within the head and careful control of the mass and magnetic path around the armature. One recent clapper-head design sustains 350-character-per-sec. speed, with medium-density characters. More typical, however, is 180 to 200 characters per sec.

The most recent technology is the "stored-energy" head, so-called because of its special actuator that includes a permanent magnet and a spring (Fig. 3). By virtue of its design, the stored-energy head is extremely efficient, long-lived and potentially very fast, capable of as many as 600 characters per sec.

Speed is only one ingredient to successful head design. Two heads that print at the same speed do not necessarily produce the same appearance of finished output. For instance, there are different designs for the

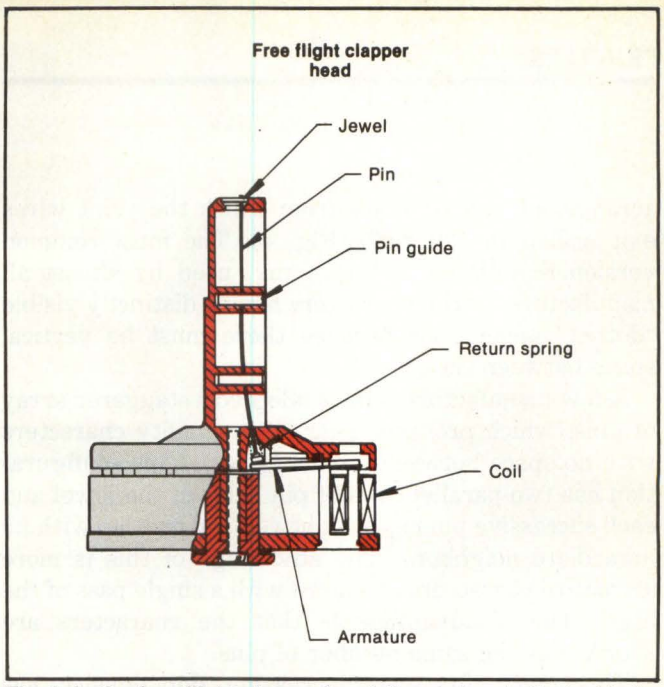


Fig. 2. In the free-flight clapper head, *the pin is not attached to the armature. Thus, when the armature reaches its fully closed position, the pin continues in "free-flight" until it hits the ribbon and paper. If the head is properly spaced from the print surface, printing occurs during this free-flight period, and the pin's impact on the ribbon, paper and print surface provides most of the energy for rebound into the head. The pin has its greatest available force just as the armature bottoms out, and less as the pin travels further.*

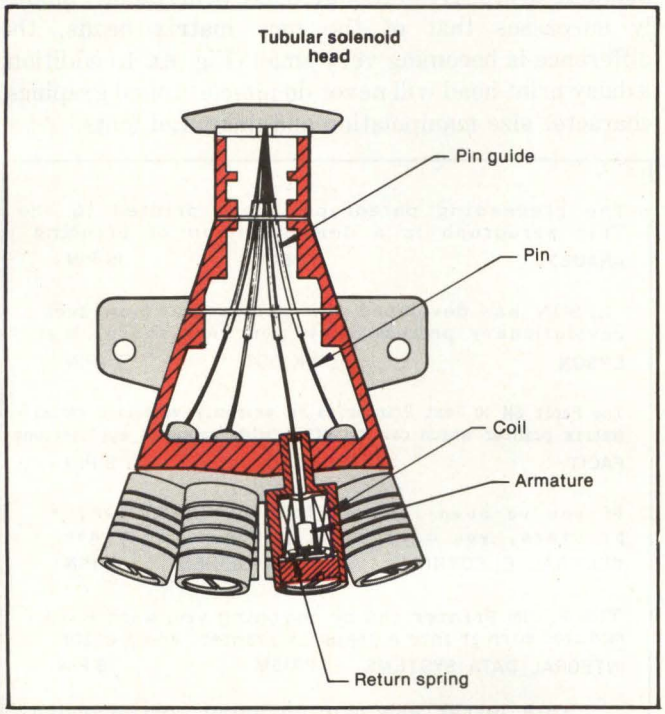


Fig. 1. The tubular solenoid head, *the earliest matrix print head, typically had seven or nine solenoids, each comprising a coil and a ferromagnetic mass, arranged conically on a die-cast housing with a stiff tungsten pin or needle attached to each solenoid core. When activated, the solenoid caused the pin to protrude rapidly from the front of the head, where it impacted the back of the ribbon, which in turn hit the paper.*

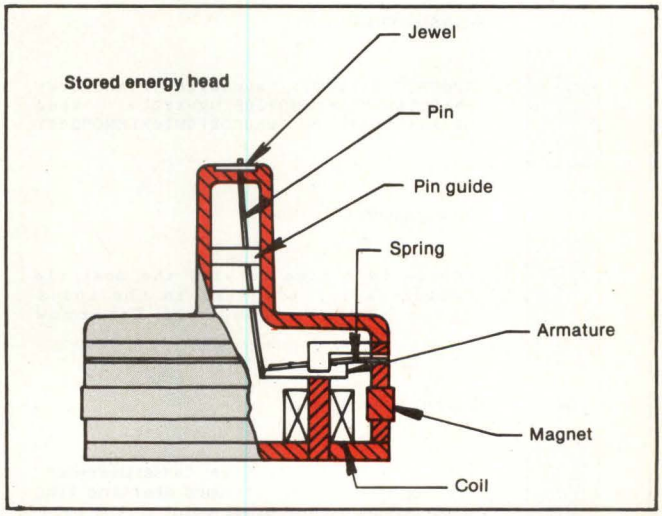


Fig. 3. The stored energy head *contains a magnet that keeps the spring and print wire poised and pre-loaded, ready to fire forward. The coil acts as a trigger, providing enough opposing magnetic field to release the spring, which then pushes the wire forward to print. While the wire is traveling forward, the current to the coil is shut off, and the rebound from the impact carries the print wire back to the position where the magnet can once again capture and hold it.*

arrangement of the holes from which the print wires exit (called the "jewel") (Fig. 4). The most common version is a simple in-line array, used by almost all manufacturers. The characters have a distinctly visible "dotted" appearance because there must be vertical space between the pins.

A few manufacturers have adopted a staggered array of pins, which produces near-letter-quality characters with no space between dots (Fig. 4B). This configuration has two parallel rows of pin holes in the jewel and each successive pin has a slight vertical overlap with its immediate neighbors. The advantage of this is more attractive characters produced with a single pass of the head. The disadvantage is that the characters are shorter for the same number of pins.

This quest for ever increasing dot density has spawned a new family of heads. These newest heads hold as many as 24 print wires in a package no larger than their nine-wire ancestors (Fig. 4C and 4D). Almost without exception, the older nine-wire designs use print wires that are 0.014 in. in diameter. These higher density heads use either 0.012- or 0.010-in. diameter wire. The resultant dots are smaller, and more dots can be compressed into an area, giving potentially better

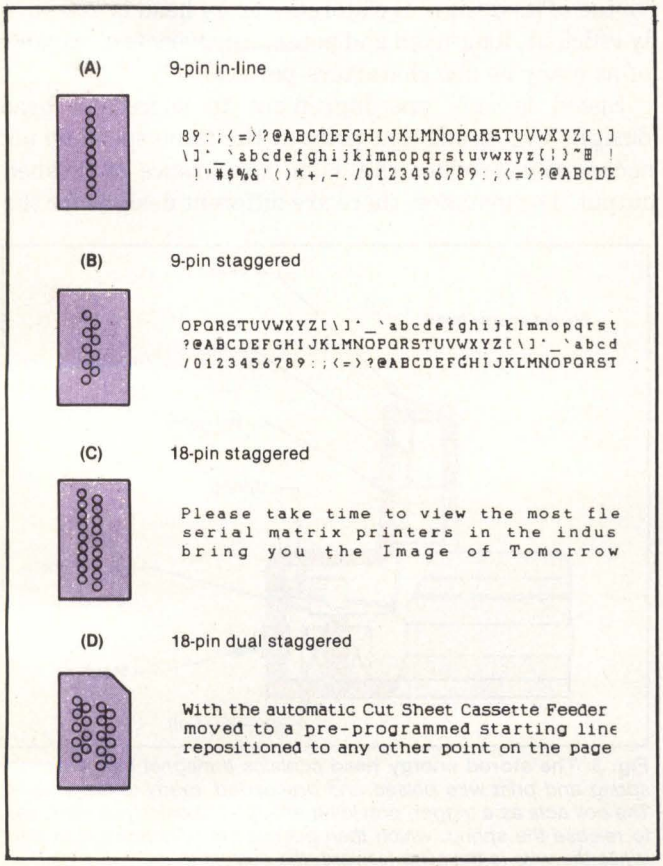


Fig. 4. A comparison of jewel layouts and their associated printouts *shows that the higher the vertical density, the smoother the character formation.*

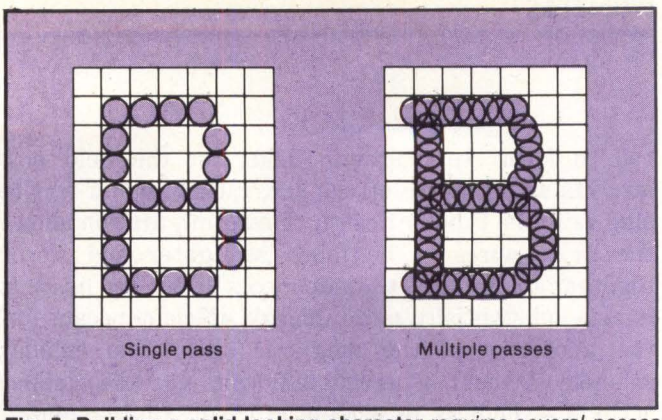


Fig. 5. Building a solid-looking character *requires several passes of the printer head. These dots show the letter "B" being formed by a nine-pin head matrix printer after one pass and after multiple passes.*

character formation and denser graphics.

Before the advent of these high-pin-count heads, the only ways to achieve higher vertical dot density were overlapped pins or multiple passes of the head, with small incremental vertical head or paper motion between passes (Fig. 5). But multiple passes have a negative effect on throughput. A 180-cps, nine-wire printer doing three-pass printing achieves a maximum print speed of 60 cps. By comparison, the new heads can accomplish similar density in a single pass, with no appreciable reduction in throughput.

This latest development, the high-pin-count head, has created the greatest concern for the daisy-wheel manufacturers. Even though daisy print quality slightly surpasses that of the new matrix heads, the difference is becoming very small (Fig. 6). In addition, a daisy print head will never do pin-controlled graphics, character size manipulation and unlimited fonts.

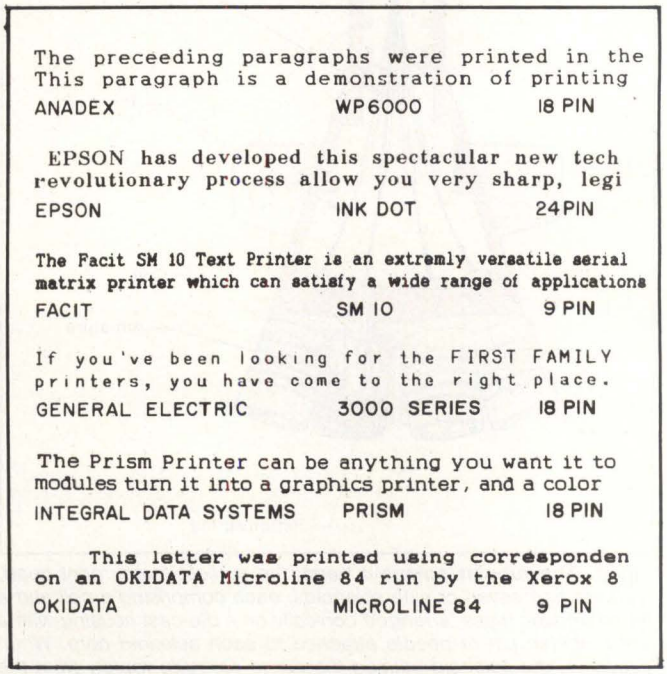
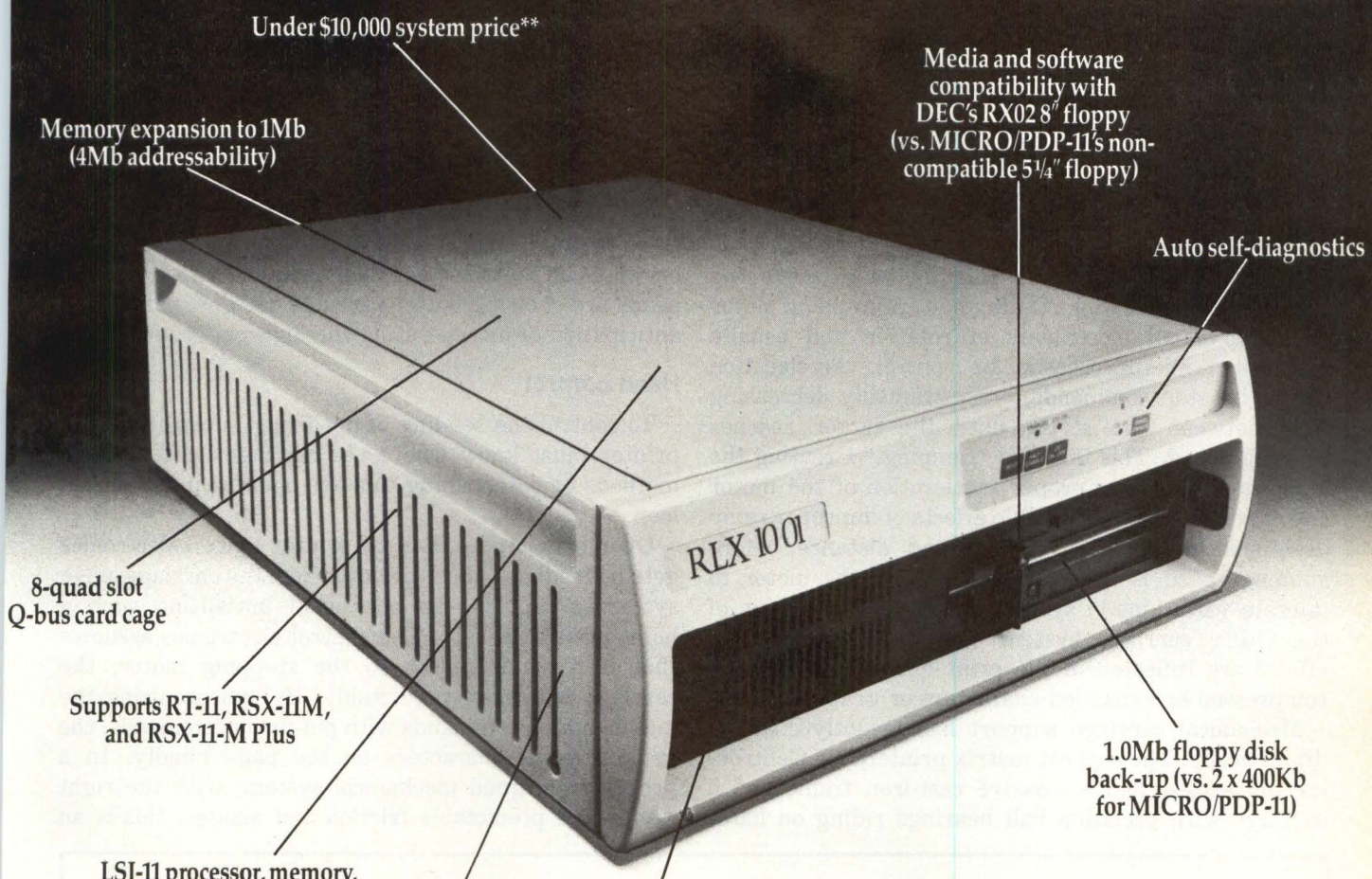


Fig. 6. Representative printing samples *show letter-quality printing from several matrix printers, many of which were introduced at the National Computer Conference in 1982.*

Like DEC's.*



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CIRCLE NO. 80 ON INQUIRY CARD

Head motion

A basic requirement of any printer is that the head and carriage move in a controlled and predictable manner. For a matrix printer, this means that the carriage should accelerate quickly and smoothly. Once at running speed, it should keep moving at a constant rate. It should slow down and stop quickly and smoothly. Additionally, the head must be kept on a level and straight path, with vibration and backlash held to a minimum.

Most printers use a stepping motor to move the carriage, connected by a timing belt. A stepping motor moves in small increments of rotation and usually requires a microprocessor for control. Acceleration occurs by step commands, with gradually decreasing time between the steps, until the motor reaches running speed. This is called "ramping." Creating the right ramp is key to proper acceleration of the motor and carriage (Fig. 7). Possible effects of improper ramp design include excessive time and distance before running speed is achieved, inability of the motor to tolerate variations in system friction and vibration of the entire carriage system during printing. These effects are reflected in the print quality as unevenly compressed or expanded characters or graphics.

Mechanical carriage support has recently changed dramatically. The earliest matrix printer, the Centronics 100 series, had a massive cast-iron frame and a carriage with precision ball bearings riding on hardened machined surfaces. This approach was copied until about five years ago, when a few printer manufacturers began offering smaller, more cost-effective printers. These new designs were not nearly as rugged or precise as the Centronics 100 series, and even to the untrained eye, print quality was visibly poorer. To cut costs, these new products had inexpensive, usually oversized carriage bearings that rode on inexpensive shafts, which were typically bent and bowed (Fig. 7). The result was that the dot locations ended up being exact images of the uncontrolled location of the head.

The emerging high-pin-count heads and their application in word processing cannot tolerate these weaknesses. A few low-cost printers have recently begun to solve this problem through careful application of self-aligning bearings and low-cost, spring-loaded sleds or rollers on the carriage. Even printers with nine-wire heads are showing better carriage designs, perhaps in anticipation of incorporating the high-pin-count heads.

Head control

To control the sending of dot-firing information, the printer must know where the carriage is. Two basic methods of determining this are open loop and closed loop.

Open loop implies that the printer control electronics gets no feedback about position from the carriage drive system except for an occasional initializing with a home-position sensor. The control electronics assumes that if it sends pulses to the stepping motor, the carriage will move predictably. By synchronizing the motor-motion commands with pin-firing commands, the printer forms characters on the page blindly. In a properly designed mechanical system, with the right ramps and predictable friction and masses, this is an

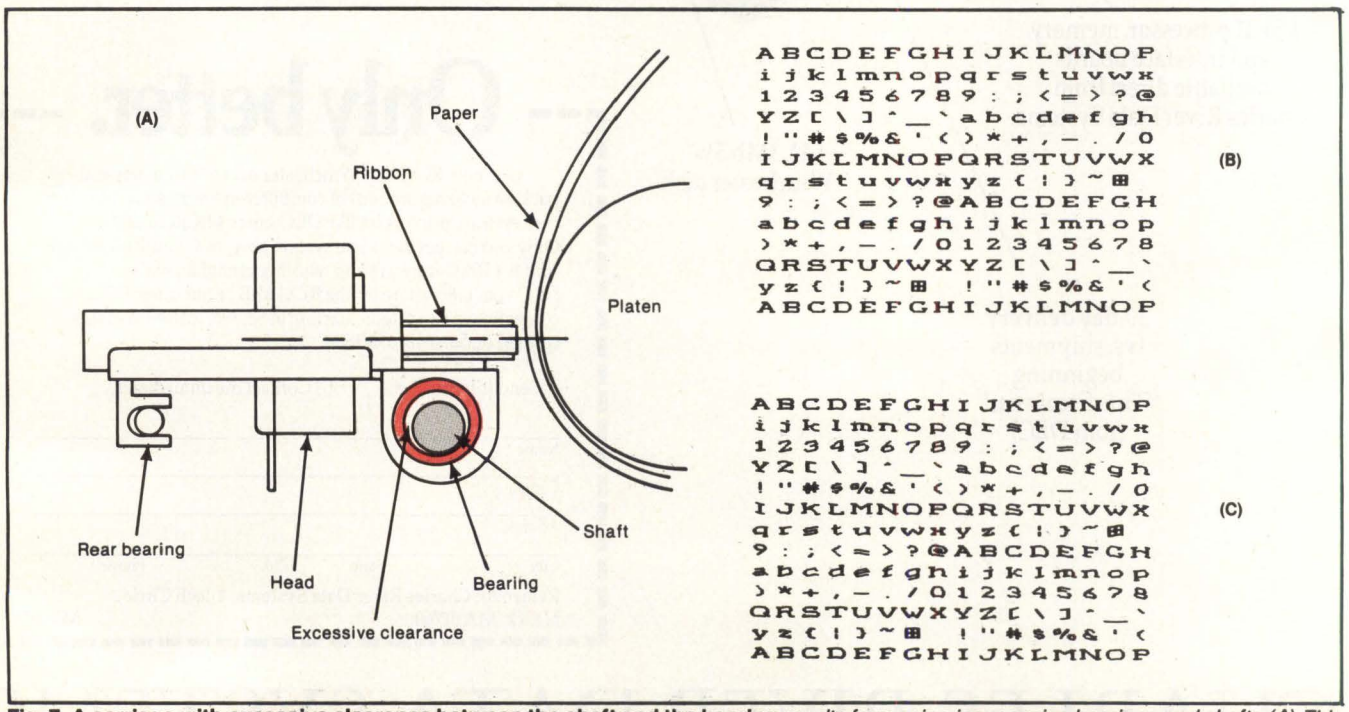
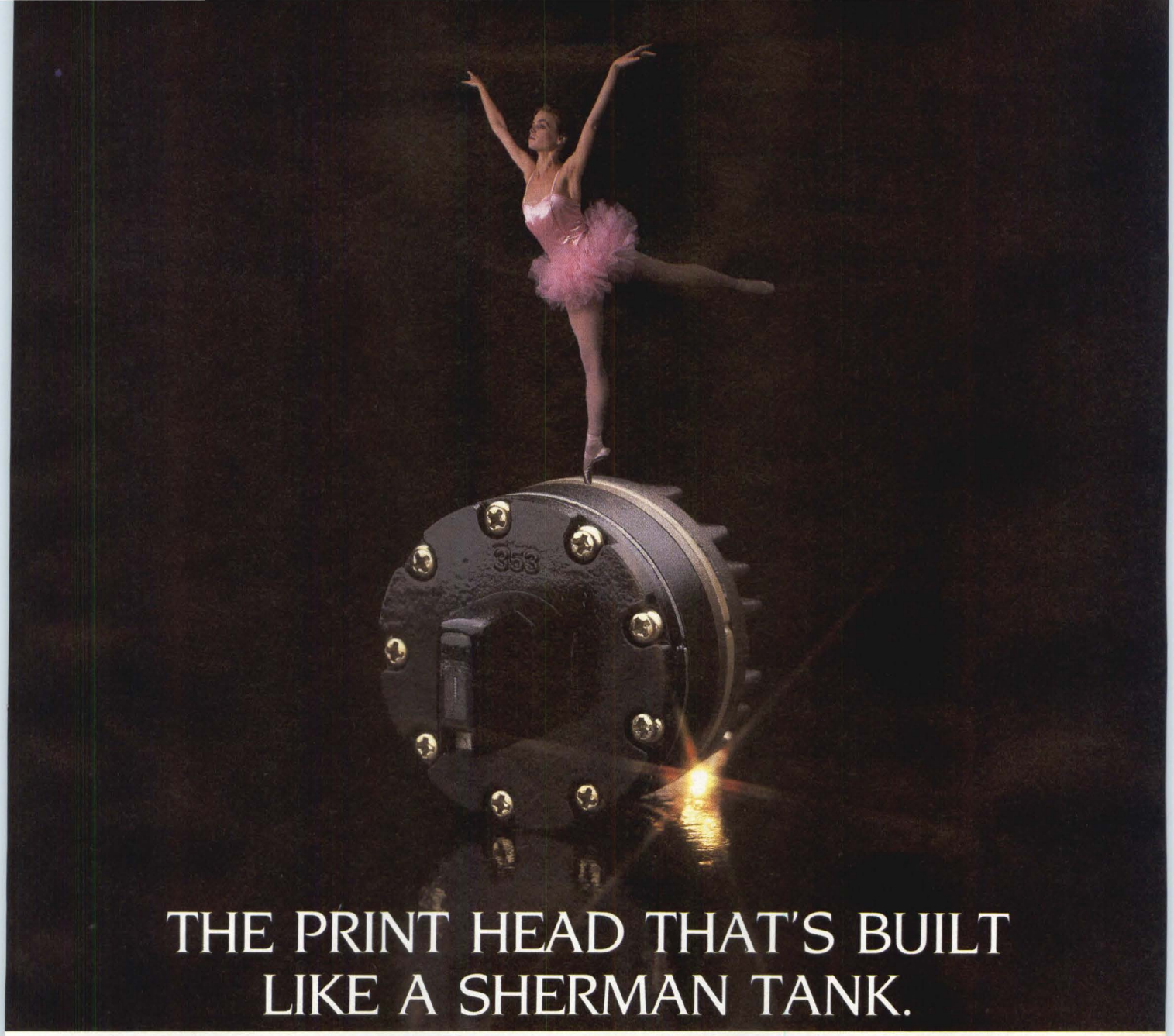


Fig. 7. A carriage with excessive clearance between the shaft and the bearing *results from using inexpensive bearings and shafts (A). This causes vertical vibration and motion, which is reflected in wavy printing (C). B shows the printout of a carriage with minimal (proper) clearance.*



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CIRCLE NO. 81 ON INQUIRY CARD

acceptable method; otherwise, it can result in improper character registration on the page. In most cases, however, careful manufacturing and process control yields an inexpensive and basically reliable product.

Closed-loop systems typically have optical, capacitive or magnetic detectors that send out pulses as the motor rotates or as the carriage moves. This feedback information can be used to ensure proper motor ramping and speed regulation and also serves as finite "tic" or location marks for the firing of the head pins. Closed-loop systems can achieve the ultimate in location control, and they can even conceal the presence of certain kinds of vibration, but at a higher cost. First, these location-detection schemes require additional detection and electronic hardware to perform this task, often adding as much as $25 to the unit's manufacturing cost. Second, if the printer relies on the encoder alone to tell it when to fire the pins, and if excess vibration exists, the carriage may get to the next tic mark before the head has recovered from the last dot. This can result in one or more weak or missing dots. The open-loop system is less likely to have this problem because dot firing is based on time intervals, not position. This advantage and its low manufacturing cost would appear to make the open-loop approach a better choice for low- to medium-performance printers.

However, the high-pin-count heads and their increased resolution of dot placement require optimal control of carriage location. In this context, the difference between the open- and closed-loop systems becomes less clear. Although closed-loop printers have additional costs inherent with the required hardware, open-loop printers also experience increased costs of manufacture because of tighter controls on mechanical consistency in such areas as carriage friction and motor parameters. The market is fairly evenly divided, with significant examples of each approach delivering roughly equal state-of-the-art performance.

Paper motion

The days when a printer need handle only pin-feed or roll paper are about gone. For word-processing applications, the ability to cope with sheet paper has become relatively commonplace, particularly in printers that use the high-pin-count heads. Some new machines make sheet feeding effortless, requiring minimal operator involvement and permitting unattended multiple-sheet printing.

The abilities of sheet-feeding printers range from manual insertion and manual alignment to fully automatic units with "twin-sheet" (letterhead and blank) capabilities. Some products require the installation of bulky accessory top-loading feeders; others partially or fully integrate these functions in the basic framework of the printer (Fig. 8).

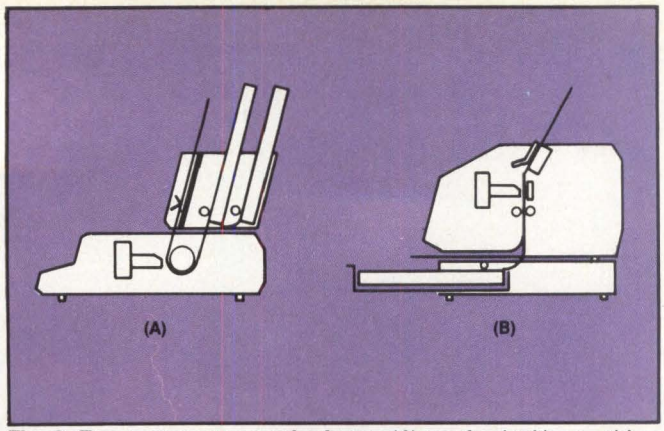

Fig. 8. Two paper-entry methods *are (A) top feed with an add-on unit and (B) bottom and front feed with a bottom-mounted feeder that is partially integrated in the printer framework.*

Sheet feeding places special demands on a printer and can add a significant amount of mechanical hardware. When printing continuous forms, it is not difficult to achieve consistent and accurate placement of data from form to form. By setting the first form, the rest fall into place. This is not as easily accomplished with single forms, and many sheet-feeding products incorporate optical edge sensors and precise diameter rollers to provide similarly acceptable tracking accuracy.

Almost all Japanese printers have manual cut-sheet capability, and most employ a rotating cylindrical platen and handle sheets much like a typewriter. Although most people are accustomed to using typewriters, this is not necessarily the most efficient means of sheet manipulation. To facilitate sheet handling, some manufacturers have adapted standard commercially available top-loading feeders (Rutishauser, BDT Products Inc. and others) for use with their printers. These feeders, although costly (usually retailing at $1000 or more), do provide unattended multipage document output and easy manual sheet insertion. Yet, from a user's viewpoint, the feeders are bulky and must be physically removed to permit tractor operation.

A more economical approach, both in terms of size and cost, is the integration of all or part of these abilities into the basic printer framework. The Integral Data Systems Prism printer (Fig. 9) has an optional front-loading chute, an optical edge sensor for semiautomatic loading and a fully automatic feeder that resides below the printer (Fig. 8) and tucks away like a drawer when not in use. Florida Data Corp. also has built an advanced sheet feeder inside its printer. A much lower priced product from Micro Peripherals Inc. provides for manual-only front loading but lacks a semiautomatic feature.

Envelope feeding presents a much more difficult technical challenge, because of the awkward proportions and uneven stiffness and bulk of the medium. Envelope feeders were notable by their absence at last year's National Computer Conference, present only in

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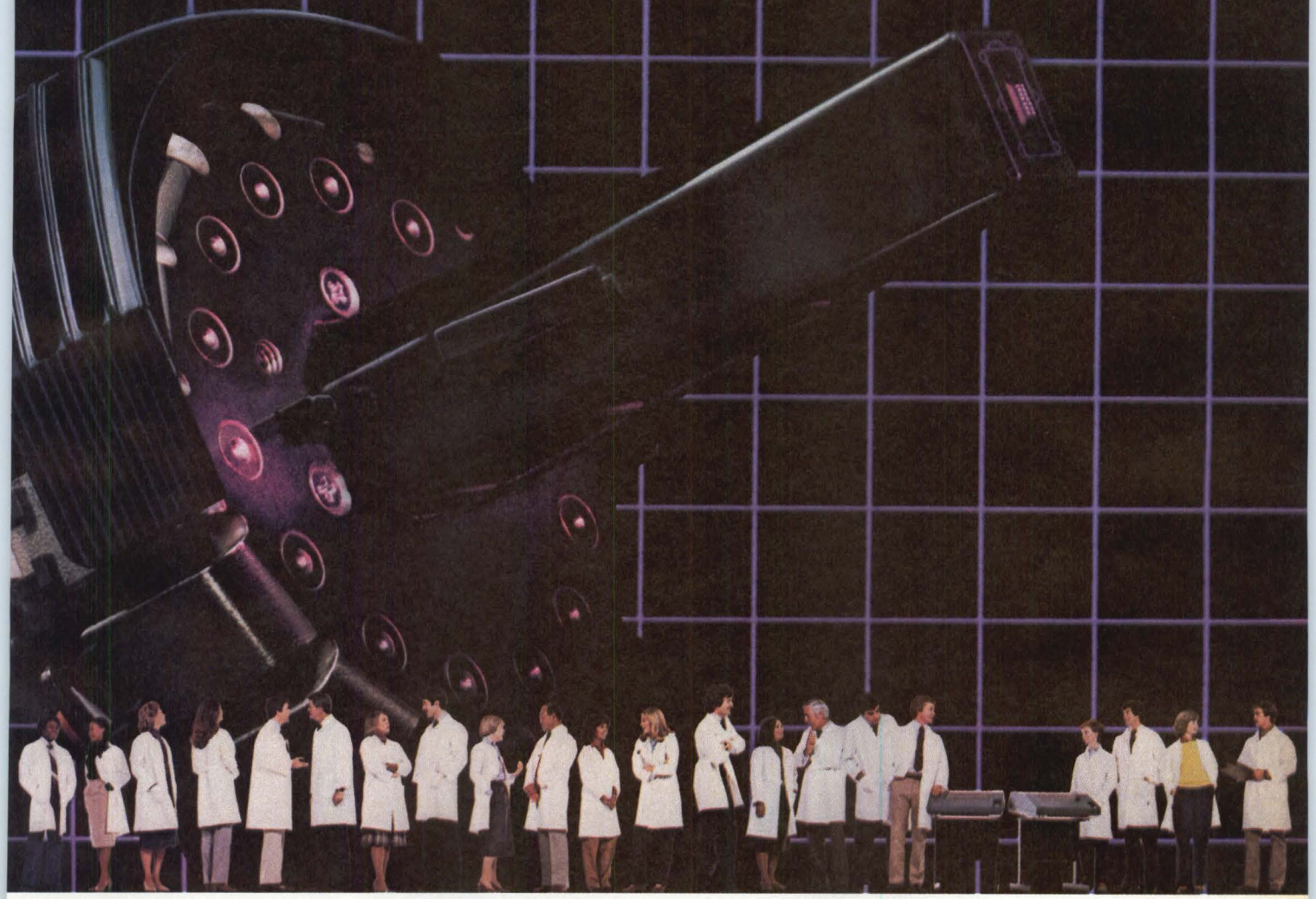

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the booths of Wang Laboratories, Inc., and manufacturers of accessory sheet-feeding equipment. Envelope feeding is necessary to satisfy word-processing stations, and many auto-sheet-feeding printers will likely include envelope feeding in the near future.

The ink supply

Designing a reliable and convenient ink-delivery system has been a major focus of matrix printer manufacturers. Spool-to-spool fabric ribbons are giving way to stuffing-box ribbon cassettes and mylar multistrike ribbons. The more recent advances provide such capabilities as clean-hand ribbon changes, extended ribbon life and multicolor printing.

Fabric ribbons are still the most widely used ink-delivery system for matrix printers. However, when used with the new high-density heads, the high impact forces and small print wires place an extreme burden on the ribbon, and any flaw in the weave can create serious problems. For instance, if the weave has an opening, the print wires can pierce the ribbon, get snagged and destroy the head as the head continues to move.

The ink's chemical composition is a significant factor in head performance because many head designs rely on a lubricative property of the ink to keep the wires moving smoothly. A printer manufacturer generally supplies ribbons with an ink chemistry optimized for its head. Yet, some inks inadvertently used by re-inking services were designed for typewriters. If misapplied, they can impair printer performance and shorten the useful lifetime of a matrix print head. For instance, certain pigments contain abrasives designed to polish continually the print hammers on a typewriter, but these will wear out the jewel of a matrix head prematurely. Other inks contain lubricants that dry and solidify in time, leaving a residue that attracts paper dust and can cement the wires to the jewel.

Mylar ribbons, formerly restricted to daisy-wheel printers and typewriters, are suitable for use with higher density heads. They give clearer and more well-defined dots than their fabric counterparts. However, there is not yet a good method of recirculating mylar in a stuffing box or other simple arrangement. The ribbon drives are still spool-to-spool and must either reverse when reaching the end, be turned over or be discarded. Even if a printer could reverse ribbon direction, mylar cannot withstand the punishment of multiple overstrikes as a fabric ribbon can and must therefore be replaced more frequently.

The latest development in ink delivery is in the Epson of America ink-dot printer, a ribbonless product, in which the ink is delivered to the tips of the print wires from a reservoir traveling with the carriage. The clarity of a dot is excellent and, coupled with Epson's 24-wire print head, produces some of the finest impact matrix printing available (Fig. 6). When the ink supply is exhausted, a user simply refills the reservoir. A similar approach is expected to appear in an imminent Centronics Data Computer Corp. product.

Color printing has attracted much attention, and many sources of high-quality multicolor ribbons have recently appeared. The colors generally occupy parallel bands on the ribbon, each a little taller than the line of print wires in the head. Ribbons with 10 vivid colors are now available, although available printers are limited to four-color bands. Through special processing, the colors are prevented from bleeding into each other, a problem that has plagued ribbon manufacturers. Color printing, joined with dot-control graphics and multiple overstrike, is a new capability, and there is a shortage of systems and software that can now fully support it.

Electronics and software

Applying microprocessors to printer-control logic has allowed some innovations, such as pin-control graphics, justification, plotting and color printing. There are almost as many features as printers, and as electronic-component costs continue to plunge, even the least expensive models will have some fancy capabilities.

As more efficient heads become practical, the bulk and cost of an electronics package will drop. It is not unrealistic that a single chip will perform almost the entire logic, I/O, head driving and housekeeping functions. This leaves motor drivers, which will probably remain discrete devices for the next few years.

Microprocessors, such as Intel Corp.'s 8049 and 8051, are in several small printers, providing both program memory and I/O functions. Memory prices are tumbling, making it feasible to store complete graphic page images in printer memory, perhaps even via a direct connection to the composite video output of a host computer or terminal.

Other enhancements include absolute positioning for plotting, incremental printing for terminal applications and bidirectional multipass printing for improved letter-quality output. Techniques borrowed from daisy-printer technology improve throughput, such as high-speed tabbing over spaces and ramping of the paper drive for multiple line or form feeding.

As with any new technology, it is possible to make a product that is too smart and therefore suffers poor market acceptance. The capabilities must be useful to prospective buyers, or they may not be interested enough to use all that power. Specifically, if a printer has a special protocol for graphics or justification that requires substantial effort to make it work, then that feature is useless. For example, the Centronics 737 has a proportional mode with an attractive font; yet, to make that font run, a user needs a post-processing program. Only now, after that printer has been on the

market for three years are people beginning to write this software, and it is limited in application to a few computers.

With most printers, getting hard copy of text information is easy when compared with graphic data printout. Because of the lack of standards for graphic information interchange, each manufacturer has developed its own standard, with no two alike. Unfortunately, it seems unlikely that a standard will emerge.

Several OEM system suppliers have resorted to specifying a printer for graphic software packages, and they will provide occasional updates to include other models or capabilities. Color capabilities only further complicate the matter. The only real hope of standardization is that newcomers will copy existing products in the hopes of providing alternative sources for system builders.

Framework, cabinet, acoustic suppression

Whenever good design is joined with a high level of tooling, both the manufacturer and the customer benefit. With intensive tooling comes the ability to design parts that work better. It is conceivable to make a printer with two molded (or die-cast) parts that do eveything from suporting PC cards, power supplies and fans to acting as carriage supports, print surfaces and paper guides. If cleverly conceived, a molded part can do all this work on the inside, while achieving an attractive outer appearance. An example of this is the DataProducts Corp. M200, which is popular in the OEM line-printer market. This printer integrates functions excellently and is particularly well-designed. Similar efforts will follow in the next generation of tabletop printer, from both domestic and foreign sources.

One potentially important feature of well-designed, highly tooled cabinetry and framework is the reduction of sound and noise output to a level acceptable for office environments. To date, matrix printers have earned a shabby reputation for acoustic noise. The sound level of most printers is so high that any nearby conversations must stop while one is running. An average typewriter puts out about 50 to 60 decibels on the A-weighted scale. By comparison, a modern matrix printer puts out nearly 75 dBa. This huge difference is a major reason this type of product has not attained acceptance in the office environment.

Providing quietized cabinets or attachments does help; however, it is tricky because noise can travel around corners, through walls and on paper extending from the print area through an exit hole. One approach is to enclose the paper path fully, thus containing the noise. While effective, this greatly increases a printer's size and is inappropriate for a product that is supposed to supplant the typewriter. Another approach is to attack noise at its source, the head. Many new heads run much quieter through the application of baffles, boots, and other sound-deadening devices within the head. These efforts will probably eventually provide enough acoustic dampening to obviate the need for fully enclosed cabinets and still be at an appropriate level for office usage.

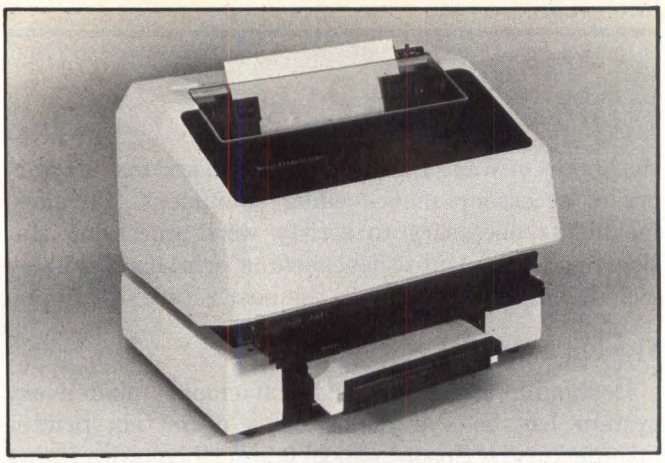

Fig. 9. The IDS Prism matrix printer *is shown installed on the new auto sheet feeder that handles as many as 200 sheets. This option allows versatility of printer use because it need not be removed when the user wants to load sheet- or tractor-feed paper manually or semiautomatically.*

What's next?

Experts close to the industry expect a rapid rise in the popularity of matrix printers as new features become a practical reality. But the manufacturers of daisy printers are not likely to lie down and play dead. In addition to reducing their products' cost and providing enhanced features, some daisy makers are also introducing their own matrix printers.

Of particular concern to domestic printers, daisy and matrix alike, is the influx of foreign printer products, notably from Japan. In general, domestic manufacturers spend most of their engineering budgets on the application of existing and recent technology. On the other hand, much R&D is occurring in Japan. This will probably mean that U.S. firms will begin to do to Japan what Japan has done to them in the past several years: copy, adapt, improve and market.

With the emergence of the ribbonless ink systems and ultra-high-efficiency and -speed print heads, dot-matrix printers will be able to accompany the workstation computers now gaining popularity. These printers will be capable of the common print modes (word processing, high-speed draft and color), and will likely employ modular upgrades for most of the major options. □

Neil Rosenberg is an engineering manager at Integral Data Systems, Milford, N.H., where he participated in the design and development of the new Prism printer family and related accessories.

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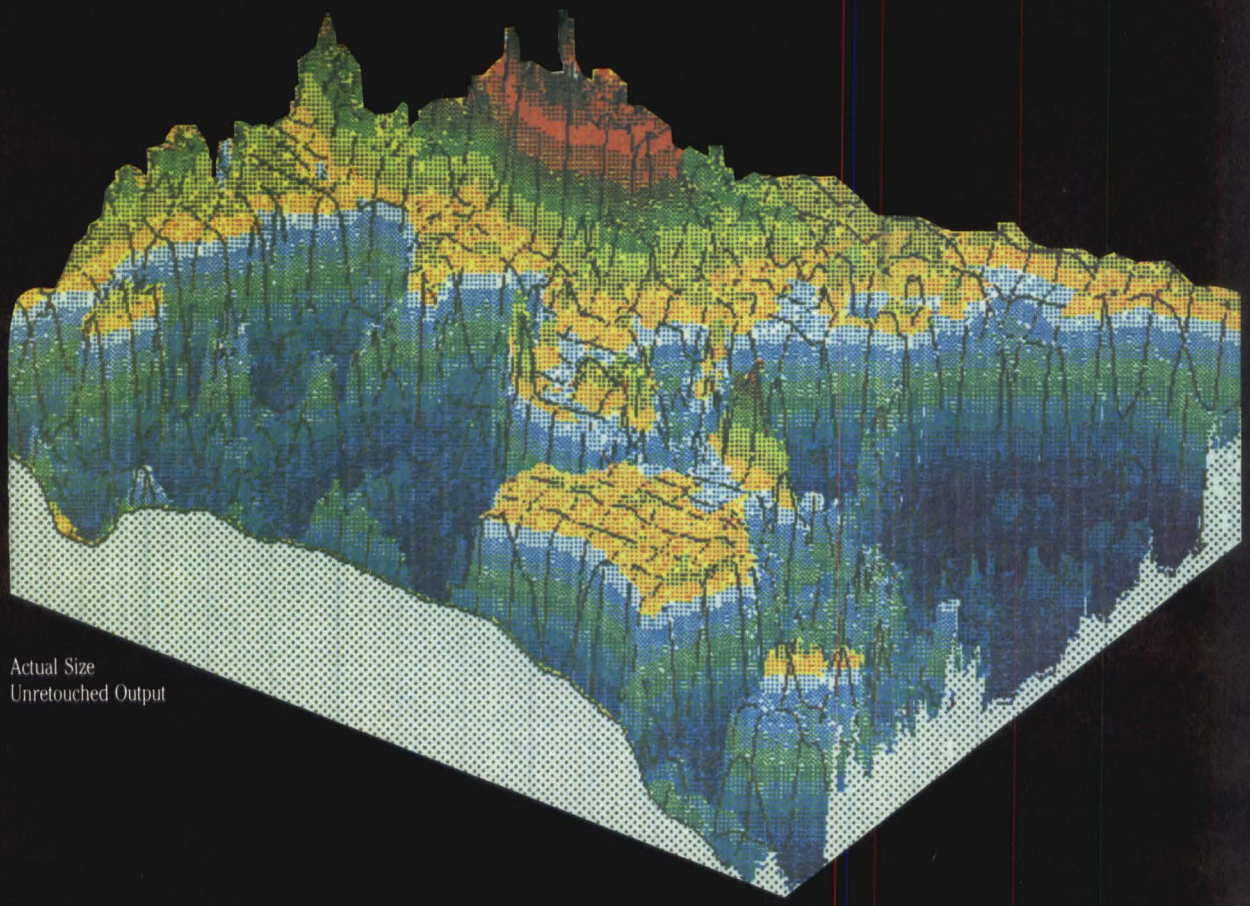

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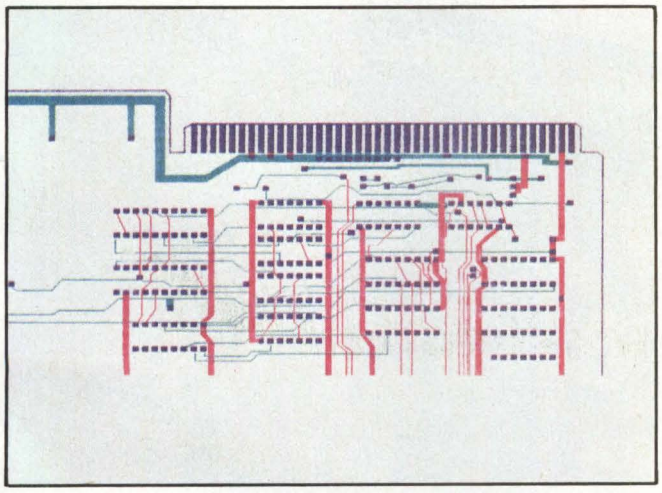
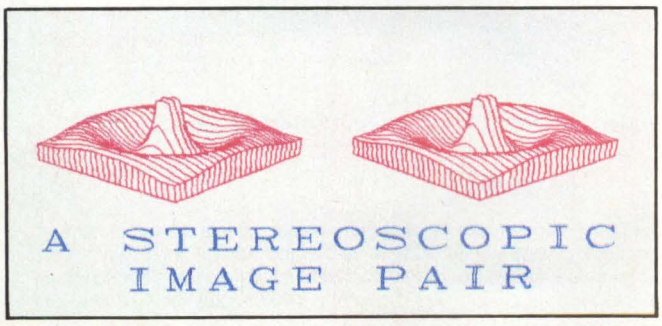
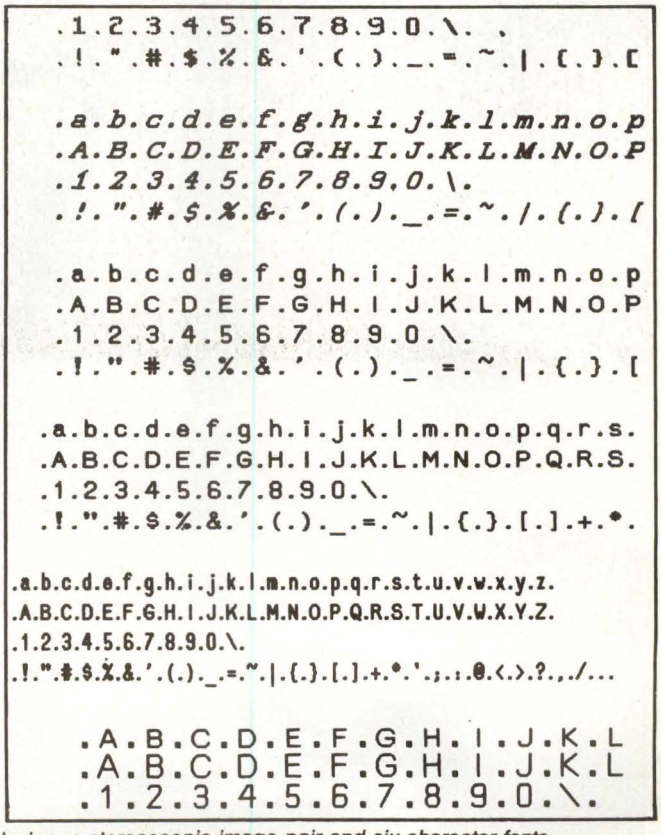
Built-in vector-to-raster conversion allows plotter graphics with letter-quality text

Many computer-graphics software applications generate images in the form of a list of vectors. Plotters can accept and draw these vectors without translation, using a simple interface that minimizes communications overhead. But because alphanumeric characters are composed of several vectors, plotters are extremely slow at text printing (about 3 characters per sec.), making them impractical for word- and data-processing applications. Plotter-drawn characters, futhermore, appear almost handwritten. Raster hard-copy devices create images by selectively turning dots on and off in a fixed matrix. They are much faster than plotters at text printing, but cannot plot vectors directly; vector information must be translated into a raster or bit-map







Print samples from the Envision 430 *include a PC-board design, a stereoscopic image pair and six character fonts.*

image, typically requiring add-on vector-to-vector conversion hardware and/or software.

The Envision Technology, Inc., 430 Color Vector-Printer is an impact matrix printer that can be controlled with high-level vector commands like a plotter through a built-in vector-to-raster conversion system. But because it is a matrix printer, it can provide 300-cps alphanumeric character printing (or 125-cps letter-quality printing) and faster graphics area fills. The printer incorporates two microprocessors and an 18-wire print head, achieving a resolution of 0.007 × 0.003 in.

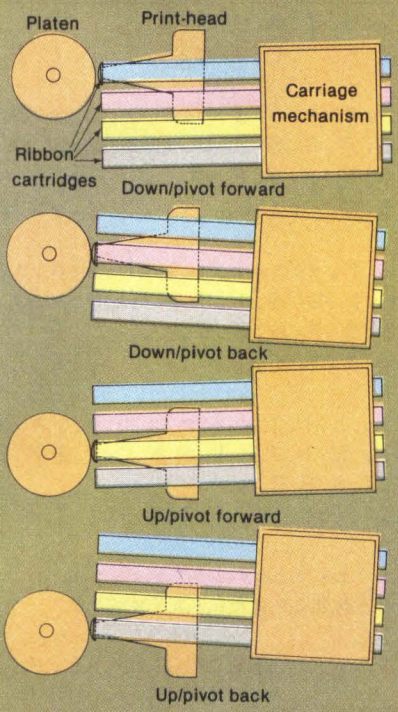
The Envision 430 incorporates two Intel Corp. 8088 16-bit microprocessors (Fig. 1). One controls the print mechanism; the other handles the host interface and

MAXIMIZING RIBBON LIFE

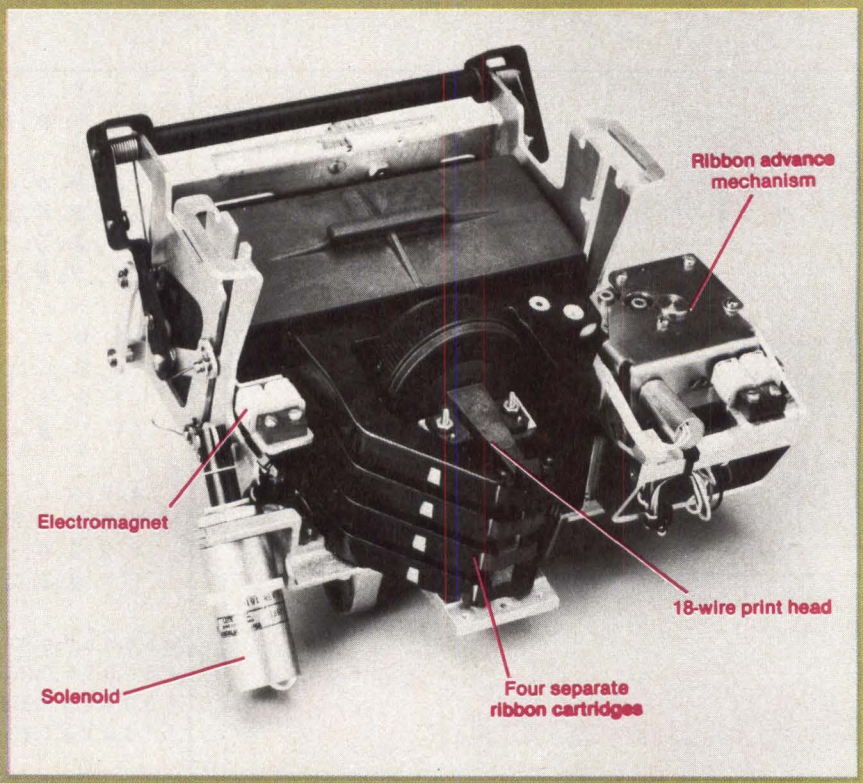
The Envision 430 maximizes ribbon life through a four-cartridge ribbon system. While conventional multicolor ribbons are advanced even if only one color is used, the 430's separate color cartridges are advanced individually as each color is used, ensuring complete use of every cartridge. In addition, the 430 adjusts ribbon advance based on the number of times each of 18 print-head wires are fired, rather than at predetermined intervals.

The 430 can print four colors without ribbon blending. Ribbon blending produces eight colors, with one of the ribbons black. Ribbon cartridges are available in mylar for high-quality print, and nylon for longer ribbon life.

Print head	Carriage position (vertical)	Electromagnet	Pivot position	Ribbon cartridge
Fixed position	Down	Off	Forward	#1
		On	Back	#2
	Up	Off	Forward	#3
		On	Back	#4



Four ribbon cartridge positions *are achieved by moving the carriage and cartridges up and down and pivoting them back and forth.*



Printing and ribbon selection mechanism *incorporates four separate ribbon cartridges for multicolor printing without ribbon waste. Colors are selected by both moving the cartridge bank up and down via a solenoid, and pivoting the bank back and forth with an electromagnet. The combination of these two motions positions any one of the four ribbons in front of the print-head. Ribbons are advanced individually as they are used.*

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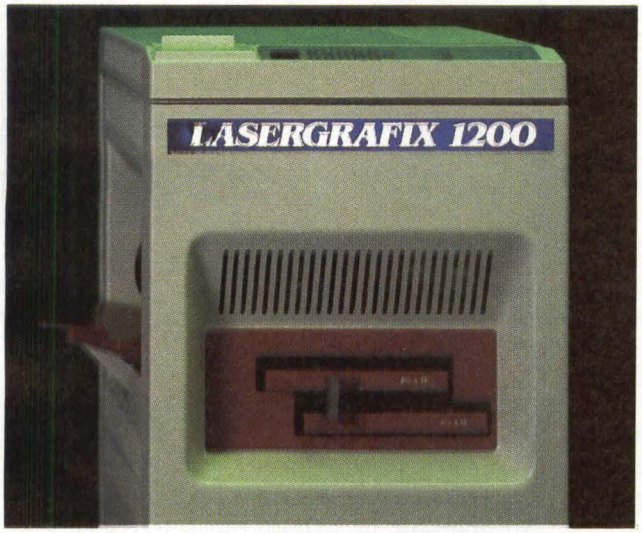

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command interpretation. The two microprocessors share a 128K-byte bit-map memory. An entire picture in the form of a list of vectors is loaded from the host computer into the printer memory. The interpreting microprocessor sorts this vector list according to location and color. It then scans the list and segments it into 18-line windows, or one line for each print-head wire (Fig. 2). Each window from the top down is converted into lines of dots and queued in the memory, in which it is accessed by the print-control microprocessor. The two microprocessors operate in parallel, so the processing of subsequent windows can continue while earlier windows are printed.

The 430's memory spools several graphs, or as many as 70 pages of 66 lines, and can generate multiple copies without host intervention.

Printing mechanism

Envision uses an 18-wire, high-frequency print head for 360-dot-per-in. horizontal resolution. Most matrix printers use seven- or nine-wire heads, requiring more

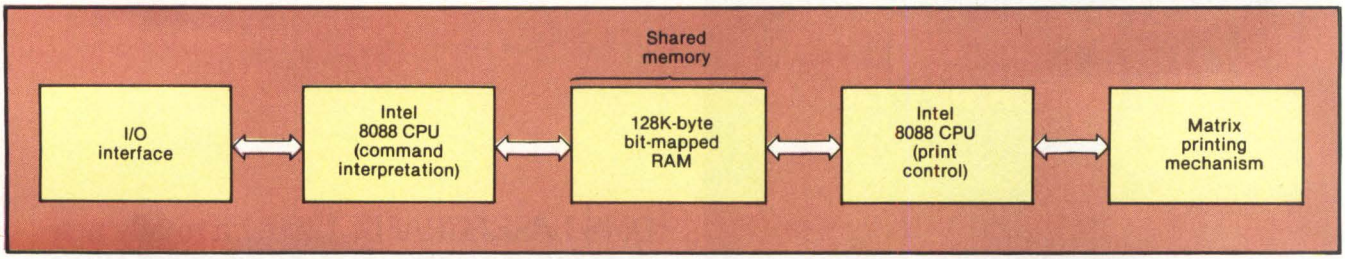


Fig. 1. Dual 16-bit microprocessor architecture *incorporates bit-mapped RAM to print letter-quality text and color graphics. The command interpretation microprocessor receives characters and creates a bit-mapped image in the shared memory. The print-control processor interprets the bit-map data, making no distinction between text and graphics.*

The Envision 430 ColorVector Printer *offers eight-color graphics printing via a plotter interface. Priced at less than $5000, it also offers letter-quality printing and high-speed mode for drafts.*

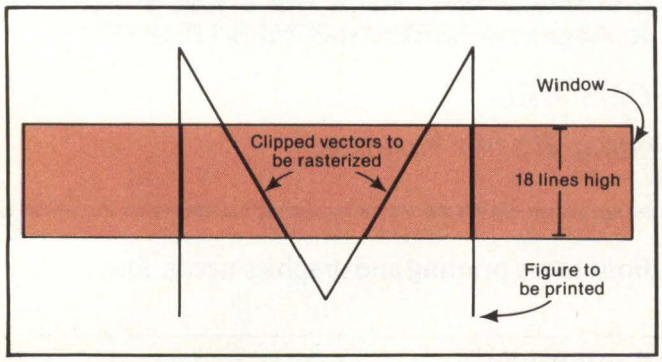


Fig. 2. Vector-to-raster conversion *involves dividing the figure to be printed into several windows, each of which is 18 lines high (one line for each wire on the print head). Windows are converted one at a time, starting from the top of the figure, with vectors clipped at the edge of the window. Portions of vectors within the window are converted to raster format and stored in the bit-map memory for printing.*

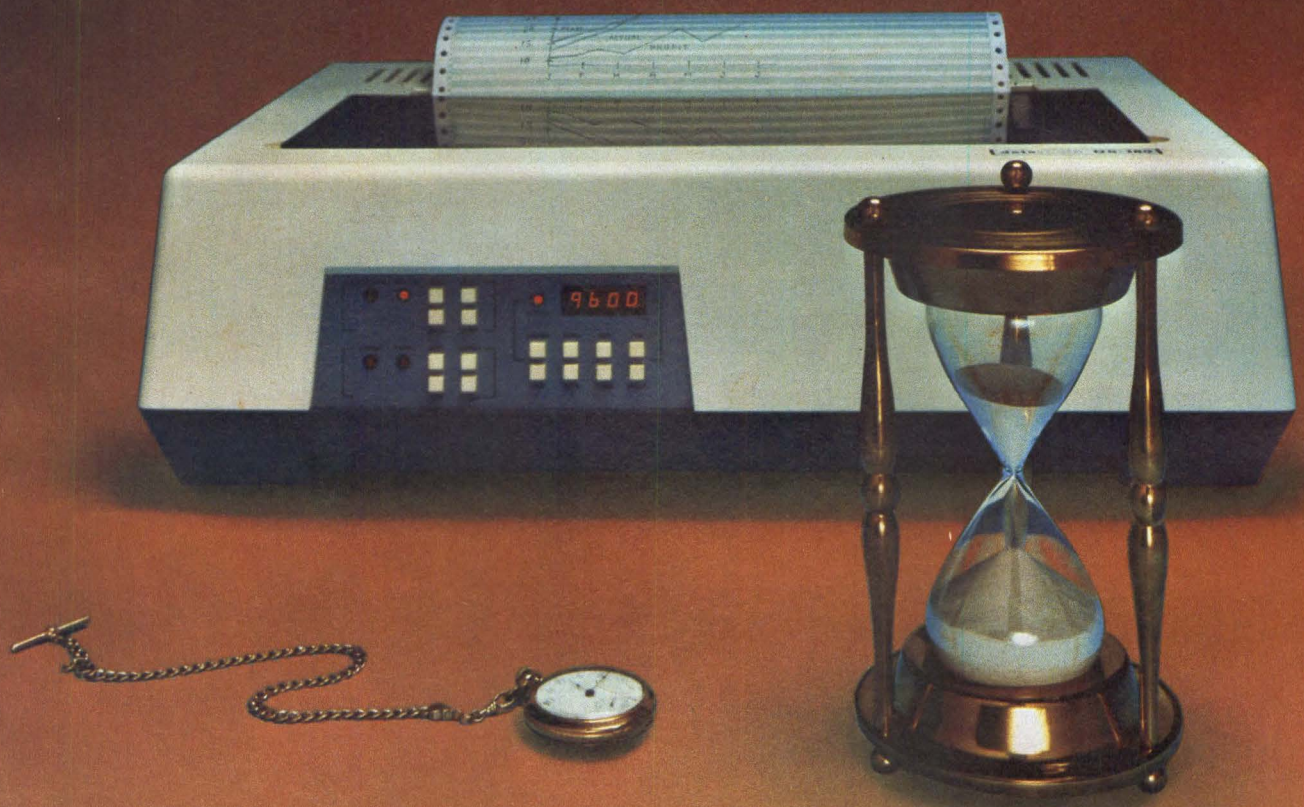
than one pass over a line and slight offsetting of the print-head position for high-quality, but slow, text printing. The 430's 18-wire print head prints letter-quality characters in a single pass without offsetting its position. An operator or a host can select character densities of 8, 10, 12 and 16.5 pitch. A variety of fonts are available, including elite, pica, Orator, italics, bold and user-defined fonts. Because fonts are contained in firmware, they can also be changed under host control.

Most printers cannot print until the print mechanism has reached a fixed velocity. A heavy-duty carriage drive can minimize the delay by providing high acceleration, but such drives add to weight, size and cost. The 430 eliminates the delay by printing *while* the carriage accelerates. The print-control microprocessor tracks the carriage through a closed-loop servo system, and adjusts for carriage velocity and direction during dot placement.

The Envision 430 supports Centronics and Diablo text protocols. The graphics protocols supported are similar to those of many popular plotters, including those from Hewlett-Packard Co. and Tektronix, Inc. OEMs can customize the hardware interface and protocols for emulation of other printer manufacturers through a translation table in firmware. An optional bidirectional tractor feed allows unattended paper handling. Communications rates can reach 38.4K baud with an RS232C interface and 60K bytes per sec. using a Centronics parallel interface. □

Edward M. Goldberg is software development manager, and Peter Moulds is product manager at Envision Technology, Inc., San Jose, Calif.

TIME-PROVEN PERFORMANCE



While new printers with impressive specifications are introduced on an almost daily basis, only time will tell the true quality of the product. Over the past 2 years our customers have continued to buy the DS180 printer, not only because of its impressive performance and competitive price, but also because of our outstanding track record for product reliability and customer support.

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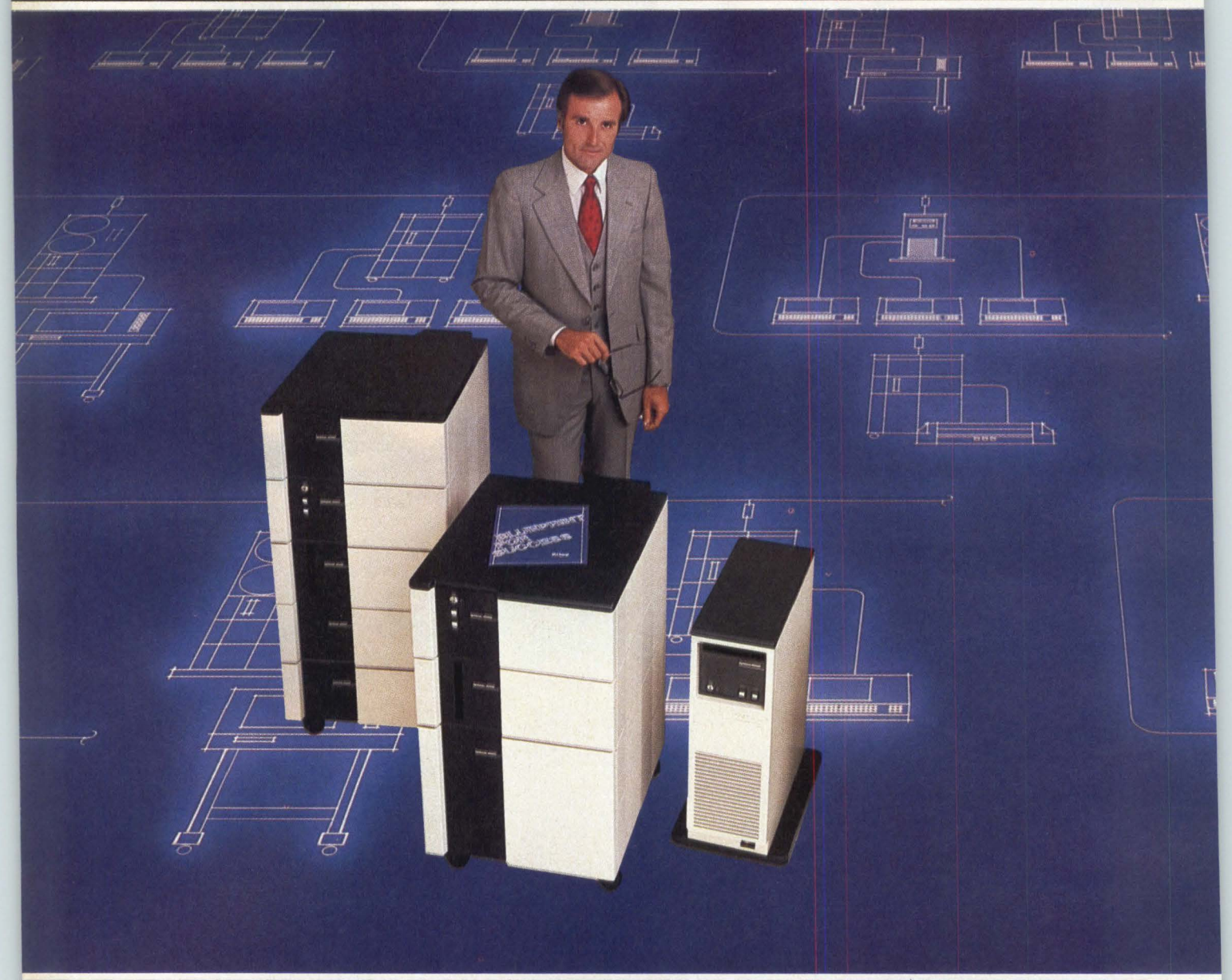
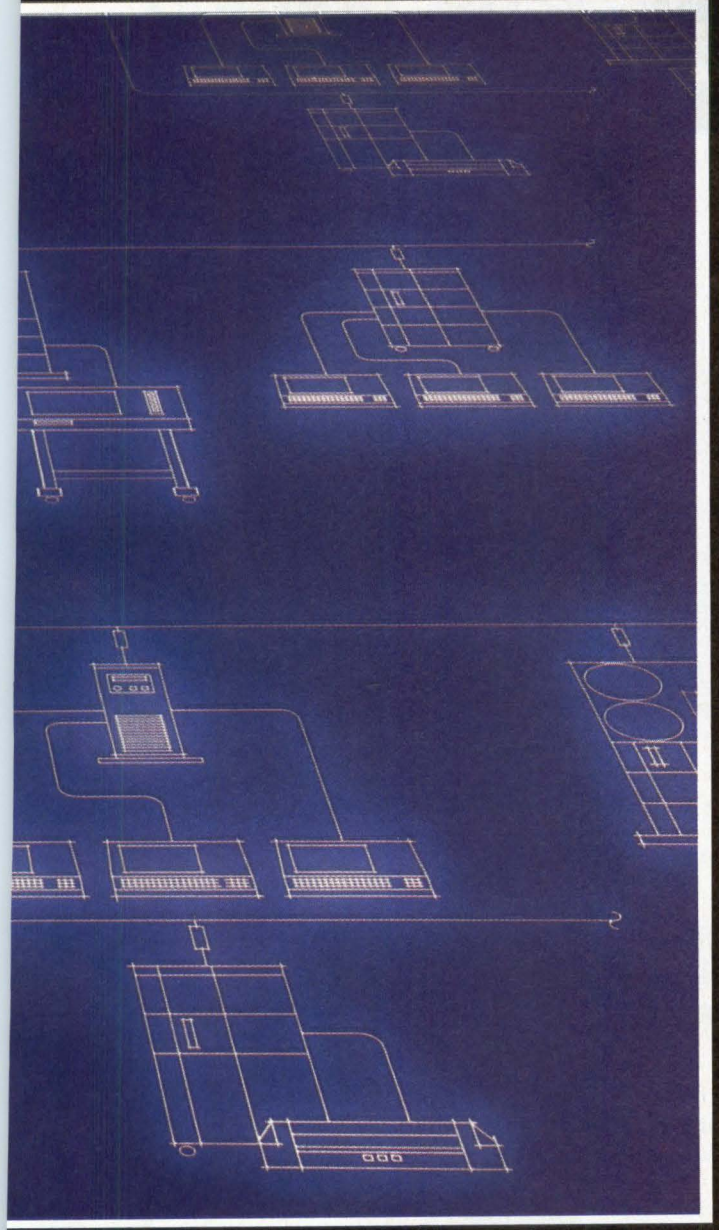
Zilog's System



8000 family spells OEM success.



Zilog's System 8000 is a growing family of totally compatible general purpose 16-bit microcomputers designed for high performance and reliability. Priced from $14,950 to $37,950, they are rapidly becoming the choice of successful OEM's for a growing variety of applications.

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For higher performance, choose the Model 21. It features 1 MB of ECC memory, a 32 MB Winchester disk and a 17 MB cartridge tape for backup.

For the highest performance of all, select the Model 31, the remarkable micro comparable in performance to minis, yet priced far less. It delivers up to 4 MB of ECC memory, plus up to 320 MB of SMD compatible disk and offers an optional 9 track tape. Model 31 also supports up to 24 users simultaneously.

Best of all, the System 8000 family has been designed to take full advantage of the powerful UNIX* operating system. System III has been added to further enhance application software development, making System 8000 computers your best choice to run high level languages such as BASIC, COBOL, FORTRAN 77, C, Pascal, PLZ/SYS and Z8000 assembler. All software is code and data compatible, allowing for total portability among all family systems. Inside all System 8000s are the high performance VLSI components you've come to expect from Zilog. The Z8000™ is a 16-bit CPU with 16 general purpose registers, an 8 MB address space and expanded capability to perform 8-bit, 16-bit and 32-bit operations.

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The combination of Victor Business Products and Sirius Systems Technology, Inc., creates a new company designed to meet the most demanding needs of the modern business office. It unites the advanced technology capabilities of Sirius with the distribution, support and marketing strengths of a company with over 65 years of experience in solving business application problems.

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The Chairman of the Board of the new Victor Technologies is Fred Sullivan, Chairman and Chief Executive Officer of Kidde, Inc., a diversified $3 billion company. The financial support of this giant conglomerate will help focus Victor's goal of becoming one of the three leading computer companies in the world.

President and Chief Executive Officer of the new company is Chuck Peddle. It was Chuck Peddle's focus and insight which led to the design and manufacture of the Victor 9000, the first and most powerful of the "third generation" of microcomputers. Acknowledged as the "father" of the personal computer concept, Peddle introduced this useful and very affordable third generation microcomputer in the European market with startling results.

The Victor 9000: Number One in Europe, in a class by itself in America.

In Europe the Victor 9000, sold under the name of Sirius 1, is the best selling microcomputer in the market. As a matter of fact, it was recently named "Computer of the Year" in West Germany.

There are demonstrably good reasons for this success. As in the United States, the Victor 9000 is the most powerful microcomputer available, offering substantially more internal memory, storage capacity and engineering advances than any other comparable product. And the Victor 9000 library of business application software and innovative line of peripherals and accessories make it a business tool of great versatility.

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CIRCLE NO. 90 ON INQUIRY CARD

High-speed magnetic printer uses perpendicular recording

JOHN M. FREEMAN, Cynthia Peripherals Corp.

Magnetic drum recording head modules produce letter-quality text at 6000 lpm

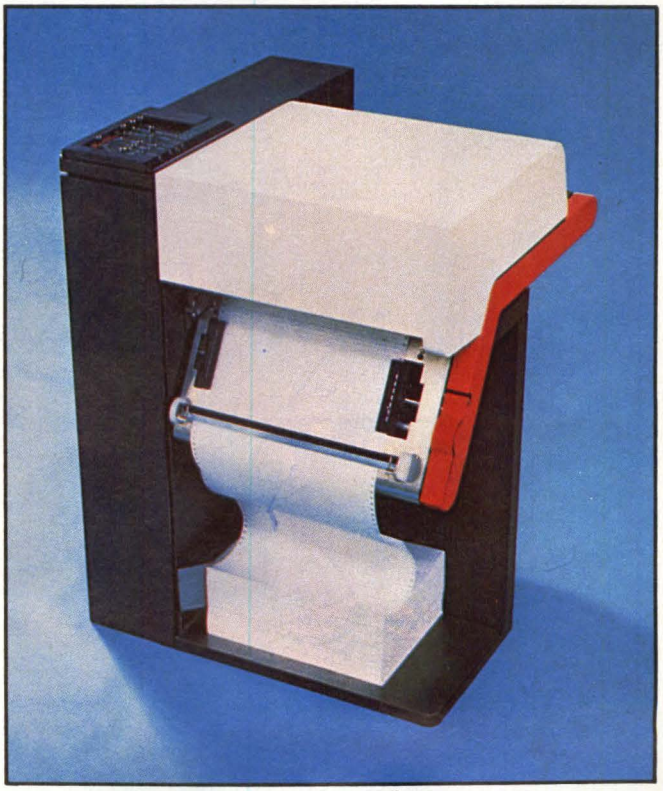
Within the past few years, many attempts have been made to make magnetic printing a viable alternative to laser printing. Most of these attempts have used conventional magnetic printing components such as longitudinal recording heads and magnetic tape.

The MP-60 printer from Cii Honeywell Bull, the parent company of Cynthia Peripheral Corp., uses a magnetic printing technology that eliminates many of the disadvantages of Xerographic and magnetic-tape processes, including the need to change or regenerate the printing medium continuously. This new technology is based on a hardened magnetic drum on which dots are recorded perpendicularly by an array of recording heads.

Non-impact printing techniques

Most low-speed non-impact printers use thermal or ink-jet techniques. In the high-speed range (several thousands of lines per min.), electrostatic or electro-optical (Xerographic or laser) technologies dominate. These high-speed, non-impact printers are sophisticated, with correspondingly high purchase and maintenance costs.

Both electrostatic and electro-optical techniques are based on a photosensitive drum that records a latent electrostatic image (Fig. 1). The drum rotates in front of an inking station, attracting toner to the latent image, and then transfers the toner to paper, on which the toner is then fixed. Poor reliability of the drum,



The CII Honeywell Bull MP-60 magnetic line printer *uses perpendicular recording on a magnetic drum to print at 6000 lpm. It accepts cut-sheet or fanfold paper, and is available with a minicomputer-oriented interface. Price is approximately $20,000 in 500-unit quantities.*

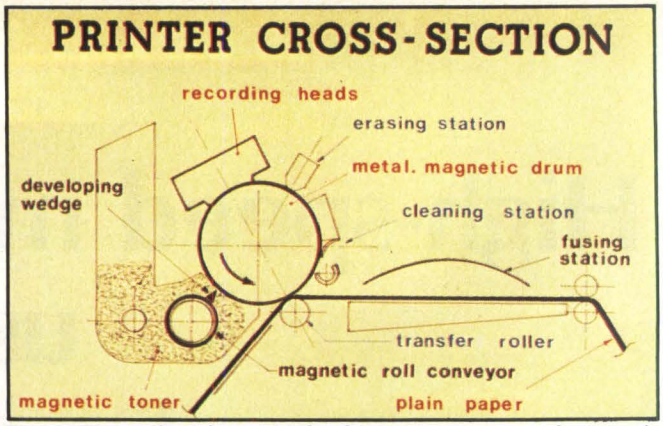


Fig. 2. Magnetic printer mechanism *uses an array of magnetic heads to record dots on a hardened drum. Toner is then applied to the drum through a wedge, and transferred to paper by a roller. Excess toner is removed by a scraper, and the region of the drum just printed is demagnetized.*

recording head and transfer station has resulted in many suppliers' basing prices on the volume of pages printed each month, to help defray the large maintenance costs associated with higher printing volumes. In addition, electrostatic printers require special paper, while laser printers require sophisticated control and adjustment devices.

Perpendicular recording on a drum

The MP-60's technology is based on a metallic, 100-mm.-diameter, magnetic drum (Fig. 2) with an external layer of magnetic alloy. The drum runs at a constant speed of 12.5 in. per sec. (linear speed at the edge of the drum). This speed leads to a printing rate of 6000 lpm, or 88 pages per min.

In the high-speed range, electrostatic or electro-optical technologies dominate.

In operation, each region of the drum first passes under a demagnetizing head. The printing station, consisting of 3360 recording heads, can then selectively record on the region. This process is repeated over different regions as the drum rotates. The dot configurations in the rows produce a latent magnetic matrix forming an image of the page to be printed. The image can comprise any combination of alphanumerics or graphics.

The magnetized regions then pass through the toning or inking station in which dry magnetic-ink particles are attracted to the drum, resulting in image "development." The ink toner is a single-component toner; that is, the development process uses only one type of particle. Many technologies use cascade or magnetic-brush development, requiring a mixture of toner and carrier. The need to control the mix of toner and carrier, despite the unpredictable consumption that

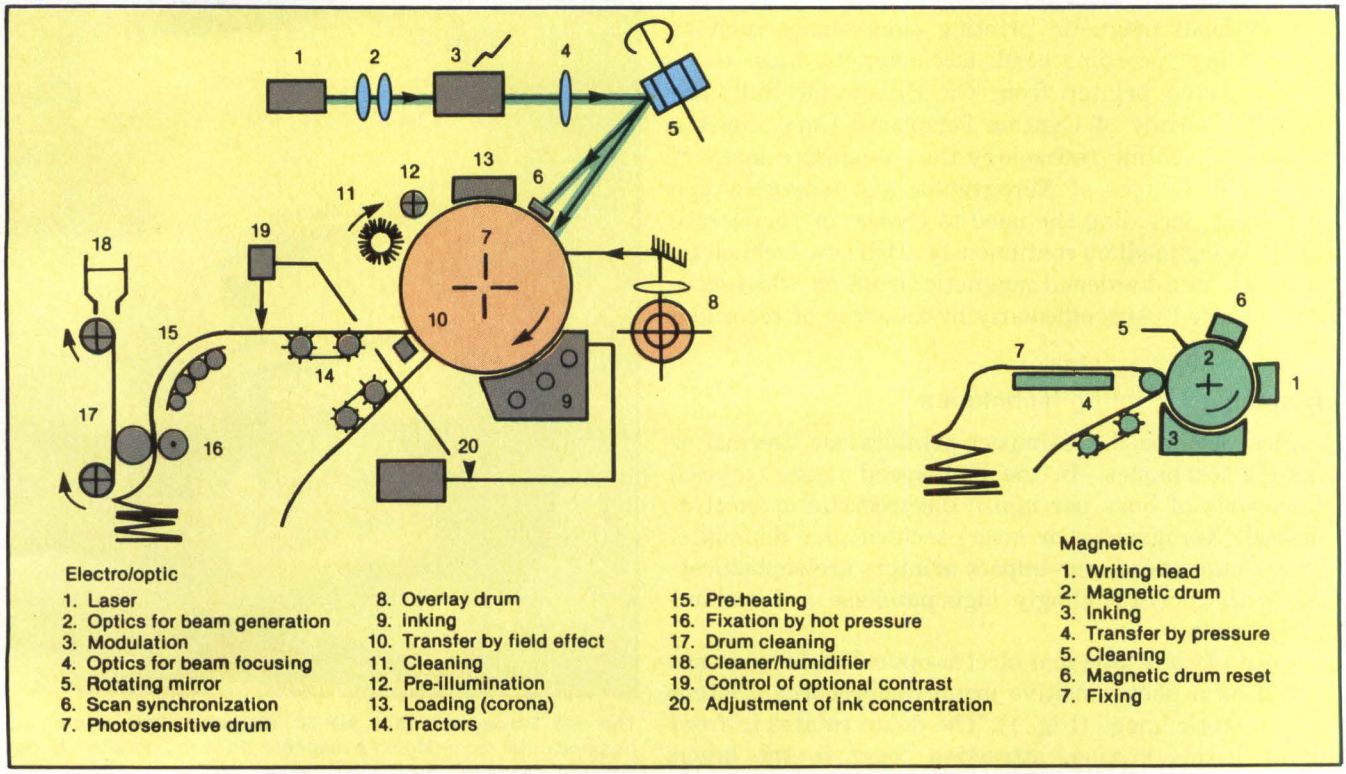


Fig. 1. Comparison of electro-optic and magnetic printing technologies *shows relative simplicity of magnetic technique. Figures are drawn to same scale.*

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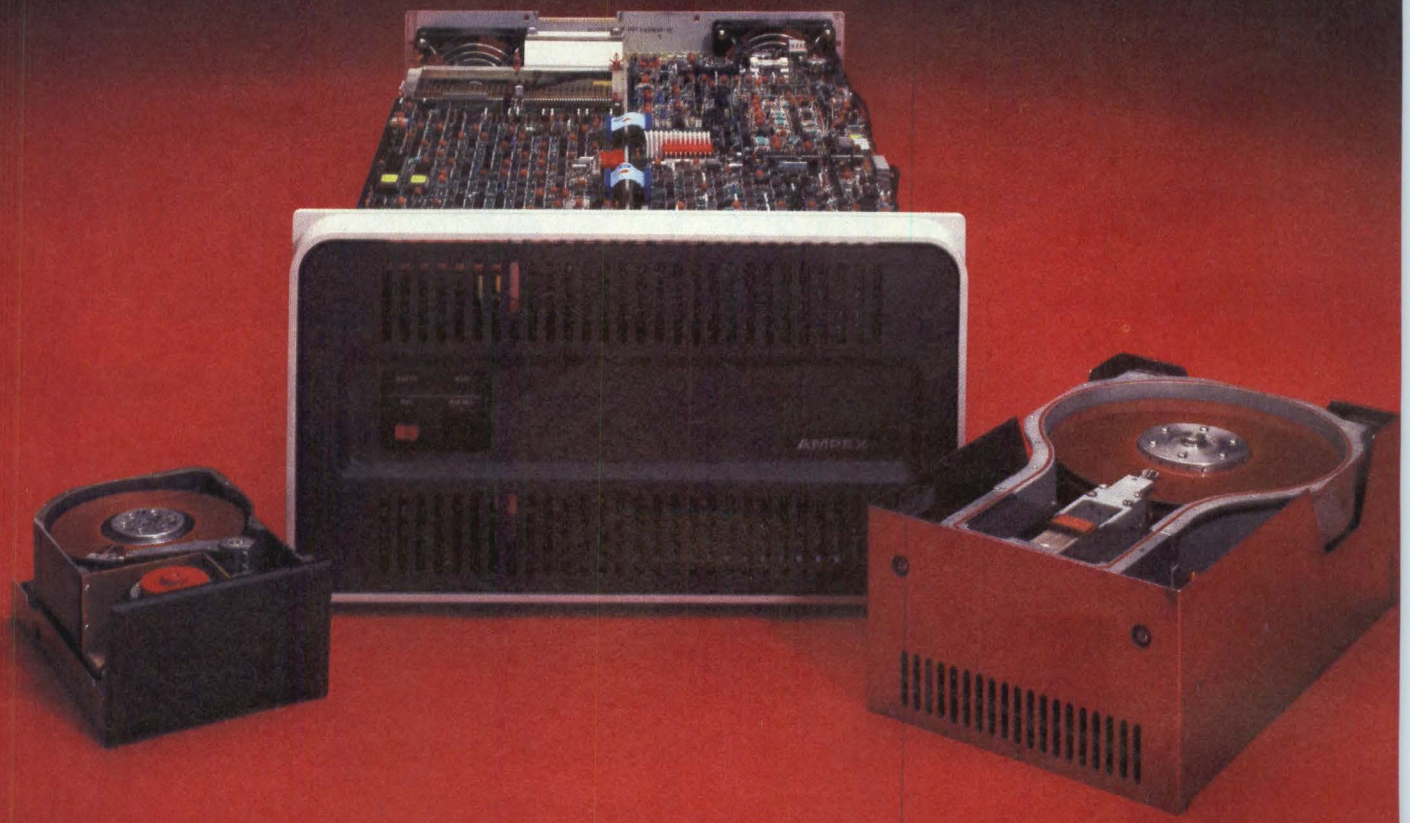

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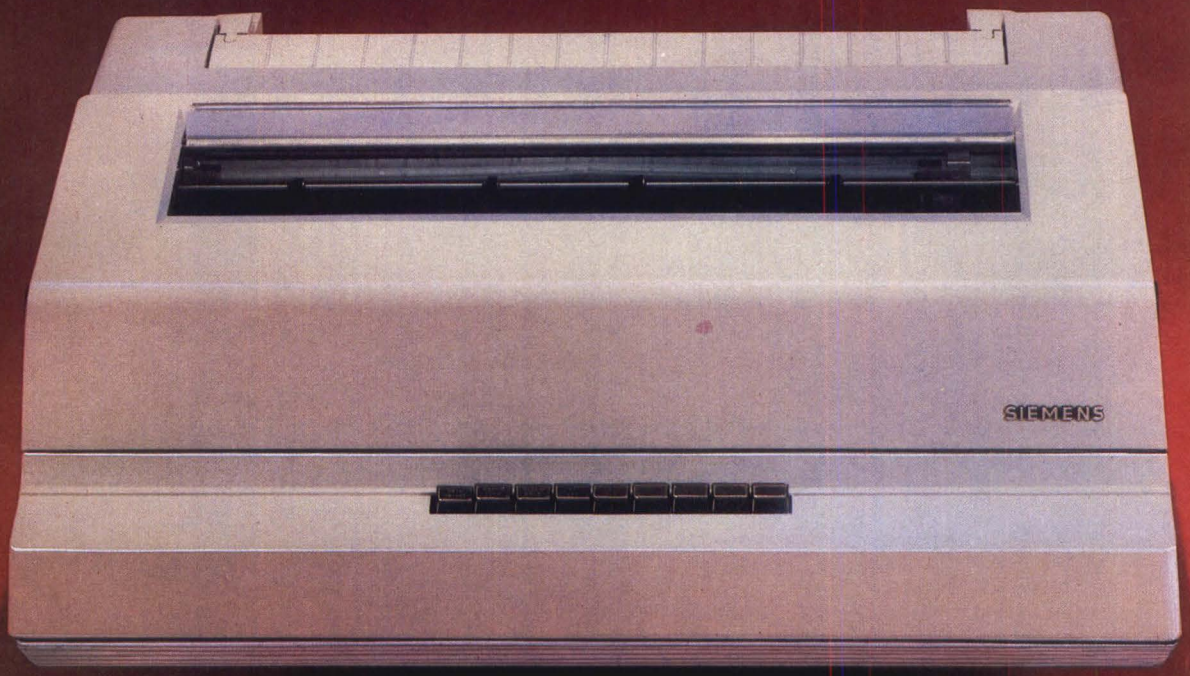

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results from random image density, leads to problems with such systems.

The single-component toner basically consists of thermoplastic resin particles ranging in size from 10 to 50 microns, enclosing several tiny submicron magnetic fillers. Image development results from the magnetic force exerted by the magnetized dots to these magnetic fillers. The particles are applied by a permanent magnetic roller, as in most single-component toning systems. However, unlike most other systems, the developing effect is obtained through a wedge that presses the toner against the drum instead of simply brushing the surface.

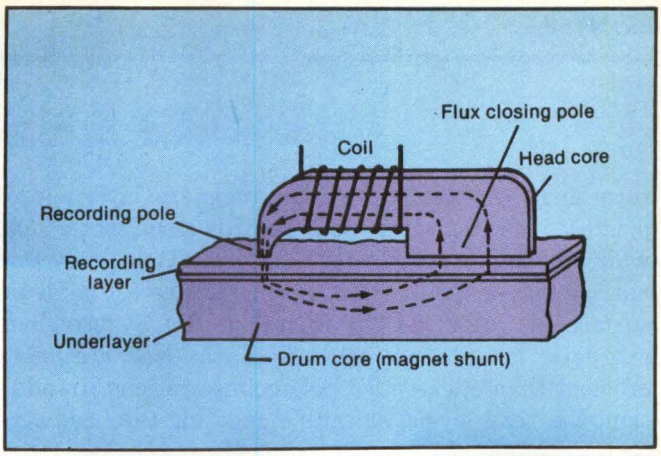


Fig. 3. Recording head *sets up a closed-loop magnetic circuit running from the recording pole, through the surface of the drum, to the flux-closing pole and through the core of the head back to the recording pole. The drum retains only the higher intensity field from the recording pole, perpendicular at the surface.*

MP-60 SPECIFICATIONS

Speed: 68 pages per min. (8½ × 11 in.) or 6000 lpm at 8 lpi
Resolution: 240 dots per in. vertical and horizontal
Character pitch: 6, 8, 10, 12, 15, or 20 characters per in., host-selectable, mixable within a page
Character Rotation: 90, 180 or 270 degrees
Buffer: 12,000 characters, 24,000 optional
Character set capacity: 512 characters, host-selectable
Bused control lines: 48
Enable lines: seven per module, 10 modules
Control Current: 70 mA
Control time: 4 μsec.

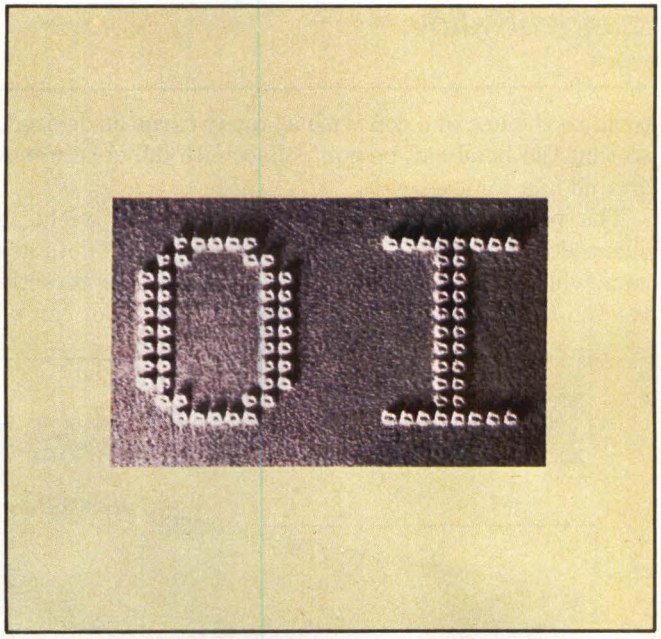


Fig. 4. Section of drum surface *shows toner held by magnetic force to magnetic image of characters.*

After the image is developed, it is transferred onto plain paper by means of a pressure roller. This roller allows the paper to be friction-driven synchronously with the magnetic drum. This mechanical transfer technique is less sensitive to humidity than the electrostatic transfer used in Xerography and other fragile-medium printers, and avoids the use of high-voltage corona wires. The hardness of the magnetic medium permits the use of such a pressure-based technique.

After the image is transferred to the paper, and before a new print cycle can be initiated, excess toner remaining on the drum is removed by a static scraper blade, as opposed to the conventional rotating-brush mechanism. The scraped toner is then transported mechanically by helicoidal screw.

Recording head design

The large number of recording heads along the drum require a small head that can be controlled with a low drive current, provides a short response time to permit multiplexed control and can be manufactured inexpensively.

The head consists of a thin, highly permeable, metallic core bearing a wound coil (Fig. 3). The core contains a recording pole and a flux-closing pole, both facing the drum surface. When the head coil is energized, a magnetic flux is created in the closed magnetic circuitry, composed of the head core and the drum ferromagnetic core, which acts as a magnetic shunt.

Two gaps exist in the closed magnetic circuit, one at the recording pole, the other at the flux-closing pole. In both gaps, the magnetic field is perpendicular to the drum's external magnetic layer, which passes through these two gaps. Because the flux-closing pole is much wider than the recording pole, the field intensity under the recording pole is much greater than the field intensity under the flux-closing pole. By positioning the

recording threshold of the drum magnetic layer appropriately, the recording pole records a magnetic dot, while the flux-closing pole does not. Thus, only one narrow magnetized region, perpendicular to the drum surface, is required to record a dot. Closed-loop magnetic circuits are used because they are more efficient than open-ended pole configurations. In addition, the head layout permits elongating the head core to allow the use of a coil with as many turns as desired, so that the head can be controlled with drive currents around 100 mA.

The MP-60's technology is based on a metallic, 100-mm.-diameter magnetic drum with an external layer of magnetic alloy.

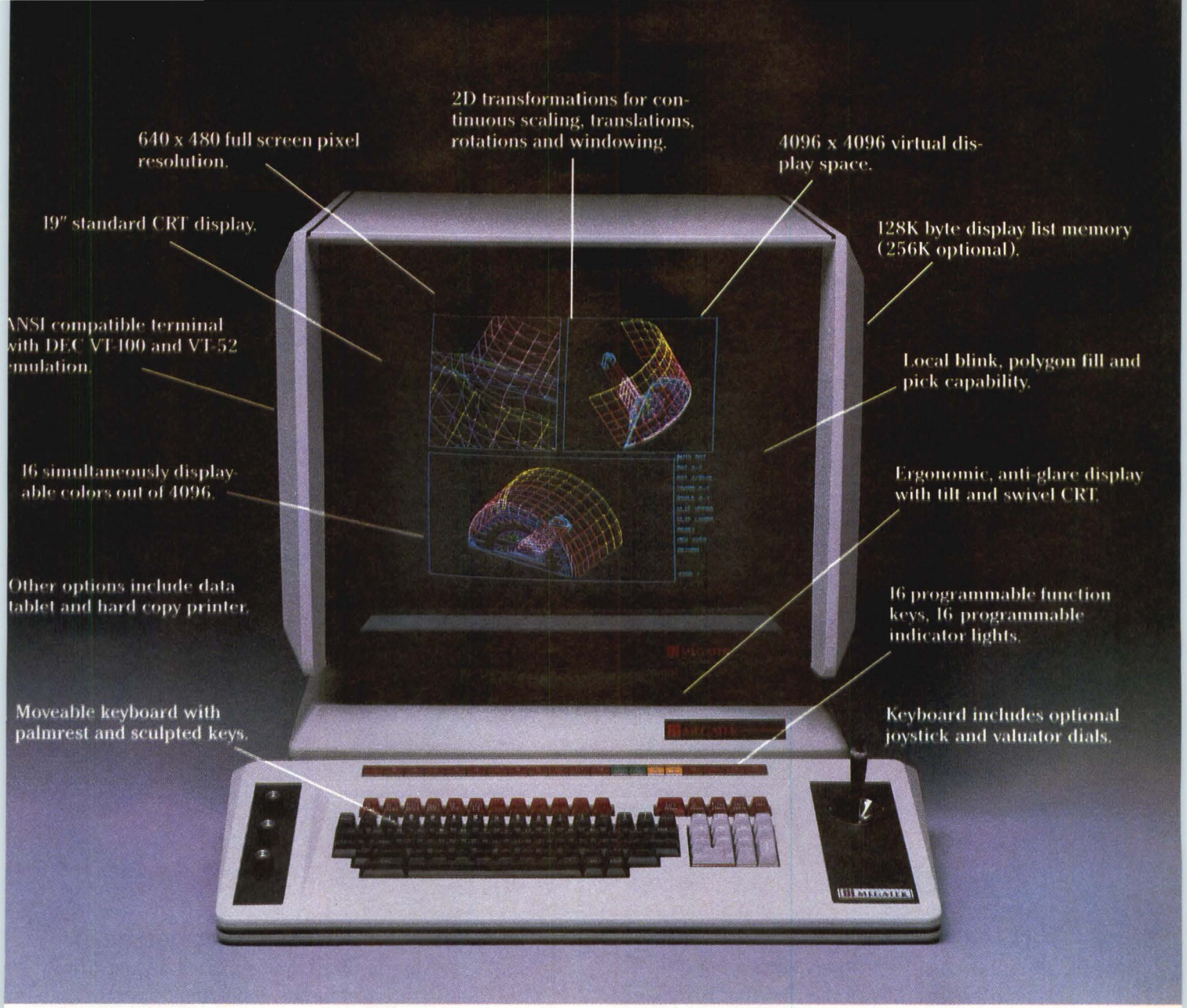
The perpendicular recording of the layer yields a sharp dot definition. The remanent magnetic dots are somewhat square (Fig 4). The dot size is directly related to the recording pole size, and each dot can be recorded with only one pulse of current.

Very close to the surface of the drum, toner particles tend to accumulate along the edges of the square dot, producing a "doughnut" effect. This gradually disappears further from the surface; at 30 to 50 microns from the drum surface, toner attraction is maximum at the middle of the dot. This height is reached by using relatively large particles, or a sufficient quantity of small particles.

The shape and layout of the head core is well-suited to high-density packing. The longest dimension of the core lies in the longitudinal direction—the direction of drum motion, or vertically with respect to the paper. In the transverse direction—parallel to the drum axis or horizontally with respect to the paper—the head core is flat, allowing the packing of head cores at the required pitch.

Heads are packaged in sealed modules, each containing 336 heads. The heads are arranged in two rows, one for even-numbered heads and the other for odd-numbered heads, with all the recording poles aligned. A print station of 3360 heads comprises 10 modules, side by side, capable of letter-quality text or graphics printing. □

John M. Freeman is printer product marketing director at Cynthia Peripherals Corp., Palo Alto, Calif.



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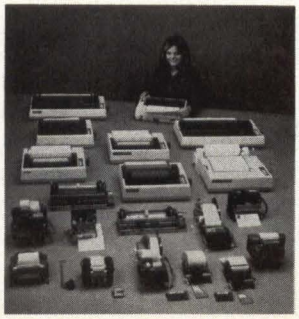

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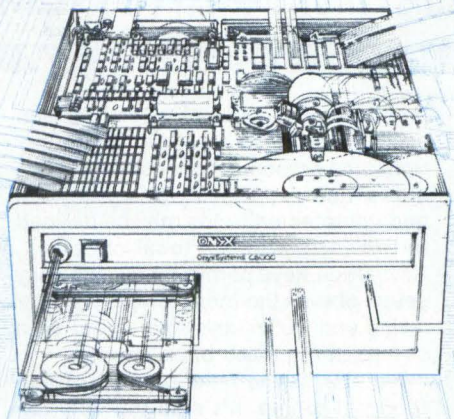

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CIRCLE NO. 96 ON INQUIRY CARD

Controller/transceiver board drives Ethernet into PC domain

BOB METCALFE, 3Com Corp.

Outfitted with a compact circuit board, IBM PCs can be part of a high-speed LAN at reasonable cost

Until very recently, the cost of connecting microcomputers to the Ethernet local network was prohibitive to both personal-computer makers and users. But the introduction of VLSI controller chips, refinements in Ethernet transceivers and space-efficient board design have brought Ethernet connection within the realm of the second-generation, 16-bit-based microcomputer. By putting the transceiver on the controller board and using VLSI data-link controllers, it is possible to provide a complete local-network connection, including software, for less than $1000 per station.

Initially aimed at IBM Corp.'s Personal Computer, 3Com Corp.'s EtherSeries provides the Ethernet physical and data-link control layers at board level and supplies networking software for such applications as file and printer sharing and electronic mail. The product's levels of networking service allow flexibility of configuration and implementation by both OEMs and nonprogramming end users.

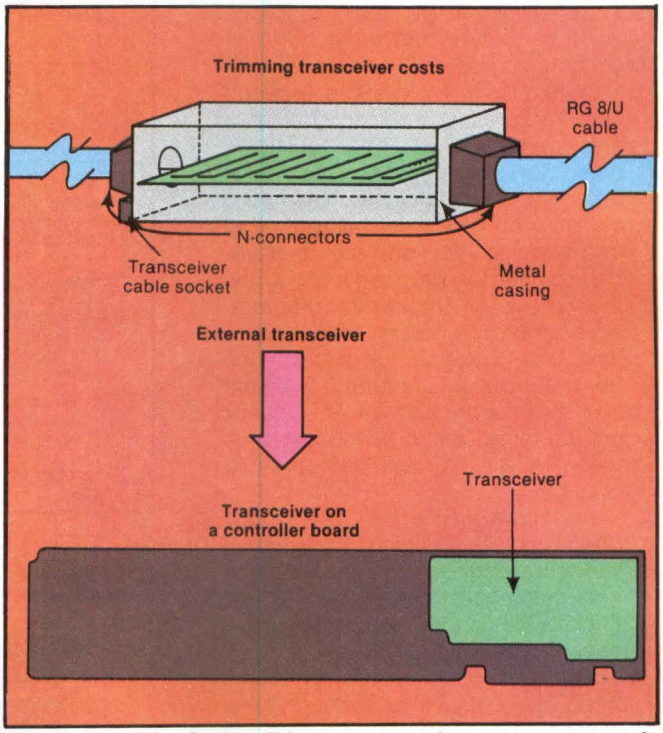


Fig. 1. Until EtherSeries, Ethernet transceivers were separately housed circuits *connected directly to the network cable and interfaced to the station using a transceiver cable containing four twisted pairs. Now, the transceiver can be located on the board next to the controller chips. A redesigned circuit also yields fewer parts, lowering the cost of the transceiver and its cable. Future VLSI of the transceiver function will facilitate implementation and eventually, with volume production, reduce board costs.*

Shaving component size and cost

To meet the goals of providing low-cost Ethernet connection required eliminating some high-level controller functions not necessary in a microcomputer local network, shrinking the controller circuitry and redesigning the transceiver to fit on a controller board. The combined power consumption of the controller and transceiver was reduced by a factor of four, and 104 sq. in. of components were squeezed onto a 52-sq.-in. PC board.

3Com worked closely with Seeq Technology Inc. in designing and testing a suitable Ethernet controller chip. Like most other chips being developed by semiconductor manufacturers, Seeq's meets the required OSI level two requirements, but it has fewer added functions, which lowers production costs (see "Transmission control chip," p. 180). Because this controller incorporated much of the circuitry found on board-level controllers, the board size could be reduced, and other Ethernet functions could be built on the same smaller board. This favorably affected the economics of board manufacturing: the layout was less complex, boards were less costly, parts count fell

drastically, and statistical reliability increased.

The transceiver also needed cost trimming. Until EtherSeries, Ethernet transceivers were housed in separate enclosures containing the transceiver circuitry, a tap or a pair of N-connectors and a transceiver cable socket. With redesign, it was possible to put the transceiver circuit on the same PC board as the controller chip and its support circuits. This immediately eliminated the cost of the separate enclosures, the transceiver cable connector, the transceiver cable and the power regulator (Fig. 1). The EtherSeries controller is connected directly to the transceiver through copper connections on their common board.

In putting the transceiver on the board, parts location becomes even more critical than for a separate-

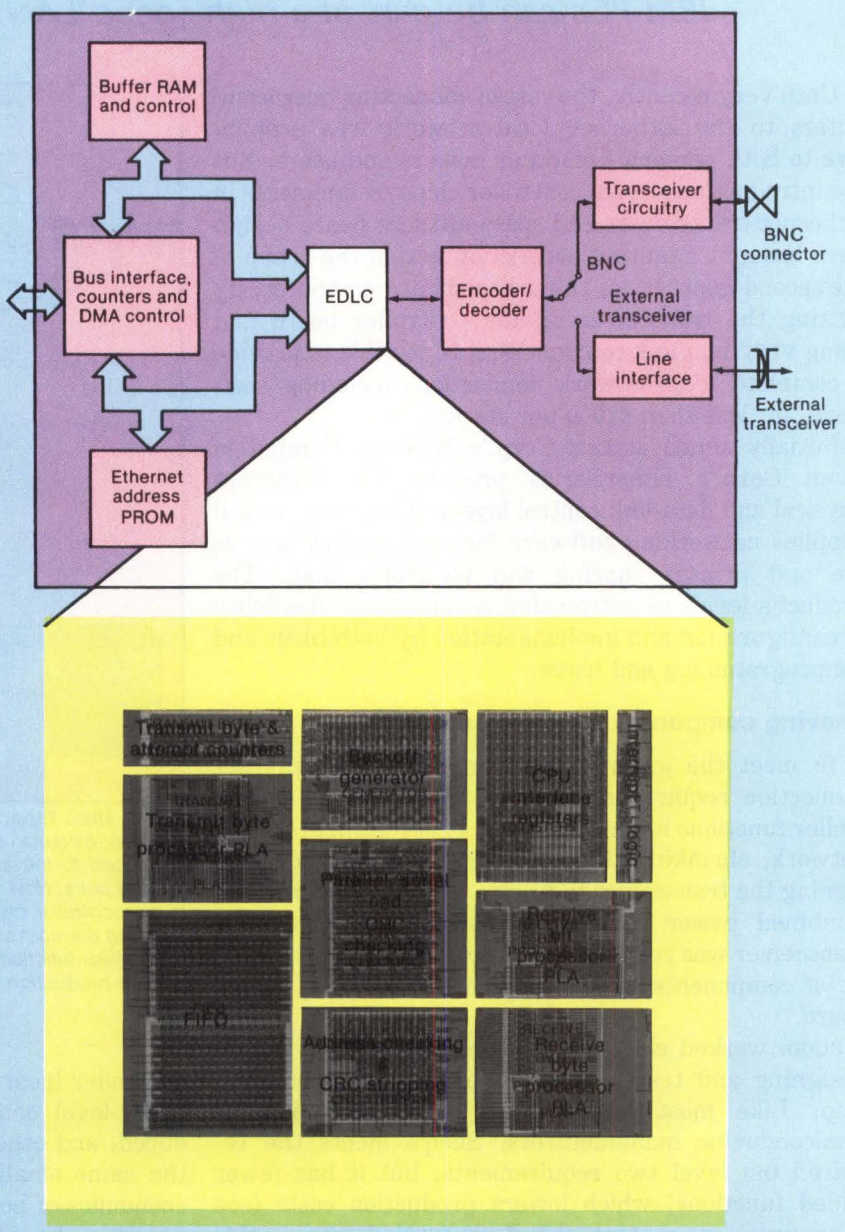
TRANSMISSION CONTROL CHIP

At the heart of 3com's EtherSeries is Seeq Technology Inc.'s 8001 Ethernet data-link controller chip. The 8001 provides the minimum CSMA/CD functions according to Ethernet specifications, allowing system integrators to supply the higher level functions such as buffer management, DMA control and address hashing.

Developed with the help of a silicon compiler, the 8001 silicon structures are arranged in a logical functional order. The chip contains (from lower left, counterclockwise) two FIFO buffers, an address-checking and CRC-stripping section, the receive-byte processor program-logic array, the receive-bit processor program-logic array, the CPU interface registers, the back-off generator, the transmit-byte and attempt counters and the transmit-byte processor program-logic array. In the center is the parallel/serial and CRC-checking circuitry.

On 3com's EtherLink board, the Seeq chip is coupled to a serial interface subsystem on one side and a 2K-byte packet buffer on the other. Packets intended for transmission are transferred via DMA over the PC system bus to the on-board transmit FIFO. The controller performs framing of the packet to include the prescribed preamble and CRC information. (The address fields, type field and data field are prepared in external memory before initiating transmission and pass transparently through the EDLC chip.)

If the network has been quiet for at least 9.6 μsec. and the back-off time requirements are satisfied, the packet data are serialized and shifted to the transceiver for transmission. If collision occurs, the controller halts the transmission by sending a jam pattern and signaling the CPU to begin the back-off algorithm. Transmission is reinitiated when the initial bytes of the frame information field are reloaded into the EDLC transmit FIFO.



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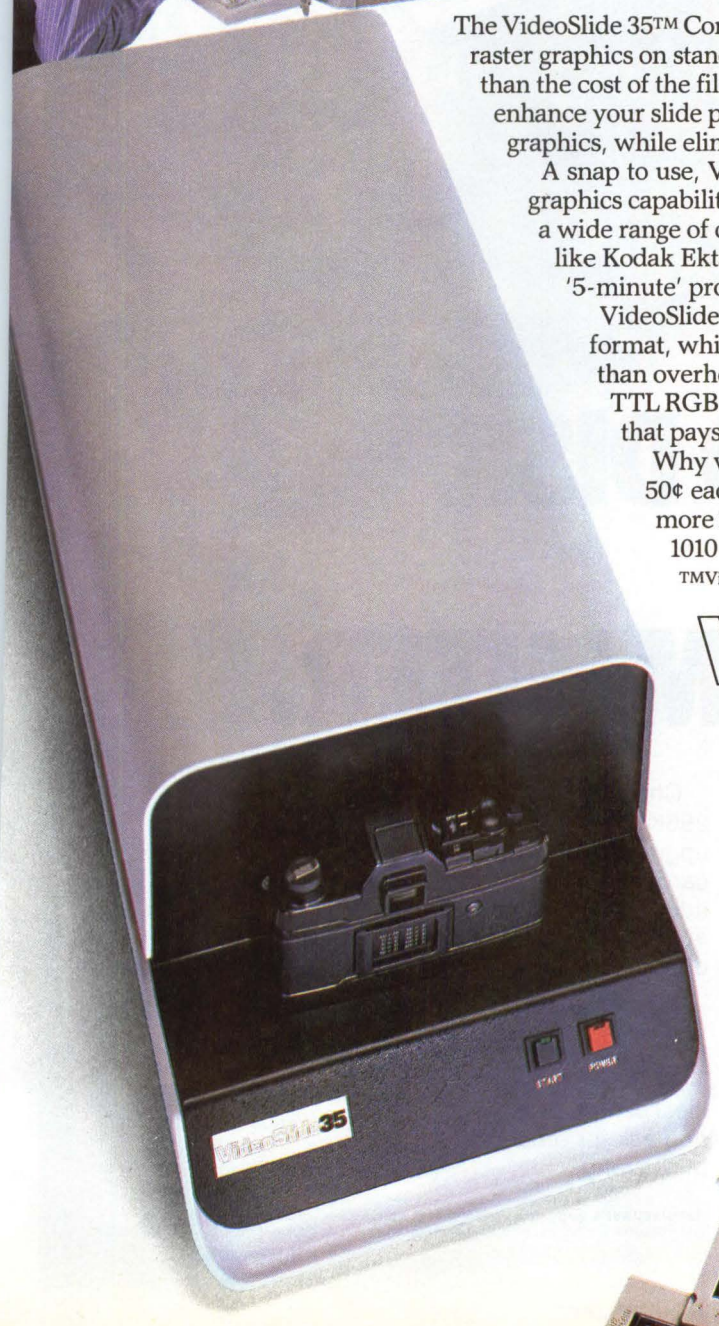

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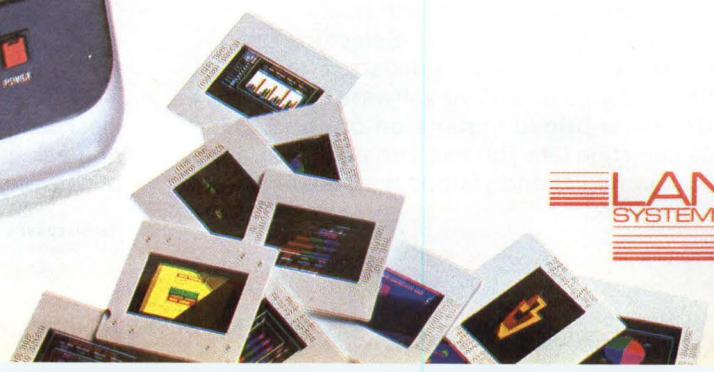

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CIRCLE NO. 97 ON INQUIRY CARD

ly housed transceiver. Now, standard logic circuits and buses with 5V square-wave pulses coexist in close proximity with precision analog circuits designed to respond to millivolt levels. This called for the combined talents of analog and digital engineers to ensure conformity to both FCC regulations and Ethernet specifications.

Because EtherSeries' on-board transceiver allows direct or indirect Ethernet connection, users have a choice of cabling. Ethernet uses a 50-ohm coaxial cable, which is available in more than one diameter and price. Therefore, users can take advantage of lower cost, thinner cable for shorter distances.

The main differences between a thick, 50-ohm cable and a thin one are flexibility and attenuation. Thinner cable is easier to bend around corners and, consequently, easier to bring to a workstation cabinet rather than to install in walls and ceilings and bring a transceiver to it. Thinner cable has a higher attenuation factor, though, which means that signal levels reach limiting values over shorter distances than with thicker cables.

EtherSeries permits two connection methods (Fig. 2). The on-board transceiver has a BNC connector located at the rear of the IBM PC to which a BNC "tee" connector and the thinner RG 58 A/U coaxial cable can be connected. This coaxial cable, in turn, can be directly connected to the thicker RG 8/U type, using a standard adapter. Users can alternately connect the PC to an external transceiver that is connected to RG 8/U-type cable. The use of thinner cable in no way interferes with the 10M-bps Ethernet-specified data-transfer rate. EtherSeries supports as much as 350m. of thin coaxial cable.

Implementation

EtherSeries has several levels of networking services. The fundamental connection of the IBM PC to Ethernet is implemented by EtherLink. Higher level local-network services (those providing network-through application-level protocols) are handled through EtherShare, EtherDisk, EtherPrint and EtherMail. The hardware and software can be combined to build configurations ranging from a backbone local network to a complete networking system (Fig. 3). Consequently, OEMs can purchase the hardware and possibly system software, but add value to their products by supplying application software. On the other side, professional nonprogramming users can buy the whole package to take advantage of application programs that require little or no training, an option that will become even more attractive as 16-bit-based personal computers infiltrate high-level management in business.

IBM PCs equipped with EtherLink become network stations retaining all their personal-computer charac-

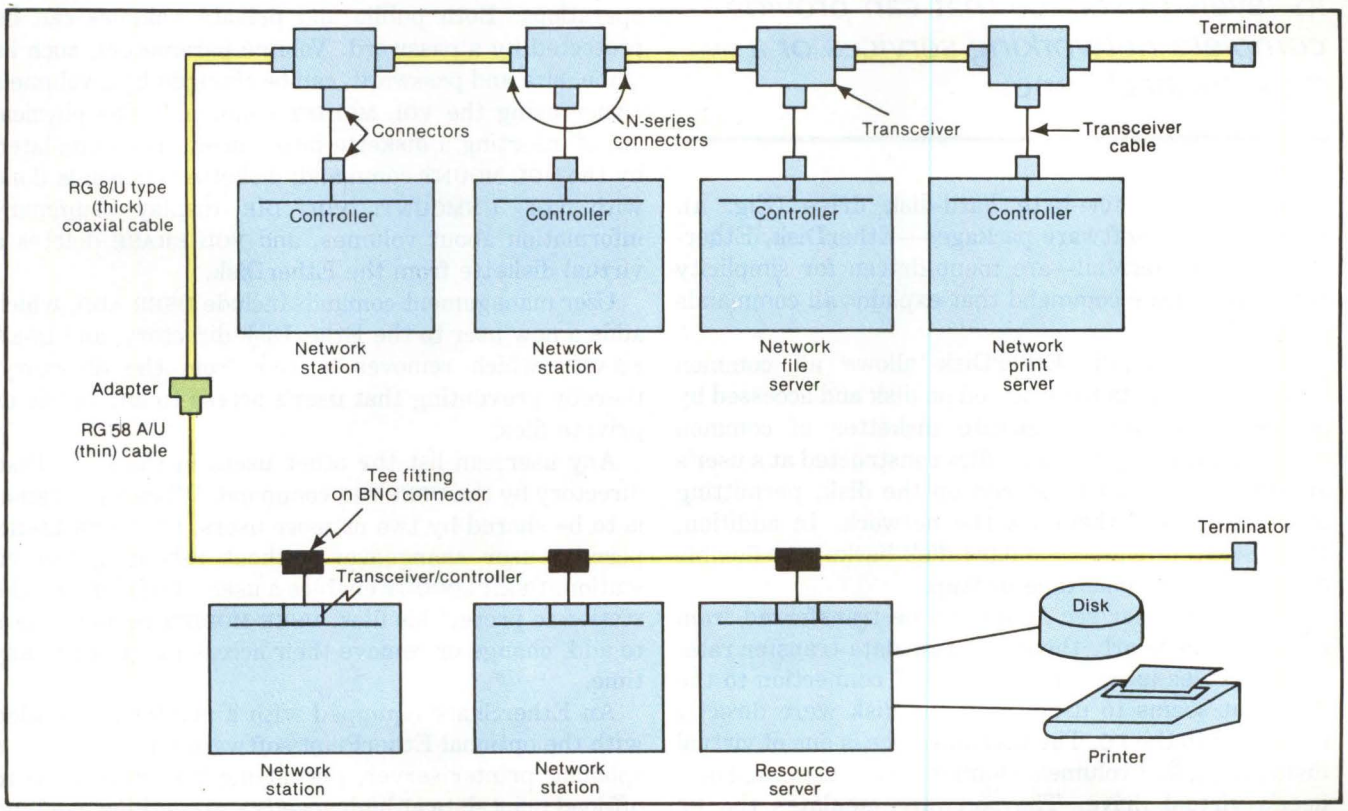

Fig. 2. Cable and connector costs can be lowered *by using thin RG 58 A/U instead of thick RG 8/U coaxial cable. Thick cable requires an external transceiver and cabling from the controller board to the transceiver; thin cable connects directly to Ethernet's "tee" connector. There is no performance penalty in thinner cable, although its attenuation factor does limit distance. Thin and thick cables can be connected through an adapter.*

teristics and gaining access to networked resources such as expensive peripherals. EtherLink consists of an Ethernet controller/transceiver board that plugs into the PC's backplane, a software diskette and a user's manual. The EtherLink software package includes two applications: remote disk access from one PC to any other connected to the network and printer sharing. All disk requests, including those of IBM DOS, are automatically and transparently routed across the network so that file transfer is achieved through the IBM DOS copy command. A PC with a printer can be shared by other PCs that are attached to the network but do not have their own printer. In both cases, the PC with the printer or disk to be shared effectively becomes a resource server.

Higher level services

Extended disk- and printer-sharing capabilities, as well as other higher level services such as electronic mail, are available through EtherShare, a network resource server. The basic EtherShare is a 16-bit computer with 10M-byte hard-disk drive (Fig. 4). Accompanying software packages—EtherDisk, EtherPrint and EtherMail—are menu-driven for simplicity and offer a HELP command that explains all commands and procedures.

An important feature of EtherSeries is its levels of service that can provide complete networking services or a network backbone.

EtherShare with EtherDisk allows all common programs and data to be stored on disk and accessed by any PC, eliminating separate diskettes of common programs at every PC. Data files constructed at a user's PC station also can be stored on the disk, permitting others to access them via the network. In addition, EtherShare provides standard disk backup on flexible diskettes or optional tape backup.

At 10M bits per sec., data can be transferred from disk to PC at nearly the disk's raw data-transfer rate. This provides users with a "virtual" connection to the disk that seems to users as if the disk were directly connected to the PC. The user interface is one of virtual diskettes, called volumes, mounted and unmounted on a user's virtual drive. The software emulates the PC diskette drive such that, once a virtual diskette has been mounted, all standard IBM DOS functions work as usual.

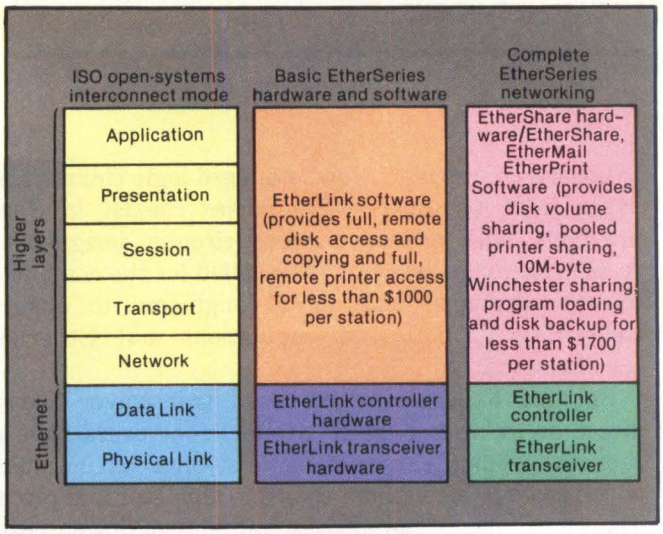

Fig. 3. EtherSeries provides all levels of the ISO's open-systems-interconnection model. *Because of EtherSeries' modularity, users can add or subtract services at the higher levels to suit their networking needs.*

Two programs support the EtherDisk software. One is for creating and manipulating volumes in the EtherShare, and one is for managing users assigned to the EtherShare. When volumes are created through the VOL CREATE command, they are defined as "public" or "private." Public volumes are available to all users listed in the EtherShare directory and are limited to read-only operations. Private volumes can be accessed only by their creator and are available for read/write operations. Both public and private volumes can be protected by a password. Volume parameters, such as name, size and password, can be changed by a volume's owner using the VOL MODIFY command. The physical act of inserting a diskette into a user's PC is emulated by the VOL MOUNT command; diskette removal is done with VOL UNMOUNT. VOL DIR displays summary information about volumes, and VOL ERASE deletes a virtual diskette from the EtherDisk.

User management comands include USER ADD, which adds a new user to the EtherDisk directory, and USER ERASE, which removes a user from the directory, thereby preventing that user's access to any public or private files.

Any user can list the other users in the EtherDisk directory by the USER DIR command. When a PC station is to be shared by two or more users, the USER LOGIN permits user changeover without rebooting the PC station. USER LOGOUT enables a user who is leaving the station to protect his files. USER MODIFY permits users to add, change or remove their access password at any time.

An EtherShare equipped with a printer and loaded with the optional EtherPrint software will behave as a spooling printer server, permitting the PC stations to off-load print data at high speeds and continue handling other tasks. This is an advantage in a text-intensive environment, such as an office, in which a high-performance PC can be severely restrained by the

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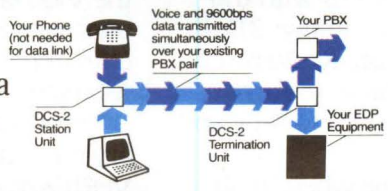

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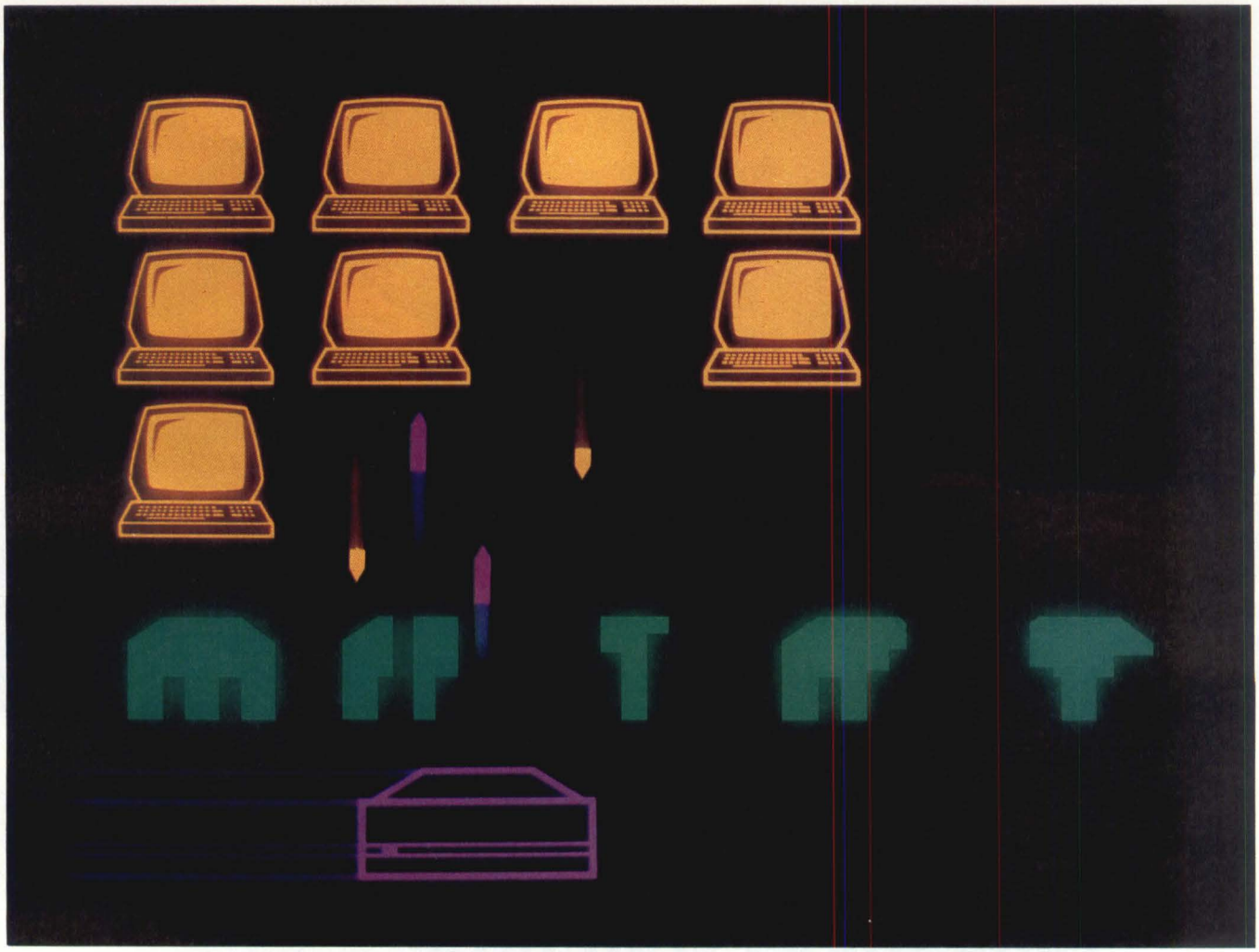

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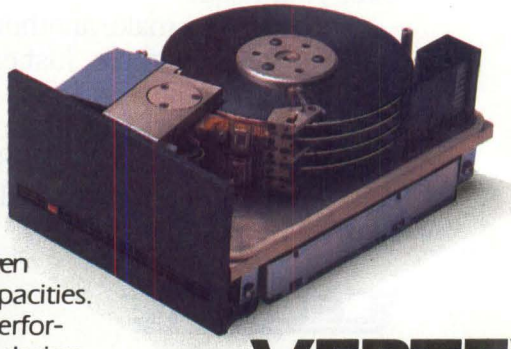

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difference between its bus transfer rate and lower printer speed. The EtherShare/EtherPrint duo performs queuing and buffering so that the printer operates at its highest rate without causing the PCs to

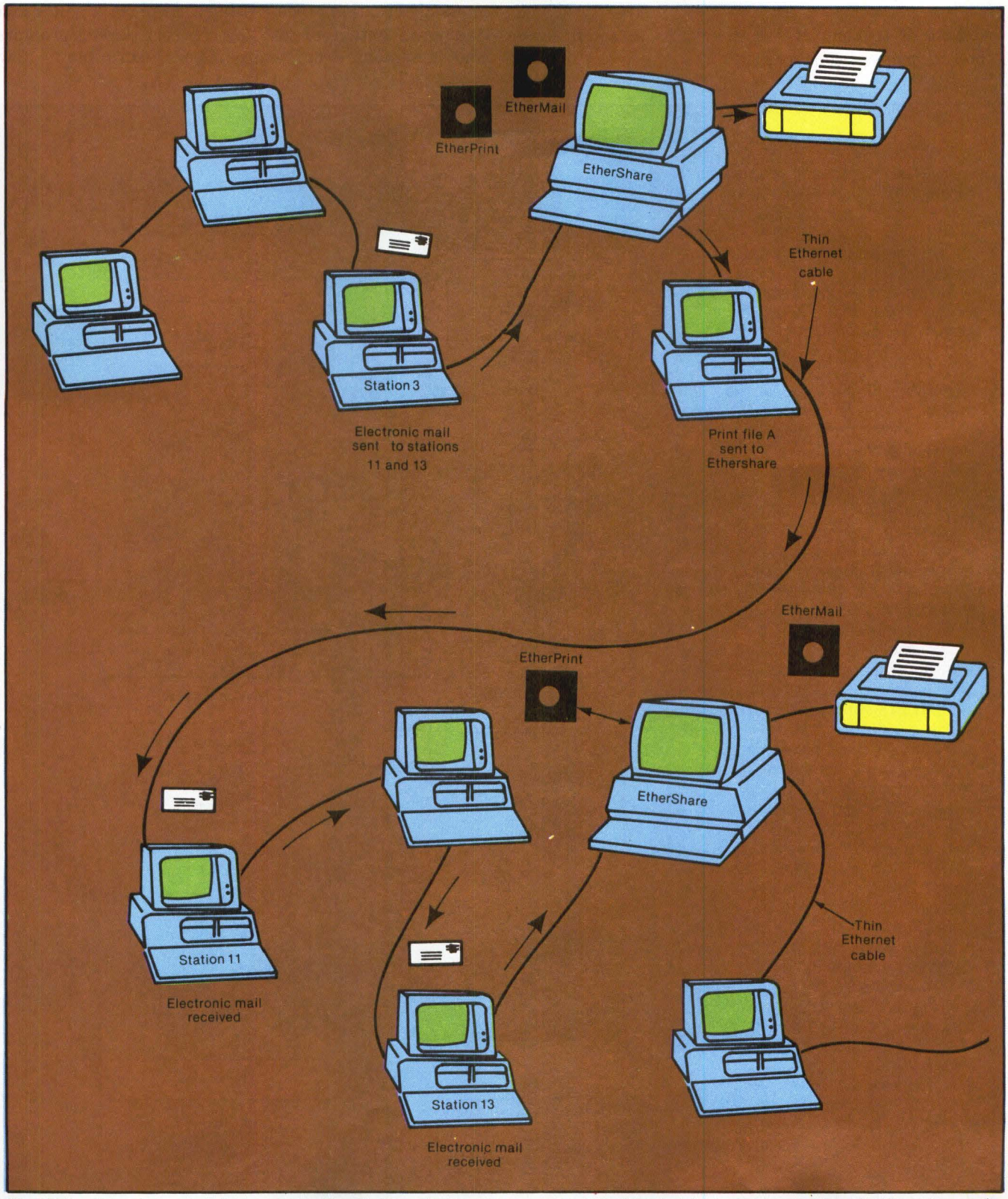


Fig. 4. EtherShare is a network resource server *that can also be used as a spooled printer (print server) when equipped with a letter-quality or high-speed printer. The standard EtherShare provides disk sharing, disk backup and networked program loading and optionally supports tape backup. When loaded with EtherMail software, EtherShare provides a simple yet comprehensive electronic-mail capability. EtherPrint software plus an add-on printer permits EtherShare to provide shared spooling printer service. EtherShare is also used for running EtherSeries application software.*

wait for it to complete its service. Users can access spooled printers concurrently.

An EtherShare loaded with optional EtherMail software becomes a post office for receiving and distributing electronic mail among PC network users. The EtherMail software supports a very simple message-creation process using a simple text editor and taking advantage of soft-key controls, screen prompts and mnemonic commands. Users can obtain new

EVOLUTION TO LOWER COST CONTROLLERS

Technology advancements have reduced the Ethernet-computer interface from multiple boards to one microcomputer-sized card, decreasing connection costs by more than 30 percent.

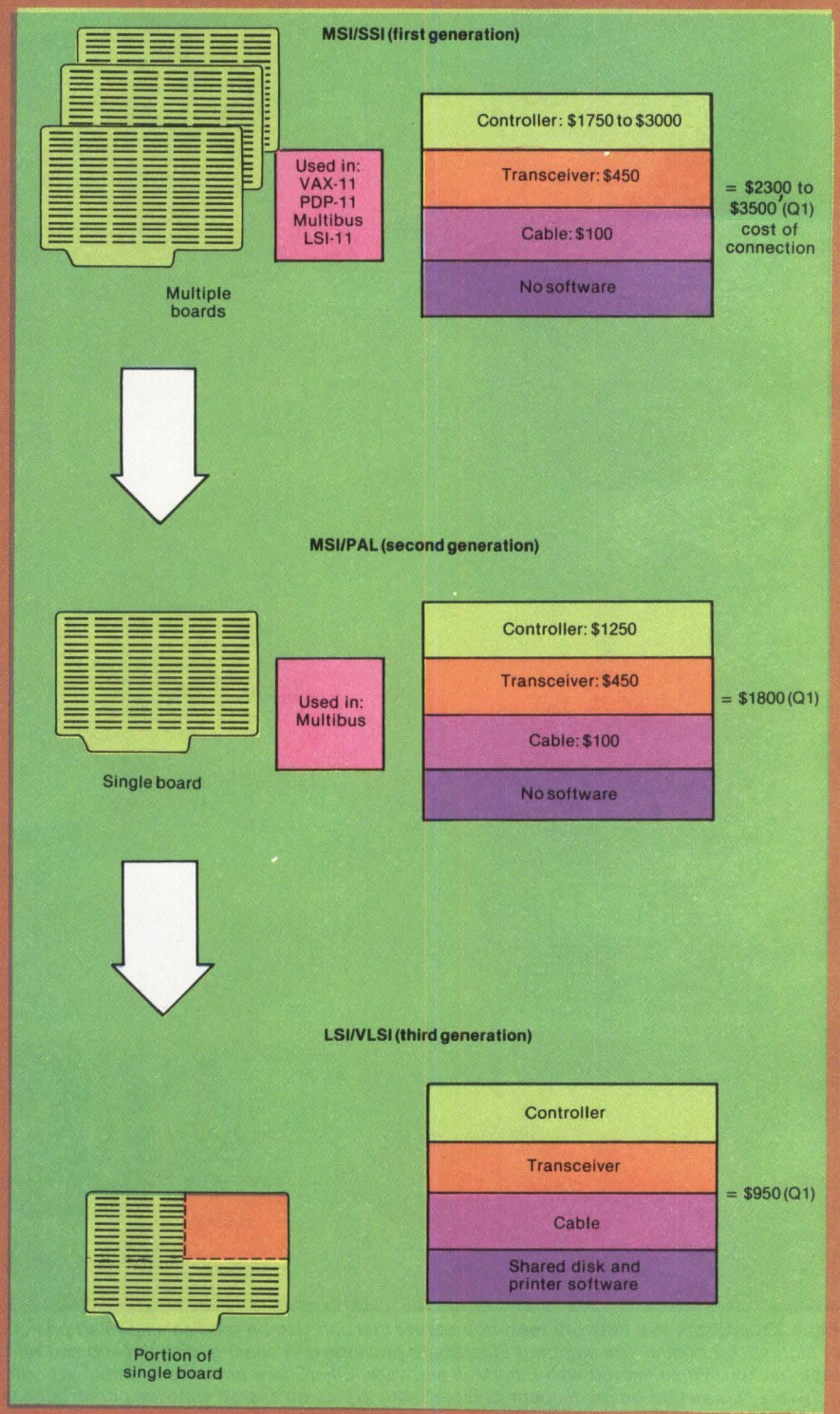
Following the 1980 joint announcement of Ethernet specifications by Digital Equipment Corp., Intel Corp. and Xerox Corp., the first controllers brought to market were subsystems designed using microprocessor and/or SSI and MSI bipolar (TTL) logic chips. To implement these controllers usually required two or more boards, and the costs ranged from $3000 to $3500, not including transceivers or software.

Within a year, more controllers were announced using off-the-shelf programmable-array-logic chips. Aimed at the moderate ranges of Ethernet network applications, these newer controllers lowered the costs of connection by more than half to about $1500, including compatible transceivers. Nevertheless, that level of integration still imposed size, cost and power constraints, barring Ethernet's entry into the personal-computer fold.

Through the new LSI and VLSI controller chips, 3com Corp. finally scaled down the board size, power requirements and cost to fit the personal-computer market. These chips, being produced by semiconductor manufacturers such as Intel, American Micro Devices, Inc., Mostek Corp., Fujitsu, Seeq Technology Inc., National Semiconductor Corp. and Zilog, Inc., provide the basic Ethernet data-link protocol, although they vary considerably in price and added functions.

To squeeze more on a board, 3com incorporated Seeq's EDLC 8001, which packs the controller circuitry onto one chip that occupies only one portion of a microcomputer board. This allowed room on the board for other Ethernet functions, including the transceiver.

Ethernet connection boards will shrink even more in size and price when the encoder/decoder and transceiver chips arrive.



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messages addressed to them, display the messages, delete them, forward them to others and add attachments and create their own new messages. The recipients of messages can include EtherShare user names as well as distribution lists.

The electronic-mail user interface is human-engineered and simple. For example, the MAIL command returns a list of all messages in the current message volume. In addition, the bottom of the screen offers a list of soft-key numbers and the commands associated with them. These allow a user to GET new messages transferred to his PC station, SHOW (display) any message on the screen and return to IBM DOS with DONE if that is all the user requires.

The combined power consumption of the controller and transceiver was reduced by a factor of four, and 104 sq. in. of components were squeezed onto a 52-sq.-in. board.

When a message has been created and the recipient list has been completed, the user makes a request to send. The EtherShare locates all destination addresses. Next follows an "OK-to-send?" query. If the user types "Y," the server begins distributing the mail, and the PC station can then go on to other processing tasks.

First of a series

As second-generation personal computers continue to penetrate the professional nonprogramming user domain, demand will increase for the interconnection of different vendors' machines. Connecting these computers to enable them to share information, peripherals and messages will be made easier as VLSI-chip technology becomes more sophisticated.

3Com is working with semiconductor manufacturers in developing the encoder/decoder and transceiver chips that will further reduce the size of the boards. Plans include expanding the EtherSeries line with products for connecting the Apple Computer, Inc. (in early 1983), and Digital Equipment Corp. microcomputer (within a year and a half), as well as application software for providing services such as voice mail and forms generation. □

Bob Metcalfe is chairman of 3Com Corp., Mountain View, Calif.

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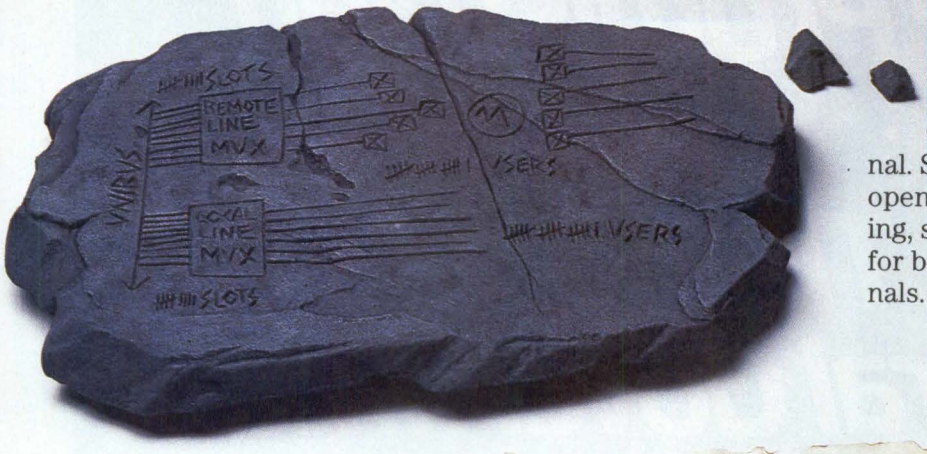

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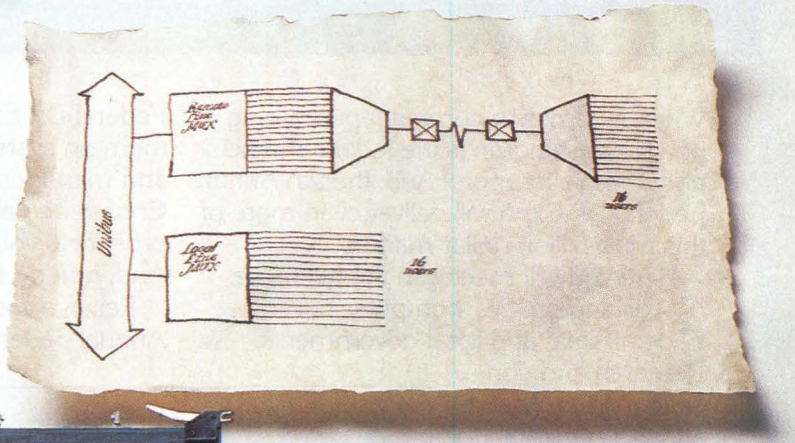

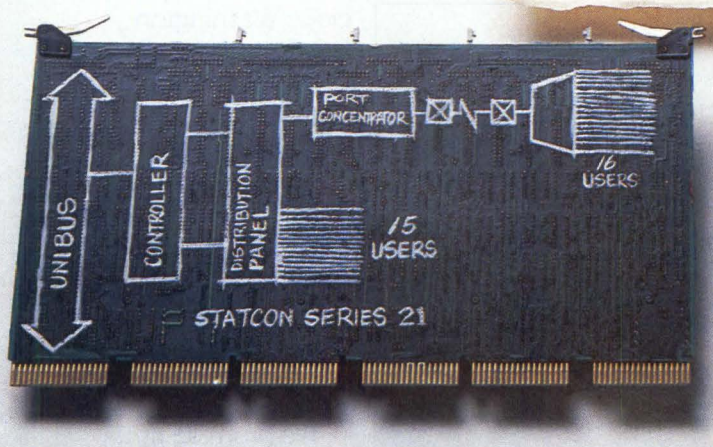

The Emulex Way.

Introducing *statistical concentration.* Remote concentrated lines are handled by a simple, low-cost port concentrator. All data is funneled on one cable into a single MUX port. All those unused ports now freed to work local terminals.

Emulex announces two complete, software-transparent packaged solutions: STATCON Series 11 and 21.

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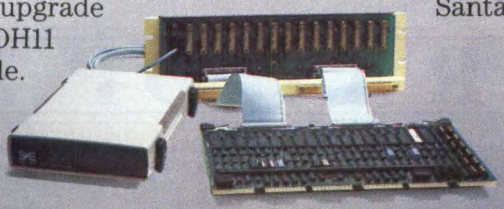
Communicate with Emulex today. Phone toll-free: (800) 854-7112. In Calif.: (714) 557-7580. Or write: Emulex Corporation, 2001 E. Deere Ave., Santa Ana, CA 92705.



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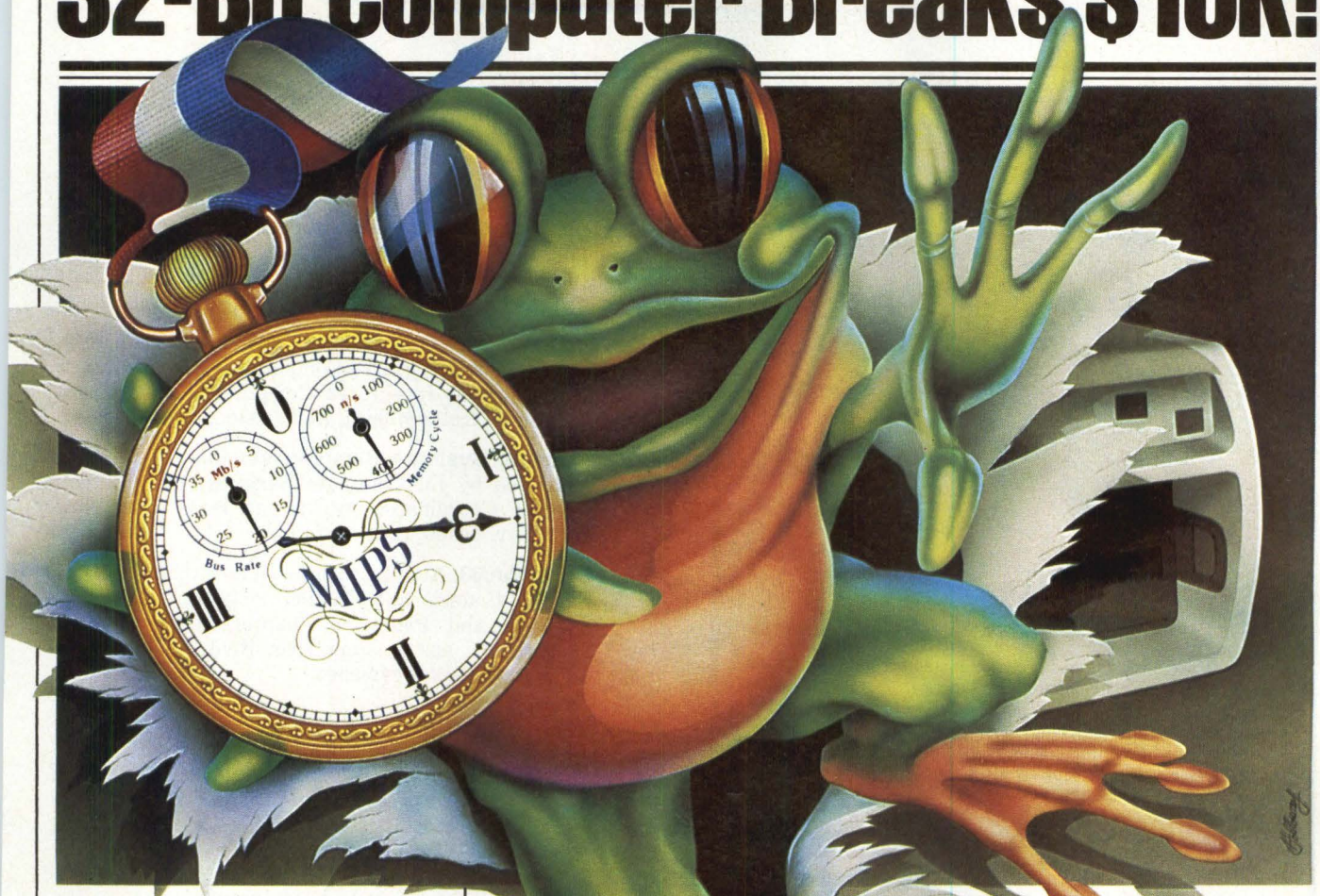
32-Bit Computer Breaks $10K!

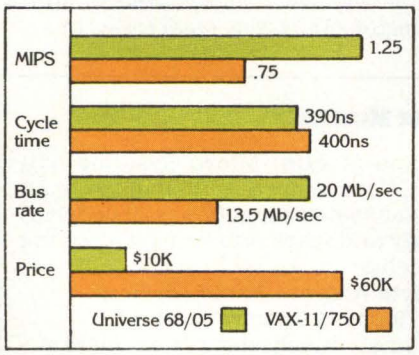


Universe 68/05 First to Smash Price Barrier

The new Universe 68/05 is the first true 32-bit computer priced under $10,000 (OEM quantity one). "True" because, unlike other 68000-based systems, the Universe 68/05 handles 32 bits in parallel on its VERSAbus.

Outperforms VAX*

Its *price* is even more impressive when you look at Universe 68/05 *performance* versus that of 32-bit "superminis" several times more expensive, like the VAX-11/750.



High-Speed 68000, 4Kb Cache, 32-Bit Bus

The key to that performance is a 4Kb cache that eliminates processor wait-states and takes full advantage of a 12.5MHz 68000 processor. Also included are a separate 68000 I/O processor, four serial I/O ports (expandable to 64), 256Kb RAM (expandable to 3Mb), 20Mb/sec, 32-bit VERSAbus, 10Mb Winchester, 1.25Mb floppy disk, and 5-slot card cage. All in a 7-inch enclosure.

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UNOS*, our UNIX* Rev7-compatible operating system with real-time features, runs Pascal, Fortran, C, BASIC, DBMS, and third party application programs.

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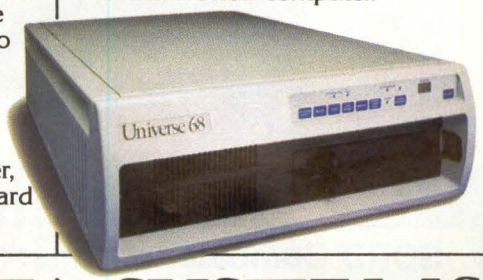

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CIRCLE NO. 103 ON INQUIRY CARD

Mini-Micro World

CALENDAR

JANUARY

12 **Meeting of the Association for Women in Computing,** Los Angeles, sponsored by the AWC. Contact: Vicky Gray, publicity vice president, P.O. Box 43677, Los Angeles, Calif. 90043.

18-21 **Distributed Processing short course,** Los Angeles, sponsored by Integrated Computer Systems. Contact: Ruth Dordick, Integrated Computer Systems, 3304 Pico Blvd., Santa Monica, Calif. 90405, (213) 450-2060.

18-21 **Local Area Networks short course,** Los Angeles, sponsored by Integrated Computer Systems. Contact: Ruth Dordick, Integrated Computer Systems, 3304 Pico Blvd., Santa Monica, Calif. 90405, (213) 450-2060.

18-20 **Strategic Systems Planning seminar,** New York, sponsored by IM Computer Services, Inc. Contact: Seminar Coordinator, IMCSI, 230 Park Ave., New York, N.Y. 10169, (212) 490-3366.

18-20 **Southcon/83,** Atlanta, sponsored by Atlanta Section, Florida Council and Region 3 IEEE, and Dixie, Sunshine and Piedmont Chapters ERA. Contact: Southcon/83, 999 N. Sepulveda Blvd., El Segundo, Calif. 90245, (213) 772-2965.

FEBRUARY

1-4 **Embedded Computer Systems short course,** San Francisco, sponsored by Integrated Computer Systems. Contact: Ruth Dordick, Integrated Computer Systems, 3304 Pico Blvd., Santa Monica, Calif. 90405, (213) 450-2060.

1-4 **Computer Network Designs and Protocols short course,** San Francisco, sponsored by Integrated Computer Systems, 3304 Pico Blvd., Santa Monica, Calif. 90405 (213) 450-2060.

6-9 **Telecommunications and Financial Networks Workshop,** Kissimmee, Fla., sponsored by the American Bankers Association. Contact: ABA, 1120 Connecticut Ave. N.W., Washington, D.C. 20036, (202) 467-6738.

21-23 **1983 Office Automation Conference,** Philadelphia, sponsored by the American Federation of Information Processing Societies, Inc. Contact: AFIPS, 1815 N. Lynn St., Arlington, Va. 22209, (703) 558-3617.

NEXT MONTH IN MMS

The February issue of Mini-Micro Systems will feature disk drives. Topics covered will include small and large Winchester systems and floppy-disk drives and how technology and market forces are affecting them. Some Highlights:

- **Multiple-megabyte Winchester disk drives.**
- **A profile of the floppy-disk drive market.**
- **A profile of the small Winchester system market.**
- **Thin-film technology and its implications.**
- **Large disk drives.**

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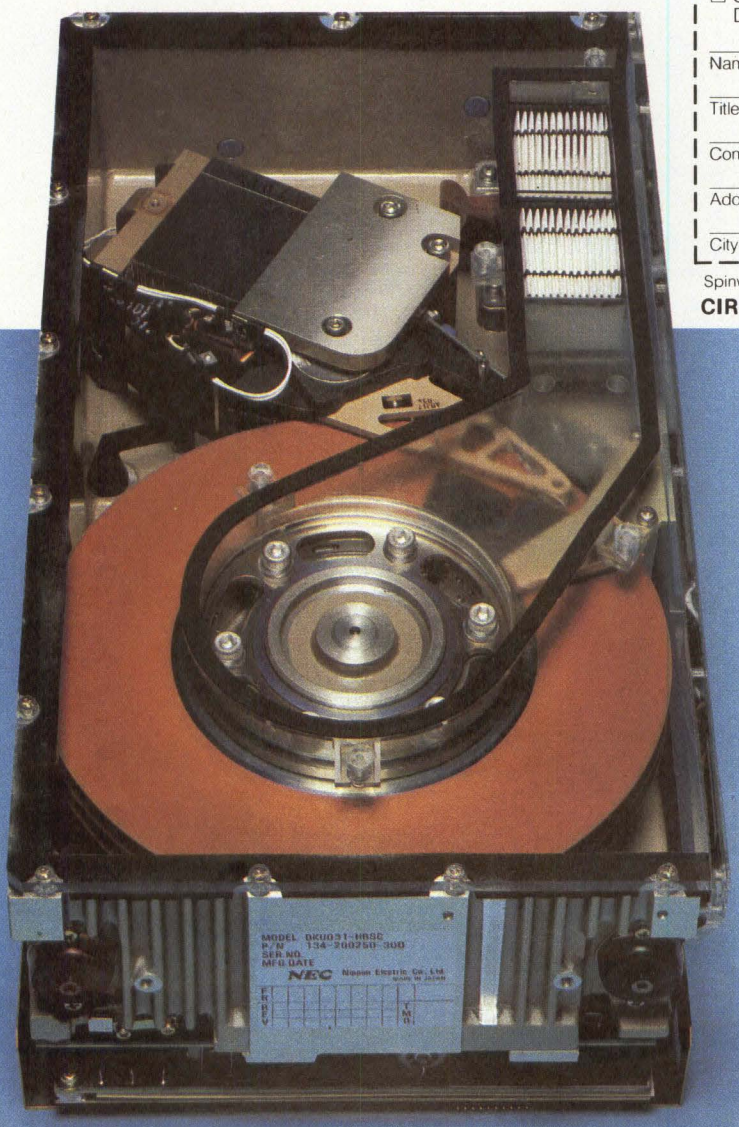

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Advanced 32/16-bit architecture. Industry standard Multibus.™ UNIX System III operating system. Everything you've been reading about. And wanted.

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CIE Systems' M68000-based business computer. Performance. Quality. And a Giant Commitment.

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CIE SYSTEMS

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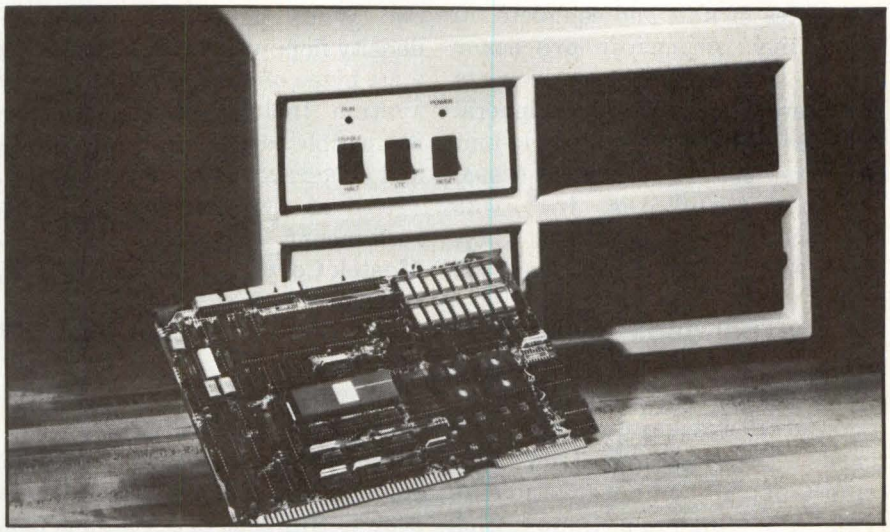
Software-development system has 8-MHz MC6800

The OB68K/SYS is an MC68000-based software-development system. At the heart of the system is the OB68K1 single- board computer featuring an 8-MHz, 16-bit Motorola MC68000 CPU, 128K bytes of dynamic RAM, eight sockets that can be user-configured for as much as 64K bytes of EPROM, two RS232C ports, two 16-bit software-definable parallel ports, a crystal-controlled baud-rate generator (50 to 19.2K baud), three 16-bit timer/counters and Multibus/IEEE 796 bus compatibility.

A companion board for the OB68K1, the OB68K/INT, acts as an interface between the IEEE 796 bus and the mass-storage system. It features a high-speed interface for the controller board, a Centronics printer port and two user-definable 16-bit parallel ports.

A stand-alone floppy/hard disk controller is mounted above the mass-storage area. It controls as many as two SA850 type floppy disk drives and two Q20XX type Winchester drives. The system includes a 20M-byte Winchester disk memory storage subsystem and a 1M-byte, double-sided, double-density floppy disk memory storage subsystem.

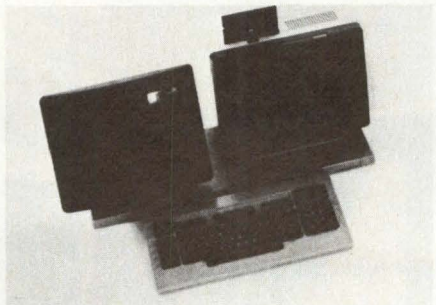


Omnibyte Corp.'s OB68K/SYS MC68000-based software-development system *combines a 128K RAM single-board computer with an interface board, a floppy/hard disk controller, a 20M-byte hard disk, a 1M-byte floppy disk and development software for less than $12,000.*

MSP, a real-time, multitasking operating system with editor, assembler, linking loader and utilities, is available. The OB68K/SYS package comes with an eight-slot card cage, dual 200W switching power supplies and dual cooling fans with removable filters. The unit can be rack-mounted into standard 19-in. RETMA racks or used in its desk-top enclosure. Typical system price is less than $12,000. **Omnibyte Corp.,** 245 Roosevelt Rd., West Chicago, Ill. 60185. **Circle No** 300

OEM workstations use Intel 8086

The AWS Turbo workstation uses an 8-MHz, 16-bit Intel 8086 microprocessor and has as much as 512K bytes of RAM and as much as 5M bytes of mass storage in a combination of minifloppy and mini-Winchester disk drives. It incorporates the vendor's CTOS operating system for real-time, multitask operation and supports COBOL, FORTRAN, BASIC, Pascal and Assembly language. It also supports 3270 terminal emulator,



2780/3780 remote-job-entry terminal emulator, asynchronous terminal emulator and X.25 emulator communications protocols. The workstations can be used as stand-alone units or clustered in various configurations that share peripherals and databases. Prices start from $4790. **Convergent Technologies,** 2500 Augustine Dr., Santa Clara, Calif. 95051.

Circle No 301

Business system provides word processing

Z-Disk, a multi-user, multitasking small-business system based on MP/M, CP/NOS and COMSTAR software provides word processing, file processing, electronic mail, special-

ized office-forms output, financial planning and interoffice communications. For each user, Z-Disk dedicates a user processor module consisting of a Z80A microprocessor, 64K bytes of RAM and complete I/O capability. A master processor module supervises all user requests for shared storage and peripheral devices on the system. Single-unit quantity prices start at $2995. **Product Associates, Inc.,** 465 Convention Way, Redwood City, Calif. 94063. **Circle No** 302

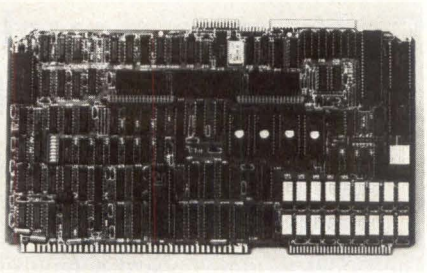
User-expandable system uses STD bus

The Z80-based Matrix 200 microcomputer system includes two cards, the vendor's MDX-CPU3 single-board computer and the vendor's MDX-FLP2 floppy disk controller card, leaving eight slots of the 10-slot card cage available for user expansion options. Designed around the STD bus, the system features 64K bytes of memory, with two 8-in., double-sided, double-density floppy disk drives providing 3.2M bytes of storage capacity. The system includes a Centronics-compatible parallel printer interface and an RS232C-compatible interface. Priced at $5995, it is available in rack-mount or tabletop versions. **Mostek Corp.,** 1215 W. Crosby Rd., Carrollton, Texas 75006.

Circle No 303

Multibus SBC uses FPLS technology

The MC 86 Multibus-compatible single-board computer, based on a 5- or 10-MHz 8086 CPU, contains 128K



bytes of dual-ported parity RAM, 64K bytes of PROM, one RS232 port, 24 parallel I/O lines, three 16-bit interval timers, two SBX I/O expansion ports, multi-mode interrupt controller and 8087 co-processor or 951 math processor. By using field-programmable logic sequencers, the 10-MHz MC 86 can complete a RAM cycle in 400 nsec. (maximum). Price is $2795 in single-unit quantities. **Comark Corp.,** 257 Crescent St., Waltham, Mass. 02154. **Circle No** 304

Single-board processor is S-100 bus compatible

The model CPZ-48000 Z80A-based, board-level computer system interfaces with any S-100 bus product. It operates at 4 MHz and has 64K bytes of on-board dynamic RAM with memory bank selection of 4K to 64K bytes under software control. Its floppy disk controller can drive as many as four 5¼- or 8-in. drives in DMA, interrupt or programmed I/O mode. The CPZ-48000 has two synchronous or asynchronous serial I/O channels and two parallel I/O channels with software-selectable baud rates. It supports CP/M, MP/M and Turbodos operating systems and includes an implementation of Turbo-Disk. Other features include a real-time clock, a memory management unit that can address 16M bytes of system memory and a 2K- or 4K-byte on-board EPROM. Price is $995. **Intercontinental Micro Systems,** 1733 S. Douglass Rd., Suite E, Anaheim, Calif. 92806.

Circle No 305

Here's Why Precision Visuals Is Now The Leader In Graphics Software Tools!

One Program Drives Many Devices

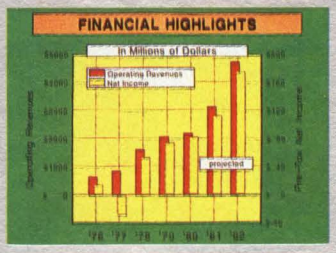
This single advantage can save you hundreds of hours of programming time. It enables you to use your hardware (both host computer and graphics devices) to its fullest. It protects your software investment against obsolescence and frees you from exclusive ties to hardware vendors.

Precision Visuals currently offers tailored interfaces for over 30 graphics devices from these companies: AED ☐ Applicon ☐ Calcomp ☐ Calcomp lookalikes ☐ Chromatics ☐ DEC ☐ Digital Engineering ☐ HP ☐ Houston Instruments ☐ IBM ☐ Imlac ☐ III ☐ KMW ☐ Megatek ☐ Printronix ☐ Ramtek ☐ Raster Technologies ☐ Sanders ☐ Selanar ☐ Servogor ☐ Tektronix ☐ Tektronix lookalikes ☐ TI ☐ Trilog ☐ Versatec ☐ Visual Technology ☐ Zeta.

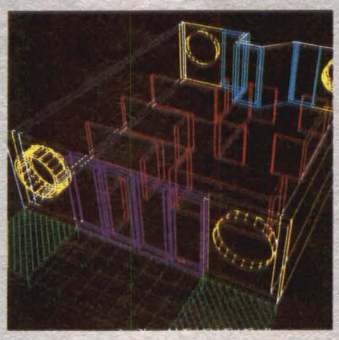
They Run On Most Popular Computers

Including IBM, VAX, PR1ME, Hewlett-Packard, CDC, Honeywell, Data General, DEC 10/20, Harris, Univac, Cray, and DEC PDP-11.

Precision Visuals software tools require a surprisingly small amount of computer resources. Even on smaller machines they provide access to the full capabilities of the CORE graphics standard.



Make better decisions, faster, using GRAFMAKER's specially-placed annotation and color.



Build highly interactive computer-aided design applications with the DI-3000 core system.

Rich Capabilities Mean Limitless Applications

Precision Visuals software tools are proven in applications such as computer-aided design, business graphics, process control, mapping, geological data analysis, document layout, plus many specialized applications. System integrators (OEMs) use them as the graphics nucleus in turnkey systems and as the graphics component of database management and financial modeling systems.

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These are single-CPU, end-user, U.S. list prices. Multiple CPU and OEM discounts are also available.

Find out how Precision Visuals graphics software tools can open a new world of flexibility, economy, and standardization for your graphics applications. Call us at 303/530-9000.

"At Martin Marietta, DI-3000 serves as a common interface between our numerous graphics devices and software applications. We use DI-3000 for applications including structural analysis, business charts, graphs, animation, 3D modeling, and general-purpose graphics."

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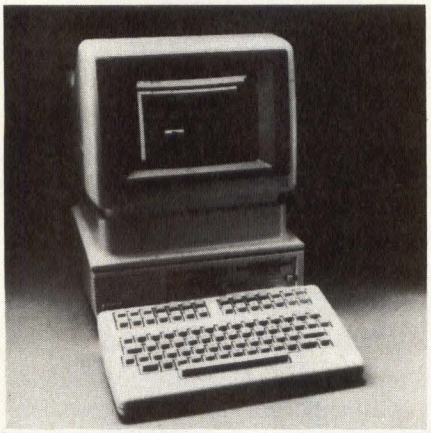
CIRCLE NO. 107 ON INQUIRY CARD

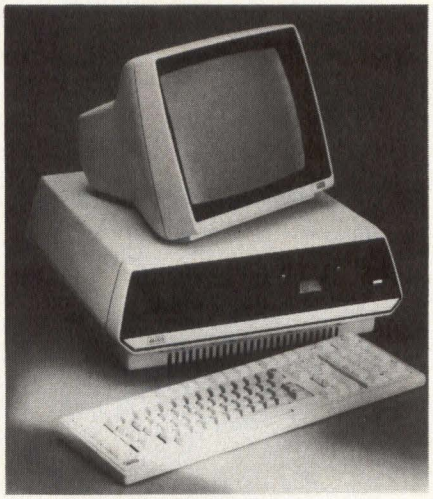


Personal computer features optional 3½-in. floppy

The HP 120 personal office computer features dual Z80A microprocessors, 64K bytes of main memory, 16K bytes of screen display memory and 32K bytes of ROM for internal functions. It has an IEEE-488 connector and two RS232C ports. Its 9-in. screen is available with a tilt and swivel option. Mass storage is available in the form of single or dual 3½-in. microfloppy disk drives that store 248K bytes (formatted) each or in a combination of a 3½-in. microfloppy and a 4.6M-byte Winchester disk drive. Base price of the HP 120 is $2775 including a processor, a display, 64K bytes of internal memory and a keyboard. **Hewlett-Packard Co.,** 3000 Hanover St., Palo Alto, Calif. 94304. **Circle No 306**

Desk-top micro has 15M bytes of disk storage

The enhanced version of the DMS-15 CP/M-based microcomputer has a DSC-3 (Z80A) processor, 64K bytes of RAM, a 9-in. CRT, one 5¼-in. double-sided, double-density floppy disk drive that stores 614K bytes, 15M bytes of formatted Winchester disk storage and four RS232 ports. This stand-alone system can also serve as the master station in the vendor's HiNet local-area network and includes the network interface. The DMS-15, including CP/M, sells for $7495 in single-unit quantities. The software needed to run the system as the HiNet master station sells for $500. **Digital Microsystems,** 1755 Embarcadero, Oakland, Calif. 94606. **Circle No 307**



Microcomputer features networking capabilities

The five-user Altos 586 microcomputer uses a 10-MHZ, 16-bit Intel 8086 processor with 256K or 512K of RAM, expandable to 1M byte. It features six RS232 ports, and can be upgraded to 10 through an integral communications board that provides communication with mainframes. Protocols include IBM 2780/3780 (synchronous), 3270, SNA/SDLC and X.25. The board also offers an auto-dial/auto-answer modem. As many as 32 other 16-bit Altos microcomputers can be networked using RS422 cabling connected to an integral interface and Altos-Net networking software. Users can upgrade to Ethernet by adding a board slotted into the system's Multibus-type interface. In addition to XENIX/UNIX, the system supports MS/DOS, Pick, CP/M-86, MP/M-86 and OASIS-16 operating systems. Languages include BASIC, COBOL, FORTRAN, Pascal and C. Model 586-2

WHAT IS THE TRUE COST OF A DISKETTE?

If you said at least $186.50*, you're probably close.

Confused? It's simple. The minimum cost of a one-sided, single density 8" diskette equals the purchase price plus the cost of the time to fully load the data onto the disc*. The adjacent diagram tells the story. As you can see, the purchase price of a diskette is a small fraction of the total cost of ownership. So why not pay a few cents more for the best diskette available?

That's where Dysan's quality comes in. Dysan diskettes and mini-diskettes are manufactured to the toughest quality standards in the industry. Every diskette is tested between the tracks as well as on the tracks to insure you 100% error-free recording over the entire disc surface. Dysan quality protects your investment of $186.50.

You know how costly time and data losses can be should your "bargain" diskette be faulty. Every penny you think you save on the purchase of magnetic media could cost you dearly. Why take the risk when you can have Dysan?

dysan Dysan CORPORATION

Our Media Is Our Message

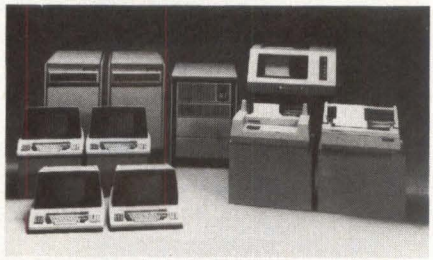
5201 Patrick Henry Drive
Santa Clara, CA 95050

*$4.00 represents Dysan's suggested retail price for a one-sided, single density 8" diskette, packaged ten to a box. Minimum total cost of ownership = $186.50

*$182.50 represents the cost of data loading (approximately 22 hours at 11,106 keystrokes/hour at a labor cost of $8.23/hour), based on 1981 Data Entry Management Association (DEMA) National Averages.

CIRCLE NO. 108 ON INQUIRY CARD

offers dual 5¼-in., 1M-byte floppy disks and is priced at $4990. Model 586-10 features 10M-byte hard disk storage with floppy disk backup priced at $7990. **Altos Computer Systems,** 2360 Bering Dr., San Jose, Calif. 91531. **Circle No** 308

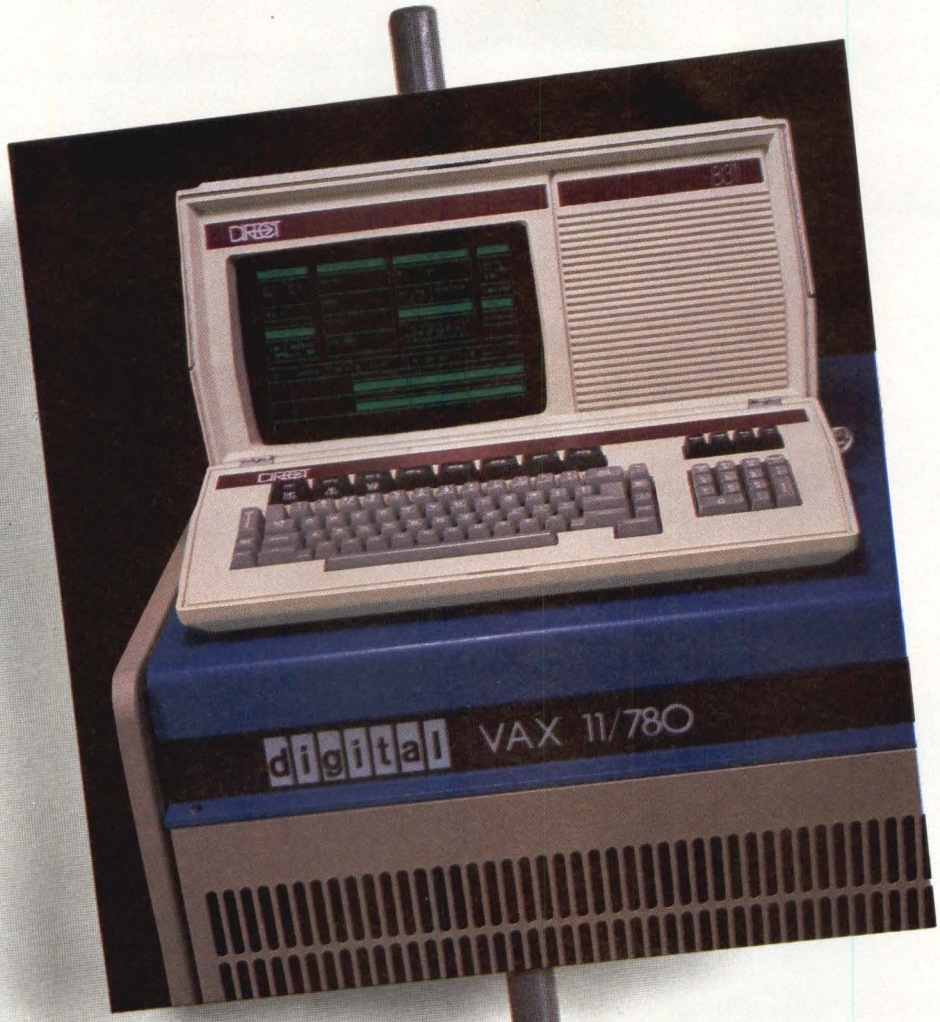


Computer systems feature mass-storage capabilities

The Business System 800 series of multitasking, multi-user minicomputers consists of six packaged computer systems. Data storage capabilities range from 80M bytes of formatted data storage in the System 861 to 238M bytes in the System 886. The computers use the high-speed 16-bit model 990/12 processor and 512K to 2M bytes of error-correcting memory. Each 800 series system, in its minimum configuration, includes two model 911 video display terminals that feature high-resolution display screens, upper- and lower-case ASCII character sets and separate cable-connected keyboards with 10-key numeric pads and special function keys. The Business System 800 series supports the DX10 and DNOS operating systems. Both operating systems support COBOL, FORTRAN, BASIC, RPG II and Pascal programming languages. Available utilities include a data dictionary, a database-management system, a query language and word-processing capabilities. Prices range from $51,000 to $86,000 in single-unit quantities. **Texas Instruments Inc.,** P.O. Box 202146, Att: H-636, Dallas, Texas 75220

Circle No 309

SUPPORT THIS UNION AND AVOID A WORK SLOWDOWN.



Organize your DP operation around a VAX computer and Direct 831 terminals and enjoy an important benefit of a DEC-Direct union. More power. The kind that gets work done faster.

To the 831's VT100-compatible features you can add an optional integral modem to put the power of your VAX in the hands of anyone with a telephone.

Or add PLOT 10 graphics and deliver the big picture when there's no time to wade through words.

But that's just for starters.

The 831's block mode frees your VAX from the chore of creating and editing data. (That's why many users, including DEC itself, view block mode as an answer for overburdened CPUs.)

And if that's not enough, you can unite host and personal processing by field-upgrading the 831 to our Direct 1031, a self-contained terminal/personal computer. The 1031 makes the entire array of CP/M-compatible software available to off-load your host, leaving you more VAX processing power for the jobs only a VAX can handle.

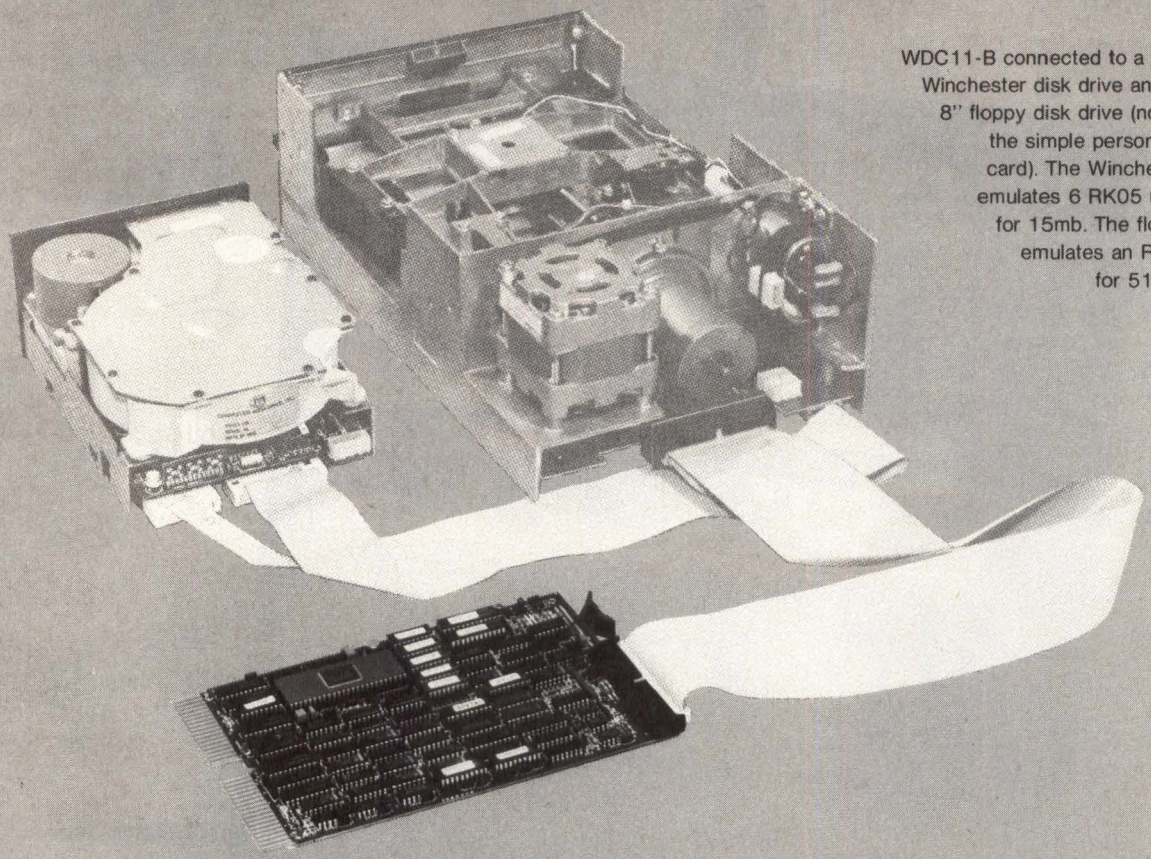
To further our cause, we're prepared to stage a demonstration at your place of business. Contact us at Direct, Inc., 4201 Burton Drive, Santa Clara, CA 95054. Telephone 800-538-8404 (408-980-1414 in California). Direct and DEC. It's one union that gives you more than you bargained for.

DIRECT

CIRCLE NO. 111 ON INQUIRY CARD

The WDC11 series...

The FIRST family of Winchester/Floppy controllers for the LSI-11/Q-Bus



WDC11-B connected to a 5¼" Winchester disk drive and an 8" floppy disk drive (notice the simple personality card). The Winchester emulates 6 RK05 units for 15mb. The floppy emulates an RX02 for 512kb.

Unsurpassed Freedom Of Choice

Choose the **disk drive sizes** that are right for YOUR application: The WDC11 controls 8" and 5.25" drives, Winchester and floppy.

The **DEC emulations** that YOU need: RK05, RL01/02, RP02 for the Winchester and RX02/03 for the floppy. All Winchester emulations provide 22-bit addressing; RLV12-compatible.

The **disk drive vendors** that YOU want to use: The following manufacturers build drives that are currently supported: Shugart, Quantum, Tandon, Qume, Computer Memories, Disctron (RMS), Rodime, Ampex, Micro Peripherals, Seagate. Any drive with a standard interface (SA1000, SA800/850, ST506, or TM100-4) can be controlled by the WDC11. A single PROM chip adapts the WDC11 to a specific drive configuration.

The **controller form-factor** YOU want: A single, dual-width card includes the Winchester controller, the floppy controller and an intelligent bootstrap. There is no external formatter board that you need to mount and supply power to. The WDC11 requires only 2.7A of +5V. Simple personality cards adapt the WDC11 to multiple drives, various pinouts and signal levels.

The **experience** YOU are looking for: Andromeda has been shipping WDC11's since the Summer of 1981.

The **growth potential** that YOU require: As new, higher capacity, higher performance disk drives become available, the WDC11 can be adapted to them by simply changing the configuration PROM. New emulations and data formats can be handled in a similar fashion.

DEC, LSI-11, RK05, RL01/02, RX02, and RP02 are trademarks of the Digital Equipment Corp.

ANDROMEDA® SYSTEMS INC.

9000 ETON AVENUE
CANOGA PARK, CA 91304
Ph: [213] 709-7600
TWX: [910] 494-1248

CIRCLE NO. 112 ON INQUIRY CARD

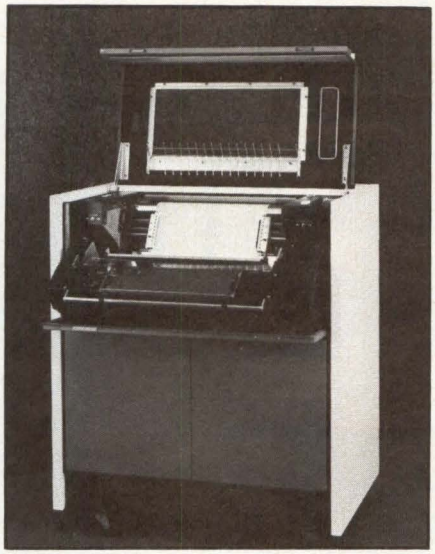
Data Printer makes first foray into end-user market

Data Printer Corp., a Malden, Mass., supplier of OEM chain-train printers, this month makes its first foray into the end-user market with the introduction of the BT 1500 band-train printer.

The 1500-lpm unit offers a choice of bands containing 48-, 64- or 96-character sets. The company's Gothic type style is available, and special type in special arrangements for codes is optional. The band prints as many as 132 characters at 10 cpi, and 136-character printing is optional. The MTBF for the BT 1500 is rated at 1000 hours for 60-percent duty cycles. The company defines a 60-percent duty-cycle printer as one that operates approximately 14 out of 24 hours.

Bit-parallel, character-serial, externally strobed and TTL-compatible interfaces are standard. The BT 1500 is also pin/plug-compatilbe with the company's S-1003 universal interface. Control Data Corp., Dataproducts 2200 series, Centronics parallel and RS232 interfaces are optional.

The printer is the first member of a band-train family, and incorporates an Intel 8080A 8-bit microprocessor controller to provide electronic character alignment. The microprocessor memorizes where each character should be, and if a character goes out of alignment, an operator can adjust it using two buttons on the printer. Pressing the left or right button, the operator increments the character slightly in either direction. This feature, says Paul Goldberg, product marketing specialist at Data Printer, allows a user to align characters in minutes instead of requiring three hours of a technician's time twice a year.



The BT 1500 *is the first member of Data Printer's Band Train family of printers, and the company's first foray into the end-user market. Print speed is 1500 lpm.*

Two comparable offerings in IBM's chain-train printer line are the 1110-lpm 1403-N1 and 1404-2. Both offer 48-character sets and 132 print positions, the same specs as the BT 1500. The BT 1500's single-unit price is $19,100. The 1403-N1 is $40,040, and the 1404-2 sells for $99,390.

Dataproducts' band offering, the BP 1500, is almost identical in price and specifications to the BT 1500. At a retail price of $19,950, the printer offers a 1500-lpm speed; 48-, 64- and 96-character sets; and 132 or 136 print positions.

Data Printer is also interested in claiming its share of the replacement market. According to research firm Advanced Resources Development, one-half the line printers in use were installed in 1977 or before. "IBM 1403s have been out there 10 or 15 years," says Goldberg, "and Data Printer can replace those."

Goldberg says that the design of the BT 1500 allows quick font changing. It takes a few minutes to replace the band, he says, compared with the hours it takes to replace a chain. The width of the cloth ribbon, (15 yd. × 14½ in.) adds to ease of use, compared to changing paper and carbon ribbons. The printer accepts single sheets and fanfold paper, and prints on multipart paper.

A novel feature of the BT 1500 is its vacuum-cleaner system, designed to keep the band area free of paper dust. Goldberg says it was incorporated into the printer without additional cost.

The BT 1500's $19,100 single-unit price is discounted to $17,000 in low OEM quantities. Production quantities will be available this month.

—Nancy Love

Data Printer Corp., 99 Middlesex St., Malden, Mass. 02148 **Circle No 310**

DEC-compatible printer includes plotting package

The model 1000A printer/plotter gives DEC users the ability to print and plot with one device. It is based on a 200-cps serial dot-matrix line printer with a 72-dpi graphics print capability. The package includes CCSI-PLOT, a FORTRAN-callable, CalComp-compatible plot library that allows a user a generate a variety of plotted information including labeled and annotated axes, textual or character-string data, graphs from data arrays of x and y coordinates and FORTRAN IV variables in F or I format. Available interfaces include RS232C or Centronics parallel. Price is $3500 including a printer/plotter, an expanded buffer option (3.5K bytes), a printer stand, software, documentation and license. **Basic Information Systems, Inc.,** 230 W. Florence Ave., Inglewood, Calif. 90301. **Circle No 311**

Low-cost terminal features MC68008

Beehive International's ATL-008 interactive video terminal uses the 8-MHz, 16-bit MC68008 microprocessor and sells for $1395 in single-unit quantity. A standard model comes with 32K bytes of RAM (expandable to 128K bytes) and 512 bytes of nonvolatile RAM (expandable to 2048 bytes). Eight soft function keys allow multiple functions from a single key depending on the operating mode selected. In addition, there are 16 pre-programmed function keys and eight user-defined keys.

The 14-in. P31 phosphor tilt and swivel display screen features a 7 × 9 character matrix displayed in a 9 × 13 cell. The screen displays 24 rows of data, a status line and a soft-key label line in 80- or 132-column format. In addition to the 256-character set that includes control characters, 64 plotting and business graphics characters and 10 resident foreign character sets, an additional 256-character set can be addressed on a character-by-character basis. A 15-in., bit-mapped monochrome display monitor and a 13-in., bit-mapped color display monitor will be available by 1984.

The ATL-008's editing capabilities include fixed and variable tab stops, programmable editing extents, insert/delete character and line, many erase commands and logical attributes.

The ATL-008 is compatible with ANSI X3.64. Its programmable, bidirectional buffered communications port allows asynchronous and isochronous (similar to asynchronous but externally clocked) operation with data rates as fast as 19.2K baud.

The ATL-008 is the first in a series of seven products the vendor will introduce into new markets. By 1986, the company expects that two-thirds of its revenues will come from new workstation business. **Beehive International,** P.O. Box 25668, Salt Lake City, Utah 84125.

Circle No 312

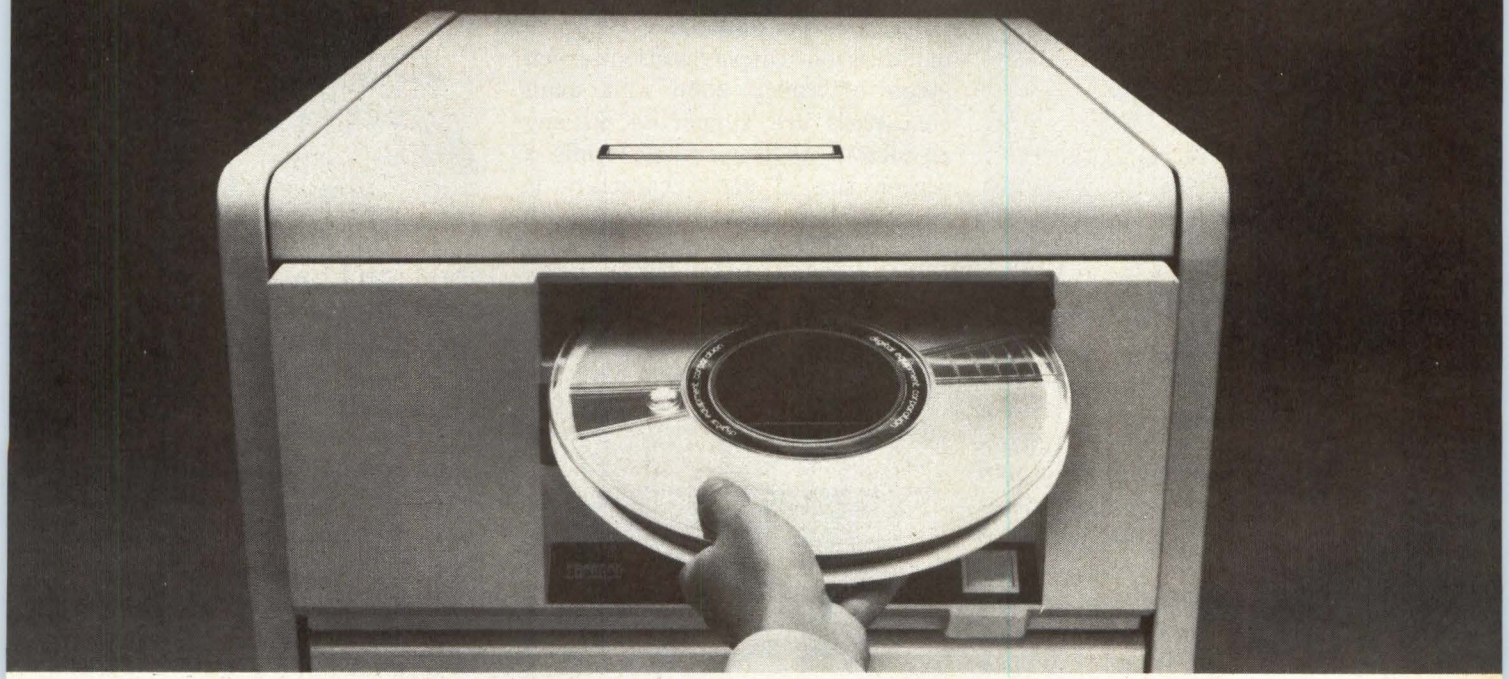
Beehive International's *ATL-008 terminal's ergonomic design features a detached keyboard with 14-station numeric keypad with Enter key.*

Smart terminal can be customized by users

The Esprit III video display terminal, which emulates the Tele-Video 950, incorporates a 6502 microprocessor and provides a PROM set with a remote access command for user-designed functions. The terminal features a tilting, nonglare, green phosphor screen that displays 24 lines of 80 characters and a 25th programmable status line. Other display features include reverse video, half intensity, blink, blank and underline video attributes and line-drawing graphics. The detached keyboard features a 14-key numeric pad and 22 user-definable function keys. Available interfaces include RS232C, current loop and a bidirectional auxiliary port with independent baud-rate selection. Price is $895 in single-unit quantities. **Hazeltine Corp., Computer Terminal Equipment,** Commack, N.Y. 11725.

Circle No 313

THIS YEAR THE PDP-11/23 HAS MORE IN STORE FOR YOU.



Digital's TSV05. A high-speed streaming magtape unit designed for the PDP-11/23 and PDP-11/23 PLUS small systems.

Built to operate with the PDP-11/23 and PDP-11/23 PLUS, the TSV05 is also compatable with Digital's MINC and MICRO/PDP-11 small systems. And the TSV05 can store up to 46mb of data. That's *four to ten times* the storage capacity you're currently getting with hard or floppy disks.

The TSV05 uses any of three ½" tape reel sizes (7", 8", or 10.5") formatted in ANSI standard 1600 bpi. It will handle a variety of applications including interchange, journaling, archiving, software distribution, and disk backup. In fact, it now delivers an unparalleled 100 ips for high-speed streaming disk backup.

As for making room for it in your office, the TSV05 is only big on the inside. The 9" tape transport and its power controller are attractively packaged in Digital's standard 40" high cabinet series. And it uses less power than traditional magtape units.

Thanks to its unique front-loading design with automatic tape threading, inserting a TSV05 magtape is as easy as loading a floppy disk. Even routine servicing has been reduced to its simplest form with easy service access to all system components.

As you might expect from any Digital product, the TSV05 meets Digital's rigid standards for reliability and quality. In fact, every unit features special built-in microprocessor-based diagnostics to insure the integrity of your tape subsystem.

Then there's one final back-up system, and it comes standard with every TSV05 Digital sells: our worldwide network of 16,000 service professionals, and our fully stocked spare parts service centers.

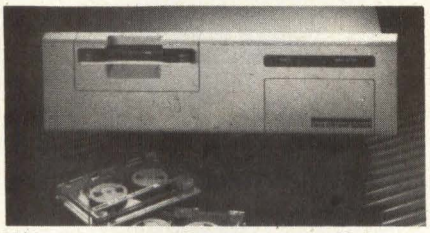
To find out more about magtape capability for your PDP-11/23 series computer, call 800-832-6277. Or write **Digital Equipment Corporation,** 5 Flagstone Drive, Hudson, NH 03051.

digital

CIRCLE NO. 114 ON INQUIRY CARD

Peripherals

NEW PRODUCTS



Winchester is compatible with DEC Q-bus minis

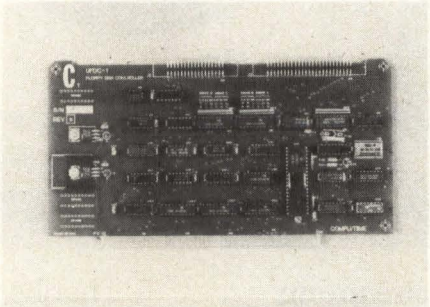
The model DSD 890 combines a 31.2M-byte (formatted) capacity, 8-in. fixed Winchester disk with a 16.25M-byte capacity, ¼-in., removable cassette-tape backup. The DSD 890's Winchester emulates three DEC RLO2 cartridge disks, while the 890's ¼-in. tape emulates the ½-in. TSV05 tape subsystem. The DSD 890 is compatible with DEC LSI-11 (Q-bus) minicomputers and operates with RT, RSX, TSX, RSTS and UNIX operating software. It also supports 22-bit addressing. Operating in a noninterleaved mode, the DSD 890 features a transfer rate of 364K bytes per sec. The hard disk portion of the system also features a 65-msec. average access time. The tape portion of the system features 6400-bpi recording on four tracks and operates at 30 ips. Price is $9895 in single-unit quantities. **Data Systems Design,** 2241 Lundy Ave., San Jose, Calif. 95131

Circle No 314

SNA controller works with ASCII CRTs

The 6274 communications control unit allows ASCII CRTs to access IBM host systems operating under Systems Network Architecture. The 6274 communicates with the IBM host computer via Synchronous Data Link Control protocol and is a Physical Unit Type 2 device. Using ASCII CRTs with cursor addressing, the 6274 is compatible with IBM 3274-21C control units and attached 3278 display stations and 3287 printers, and can run with existing IBM 3270 applications without modification. Display station screen sizes of 1920, 2560 and 3440 characters are supported on any 80-column ASCII terminal, while a screen size of 3564 characters is supported on ASCII terminals with 132-column capabilities. Price is $10,950. **Carterfone Communications Corp.,** 1111 W. Mockingbird Lane, Suite 1400, Dallas, Texas 75247.

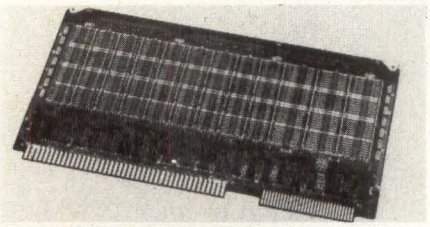
Circle No 315



Floppy disk controller reads different-sized disks

The Compu/time Universal Floppy Disk Controller I (UFDC-1) is an S-100 IEEE 696-compatible board capable of connecting as many as four floppy disk drives. The controller can connect any combination of 5¼- or 8-in. drives with ANSI-standard interfaces and supports single- or double-density formats and single- or double-sided drives. By placing the CP/M boot program in ROM and the CP/M disk-translation tables on the disk sector normally containing the boot program the controller allows the automatic mixing of disk densities and the ability to read various types of formatted disks. Supplied with the UFDC-I is a technical information and user's manual and an 8-in., single-sided, single-density CP/M disk containing the Monitor/BIOS and disk formatter source listings. The UFDC-I is priced at $325 for the assembled and tested version or $295 in kit form. **GSR Computers,** 60-10 69th St., Maspeth, N.Y. 11378.

Circle No 316



Interface board is for Multibus computers

The MNTL-GPIO-16 general-purpose bus foundation module for Intel Multibus computers consists of basic Multibus logic elements plus wire-wrap positions for as many as 48 ICs using low-profile sockets or direct mounting of 14- to 40-pin ICs. Wire-wrap posts are on the component side of the board and permit designer-wired options for multiple controller applications, address selection and interrupt control. The module has provisions for as many as three 50-pin ribbon cable connectors to external devices or modules. Price is $295. **MDB Systems, Inc.,** 1995 N. Batavia St., Orange, Calif. 92665

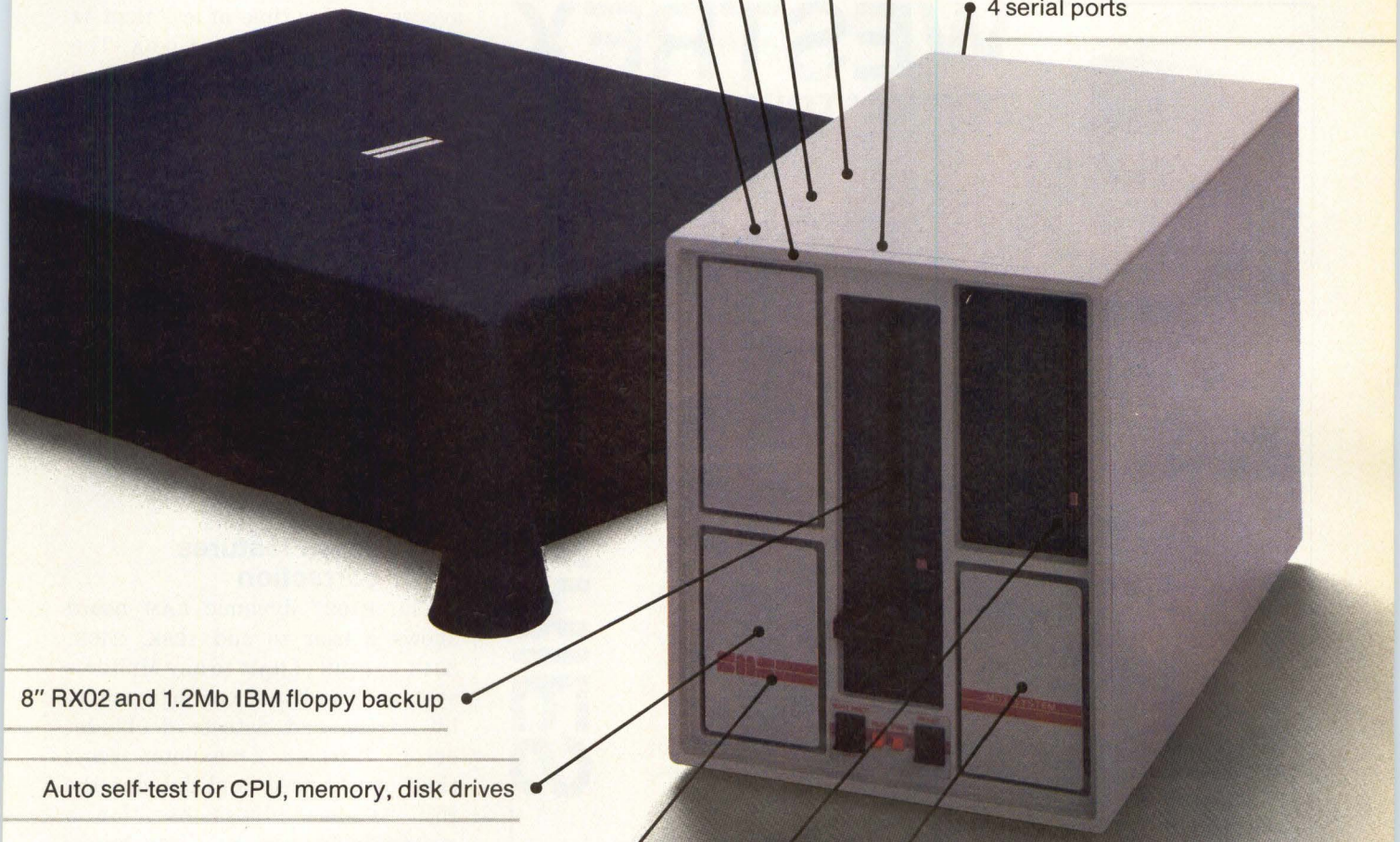
Circle No 317

LSI devices control DRAMs

The DP8408-2 DRAM controller/driver and the DP8409-2 multi-mode dynamic RAM controller/driver 48-pin devices can drive all 4K-, 16K- and 64K-byte dynamic RAMs in all configurations. Both devices feature many modes of operation including externally controlled refresh and access, all-RAS write and automatic access. The automatic access modes make dynamic RAMs appear static to a system designer. The DP8409 device also includes automatic refresh, burst refresh and all-RAS automatic write. The DP8408N-2 is priced at $37.45 each, and the DP8409N-2 is priced at $42.75 in quantities of 100 or more. **National Semiconductor Corp.,** 2900 Semiconductor Dr., Santa Clara, Calif. 95051. **Circle No** 318

Available now! And SMS is not afraid to show it

A Micro Winchester System in a Micro Package



- Compact 9.5"W x 11.2"H x 17"D table top package
- 256Kb main memory (4Mb addressability)
- Expansion space for 4 dual LSI-11 boards
- PDP-11* architecture compatible with DEC* RT-11, RSX-11M and Unix** software
- LSI-11/23 processor
- 4 serial ports
- 8" RX02 and 1.2Mb IBM floppy backup
- Auto self-test for CPU, memory, disk drives
- Easy access to LED display of system faults
- 10.6Mb or 15.9Mb 5¼" Winchester package
- Advanced disk controller with ECC, flaw management, bootstrap, error retry, and direct non-interleave data transfer
- AVAILABLE WITHOUT CPU and memory for volume requirements

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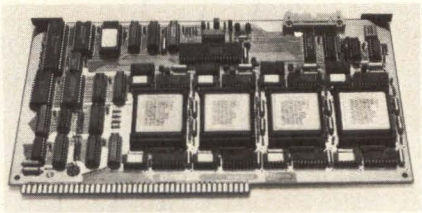
* Trademark of Digital Equipment Corporation. ** Trademark of Western Electric.

CIRCLE NO. 113 ON INQUIRY CARD

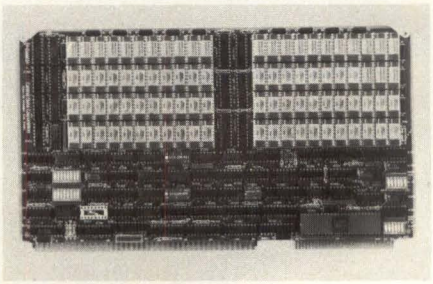
Bubble-memory system is for Multibus micros

The MBI-1 magnetic-bubble mass-storage system for Multibus microcomputer systems includes a Z80-based intelligent controller and as much as 512K bytes of solid-state



mass storage on a PC module. The system is available in 128K-, 256K- and 512K-byte capacities and can be expanded to as much as 8M bytes using expansion boards available from the vendor. The 512K-byte capacity module features a 270K-bit-per-sec. transfer rate and an average access time of less than 41 msec. It consumes 5V at 0.9A. The MBI-1 is priced at $997 for a 128K-byte version and $2247 for a 512K-byte system in 100-unit quantities. **Bubbl-Tec,** 6800 Sierra Court, Dublin, Calif. 94568

Circle No 319



RAM board features error correction

The B1027 dynamic RAM board allows a user to add 128K, 256K, 384K or 512K of RAM to any Multibus system. The board corrects single-bit errors and detects double-bit errors. It runs at a maximum access time of 275 nsec. and decodes the full 24-bit address bus for a system-wide memory of 16M bytes. The board is divided into two 256K sections, each of which can be addressed on a 256K memory boundary. Sockets with built-in bypass capacitors increase the noise immunity of the board. The PC board is constructed in four layers, with the two internal layers being power and ground, to further minimize noise. In 100-unit quantities, the 128K-byte board is priced at $895, and the 512K-byte board is priced at $1725. **Central Data Corp.,** 1602 Newton Dr., Champaign, Ill. 61820

Circle No 320

MAKING THE LEADING EDGE WORK FOR YOU

Introducing a brainy new solution from the Wizards of Winchester Disk Controllers.

A new Winchester controller. Plus floppy controller. On one low cost board. Small enough to mount atop a 5¼" drive. And ST500/SA1000 compatible. "Smart," you say? What did you expect from the Wizards of Winchester Disk Controllers?

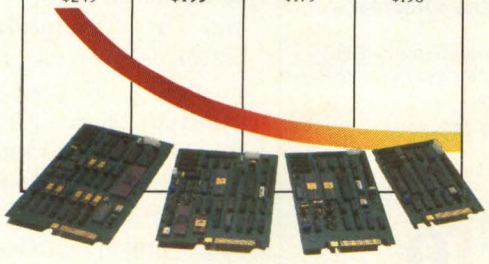
We promised you more for less. Our new WD1002 delivers. At $195 (U.S. OEM quantities) it's $50 less than its predecessor, the WD1001.

The big news, though, is that we've made the WD1002 the brainiest disk controller yet, with an abundance of new LSI innovations. Such as our WD1010 single-chip Winchester controller device. It replaces the microprocessor on our earlier boards. And about 25 other devices. Plus we've added the new WD1014 Error Correction device and the WD1015 Buffer Manager device.

Because just about every system with a Winchester has a floppy nearby, we included our new WD279X single chip floppy disk controller, too. So you get a complete, powerful solution on one reliable 5¾" x 8" board. And you're on the upgrade path to our upcoming WD1003 and WD1004 boards.

U.S. OEM Quantities

WD1001	**WD1002**	WD1003	WD1004
Summer '82	**NOW**	Summer '83	Fall '83
$245	**$195**	$175	$150



To make our disk controllers even more irresistible, we'll customize them to your bus and form factor. Or sell you our LSI, along with everything you need to build a controller yourself.

It doesn't take too much brains to see that it's safe, smart and simple to commit your disk-based systems to WD. Call our controller hotline, 714/966-7827 and we'll arrange to sit down with you and get into the details you need.

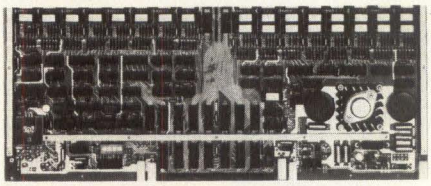
WESTERN DIGITAL
CORPORATION

Components Group, 2445 McCabe Way, Irvine, CA 92714, (714) 557-3550

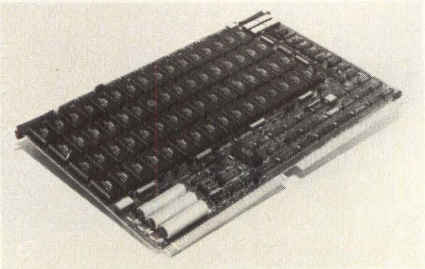
CIRCLE NO. 125 ON INQUIRY CARD

Add-in for P-E 3200 series stores 2M bytes

The single-board DR-330 semiconductor add-in memories for Perkin-Elmer's 3200 series of minicomputers are available in 256K-, 512K-, 1M- and 2M-byte configurations. The 256K- and 512K-byte versions use 16K RAMs; the 1M- and 2M-byte versions employ 64K dynamic RAMs. The 2M-byte DR-330 is internally organized as 512K × 39. All DR-330 devices have 400- and 240-nsec. cycle and access times, respectively.



Address selection is implemented with on-board switches. The 256K-, 512K-, 1M- and 2M-byte DR-330 are priced at $2640, $3900, $6400 and $10,600, respectively. **Dataram Corp.**, Princeton Rd., Cranbury, N.J. 08512. **Circle No** 321

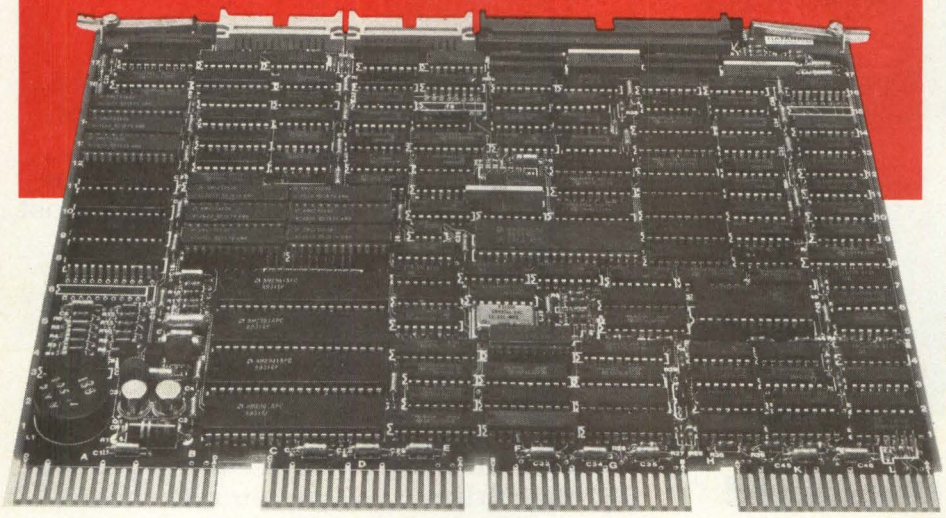


Add-in memory offers nonvolatile 128K

Intended for Versabus microprocessor systems, the MM-68000C add-in memory provides 128K bytes of storage and a real-time calendar. The board is available with rechargeable batteries with a two-week data-retention rating, or with nonrechargeable batteries having one-year data retention. The board features cycle and access times of 220 nsec. with no refresh delays. Module selection is on 1000 (hex) boundaries that are switch-selectable in the 16M-byte address field. Switch-selectable write protect is also included with 8K-byte boundaries. Static, CMOS memories and three redundant, on-board batteries provide the nonvolatile capability. A user can unplug a 32K-byte block of CMOS RAMs and substitute 2716 EPROMs, providing fixed program memory as well as CMOS RAM. Price is $2350 in single-unit quantities. **Micro Memory, Inc.**, 9436 Irondale Ave., Chatsworth, Calif. 91311.

Circle No 322

DEC®-COMPATIBLE PERIPHERAL CONTROLLERS



LSI-11® compatible controller for 80-300MB SMD and Winchester drives from CDC, Ampex, and Fujitsu

Dataram Corporation offers the industry's widest range of DEC-compatible peripheral controllers — from comparatively simple NRZI tape controllers to complex 300 MB storage module drive (SMD) controllers.

An impressive array of state-of-the-art controllers, all built around high-speed bipolar microprocessors. All software compatible with the host LSI-11, PDP®-11, or VAX® minicomputer...and all available now.

And Dataram's controllers are designed to save you money, and, more importantly, space — our controllers typically occupy half the space required for the comparable controller from DEC. Doing it with a level of performance that makes any member of this family worth looking at.

The chart shows our current family of peripheral controllers, growing every day. If you don't see the controller you need, we're probably working on it right now. Call us and discuss your requirements.

CONTROLLER	DESCRIPTION	COMPATIBILITY
C03	Cartridge disk controller	RK05
C33	Cartridge disk controller	RK05
T03	NRZI mag tape controller	TM11/TU10
T04/C	Mag tape streamer coupler	TM11/TU10
T04/N	NRZI mag tape controller	TM11/TU10
T04/D	Dual density mag tape controller	TM11/TU10
T34/C	Mag tape streamer coupler	TM11/TU10
T34/N	NRZI mag tape controller	TM11/TU10
T34/D	Dual density mag tape controller	TM11/TU10
T36	Dual density mag tape controller	TM11/TU10
T34/T	GCR mag tape controller	TM11/TU10
S03/A, S04/A	80 MB/300 MB SMD controller	RM02/RM05
S03/A1, S04/A1	80 MB/160 MB SMD controller	RM02
S03/B	80 MB/300 MB SMD controller	RK07
S03/C	200 MB/300 MB SMD controller	RP06
S03/D, S04/D	96 MB CMD controller	RK06
S33/A	80 MB/300 MB SMD controller	RM02/RM05
S33/A1	80 MB/160 MB SMD controller	RM02
S33/B	80 MB/300 MB SMD controller	RK07
S33/C	200 MB/300 MB SMD controller	RP06
S33/D	96 MB CMD controller	RK06

Products printed in red are LSI-11 Bus compatible.
Products printed in black are UNIBUS® compatible for PDP-11 and/or VAX minicomputers.

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DATARAM CORPORATION

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CIRCLE NO. 117 ON INQUIRY CARD

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FREE SOFTWARE
$3500 worth of office productivity programs with each $4995 system.

"You can search the world over and probably never find a value like Voyager."

— Arte Johnson

Besides having a really great design to it — it has its own bundled software (everything from word processing to spread sheet) that's among the hottest programs around. It's easy to use because it's menu driven.

More useful because it can do two jobs simultaneously with background printing.

You'll find its business capabilities, outstanding performance and price interesting too. And while you're discovering what you can get for your money, you'll find there's lots more to look into.

You can clearly see a difference.

Voyager isn't boxy, stationary and boring looking.

The disk drives and computer itself fit under or near a desk. The keyboard's lightweight and conveniently detachable. It has a classy look that goes along with its design of exacting European standards. And the monitor is what's really interesting.

It's mounted on a base that not only allows you to adjust your viewing angle, you can rotate it almost 360 degrees. That means you can change the position for comfort, show someone else the screen, even use it for conferences, where visual information can be almost instantly created, displayed and changed. And the easy viewing screen has higher resolution than most.

More that's interesting.

If you want big business power plus upgradability, you'll find it with Voyager. You can add hard disks and easily upgrade the original machine to get the most from a small priced system.

With the complete system you get two 5¼" disk drives, CPU, monitor, keyboard, everything but the printer (it's optional), including CP/M* and Voyager software library packages. Plus, it costs a lot less than any comparable system.

And with our unique service program, if anything goes wrong anytime, we'll loan you a replacement fast. Within 8 business hours.

So if you're looking for the best value in business systems your search is over. See Voyager at your local dealer. You should find its low introductory price verrry interesting.

Call for your nearest dealer.

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DEALERS NOTE: This is the first ad in a series to help bring customers to you.

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(800) 235-3561 Outside California

CIRCLE NO. 118 ON INQUIRY CARD

Modem operates at 4800 bps

The AJ 4048 full-duplex, originate/auto answer modem for communications at 4800 bps over dial-up or two-wire unconditioned leased lines features selectable synchronous or asynchronous operation, data terminal interface via RS232C connector, front-panel display indicators and membrane front switches. The unit is available for stand-alone or rack-mounted applications. Diagnostics include CCITT recommended local analog and remote digital loopback as well as local and remote self-testing. In addition, remote modem diagnostics report-back can be initiated under local control. Price is expected to be less than $5000 in single-unit quantities. **Anderson Jacobson, Inc.,** 521 Charcot Ave., San Jose, Calif. 95131

Circle No 323

Modem module has 300-baud capability

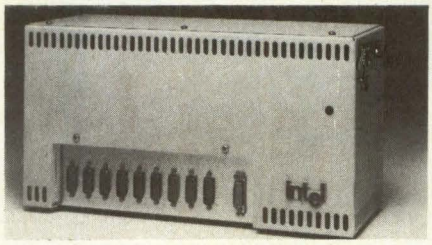
The model CS-30A modem module provides a direct access to phone lines through a single component for microprocessor control. The module has a 300-baud capability with logic-selectable answer or originate modes and is capable of dial out in DTMF or rotary format. It features a ring detector for auto-answer and auxiliary audio-input/received-line audio-output functions. The unit measures 4 × 3¼ × 1 in. Price is $149.95 each in quantities of one to nine or $109 in quantities of 100. **Avcom, Inc.,** P.O. Box 29153, Columbus, Ohio 43229

Circle No 324

International dial modem operates at 2400 bps

Designed for the international market (and meeting CCITT recommendation V.22bis), the model CDS V.22bis dial modem operates at 2400 bps full duplex in synchronous and asynchronous modes. It features automatic adaptive equalization and local and remote diagnostics including analog and digital self-tests and an internal test-pattern generator/checker. The modem supports HDLC, SDLC, X.25 and Teletex protocols. Price is $1795 in single-unit quantities. **Concord Data Systems,** 303 Bear Hill Rd., Waltham, Mass. 02154

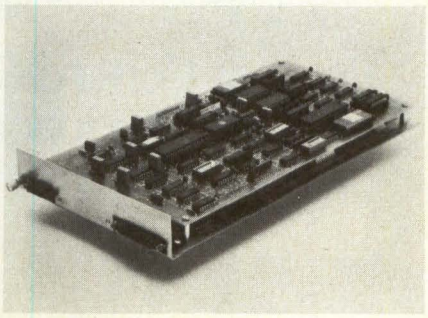
Circle No 325



Cluster module replaces Ethernet tranceivers, cables

The Intellink cluster module provides an Ethernet-compatible interface for as many as nine Ethernet workstations. Instead of using one transceiver per workstation and a length of coaxial cable, nine workstations can be attached to the Intellink using Ethernet-specified cables and connectors. The module can also serve as a transceiver multiplexer that permits eight workstations to share a single transceiver, which in turn, is connected to a standard Ethernet network coaxial cable. The module can also be used with the vendor's iSBC 550 Ethernet controller board and iNA 950 LAN S/W to form a complete Multibus-based local-area network. The single-unit price of the Intellink cluster module, model iDCM 911-1, is $2450. **Intel Corp.,** 3065 Bowers Ave., Santa Clara, Calif. 95051.

Circle No 326

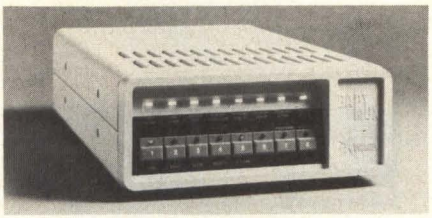


4800-bps modem is Bell-compatible

The Bell 208A/B-compatible VA4840 4800-bps modem operates without conditioning-level requirements over two-wire switched networks or two-/four-wire leased lines. It can operate in a point-to-point network or in a multi-point environment. Automatic adaptive equalization allows the modem's receiver to change its filtering and adapt to telephone-line conditions involving amplitude roll-off, phase delay, frequency offset and carrier phase jitter. Its built-in general-purpose, 8-bit microprocessor controls a 16-bit multiplier and memory to perform all signal-processing functions. The VA4840 is FCC approved for direct connection to the switched network using programmable data jacks or RJ11C telephone jacks. Automatic idle test, analog loopback/busy/out, local and remote digital loopback and self-test user diagnostics are included. Price is $1600 in single-unit quantities. **Racal-Vadic,** 222 Caspian Dr., Sunnyvale, Calif. 94086.

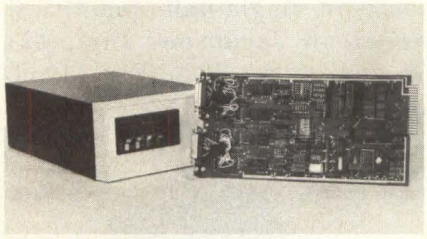
Circle No 327

Multiplexer provides remote programming



The enhanced Babymux statistical multiplexer provides remote programming, which lets a system manager reconfigure or inspect his remote Babymux multiplexers through local multiplexers at a central computer site. Remote programming also allows an unbalanced configuration between the local and remote multiplexers. Babymux is programmed through its front panel, which also provides status information on communications line usage, terminal activity and data transmitted. It supports any standard RS232 asynchronous device. The basic Babymux two-channel multiplexer unit sells for $1350. It is expandable to five or eight channels with the addition of three-channel expander kits priced at $475. **Network Products, Inc.,** Progress Center, Research Triangle Park, N.C. 27709.

Circle No 328



Multiplexer features error checking

The Prism 3/A statistical multiplexer allows a user to employ as many as three computer terminals over one telephone line. The device dynamically assigns high priority to keyboard input and has a special error-checking and -detection protocol for high-priority lines. Each channel can be programmed for speeds as high as 19.2K bps with receive and transmit rates independently selectable. Local echo, printhead flyback buffering delay and parity can be specified on a line-by-line basis. Space compression and hardware or software flow control can make the apparent data rate much higher than that obtained from the modem. The hardware flow control line is byte-aligned to interface with Hewlett-Packard or Data General machines. The Prism

UDS serves up 9600 bps

Universal Data Systems' new 9600 bps modem brings economy and operating ease to high speed data communications systems.

☐ Front panel switch selects operating/test modes. Rear panel switch initiates fall-back frequency operation.

☐ Analog and remotely activated digital loopback capability conforms to CCITT V.54. A 511 pseudo-random test pattern, compatible with CCITT V.52, is provided.

☐ Digital adaptive equalizer is strappable to T or T/2 configuration.

☐ V.29 compatible and 100 ms mode are strap selectable.

☐ Pre-equalizer available for operation over unconditioned lines.

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CIRCLE NO. 120 ON INQUIRY CARD

Created by Dayner/Hall, Inc., Winter Park, FL

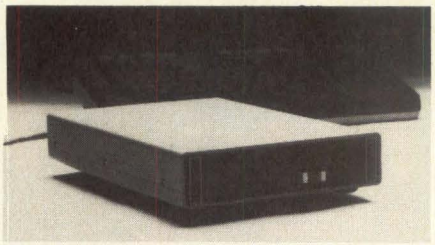
3/A can be used with any asynchronous modem or line driver, and is designed for installation within a Racal-Vadic modem chassis. Price is $875. **Western DataCom,** 5083 Market St., Youngstown, Ohio 44512. **Circle No** 329

Modems feature 4800- or 9600-bps operation

Measuring 8 × 11 × 2 in., the Micro4000 models 4048/V.27+ and 4096/V.29+ synchronous modems operate at 4800 and 9600 bps, respectively, and feature multipoint

and point-to-point operation, remote loopbacks for mulitpoint and point-to-point troubleshooting, speed-shift synchronization and an anti-streaming feature that prevents a malfunctioning terminal from monopolizing a multidrop line. The modems operate over unconditioned leased telephone lines and are capable of two-wire, half-duplex or four-wire, full- or half-duplex operation. Prices are $2595 for the model 4048/V.27+ and $3095 for the model 4096/V.29+. **Micom Systems, Inc.,** 20151 Nordhoff St., Chatsworth, Calif. 91311

Circle No 330

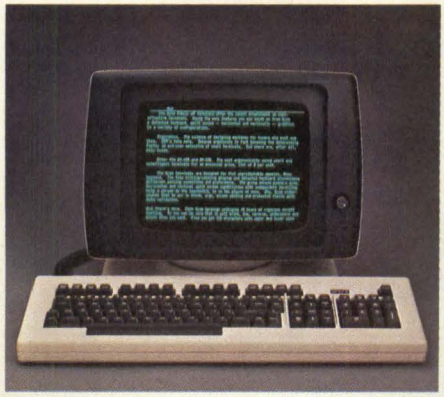


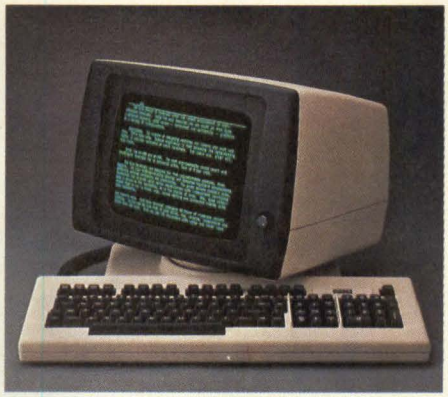
Terminal-controlled modem is Bell 212-compatible

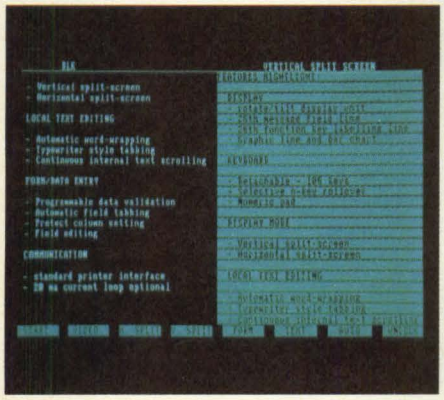
The model 212 terminal-controlled modem is Bell 103- and 212-compatible and operates over two-wire dial-up networks in the full-duplex mode at asynchronos data rates of 0 to 300 and 1200 bps. It features auto-dialing, menu-controlled options and operation, complete keyboard control of modem functions and diagnostics and a nonvolatile memory. Price is $795 in single-unit quantities. **Prentice Corp.,** 266 Caspian Dr., Sunnyvale, Calif. 94086

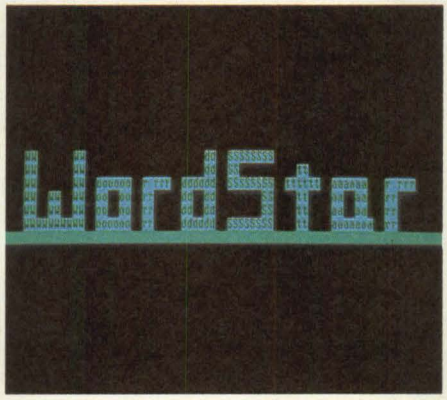
Circle No 331

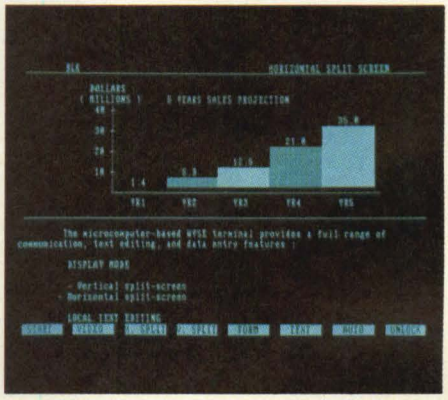
A WORD TO THE WISE.











No one gives you more in an ergonomically engineered smart terminal than Wyse.

These days there's little room for waste of the corporate dollar. And these days the WY-100 smart terminal looks even better when you compare it to the other guys.

You definitely get more from Wyse — the leader in low-cost, high-performance, ergonomically engineered smart terminals.

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You also get a terminal with an uncanny way of pleasing people. It comes with an easy-on-the-eyes green phosphor screen. And a fully tilting/rotating display and detached keyboard. (After all, one person's just-right-tilt is another's not-quite-right-tilt).

When the workload seems impossible, horizontal and vertical split screen capabilities with independent scrolling allow you to be in two places at once.

There's more. You get programmable function keys and transparent print. Plus 128 characters with upper and lower case, line drawing and graphics, and a keyboard with 105 keys — including cursor pad, special mode and function keys.

Of course, all of this wouldn't mean much if you couldn't count on Wyse quality. That's why each WY-100 is put through an extensive on/off testing program.

On top of that, WordStar® and other emulations are now available from your distributor. Which means you can automatically get 32 of WordStar's most commonly used multi-key commands fully-implemented on our function keys for faster, easier use.

We think you'll be quite impressed when you compare the WY-100 to other terminals in its class. But don't take our word for it. Call or write us today. We'll send you detailed information on why the WY-100 smart terminal gives you more. A lot more.

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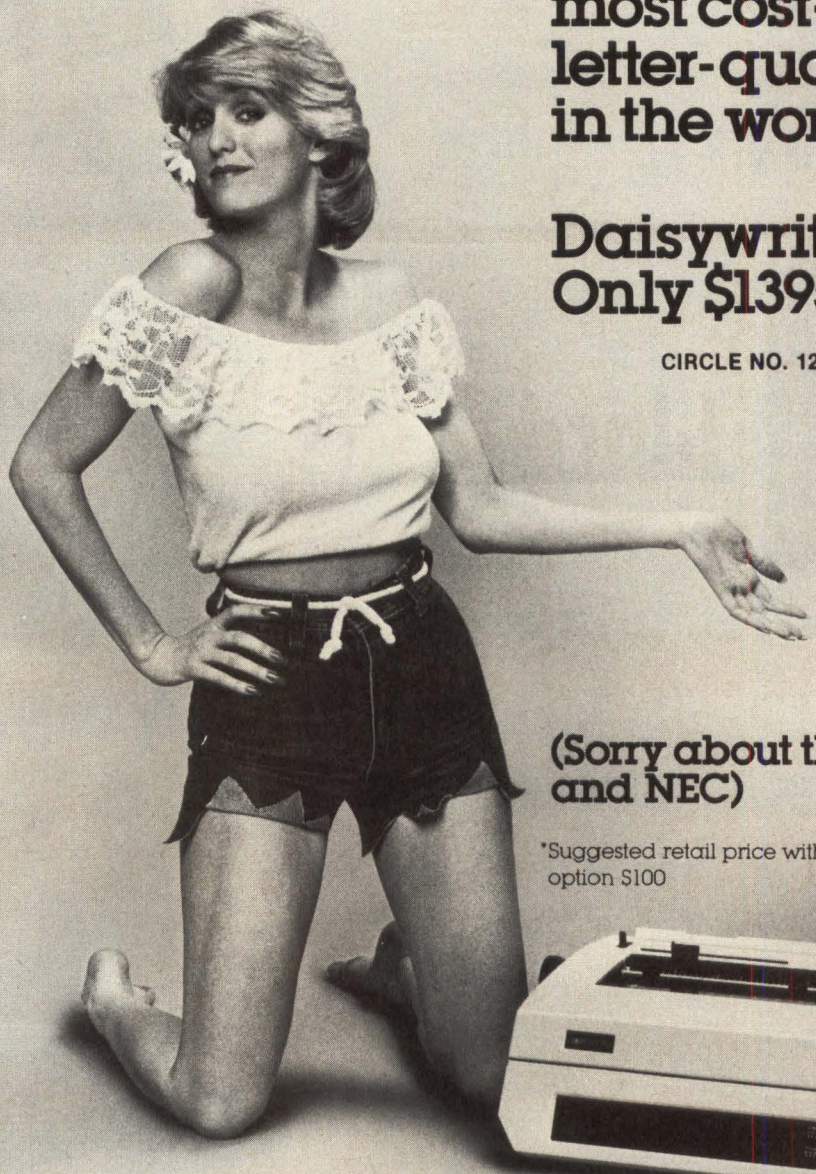
CIRCLE NO. 127 ON INQUIRY CARD



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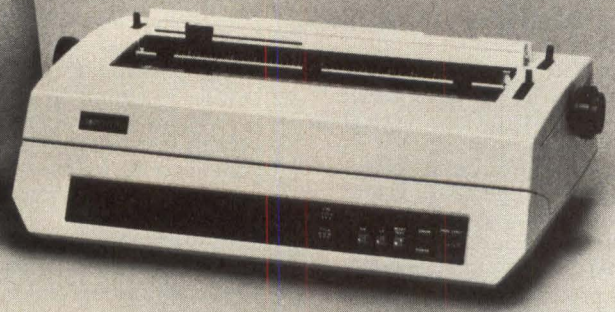

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Software workstations have many applications

The Boeing Intelligent Terminal System family of software products turns personal computers such as the Terak 8510, Xerox 820 models 1 and 2, IBM PC, DEC PDP 11/50 and PDP 11/23 and others into workstations that perform functions such as business or technical chart and graph preparation, document preparation and maintenance, local data entry and verification, remote job entry to a mainframe, electronic spread-sheet calculation and preparation of presentation-quality graphics.

The BITS family includes eight software workstations. An intelligent terminal software workstation, the basic system around which the others are built, contains a hardware-independent control program, a screen editor and a standard teletype TTY telecommunications ability for BITS-to-host or BITS-to-BITS communications. The remaining software workstations include two data-entry workstations, three business - management workstations, an EIS/ODC workstation and a text-processing workstation.

The two data-entry software workstations include a forms compose/editor program for generating full-screen templates (forms) and a data-entry program for collecting data against the screen forms.

The three business-management software workstations offered are BITSCALC, a 3D electronic spreadsheet processor; BITSGRAF, a menu-oriented graphics system; and Business Graphics Utilities for generating bar, pie, schedule, manpower and other charts.

The EIS/ODC software workstation is an off-line data-collection facility for EIS, a fully integrated decision-support system available from the vendor on a time-sharing basis.

In addition to the software workstations, other BITS offerings include Pascal, FORTRAN and BASIC compilers for application development, an R3780 communications option that allows a BITS terminal to function as an IBM 3780 for use as a remote-job-entry station and a graphics primitive library of routines that can be used in user-developed FORTRAN programs.

Price of the intelligent terminal software workstation is $300, or $200 when ordered with another BITS software workstation. Prices of the remaining software workstations are $300 to $600 each, depending on workstation. **Boeing Computer Services Co.,** 7980 Gallows Court, Vienna, Va. 22180.

Circle No 332

UNIX benchmarks are portable

Designed for use by end users, OEMs and system integrators, a set of portable UNIX benchmarks includes nine tests that run unattended on any UNIX-based system. The benchmarks first examine the system for Version 7 command-list completeness and local command additions. Then two CPU measurements time looping and floating-point calculations. Benchmarks examine disk-transfer speeds for various record lengths. C-compiler optimization is examined for short, integer and long types. Memory/paging throughput, context switching and communications speeds are also measured. Multi-user performance is examined for simulated

multiple users doing sorting and editing. The package is provided on nine-track, 1600-bpi TAR/tape with full source for shell scripts and C programs, documentation and sample benchmarks from VAX 750, VAX 780 and PDP 11/70 for comparison. Price is $1250. **Aim Technology,** 3333 Bowers Ave., #199, Santa Clara, Calif. 95051. **Circle No** 333

IMSL Library is available on the HP-1000

The IMSL Library, more than 540 FORTRAN subroutines, is now available for the Hewlett-Packard 1000 Series. The IMSL Library subroutines serve as building blocks in scientific and engineering application programs. The subroutines cover a broad range of applied mathematics and statistics including linear and nonlinear equations, Eigensystem analysis, interpolation, differential equations, optimization, analysis of variance, regression, forecasting, multivariate statistics, random number generation and special functions. The library offers HP-1000 users 32-bit, single-precision and 64-bit, double-precision accuracy. Annual subscription rates are $2000 for an initial subscription, $1500 per yer for renewals. **IMSL, Inc.,** 7500 Bellaire Blvd., Houston, Texas 77036. **Circle No** 334

Software makes Cluster/ One compatible with CP/M

Software that makes the Cluster/ One local-area network compatible with CP/M on the Apple II is now available. Version 1.3 of the Network File Server, an upgrade of the vendor's network file-management program, provides the base for the Apple II CP/M support feature. The support feature allows users to define and use CP/M format virtual diskettes with storage capacities from 32K to 8M bytes. The system requires no local disks to initialize CP/M at a user station. The support station requires that each user station have the Microsoft Softcard or equivalent cards. The Apple II CP/M support feature, including one Softcard, is available for $995; Network File Server Version 1.3 is priced at $1995. **Nestar Systems, Inc.,** 2585 E. Bayshore Rd., Palo Alto, Calif. 94303. **Circle No** 335

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Our VARs also give IBM support as a very good reason. We not only help them decide on the right IBM products, we also help them sell with support that ranges from a broad spectrum of marketing aids to technical assistance and business management seminars. In one VAR's words, "It's the team of people we can turn to. IBM always comes up with the answers we need."

Several VARs mention IBM hardware as a big plus. One says: "Its standing in the field helps reduce the selling hurdles." Another praises IBM's ability to, "keep customers up to date as new hardware develops." Both are referring to the success they had with the Series/1. We expect we'll soon be hearing the same praise about the Datamaster small business computer, which is now available to our VAR customers.

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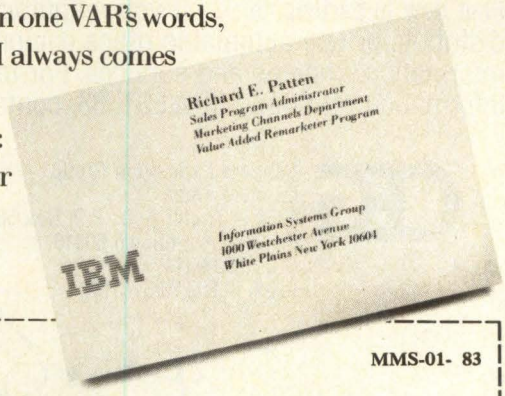

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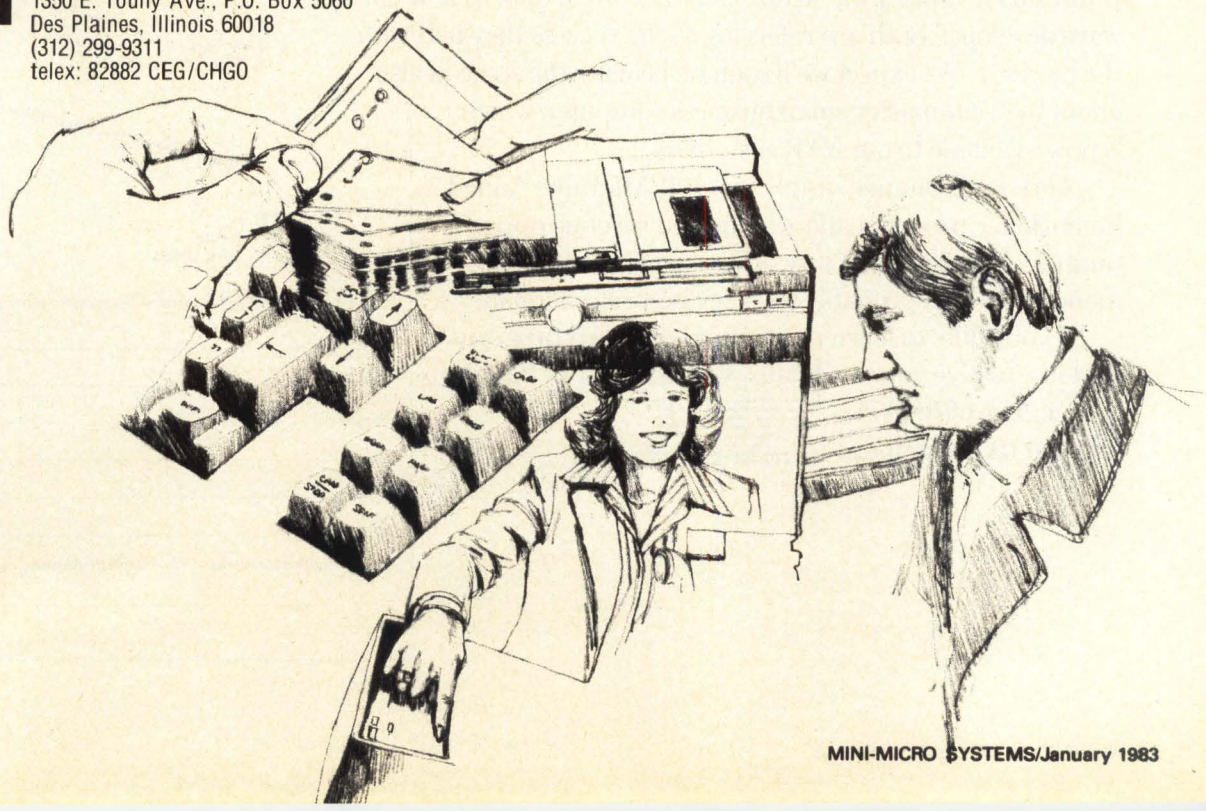
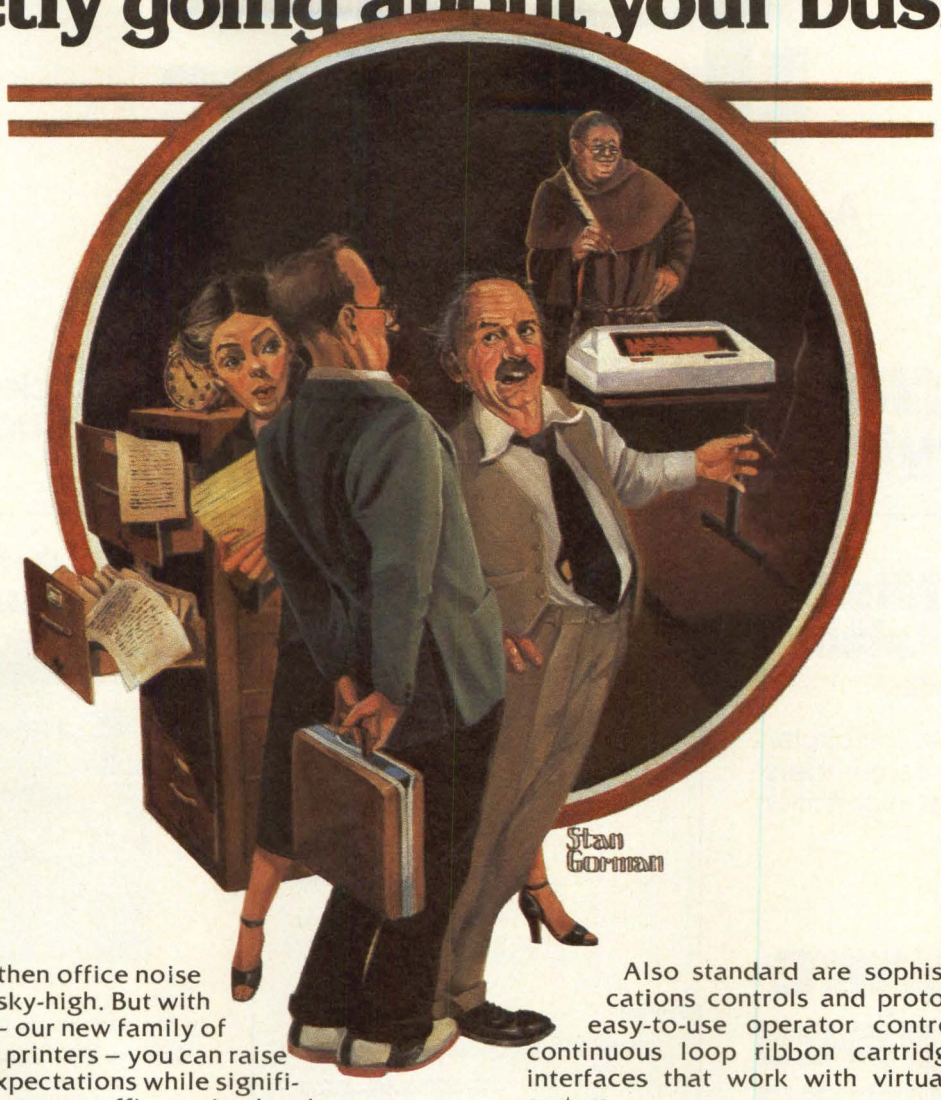


Anadex SILENT/SCRIBE™ printers. Quietly going about your business.



Now and then office noise levels can go sky-high. But with Silent/Scribe – our new family of matrix impact printers – you can raise your printer expectations while significantly lowering your office noise level.

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SILENT/SCRIBE MODELS

Standard Features	Char. per Inch	DP-9000A	DP-9500A	DP-9001A	DP-9501A	DP-9620A
Printing Speed	10	150	150	120	120	200
(Char. per Sec.)	12	180	180	—	—	120
	12.5	—	—	150	150	—
	13.3	200	200	—	—	—
	15	—	—	180	180	150
	16.4	—	—	200	200	164
Enhanced	10	—	—	—	—	100
Expanded Print (Double Width)		Yes	Yes	Yes	Yes	Yes
Dot Addressable Graphics (Dot/In., H/V)		60/72	60/72	75/72	75/72	72/72
Max. Line Width (In.)		8.0	13.2	8.0	13.2	13.2
Audible Alarm		Opt.	Opt.	Opt.	Opt.	Yes
Out-of-Paper Sense		Yes	Yes	Yes	Yes	Yes
Ribbon, Continuous Loop Cartridge (Yds)		30	30	30	30	30
Interfacing:						
Parallel Cent. Comp.		Yes	Yes	Yes	Yes	Yes
RS-232-C Serial		Yes	Yes	Yes	Yes	Yes

And Silent/Scribe is as easy to buy as it is to live with. You can select a variety of printing speeds, fonts and line widths. Some models provide both draft and enhanced quality copy. All models have superb dot-addressable graphics at no extra cost.

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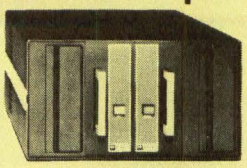
Sprint 68 Microcomputer



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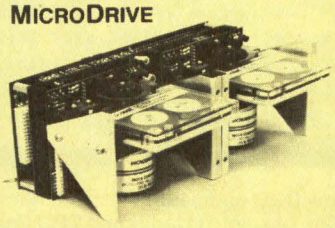

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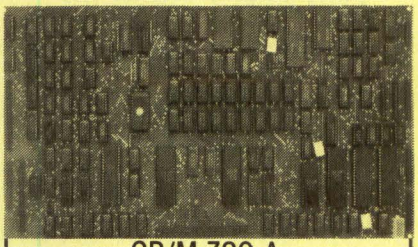

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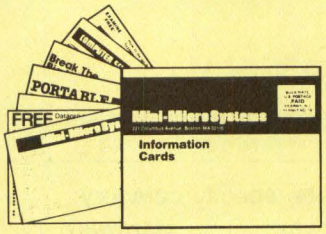

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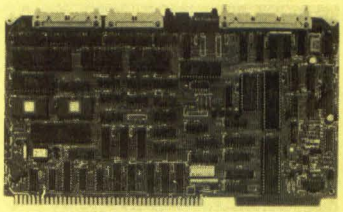

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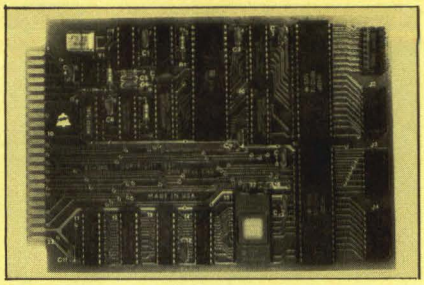

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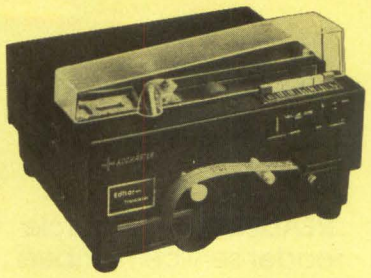

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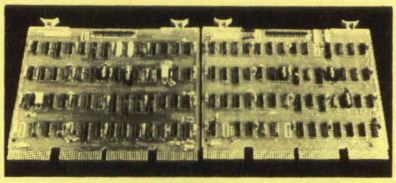

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The PPL-1 Peripheral Processor Link is a unique shared memory interface between any two Q-bus (LSI-11) and/or Unibus (PDP-11)-based DEC CPU's. Two quad boards and a connecting cable link the peripheral unit with the host. Up to 32KB of memory can be accessed by the peripheral processor in 4KB boundaries anywhere in the address space of the host. Address spaces are 18 bits for Unibus and 22 bits for the Q-bus. This memory sharing does not require software to support the link. 16 vectored interrupts (8 from each direction) provide necessary hardware for protocol implementation.

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Literature

NEW PRODUCTS

Catalog lists data-comm products

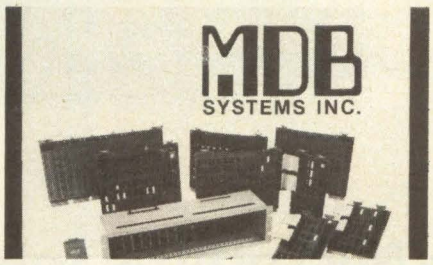
The vendor's line of data-communications equipment, including synchronous and asynchronous limited-distance modems; terminal, port and modem-sharing devices; and modem eliminators is described in a 41-page publication. The catalog lists the vendor's latest additions to its product line including the model 67/60 modem and multiplexer tester, the model 4020+4030 datacomm testers and the model 4031 ROM-PAC programmer. Included are descriptions of miniTech, EIA Patch, monitor and switching modules and data-interface cables. Photos and general specifications of the vendor's line of high-speed tests, data traps and monitors and error-correction systems are included. **International Data Sciences, Inc.,** 7 Wellington Rd., Lincoln, R.I. 02865. **Circle No** 336

Brochure describes integrated office system

The Omny integrated office system, a Motorola 68000-based minicomputer that supports numerous full-page proprietary terminals for heavy-volume word processing, is described in a technical brochure. The six-page brochure explains the system's task switching, I/O and design expansion, and lists specifications. In addition, Omny's CPU board, I/O controller board and configuration are illustrated. **Sharedata, Inc.,** 1995 Oakcrest, St. Paul, Minn. 55113. **Circle No** 337

Brochure describes display system

A 20-page brochure describes the vendor's PDS 270, a microprocessor-based communications display system that uses high-speed synchronous data-loop technology for interconnecting display terminals and printers. Highlighted in the brochure is the display system's ability to eliminate CPU polling and overhead, allow for minimum operator training resulting from system software transparency and increase productivity resulting from faster response time. **Paradyne,** P.O. Box 1347, 8850 Ulmerton Rd., Largo, Fla. 33540. **Circle No** 338



Brochure describes PDP-11, VAX interfaces

Interface products for Digital Equipment Corp. PDP-11 and VAX computers are described in a 16-page brochure. Product catagories include synchronous and asynchronous communications/terminal interface modules, multiplexers, inter-processor link subsystems, peripheral-device controllers, system modules, PROM modules, foundation modules and special performance products and accessories. The illustrated brochure incorporates interface data and I/O pin connections. **MDB Systems, Inc.,** 1995 N. Batavia St., Orange, Calif. 92665. **Circle No** 339

Color graphics terminal described in brochure

The Jupiter 7 color graphics terminal, a raster device with 768 × 575 viewable pixel resolution and 256 simultaneously displayable colors, is described in a full-color, eight-page brochure. The brochure describes the Jupiter 7's detached keyboard with 30 user-definable keys, a hexadecimal keypad and twin joysticks. It also describes the terminal's firmware anti-aliasing capability and hardware grid system. Application packages that can be run with this AED 512 and 767 plug-compatible terminal are also listed. **Jupiter Systems, Inc.,** 2126 Sixth St., Berkeley, Calif. 94710. **Circle No** 340

Bulletin describes 64K-byte microcomputer

The Z80A-based QDP-100 microcomputer with 64K bytes of standard RAM is described in a two-page bulletin. The bulletin notes that several versions of the QDP-100 are available. One has dual 8-in. floppy disk drives, and another has a 10M- or 15M-byte hard disk and one floppy disk drive. The bulletin also details the system's one-key start-up, an on-line help system and a menu-style listing of operating options. **Quasar Data Products,** 10330 Bracksville Rd., Cleveland, Ohio 44141. **Circle No** 341

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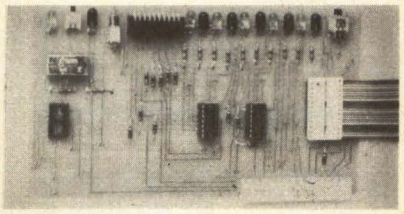

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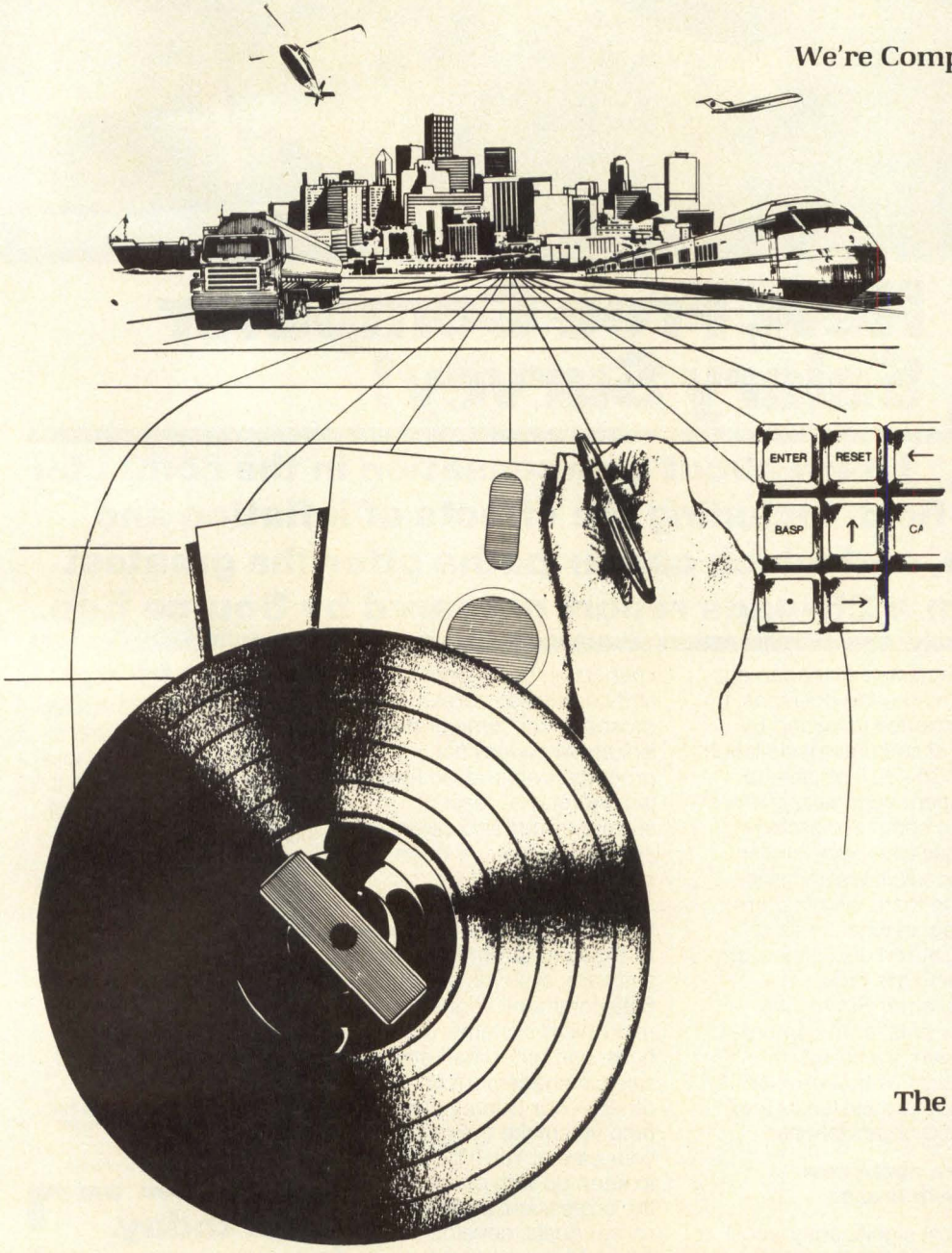

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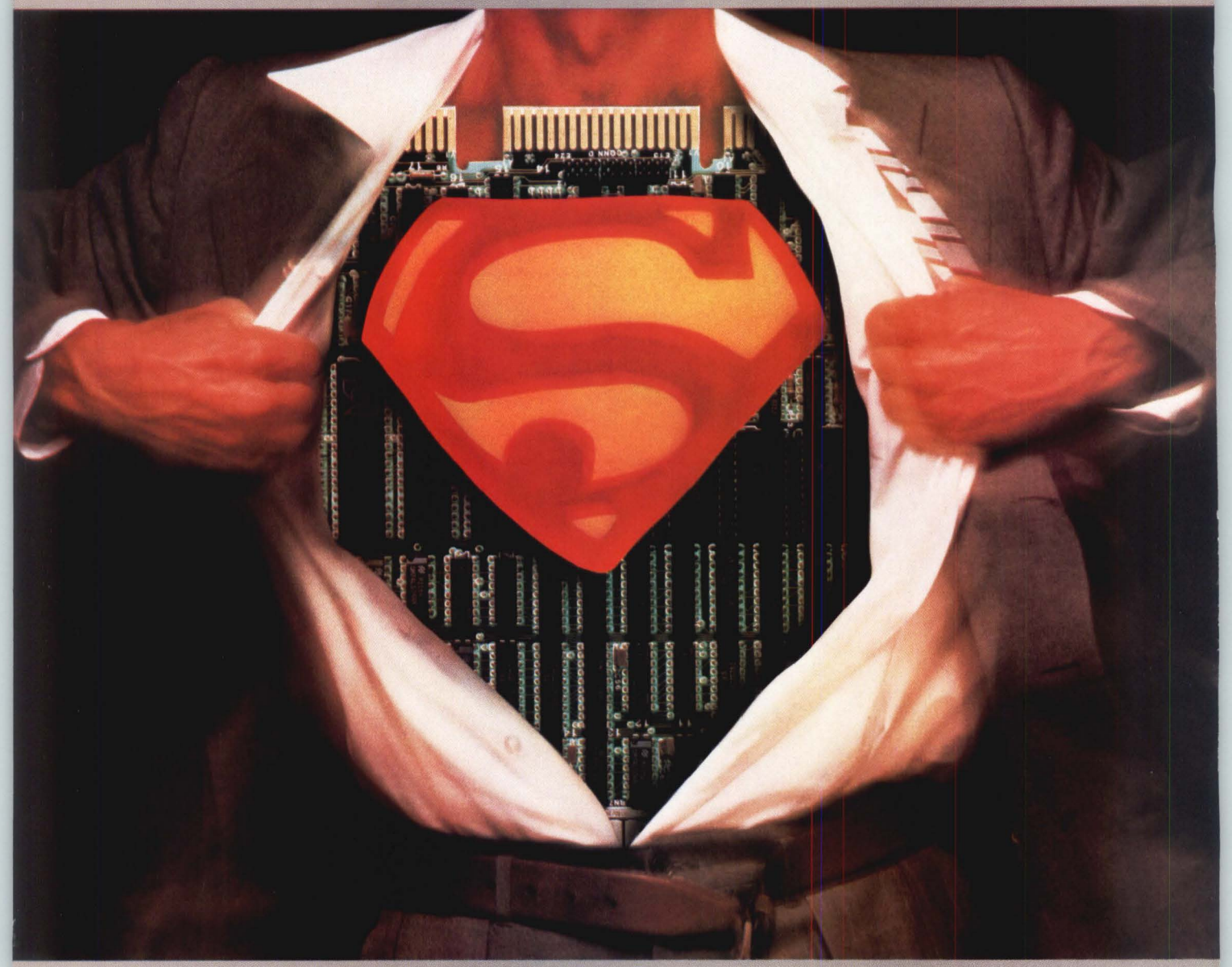

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