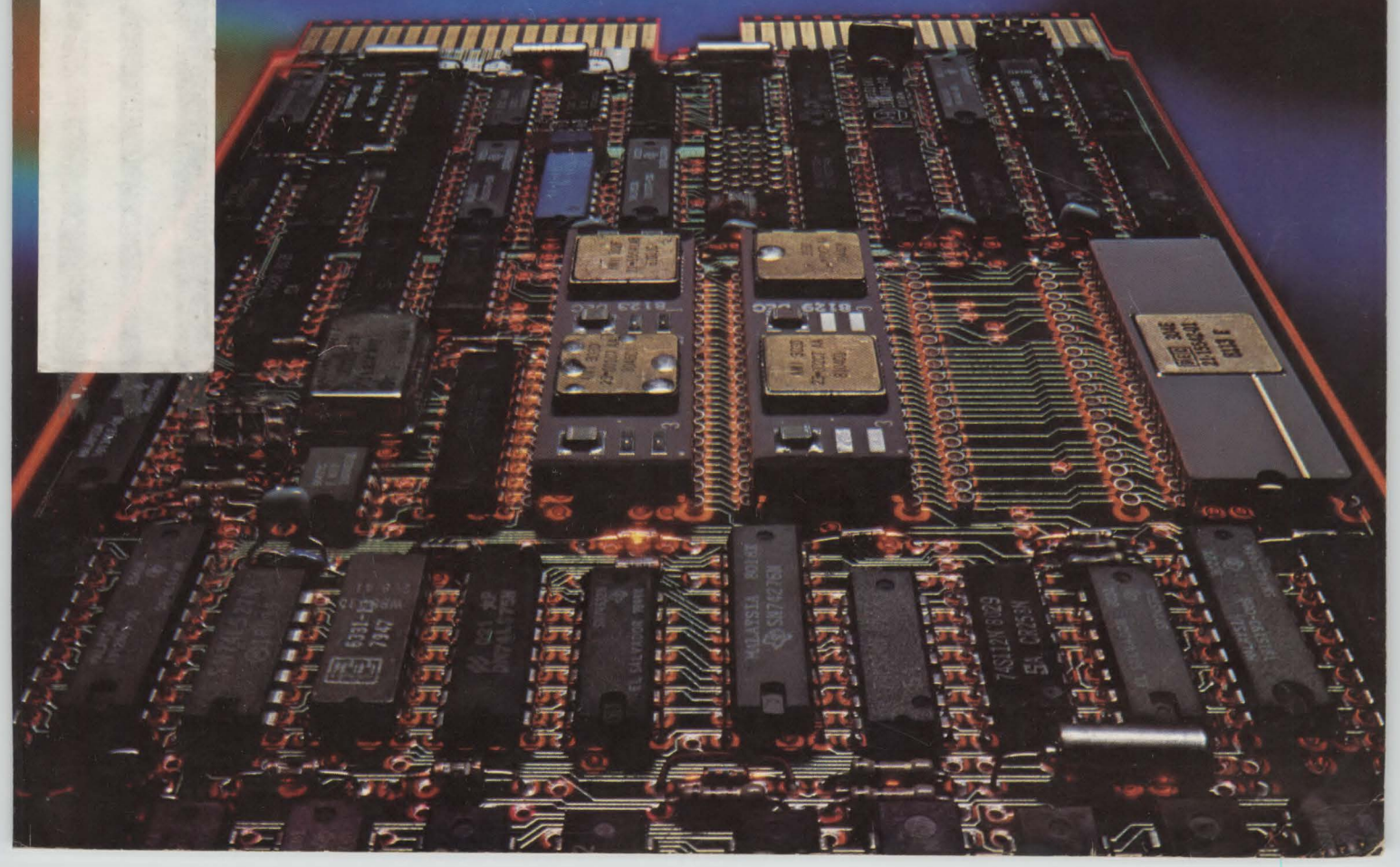
Mini-Micro Systems

A CAHNERS PUBLICATION

AUGUST 1982

MICROCOMPUTERS

Single-board and desk-top systems



Dataram M23

The Useable 4.0MB LSI-11®

A dramatic innovation unlocks the power of the LSI-11/23

The M23: The answer to your high-performance LSI-11/23 needs

What controllers can be used?
The key to the M23 System, Dataram's proprietary memory management Q-MAP enables you to use the full 4.0MB power of the LSI-11/23. It provides I/O mapping, which supports a wide range of existing peripheral controllers on an 18-bit bus (Q18). While still maintaining the 22-bit bus (Q22) for 4.0MB main memory addressing.

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Memory?
A 1.0MB quad board is contained in the basic M23 configuration. Think of it, a full 4.0MB on only four DEC quad boards! And each additional 1.0MB is only $3400.

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More information?
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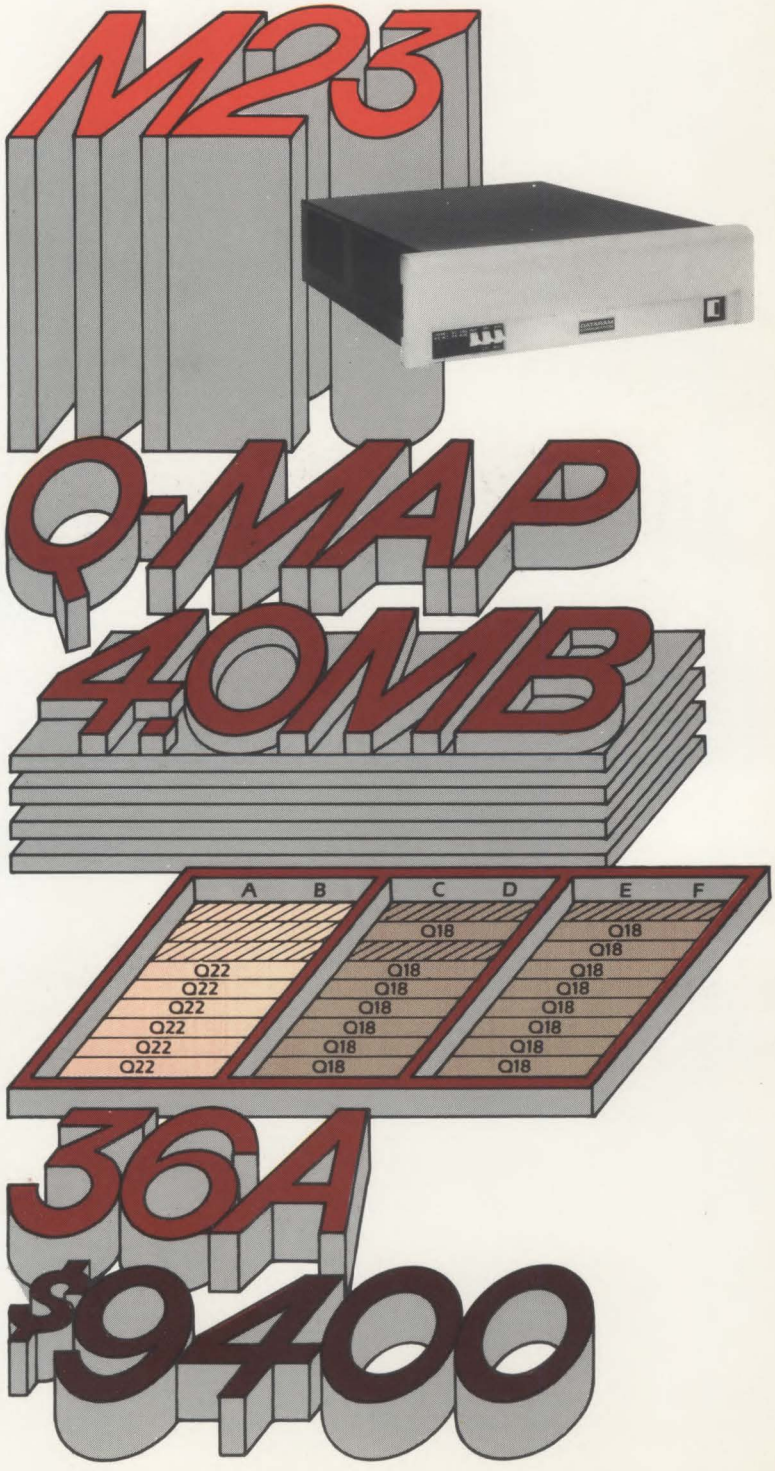

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DATARAM CORPORATION

CIRCLE NO. 2 ON INQUIRY CARD

Stay on top of business, wherever your business takes you.

Virtually anywhere you do business, our *Silent 700*† Portable Data Terminals can help you stay on top of things. All you need are a standard telephone and an electrical outlet. Plug it in, dial up your central computer and data base, and get the information you need, when and where you need it. Whether you're in sales, service, engineering, manufacturing or management.

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CIRCLE NO. 4 ON INQUIRY CARD

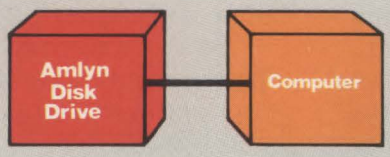
THE 8MBYTE FLOPPY SURPRISE

At last, a disk drive which accommodates both stand alone removable media data storage and Winchester backup applications — all with one device. The Amlyn drive is a superstar as the sole storage device on your system. It combines the benefits of high performance, high capacity data storage with removable, low cost user friendly media. All this for less than half the price of a Winchester drive and its backup device.

If you use Winchester drives, you need backup. Amlyn's drive is THE backup device which is interface, format and software compatible with the Winchester itself. So compatible, it can take over for your Winchester when it fails so that a Winchester failure doesn't shut your system down. Amlyn backs up your Winchester drive itself — not just the data on it. Now backup is more than something you hold in your hand when your Winchester fails.

Dynamic On-Line Operation

Amlyn drives provide 8 MBytes in the same space as a standard mini-floppy. Amlyn has combined the capacity of Winchester drives with the advantage of removable media.



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Random Access Winchester Back-Up

Now, you can have Winchester system backup, not just data backup with interface and software compatibility to your Winchester as well.

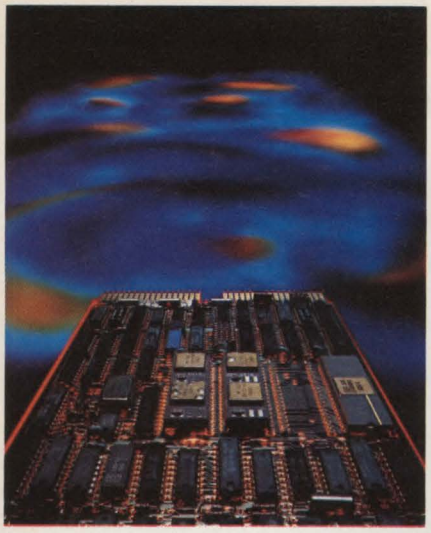
Removable Media

Amlyn's 8 MByte removable MiniPac cartridge holds and protects diskettes from damage and mishandling, and are easily removed and replaced. Each cartridge holds five mini-floppy diskettes.

Standard and Flushmount Design

Amlyn drives allow OEM and systems house design flexibility with a variety of styles which assure form factor compatibility with standard mini-floppy dimensions.

CIRCLE NO. 5 ON INQUIRY CARD



Single-board computers may be small, but they pack a lot of power (p. 147). Art direction by Vicki Blake; photography by Stills Studio—Jim Conaty, Boston.

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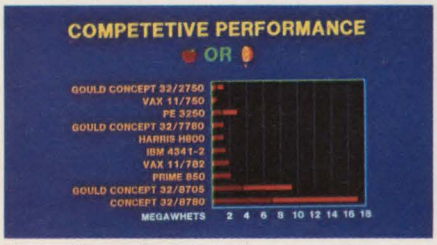

Page 33 . . . . A mini challenges mainframes

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Mini-Micro Systems

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MINI-MICRO WORLD

INTERPRETER

SYSTEMS IN INDUSTRY

FEATURES

For feature highlights, see p. 145

DEPARTMENTS

Only one company has the complete range of disks and disk backup—Kennedy

That's right. Ask any other supplier of peripheral products for system backup, and you'll find that some can supply a disk, some can supply a cartridge recorder, others a streaming transport. But none can supply the choice which Kennedy can offer.

Kennedy is the only company that can offer an SMD compatible, 8" 40 MByte disk drive (Model 7300) and an 80 MByte 14" Winchester disk drive (Model 5380). To back them up, Kennedy has a ¼" cartridge recorder (Model 6450), and Model 6809, ½" Data Streamer Tape Transport.

Kennedy was the first to utilize the ¼" 3M cartridge for disk backup; Kennedy was the pioneer in Winchester disk technology, and was a leader in developing a low cost streaming tape drive.

All of these products were conceived and designed to meet the need for reliable, low cost backup — for our systems or for any other system.

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CIRCLE NO. 6 ON INQUIRY CARD

BUGS REPORTED IN FORTUNE MICRO; COMPANY PLANS PICK OS

Although Fortune Systems has begun to ship its MC68000-based desk-top system that runs UNIX (MMS, February, p. 26), one of three are reportedly dead on arrival and are being returned. Thompson CSF is believed to have returned its entire initial shipment of 200 units. In addition to the hardware problems, Fortune has also not delivered its promised software, reportedly because documentation has not been completed. Fortune strongly denies any problems with its systems, but offers no further comment.

Meanwhile, the company is expecting to have a tentative agreement in place this month to license the Pick operating system. However, Fortune officials say negotiations with Pick Computer Works have been going on for two years, and the move does not signal a retreat from UNIX. Perhaps to underscore that point, Fortune will farm out marketing of Pick-based systems to a newly formed distribution company that will have exclusive rights to market the systems to dealers and third-party resellers. Although the company is hoping to ship thousands of Pick-based systems per year, most of its small business sales are expected to be UNIX-based products that run Basic Four-compatible application packages.

HONEYWELL ASSAYS MARKET WITH PROPRIETARY MICROCOMPUTER

Honeywell Information Systems is getting ready to throw its hat into the microcomputer ring with the first of a series of products that will be based on the Micro 6, a microprocessor implementation of Honeywell's Level 6/DPS 6 minicomputer architecture using a proprietary chip. Micro 6 resulted from a development effort over the past several years, which reportedly was given the final go-ahead a year ago when the company ruled out use of a standard microcomputer chip from an outside supplier. The 16-bit processor is understood to run both GCOS 6 Mod 200 and Mod 400, the operating systems used in current Honeywell minis. Among the first Micro 6 products are a lower priced version of the company's Infowriter word processor, which should appear by mid-October. The new system is expected to be priced in the range of high-end personal computers such as the two in Digital Equipment Corp.'s Professional series, which sell for $3745 and $4995, respectively. In addition to the new models, the Infowriter program is being expanded with an OEM marketing effort that has been kicked off with an order for more than 1000 units from an unnamed Honeywell OEM.

SYNAPSE TRANSACTION PROCESSOR USES MULTIPLE 68000s

Synapse Computer Corp., Milpitas, Calif., will introduce this month a multiple MC68000-based, fault-tolerant system aimed at the growing transaction-processing market. Deliveries of the Synapse N + 1 are scheduled for September. A typical system includes two MC68000-based general-purpose processors, three MC68000-based I/O processors, memory controllers, 6M bytes of RAM and two 151M-byte disk drives. Price is about $350,000. The firm will offer its Synthesis operating system, a relational DBMS and a transaction monitor in a package with the hardware. COBOL and Pascal are also available. The two-year-old company was founded by Mark Leslie and Stanton Joseph, both formerly with Data General Corp; Elliot Nestle, previously with Perkin-Elmer Corp.; and Stanley Meresman, formerly with Verbatim Corp. Second-round financing of $6 million was secured in May.

HEWLETT-PACKARD TO UNVEIL COLOR-GRAPHICS TERMINAL LINE

Hewlett-Packard Co. is about to strengthen its position in the graphics market with the 2700 series of color raster display graphics terminals. All four models, including the $19,900 base unit dubbed the model 50, feature hybrid architecture that stores images in both raster and vector formats, a large 32K × 32K pixel virtual space and 4096 colors, of which 16 can be displayed simultaneously. Screen resolution is 512 × 390 pixels. More than a dozen microprocessors, headed by an MC68000, off-load graphics functions from the host, providing pan and zoom, multiple windows and a variety of object manipulations. The first deliveries are expected in October.

Breakpoints

MOTOROLA MMUs, Q-BUS HIGHLIGHT MC68000-BASED ALCYON SYSTEM

The appearance of Motorola's MC68451 memory-management unit and the coupling of the MC68000 to DEC's LSI Q-bus (supplemented by a high-speed memory bus) highlight the initial system entry of San Diego-based Alcyon Corp. The standard AWS work station, built around C. Itoh's CIT-101 display terminal, supports as many as four users and includes an eight-slot dual-width backplane, 256K bytes of parity memory expandable to 1M byte and a parallel printer port. An integral DMA Systems 5¼-in. Winchester with 5M bytes of fixed and 5M bytes of removable storage boosts system performance with an average 40-msec. access time. the 68451s provide associative memory mapping for 32 to 64 segments. The larger APX, configured in a DEC-like free-standing office pedestal, supports as many as 16 terminals, 4M bytes of parity memory, a 60M- to 320M-byte Winchester-disk drive and a ½-in. streaming-tape drive. Software for the systems includes Alcyon's UNIX Version-7 look-alike operating system, Regulus, and the company's C compiler. A variety of third-party languages will also be available. The systems, priced from $13,000 to $30,000, are aimed at DEC OEMs in the market for high-performance microprocessor-based systems.

NOETICS READYING 68000-BASED GRAPHICS TERMINAL

Mountain View, Calif., start-up, Noetics, Inc., plans to deliver a 68000-based graphics terminal by December. Said to be priced very low—less than $3500 apiece—the hardware is bit-mapped with a 60-Hz noninterlaced screen. The device reportedly uses some custom LSI for graphics. Plans call for manufacturing the hardware in Korea, which will contribute to its low price. Company marketing vice president Marleen Martin, a former 3Com employee, indicates that Noetics is also planning products using the UNIX operating system, although she does not elaborate. Founded in January by Barry Dickson, Noetics is funded by speech-technology firm Threshold Technology, Inc. The company is running prototypes of its graphics display, Martin says.

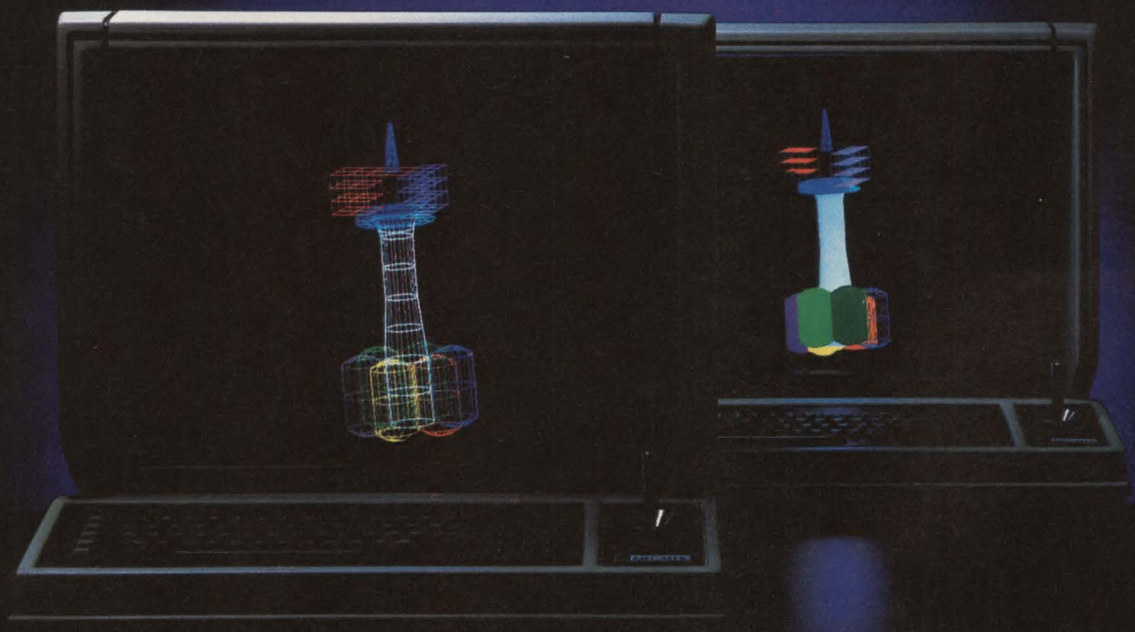
FLAT-PANEL VIDEOTEX TERMINAL UNDER DEVELOPMENT IN ENGLAND

The announcement by IBM Corp. of private Videotex software for the Series/1 minicomputer and the personal computer (see "IBM aims Videotex system at business users," p. 83) should stimulate interest in a compact portable flat-panel Videotex terminal being developed by a British company, Phosphor Products, Ltd., Poole, Dorset. The terminal is designed to plug into a standard telephone socket or acoustic coupler and to accept Videotex pages employing the alphamosaic format pioneered by common carrier British Telecom on its public Videotex service, Prestel. The Phosphor Products terminal will display as many as 24 lines, each with 40 characters, and will employ the company's patented display technology, DC electroluminescence. A layer of phosphorescent powder is sandwiched between two thin electrode panels, each containing hundreds of parallel conductors at right angles to those in the other panel. The powder lights up where the electrical impulse through two conductors crosses.

HP UNVEILS HAND-HELD PERSONAL CPU

Following in the tracks of Panasonic and I/O Industries, whose hand-held personal computers have attracted much attention and orders, Hewlett-Packard Co. next month will begin delivering its HP-75, a 10- × 5- × 1-in. hand-held CPU. The HP-75 uses the same proprietary processor as that included in HP's Series 80 family of desk-top personals, runs on batteries or AC power and has a one-line, 32-character LCD. The 16K-byte unit sells for $995. Memory can be expanded to 24K bytes via plug-in RAM cards. The unit is compatible with all peripherals that run on the HP-IL bus, the company says. Software available at introduction includes application packages for math and engineering, statistics, finance and real estate. HP plans to add graphics (for HP-IL-compatible plotters) and VisiCalc over the next several months. Software can be loaded through the HP-75's built-in magnetic strip reader (like that used in HP's hand-held calculators) by plug-in ROM modules or through tape cassettes.

Whizzard® 7600– Another Megatek First.



Megatek has pioneered dynamic interactive refresh graphics systems for years. Ten to be exact. Our Whizzard 5000 was the first advanced high-quality vector stroke generator. The 7000 modular, high-performance 3-D stroke system followed. Then, the 7250 dynamic, high-speed color raster system and 7290 system, which combined stroke and raster workstations powered by one Megatek Graphics Engine.™ All industry firsts.

Local intelligence

Now, Whizzard 7600. Another first. A new color graphics system with a powerful, user-programmable 16-bit 8086 microprocessor in a local intelligent front-end module. 7600 gives you a dramatic increase in intelligence. Four user tasks—structuring primitives, running applications subroutines or system peripherals—can be easily and simultaneously handled.

Real-time 3-D object rotation

The 7600 offers many other new innovations. Totally interactive real-time rotation of 3-D objects in 16 of 4096 available colors. Three-dimensional surfaces of up to 600 sides can be filled instantly. And, a 3-D surface processor comes with the system while a floating point processor can be added as needed. Scaling, clipping, 2-D and 3-D rotations are easy. You can choose either 4096^2 vector refresh or 512^2 or 1024^2 raster resolutions.

Offloading the host

What's more, this power and increased intelligence actually reduces drain on the host computer. That's because local intelligence and dedicated processors perform all calculations for complex transformations. Local intelligence also manages display lists, event queues and peripheral interaction, further freeing up your computer. Communication between the CPU and the 7600, up to 1000 feet, is by high-speed parallel data transfer. For greater distances, the 7600 is equipped with two standard RS232 interfaces.

Whizzard 7600. Latest advance in color graphics systems from Megatek where "firsts" have been a habit for years. For details, call or write Megatek Corporation, 3985 Sorrento Valley Blvd., San Diego, CA 92121 or (714) 455-5590. TWX 910-337-1270. MEGATEK, S.A., Avenue du Tribunal Federal, 34, CH-1000 Lausanne, Switzerland. Telephone: 41/21/207055. TELEX: 25037 MEGA CH.

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CIRCLE NO. 7 ON INQUIRY CARD

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Finally, there's one full family of printers that covers every business or word processing application—all from C. Itoh, a company known for packing more product into less price; and all distributed exclusively by Leading Edge, a company known for searching out and providing that very thing. Which means that one call to one source can get you any printer, any time you need it, for any purpose.

THE PRO'S.

The Prowriters: business printers—and more. The "more" is a dot-matrix process with more dots. It gives you denser, correspondence quality copy (as opposed to business quality copy, which looks like a bad job of spray-painting).

Prowriter: 120 cps. 80 columns dot matrix compressable to 136. 10" carriage. Parallel or serial interface.

Prowriter 2: Same as Prowriter, except 15" carriage allows full 136 columns in normal print mode. Parallel or serial interface.

THE STAR.

The Starwriter F-10. In short (or more precisely, in a sleek 6" high, 30-pound unit), it gives you more of just about everything—except bulk and noise—than any other printer in its price range. It's a 40 cps letter-quality daisy-wheel with a bunch of built-in functions to simplify and speed up word processing. It plugs into almost any micro on the market, serial or parallel.

AND THE MASTER.

The Printmaster F-10. Does all the same good stuff as the Starwriter except, at 55 cps, the Master does it faster.

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CIRCLE NO. 8 ON INQUIRY CARD

COMPUPRO TO ENTER DESKTOP MICROCOMPUTER MARKET

After eight years as a supplier of S-100 bus board products and components, Compupro, Inc., Oakland, Calif. will try to emulate the system success of S-100 veterans such as Vector Graphic, Inc., and Cromemco, Inc. Its first products, set for introduction this fall, are three systems built around a single-board CPU using Intel Corp. 8085 and 8086 microprocessors. Appropriately dubbed the 816s, the systems start with an entry-level model for $5495, which includes 128K bytes of RAM, dual 1.2M-byte floppies, CP/M-80 and CP/M-86, SuperCalc and Assembler. The high-end model, which supports as many as 16 users, includes 384K bytes of memory, MP/M-8-16 (based on Digital Research, Inc.'s MP/M but said to support simultaneous 8- and 16-bit operations), SuperCalc, Assembler and dBase II. It lists for $8995 and, like the other models, can be upgraded to 1M byte of main memory and is available with a 29M-byte, 8-in. Winchester-disk drive and a tape-cartridge drive. The three models also feature a 20-slot S-100 motherboard.

5¼-IN. WINCHESTER FORTHCOMING FROM START-UP MAXTOR

First hardware from Santa Clara start-up Maxtor Corp. could appear by year-end in the form of a 5¼-in. Winchester with capacities in excess of 50M bytes. Product specifications and pricing are sketchy, but according to one report, the new device could use 3350 double-track density technology, an ST-506 interface and be the first of a series of even higher capacity small Winchesters. The company was founded by ex-Quantum co-founder and marketing vice president Jim McCoy, who takes over as Maxtor president; ex-RMS co-founder Jack Swartz, who joins as vice president of engineering; and Ray Niedzwiecki, formerly with USI International, who becomes vice president of operations.

CADNETICS ADDS OFFICE-AUTOMATION TWIST TO CAD WORK STATION

Look for Boulder, Colo., start-up Cadnetics, Inc., to introduce a low-cost CAD work station in early 1983. The company was formed with initial funding of more than $1 million from Menlo Park, Calif.-based Technology Venture Investments and a group of private investors headed by Storage Technology Corp. president Jesse Aweida. Details on the hardware are not available, but president Bruce Holland says the work station will be influenced by the company's office-automation background: company principals come from Wang Laboratories, Inc., NBI Corp. and Auto-trol Technology Corp.

MPSI TO RELEASE COBOL APPLICATION SOFTWARE

COBOL application software for MC68000-based microcomputers will soon be available from MPSI, Palo Alto, Calif. The company's parent, London, England-based Micro Products Software Ltd., has announced an MC68000 implementation of BOS, its portable operating system that supports the company's MicroCOBOL language on a variety of popular minicomputer processors (MMS, June, 1981, p. 49). BOS also supports a wide variety of accounting packages tailored for U.S. users and vertical packages for applications such as property management and insurance brokerage. MPSI sells through distributors in Atlanta, Philadelphia, Los Angeles and Dallas.

START-UP COMPANY TO UNVEIL ION-INJECTION PRINTER

Atherton, Calif., start-up Algographic Associates will introduce this fall or next year an ion-injection non-impact printer that could possibly be named the Algographic, says a source close to the company. After some five years, R&D has been completed, and company president Evan Ragland has received a patent for the device. The printer uses ions to magnetically attract toner particles for hard-copy output. A similar product introduced by Mississauga, Canada-based Delphax Systems in 1981 (MMS, June, 1981, p. 179) made an encore at this year's NCC show, with some added features.

VME BUS PRODUCTS COMING, ASTRAEA'S DUE NEXT MONTH

Since the announcement last year of the VME bus by Motorola Inc., Mostek Corp. and

Breakpoints

Signetics/Philips (MMS, December, 1981, p. 16), a number of companies have announced their intentions to build boards and systems based on the mechanical and electrical specifications of the standard (see "Motorola brings VME bus to U.S.; Mostek, Signetics ready, too," p. 34). One company, Astraea Computer Corp., Sunnyvale, Calif., expects to have its products out the door next month. The company is building a 68000-based CPU board, a 256K-byte RAM board, a disk controller and a system controller. An I/O controller is in the works, says company founder and president, Ray Burkley. Burkley says boards will be sold to OEMs, with which Astraea already has a few million dollars in contracts.

TECH FILES: A quick look at industry developments

Microbits: Human Computing Resources Corp., Toronto, Canada, says it has begun to work to transport UNIX System III to National Semiconductor Corp.'s NS-16000 microprocessor. The implementation will support C and FORTRAN compilers, and is set to run with the semiconductor maker's 16032 CPU, 16081 floating-point unit and 16082 MMU (MMS, July, p. 20). First-quarter 1983 deliveries are planned . . . . UNIX supplier **Interactive Systems Corp.**, Santa Monica, Calif., has released its enhanced version of Bell Labs' UNIX System III. Called IS/3, the software sells for $17,500 for the PDP version and $23,000 for the VAX. A version is also available for the Z8000 on Onyx Systems, Inc.'s C8002 microsystem. IS/3 for the MC68000 will be ready this year . . . . **Zilog, Inc.**, is sampling its Z8003 and Z8004 virtual-memory processors. The devices are fully compatible with the Campbell, Calif., firm's Z8001 and Z8002 chips and run with existing Zilog MMUs. The 4-MHz versions of the chips sell for $66 (Z8003) and $45 (Z8004) in quantities of 1000.

Minibits: General Automation's search for a 32-bit minicomputer is continuing both internally and externally. Since the company began marketing **CIE System's** MC68000-based, desk-top system under an OEM agreement, internal development reportedly has turned toward a product based on the **Motorola** chip. However, talks with outside vendors have continued and include discussions described by GA as extremely tentative with **Gould S.E.L.** Meanwhile, GA is understood to be contemplating adding the Pick operating system to the CIE product. GA has been distributing Pick-based **Evolution Systems** overseas through its World Trade Division since March. But company officials want a lower priced Pick system and have reportedly grown impatient with Evolution's delayed introduction of a microprocessor-based replacement for its current mini.

Random disk files: Redesigned 5¼-in. Winchesters are expected to be unveiled by **Shugart Associates**, Sunnyvale, Calif., near year-end. The first of these drives, the SA612, will store 12M bytes of data on two platters (compared to the three-platter, 10M-byte capacity of the top end of the company's first small-Winchester line, the SA600 series), and will use manganese-zinc ferrite heads. Shugart could announce two additional small Winchesters at the same time—a single-platter, 6M-byte device and a three-platter, 19M-byte drive. All drives will be ST-506 compatible. Pricing is not available. A spokesman for the company has no comment . . . . The committee developing standards for sub-4-in. diskettes reportedly has reached agreement on a number of key specifications for this media, including bit and track densities and the number of tracks per surface, but no information is final (MMS, July, p. 6). Proposed disk capacity remains under wraps, however. The committee has also come to some agreement on outside diskette diameters, and reportedly only ⅛ in. separates members. Issues yet to be resolved include which centering technique to use and which protective packaging jacket to adopt. Some members are pushing for hard plastic jackets similar to those incorporated into the 3½-in. diskettes developed by **Sony Corp.** and into the 3-in. media proposed by **Matsushita, Hitachi** and **Maxell. Dysan Corp.**, Santa Clara, Calif., and Westford Mass., Dysan spin-off **Tabor Corp.** reportedly are pushing for a smaller sized 5¼-in. floppy disk. The committee's proposal is scheduled to be made public at the end of this month.

Now you don't have to wait for the video terminal you want. C. Itoh's growing family of high-performance video terminals won't leave you waiting for delivery. Or wanting for features.

Our CIT 101, for example, is available right now and not only emulates DEC's VT 100, but gives you far more flexibility and reliability — all for less money! You get 20% faster throughput. Standard 80/132 column performance (24 lines either way). Standard Advanced Video for VAX Edit word processing. And standard expansion card cage for maximum versatility. You also get dozens of other useful features DEC® doesn't offer.

If you need an entry level 80-column terminal, we have that too. No waiting, of course. Our CIT 80 has all the important features of DEC's VT® 101, costs less and includes a long list of most-wanted extras the VT 101 doesn't have. Things like tutorial soft setup, 19.2K baud communications, true half-duplex operation and much more. For increased versatility, there are power supply options and CRT phosphor options.

Both terminals feature modular construction and standard off-the-shelf components (no custom, hard-to-find LSIs are used). And unlike DEC, each is ergonomically designed to reduce operator fatigue.

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In the words of our President, Sirjang Lal Tandon: "Tandon Corporation has been built on a strategy of producing high performance microcomputer peripherals at prices so low that they increase the markets for the computers themselves. If we can help the computer industry create a reliable

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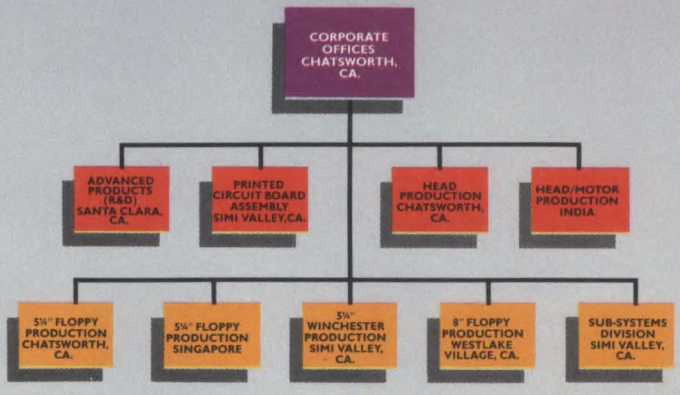
How?

We make sure that our production capabilities exceed our orders by at least 50% so we are always in a position to deliver.

And we use separate production facilities for each of our product lines,



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keeping their individual priorities distinct to further increase productivity and, ultimately, throughput.

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Has it worked?

You decide. In three short years we've become the world leader in small disk drives, shipping more 5¼" floppies, high capacity Winchesters and 8" ThinLine™ floppies than anyone else.

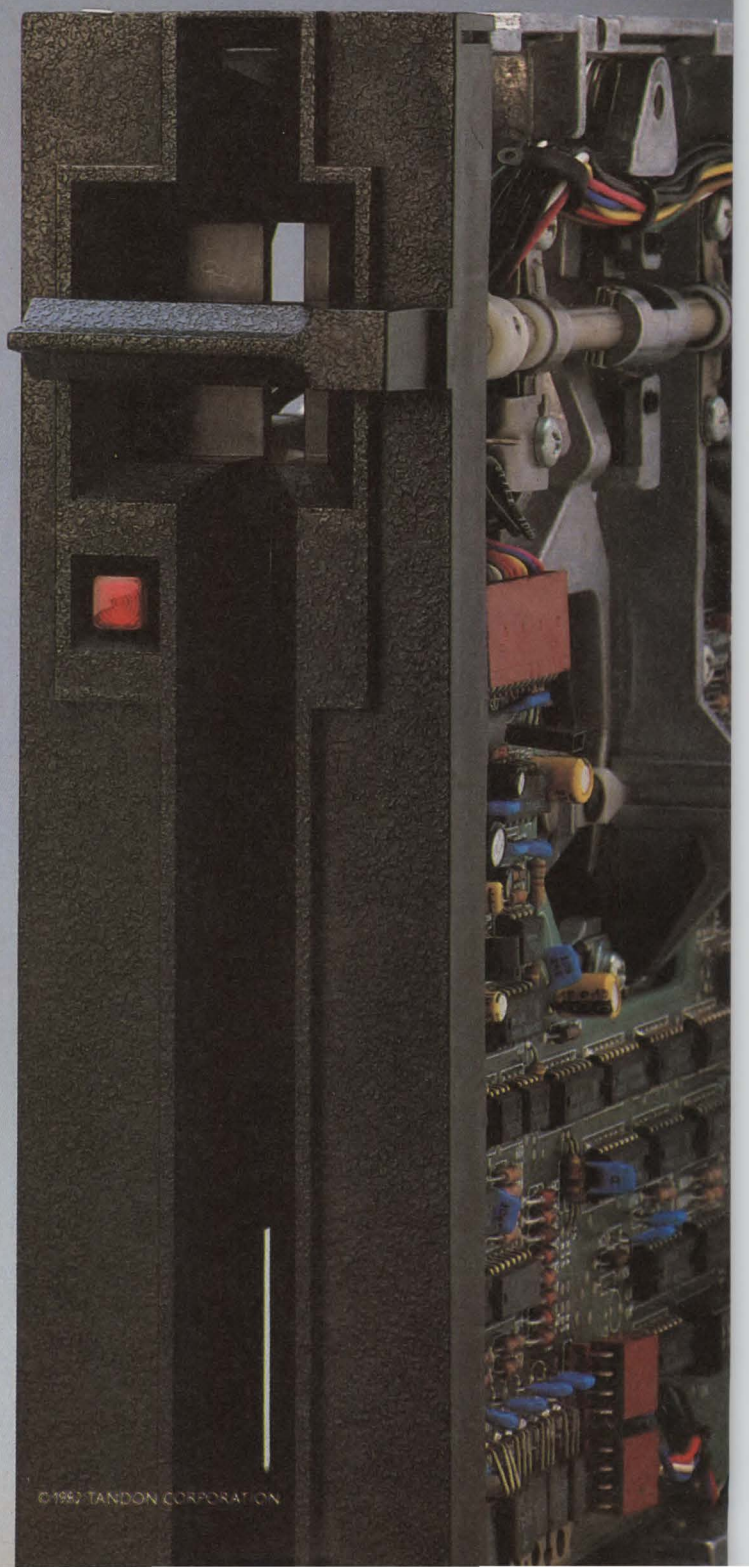
And now we're introducing five new floppy and Winchester drives that push prices lower and capacities higher than the industry has ever seen.

That's why we say we're not competing in the disk drive business.

Times have changed. Three years ago, Tandon wasn't considered competition.

Now we don't consider the competition.

ThinLine is a trademark of Tandon Corporation.



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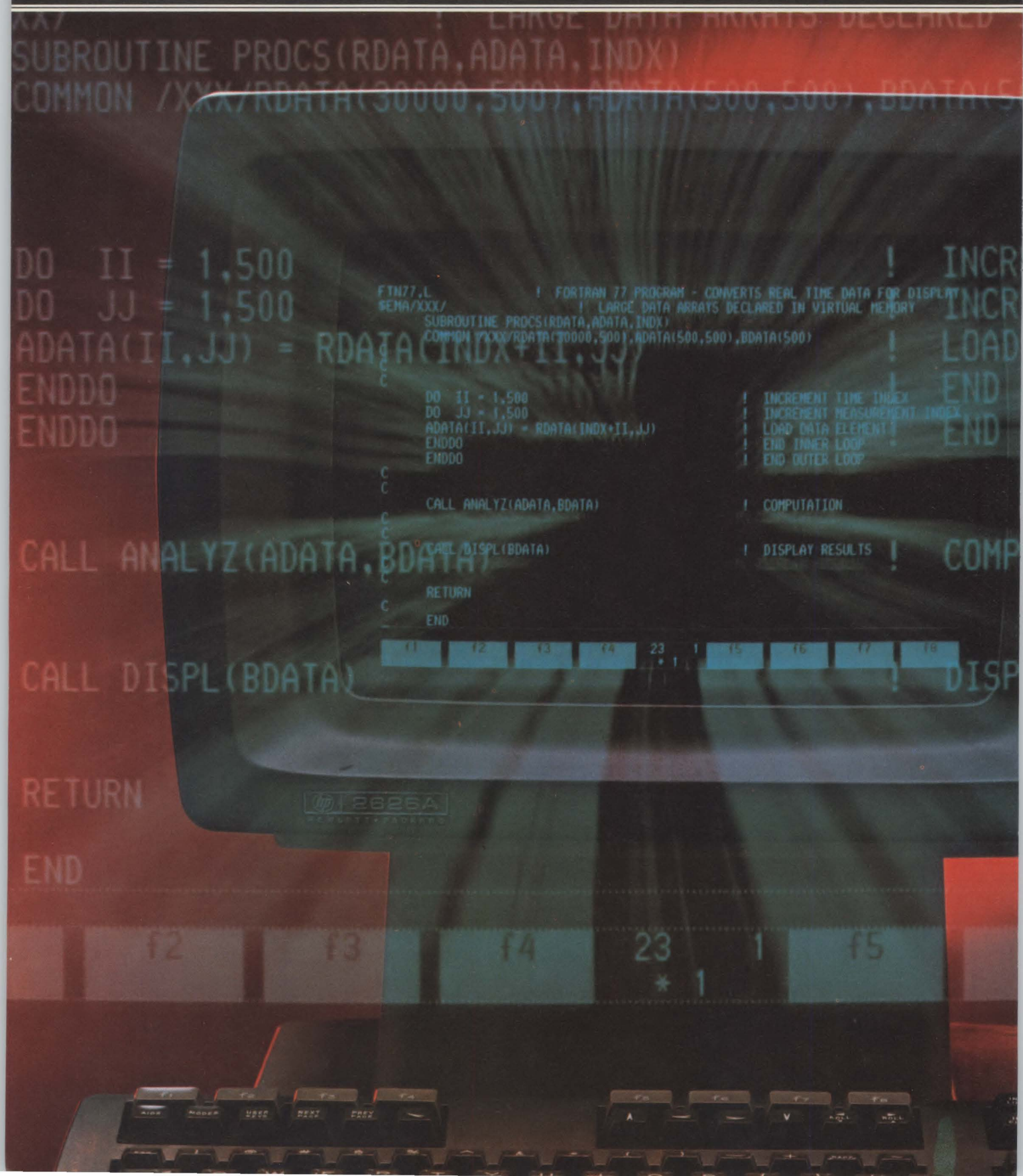
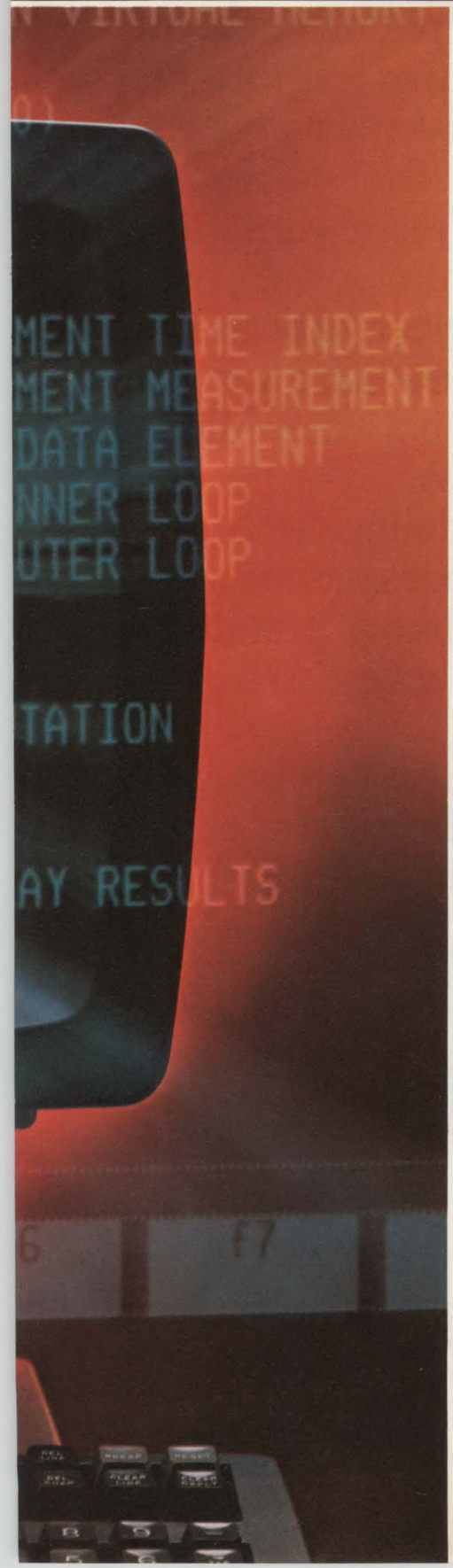
CIRCLE NO. 11 ON INQUIRY CARD

The HP 1000 you'd think you were



Model 65: sitting at a mainframe.



Now you can tackle your large applications without breaking your budget. That's because our new HP 1000 Model 65—with a powerful real-time operating system and advanced memory management scheme—can handle jobs that previously required a mainframe computer. And do it at a minicomputer price.

Extended code space for programs. Virtual memory for data.

The key to the Model 65's new power is our enhanced RTE-6/VM operating system. Using an Extended Code Space segmentation scheme, RTE-6/VM lets you compile, load and execute large programs (approaching 25,000 lines of FORTRAN code), or convert them from other computers. And because RTE-6/VM uses a virtual memory design, these programs can access a huge 128 megabytes of data—transparently. So your programs can virtually be as large as the application requires.

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A Model 65 development system gives you maximum HP 1000 power in one fully-configured package. You start with RTE-6/VM, floating point hardware and one megabyte of high-performance main memory. You also get our award-winning IMAGE data base management system; FORTRAN 77, Pascal and Macroassembler; a 16 Mb fixed disc with integrated tape cartridge; and a powerful graphics terminal to use with our Graphics/1000-II software. All for less than $65,000.

A one megabyte Model 65 development system is priced at under $65,000.

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If you're a software supplier, just picture *your* big applications on the Model 65. The cost of the "total solution" to your customer will be significantly lower. Which means more systems can be sold. And that's just the idea behind our new HP PLUS program, where selected software suppliers team up with HP to bring competitively priced, quality solutions to the marketplace. And if you're an OEM, our volume discount schedules make these systems even more attractive.

For more information, call your local HP sales office. Or write Hewlett-Packard, Attn: Joe Schoendorf, Dept. 08128, 11000 Wolfe Rd., Cupertino, CA 95014.

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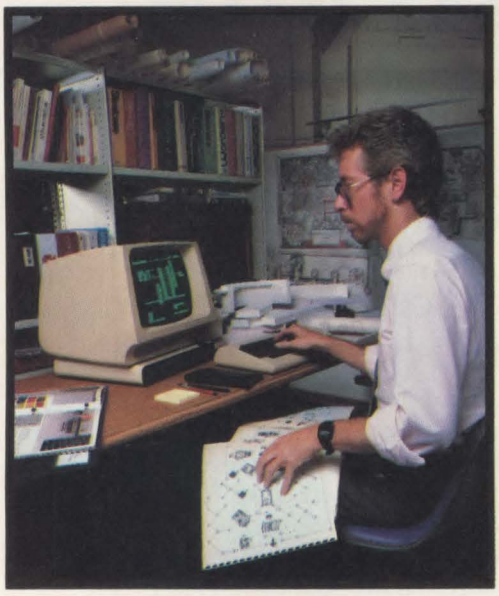
CIRCLE NO. 64 ON INQUIRY CARD

The new DMS-86 makes any terminal a 16-bit computer network station.



Slimmer than a telephone book, the hot new DMS-86 turns any terminal into a HiNet™ Local Area Network station. So now, a HiNet network can run 8 and 16-bit software simultaneously. Pay only for the power you need—exactly where you need it.

HiNet is a complete hardware/software local area network—flexible, inexpensive, fast—and from a single source.

The DMS-86 is perfect for financial modeling, MRP, scientific analysis, or word processing—any processor-intensive application. Its large internal memory acts like a "pseudo-disk," providing up to 1MB RAM and super-fast access to frequently used data in "working memory."

The CP/M®-based DMS-86 combines an 8086 processor (and optional 8087 co-processor) with 1KByte network buffer and from 256K to 1MB RAM, three RS-232C serial ports, an 8-bit bidirectional parallel port, and the HiNet networking port.

Bring 16-bit response to your favorite terminal. Check out HiNet and the small but mighty DMS-86.

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AT&T begets American Bell, swiftly hails network service

Almost as quickly as hot information travels by word of mouth, American Telephone & Telegraph Co. announced a subsidiary with a network service and almost 1000 employees only five days after the Federal Communications Commission approved a capitalization plan for the new company. The subsidiary, called American Bell, Inc., came with great fanfare after a long fermentation (MMS, March, p. 195; February, p. 19).

The Justice Department's antitrust case against AT&T began in late 1974, and a proposed settlement was reached early this year when AT&T agreed to shed its 22 local operating companies. In return, AT&T kept Long Lines, Western Electric Co. and Bell Labs, and was given the freedom to take those operations into unregulated high-technology businesses. The first result was the formation of American Bell, which almost simultaneously released the Net 1 network service to link dissimilar terminals and computers.

Salvatore J. Barbera, formerly assistant vice president and director of major projects in AT&T's business marketing organization, is chief executive officer of the new entity, headquartered in Parsippany, N.J. Other major locations are Lincroft, N.J. (an R&D team from Bell Labs), and Somerset, N.J. (marketing). There are five district sales offices. American Bell commenced operations on July 1.

While many aspects of the company have an AT&T air, AT&T is adhering closely to FCC guidelines to keep its subsidiary separate.

In announcing Net 1, formally called Advanced Information Systems/Net 1 service (the name might change because Ungermann-Bass, Inc., intends to protect the name trademark on its Net/One local-area network), American Bell talked in generalities both from a pricing and capabilities standpoint. The service (a revised version of the earlier Advanced Communications Service) essentially allows customers to connect multi-vendor terminals to each other, a central computer, a like terminal and a so-called service point through a common carrier linked to one of 17 service points to be set up by American Bell.

A service point is the location at which the customer gets and pays for service. Each service point has a Digital Equipment Corp. VAX-11/780 supermini, which serves as the main processor and houses the network logic and interpreters, an IBM Corp. Series/1 computer for wide network protocol interfacing and Western Electric modems for line access. The system uses the VAX VMS operating system.

The salient points of the service include:

- Terminal interfaces, or plug-compatible equivalents, which are Teletype model 33 ASCII character and block modes, and IBM 2741 asynchronous contention; IBM 2740-II asychronous polled; IBM 2780/3780, IBM 3275 synchronous contention; and IBM 3271 synchronous polled. Barbera says support of these older terminals represents about 84 percent of existing terminals.
- Host or plug-compatible interfaces, which are ASCII asynchronous contention, IBM 2780/3780 synchronous contention and IBM 3271 binary synchronous polled. SDLC initially will be provided, with SDLC/SNA to follow.
- Three modes, which American Bell has defined: common (for compatibility between unlike devices by defining the least common denominator formats for both end-

points, such as programs), class specific (standard data of specific terminals can be moved) and transparent (data are not translated, but interrupt and disconnect format controls are supported).

- The ability to store application software and data as part of the service. Data consist of customer files that are accessible to application programs via a read, write/delete or append request.
- Two languages targeted for customer programming in network nodes. The Net 1 customer programming language is a subset of ANSI COBOL. The Net 1 forms-definition facility lets customers define terminal form and screen displays and establish edit-validation criteria. However, customers can access only certain layers of software.
- Authorized use of Net 1 protected by system software. For example, Net 1's screening procedures determine the rights of a program to execute an application program and the access rights an application program has to a data file. A customer can program in even more authorization clearances.
- Basic application programs, including a standard message application package and a standard host-interface package.

Salvatore J. Barbera, *American Bell's chief executive officer, began his career at the Bell System as a switchman in New York.*

To use Net 1, customers must have terminals and host computers that are compatible with the service, modems or digital interface equipment and a transmission means to the service point. The modems and digital interfaces must be Bell System or compatible models.

The new company encourages software houses and customers to write application programs, and intends to offer technical consultations.

Figuring out pricing for Net 1 use can be even more difficult than figuring out a telephone bill, and is based on the same premise: a customer is charged only for use (see "Putting together Net 1's pricing pieces," p. 18). New president Barbera notes, "There is no up-front charge. A customer buys access through a carrier and pays for usage." For the first time, though, a service under the AT&T umbrella will have no charges for distance.

American Bell officials stress that Net 1 service will give smaller users more processing flexibility. Howev-

PUTTING TOGETHER NET 1'S PRICING PIECES

Pricing for components of American Bell, Inc.'s Net 1 service is complex, and probably too high for single small users. However, the network may be worthwhile for large corporations with small distribution arms.

Private-line analog ports have a $10 per month fee for each network standard address, which originates and terminates communications. There also is a $450 nonrecurring charge. A 300-bps port is $250 monthly, while a 9600-bps port is $1100 monthly. Private-line digital ports are $10 per month for each network standard address, plus a $300 nonrecurring charge. A 2400-bps port sells for $400, while a 9600-bps port sells for $800, each monthly fees. Dedicated dial ports have a $450 nonrecurring charge. A 1200-bps port is priced at $275 monthly, while a 4800-bps port is $700 monthly. Public dial ports are priced at 7¢ per min. for rates as high as 1200 bps, and 16¢ for 4800 bps. There are middle-range prices for ports with other baud rates. A billing identifier charge is $1 per month. Automatic dialing is $30 monthly, plus a $150 nonrecurring charge.

Storage pricing is 10¢ per kilobyte per month for reserved storage, and 1¢ per kilobyte per hour for demand storage.

Interactive processing runs 2¢ per AIS Net 1 resource unit. An ARU, the smallest number of computer cycles sold, would, for example, represent 100 msec. on a DEC VAX-11/780 processing application. Noninteractive processing charges are 0.5¢ per ARU.

To move information in the network, a fee of $1.75 per kilopacket (a packet holds 128 characters) is assessed for call service. Priority message service goes for $2.25 per 100,000 characters plus a 5¢ network standard address charge, and standard service goes for $1.50 for the same number of characters and the same address charge. Customers can get confirmed or timed deliveries, at 20¢ and $1 per address, respectively.

All the pricing means that a customer with a 300-bps personal computer who wants to move 1 kilopacket of information from point A to B would pay about $2.97, whereas calling directly would cost about $2.10, says Harry Newton, president of New York-based Telecomm Library, a telecommunications consulting firm. However, American Bell officials point out that the network does pay if the user wants to change or retransmit an incomplete packet. "Our charge is for a packet delivered successfully, independent of time or multiple tries. This is not true of normal telephone line (charges)," notes American Bell's chief executive officer Salvatore J. Barbera. He says it is better to use a telephone network for straight batch processing at higher speeds.

er, all small users should not get their hopes up for at least five to 10 years. Harry Newton, president of New York-based Telecom Library, a telecommunications consulting firm, says the service would be good for small users within a big network, such as local distributors for a large pharmaceutical company. The pharmaceutical company, however, would be the customer, not the small user.

Newton and others in the industry also question American Bell's ability to compete in an unregulated market, particularly because of its one-product history with AT&T.

"The Bell System has been a closed nation, with Bell Labs designing, Western Electric manufacturing and AT&T marketing products," says Jean Yates of Yates Ventures, a consulting firm specializing in Bell and the UNIX operating system. Nonetheless, one cannot discount the company's financial resources, and one of the most innovative laboratories in the world—Bell Labs. American Bell could meet its goals to be profitable in its first year of operation merely by selling equipment to its operating companies, Yates says. American Bell has probably invested $1 billion in its project to date.

American Bell's next step is to offer computer equipment, maybe the 3B20 supermini based on Bell Labs' 32-bit microprocessor. The VAX-11/780 equivalent is being sold to Bell companies for one-half the VAX's price, says Yates. The product uses UNIX, and Yates considers this writing on the wall for DEC. "UNIX is best as a file-transfer standard between multi-vendor office-automation systems," she says, speculating that this is how the UNIX buried in Net 1 is being used.

Because American Bell will have limited capacity for 18 months, the service will not be available at all 17 service points until the third quarter of next year.

—*L. Valigra*

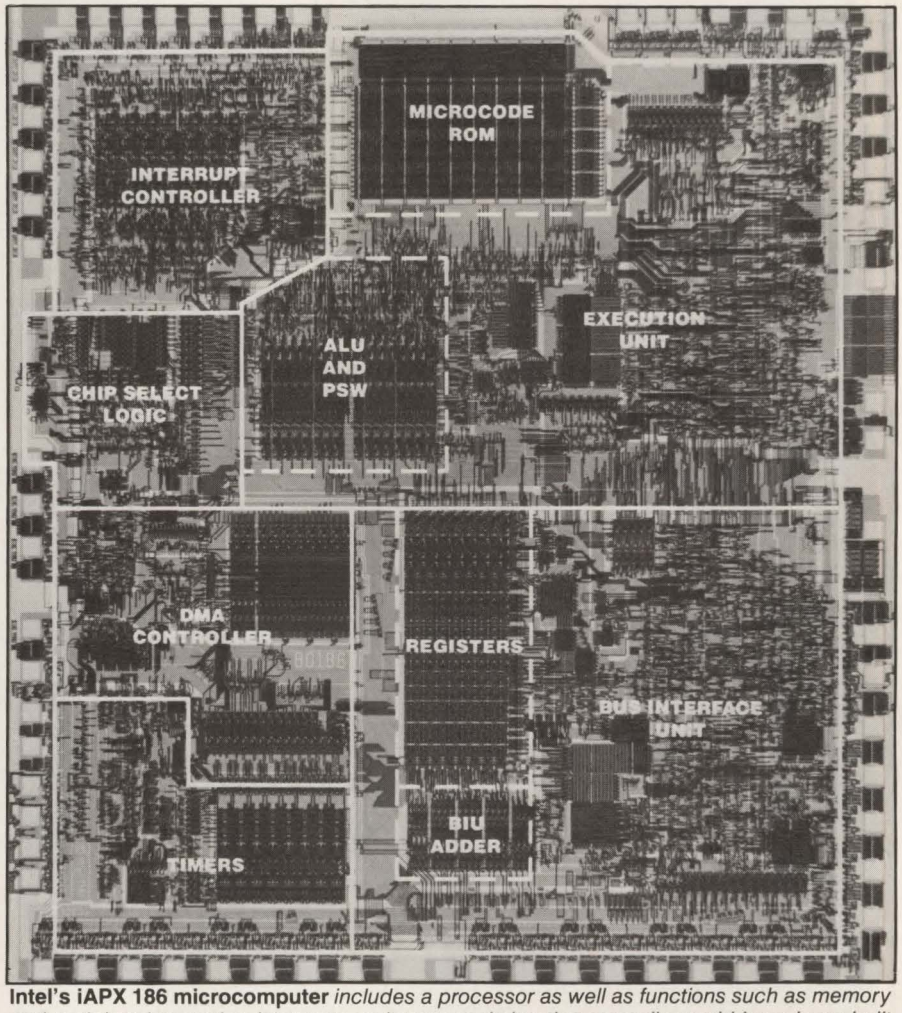
Intel 186 single-chip micro cuts system costs

As the sizes and prices of peripheral devices such as Winchester and floppy-disk drives drop, so too do the sizes and prices of small, microcomputer-based systems. And while the processors upon which these systems are built have not been very expensive—an 8086, for instance, sells for less than $30 in volume—other LSI and TTL parts to handle functions such as memory and peripheral control or interrupts and system timing have added to total cost.

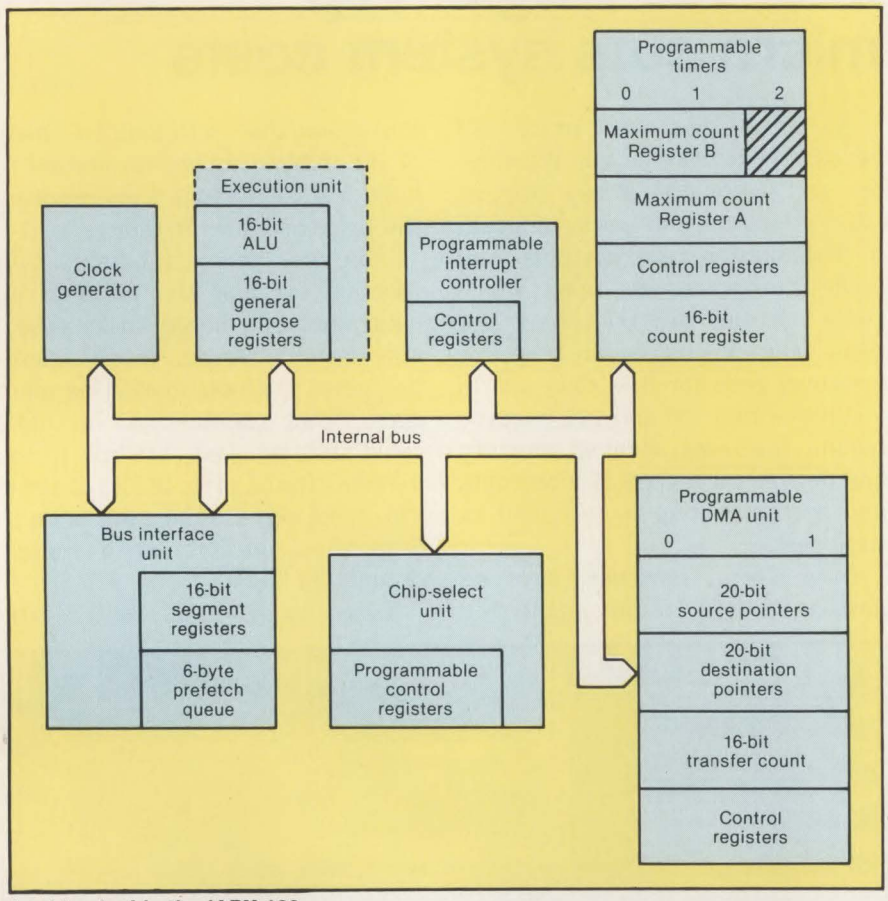
Intel Corp., however, says its new iAPX 186 16-bit single-chip microcomputer can eliminate many of the extra components needed to build a small system, thus reducing the price and size further.

"The 186 lets you build a CPU function for half the price of an equivalent CPU based on an 8086," says Bob Patterson, Intel's microprocessor products marketing manager. Total system cost, he adds, could be reduced by 25 to 50 percent. Initial price in lots of 100 is $50. Intel expects the 186's price to drop to about $30 when volume production begins.

Twice as powerful as a 5-MHz



Intel's iAPX 186 microcomputer *includes a processor as well as functions such as memory and peripheral control or interrupts and systems timing that normally would have been built using separate TTL and LSI. By including more functions on the chip, designers can halve the price of building equivalent CPU function with the popular 8086.*



Looking inside the iAPX 186.

8086, the 186 includes an on-chip interrupt controller, two 2M-byte-per-sec. direct-memory-access channels and three 16-bit programmable counters/timers. Additionally, integrated chip-select circuitry controls memory or peripheral subsystems. An 8-MHz clock generator provides timing for the 186 and external circuits. Local bus control, which eliminates the need for extra data bus transceivers, is also on chip.

Using the 186 rather than the 8086, chip count can be cut by 15 to 20 devices, Intel officials say. Patterson says that all a typical small-business system would require besides the 186 are data-communication components, RAM or ROM and special-purpose peripheral controllers, such as those for video displays or disk drives.

The company has added 10 new instructions to the 186's instruction set including some to speed number crunching and a few implemented in microcode. However, the instruction set remains compatible with 8086 and 8088 software, the company says, including operating systems such as Digital Research Inc.'s CP/M-86 and Microsoft's XENIX, available through Intel's third-party software-distribution operation. Intel says more than two dozen independent software vendors are supplying operating systems, languages or applications packages for the iAPX 86 family of processors, of which the 186 is a member. Languages supported on the 186 include FORTRAN, Pascal, PL/M and assembly. Intel plans to add ASM-86/88 and PL/M-86-88 next month.

Considering the advantages claimed for the 186, such as low price, 8086 compatibility and the presence of the top-end iAPX 286 (MMS, April, p. 52), one wonders what Intel intends to do with the 8086. "The 8086 will hold for certain applications," says Patterson. "It's still a high-volume product, and we'll continue to ship it in volume because of the number of designs in production." In the long term, however, Intel expects the 186 and 286 to garner the design wins, he says. "There aren't too many reasons to design with the 8086," Patterson says. "We see the 186 replacing it for new designs."

The 186 is available in sample quantities. Production quantities are scheduled for deliveries during the first quarter of 1983.

—Larry Lettieri

OLIVETTI OPE FOLDS U.S. OPERATIONS

Olivetti Peripheral Equipment (OPE), the Tarrytown, N.Y., fully owned subsidiary of Ing. C. Olivetti & Co. S.p.A., Italy, has folded its operations, and combined them in a joint venture for R&D, manufacturing and marketing of peripheral products with Ann Arbor, Mich.-based disk-drive manufacturer Irwin International, Inc. Samuel N. Irwin, chairman and cheif executive officer of Irwin, will be president of the new venture, called Irwin Olivetti, Inc., which will be located in Ann Arbor. Olivetti, Italy, an early investor in Irwin International, will own 35 percent of the venture, which may go public in the future. Irwin Olivetti will represent Olivetti in North America for all its OEM peripherals, including a full range of printers and magnetic-memory systems. The venture will continue to make Irwin International's high-performance 5¼-in. Winchesters.

CompuStar™

CompuStar's 255-User Controller
shown with a 96MB Disk Storage System.

The Best Made Better

When we unveiled our CompuStar™ multi-user terminal system just over a year ago, we thought we had created the most powerful, lowest-priced multi-user computer we would ever manufacture. We were wrong. Today, we've made our best even better!

Our newly redesigned CompuStar™ boasts the same performance statistics that made its predecessor such an overnight success, plus a host of exciting *new* features. CompuStar users now get the added benefits of dual character set capability, an expanded library of visual attributes including reverse video, underlining and below-the-line descenders, an enhanced disk operating system and Microsoft† BASIC — all at no extra cost! And single-user systems now start at as little as $2995.

There are four types of CompuStar™ workstations (called Video Processing Units or VPU's) that can be connected into a variety of central disk systems with 10 to 96 megabytes of multi-user storage.

Up to 255 VPU's can be tied together to form a massive multi-user network. Or, you can start with only a single VPU and easily expand your system as your processing needs become more sophisticated. But whether you start with one or one-hundred VPU's, you'll probably never outgrow your CompuStar. Unlike other systems, you configure the CompuStar the way *you* want it . . . connecting any combination of VPU's in a "daisy chain" fashion into the central disk system. And since each VPU has its own twin Z80 processors, its own CP/M* operating system and a full 64K of internal memory, (not to mention disk capacities of up to 1½ million bytes), overall system response time remains unbelievably fast! And that's a claim most of the other multi-user vendors just can't make.

Inside our new CompuStar you'll find a level of design sophistication that's destined to establish a new standard for the industry. A series of easy-to-service modular components has been engineered to yield the most impressive reliability figures we've ever seen. But CompuStar users are not only thrilled with our system's performance (and the miserly few dollars they spent to get it), they also have the peace of mind of knowing that Intertec's comprehensive customer protection and field service programs will insure their total after-the-sale satisfaction.

For more information on what just may be the last multi-user microcomputer you'll ever (have to) buy, ask your dealer today about our all new CompuStar™ system. Or, contact us at the number and address below. We'll gladly explain how we've made our best . . . even better!

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CIRCLE NO. 12 ON INQUIRY CARD

New antitrust policies ease company mergers

Illustration by Michael G. Cobb

Minicomputer, home-computer and semiconductor companies should be able to merge with relative impunity under the terms of new antitrust policies announced by the U.S. Justice Department and the Federal Trade Commission. Government officials say that of the three, only the minicomputer industry has concentration levels of any concern. Even in that industry, the top four firms account for only 50 percent or less of the market. IBM Corp., Digital Equipment Corp., Data General Corp. and Wang Laboratories, Inc., are among the leading companies.

While the home-computer industry in the late 1970s was dominated by Tandy's Radio Shack division, a number of companies including Apple Computer, Inc., Commodore Business Machines Corp., Timex, Sinclair and IBM have entered the market, increasing competition. Government officials rate even the semiconductor industry, with such giants as Texas Instruments Inc., Motorola, Inc., and National Semiconductor Corp., as only "low to moderately," concentrated.

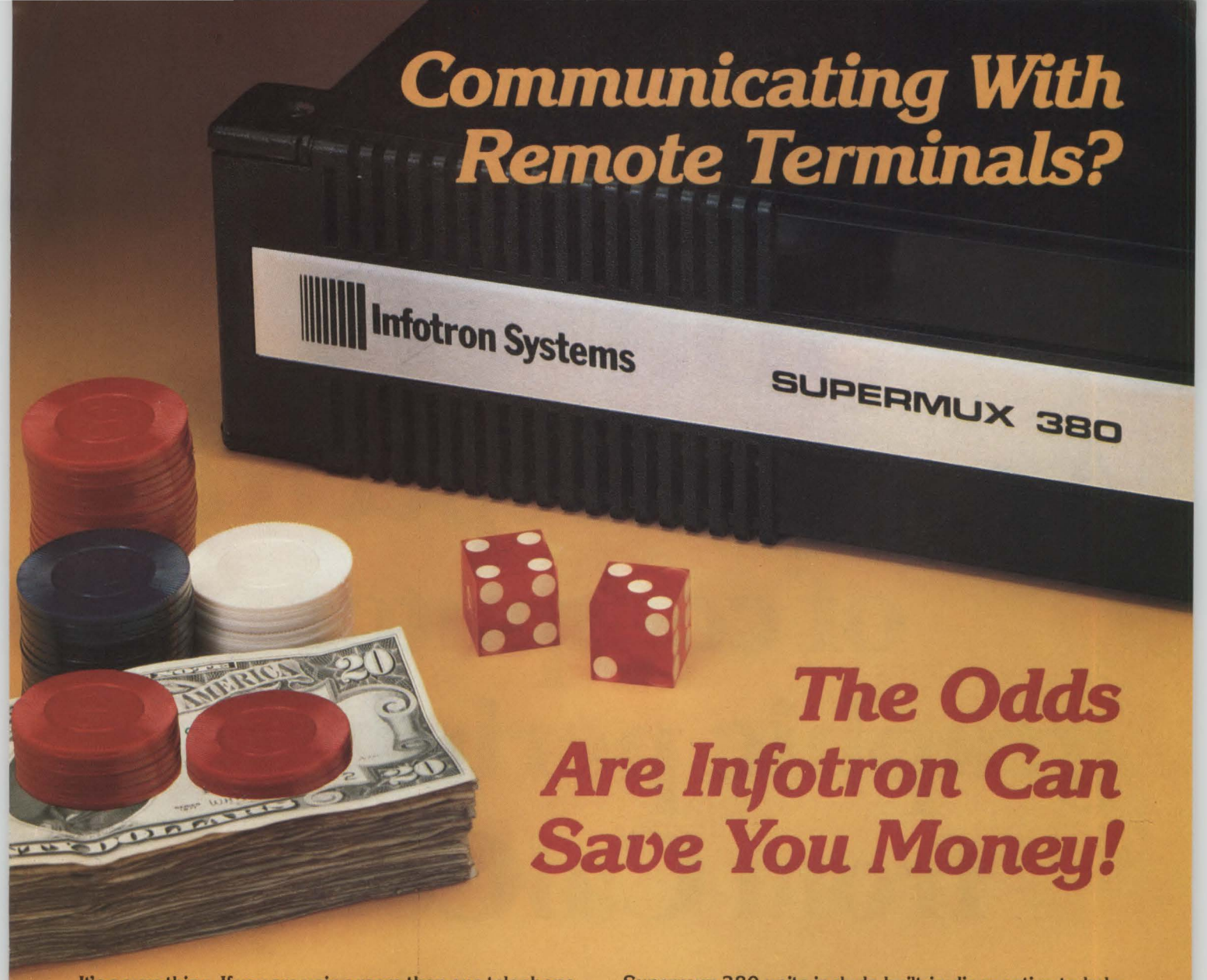
Even in highly concentrated industries in which the top four companies account for 75 percent of the market, the government intends to permit more corporate mergers. Assistant Attorney General for Antitrust William Baxter says the government's previous merger guidelines, issued in 1968, were unduly restrictive. For example, in highly concentrated industries in which four firms held 70 or 75 percent of the market, the old guidelines would have permitted, at best, two firms with a 4-percent share each to merge without a government challenge. Under the new guidelines, companies that each have 7 percent or more of the market could merge.

In low or moderately concentrated industries, such as home computers and semiconductors, the new guidelines for horizontal merg-

CHEMICAL QUADRUPLES CHIP CAPACITY, SMALLER MINIS MAY BE ON THE WAY

The smallest minicomputers on the market today could be half as big and twice as useful next year through the use of a chemical that helps make wafer-like microcircuit chips even denser, according to GAF Corp., San Mateo, Calif. Scientists at GAF developed a chemical they claim can double—or even quadruple—the capacity of microchips. Called an electron beam resist, Gaftronic EB-46 permits circuits 150 times thinner than a human hair to be etched on chips the size of snowflakes. GAF's E-beam resist has already been used to etch half-micron circuitry. That's less than half the size of today's 1.2-micron standard for the microelectronics industry. To get this precision, metal-plated glass is coated with 1/50,000 in. of the polymer-based chemical and exposed to electron beams. Ultra-fine lines appear where the electrons meet the chemical. This process is said to produce chips with finer and more accurate detail than was previously possible. This combination of electronics and chemistry has the company looking toward devices containing 256K-bit capacity by the mid-1980s. Today's chips can handle as many as 64,000 cells, a huge increase over the 1000-bit chips first produced in 1970.

Communicating With Remote Terminals?



The Odds Are Infotron Can Save You Money!

It's a sure thing. If you are using more than one telephone line per site to talk to remote terminals, Infotron can save you money. Our Supermux 380 Statistical Multiplexers pay for themselves by concentrating data from up to eight asynchronous terminals over a single telephone line. You save the cost of the extra lines and you save even more by including a built-in data set.

Supermux 380 multiplexers actually beat the odds in protecting data from telephone line "hits" that can cause errors. Data is checked and retransmitted if necessary, all transparent to existing hardware and software. And Supermux 380 units include built-in diagnostics to help pinpoint line, data set and multiplexer problems.

The odds are you won't beat the Supermux 380 for reliability and value and—you won't beat Infotron either. We've been a leader in data communications since 1968. We have a full range of products to reliably transmit data across the world or across the street—network concentrators, switching devices, statistical multiplexers, wideband multiplexers, modems and test equipment. Infotron, a sure bet.

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CIRCLE NO. 14 ON INQUIRY CARD

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Source:

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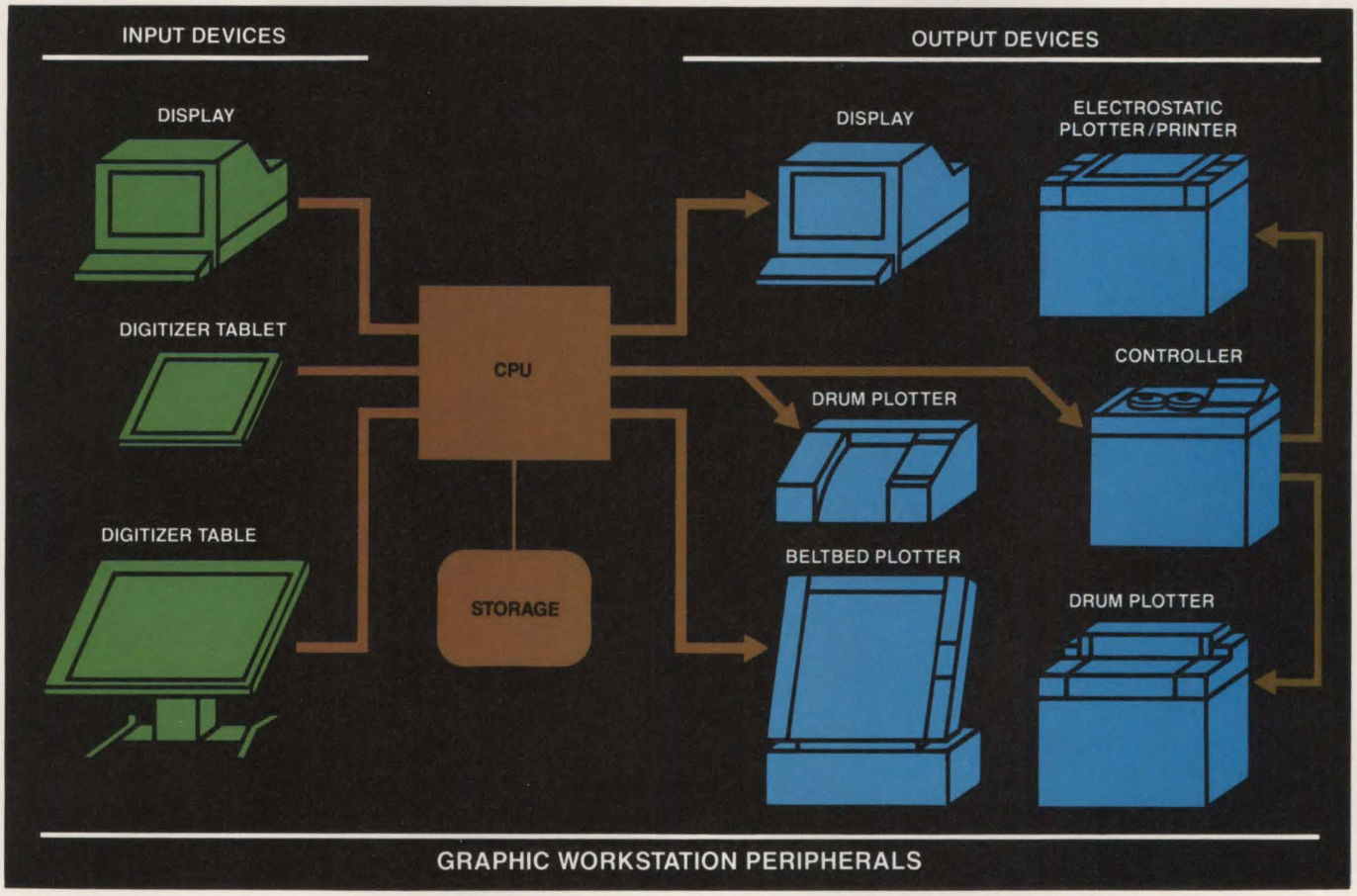

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Plotting Area - 48" x 82"
Speed - 30 Inches/Second

Beltbed Plotters:
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CIRCLE NO. 43 ON INQUIRY CARD

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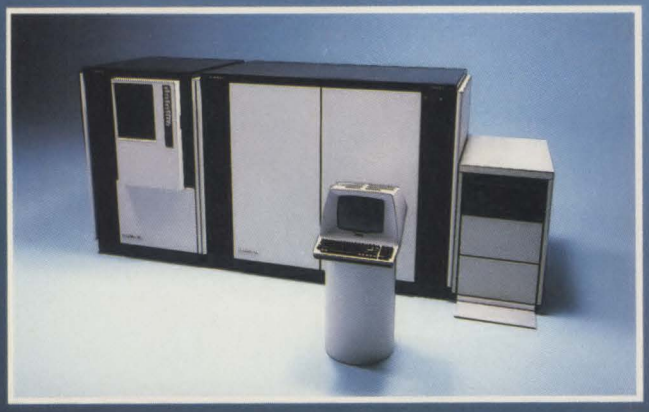
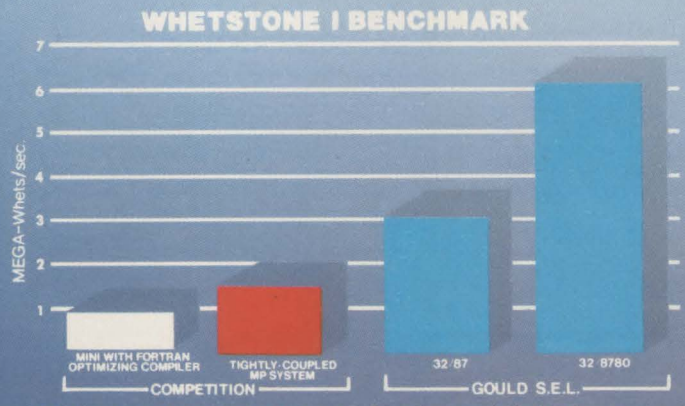


Just check out the chart to see how significant the lead really is.

You'll also notice that the traditional K-Whet scale just wasn't adequate for displaying the operation of the 32/8780. Our strength needed measurement in millions, not just thousands.



Results were achieved using system configurations equivalent to those described in published benchmark data and the software tools methodology available as standard Gould S.E.L. products.

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Electronics & Electrical Products

CIRCLE NO. 83 ON INQUIRY CARD

ers—those among competing companies—are even less restrictive. One reason is that horizontal mergers are not measured by the complex Herfindal Index, which tallies company market-share concentration levels. The index is determined by squaring a company's market share in an industry and adding the squares of the potential merging firms.

Under the Herfindal measure, Baxter says, the department is not concerned if an industry index reaches 1000. An industry with 10 firms, each holding a 10-percent market share would have an index of 1000. Attorney General William French Smith says an index of 1000 could correspond with a four-firm concentration level of 50 percent, about the same as that of the minicomputer industry.

In markets with an index higher than 1800 (about six equally sized companies), Smith says, mergers are a matter of significant competitive concern, but the department will resolve questions in favor of challenging mergers.

The Justice Department notes that most noncompetitor mergers will escape government enforcement actions. Such "nonhorizontal" mergers include vertical and conglomerate mergers. Vertical mergers are among companies in the same industry, but at different levels of the distribution chain. Conglomerate mergers involve companies in different industries. Those kinds of mergers would permit computer and semiconductor companies to move into the communications, data-transmission or any other attractive industry. The department notes it will pay particular attention to possible collusion at the retail level in vertical mergers.

James Miller III, chairman of the FTC, generally endorsed the Justice Department's merger guidelines, and says the FTC will also consider such things as barriers to entry and technological changes.

19 companies back ECMA local-network standards

On June 22, after a week of last-minute efforts to line up support, 19 companies from six countries announced they would back a set of local-area-network standards proposed by the European Computer Manufacturers Association. The ECMA standards will be submitted to the International Standards Organization for approval as worldwide standards. A key factor enticing many of the companies into supporting the ECMA proposals, which address the physical, data-link and transport layers of the seven-layer ISO model, is that the layer 1 and 2 ECMA standards are largely compatible with Ethernet.

The strong show of support for the ECMA standards followed months of well-publicized debate between the Ethernet camp and the Institute of Electrical and Electronics Engineers 802 Committee (MMS, June, p. 26; February, p. 17). ECMA's standards take a middle road between the two factions, and as a result, permit both the Ethernet backers and the 802 proponents to view the ECMA proposal as a victory for their own side.

Although it followed the 802 work from the beginning, ECMA didn't position itself as an intermediary in the 802/Ethernet debate until early this year. Maris Graube, chairman of the 802 committee, says ECMA basically adopted the parts of the 802 work that it liked, "and helped us resolve some of the issues we were still debating." Graube says the 802 document and the ECMA standards are the same except for a difference in the packet-framing delimiter. "So it confirms much of what we've been doing," Graube says.

Dara Hekimi, secretary general of ECMA, agrees with Graube, noting that there has been "collaboration and cooperation" between the two groups. But Pat Coen, chairman of the England-based Logica VTS, supports rumors that ECMA was losing patience with the 802/Ethernet stalemate. Referring to the ECMA standards agreement, he says, "The main pressure that led to the agreement was simply that we were tired of waiting for something to emerge from the U.S."

The framing delimiter issue was the major remaining difference between Ethernet and 802, and because ECMA accepted the Ethernet

Support for the proposed ECMA local-area network standards has come from these 19 companies

Cii-Honeywell Bull
Computer Technology, Ltd.
Digital Equipment Corp.
Fujitsu, Ltd. (U.K.)
Hewlett-Packard Co.
Intel Corp.
Information Technology, Ltd.
International Computers, Ltd.
Logica VTS
L.M. Ericsson
Mitel Corp.
Network Technology, Ltd.
Nixdorf Computer Corp.
Office Technology, Ltd.
Olteco Olivetti Telecom
Siemens Corp.
3Com Corp.
Three Rivers Computer Corp.
Ungermann-Bass, Inc.

approach to this issue, the Ethernet backers also view the ECMA position as a success for their side. The Ethernet firms say once the delimiter issue was resolved, they could accept the other "minor" changes required by their backing ECMA.

The minor changes required by the Ethernet forces involved a few hardware modifications, such as an improved grounding technique, and some software changes at the data-link level. Despite these changes, says Ralph Ungermann, president of Ungermann-Bass, Inc., Santa Clara, Calif., the installed base of Ethernet hardware and the soon-to-be-available Ethernet chips are hardware "totally compatible" with the ECMA standards.

"I think 802 really underestimated the impact on Xerox and on other companies like us if we had to go back and change the framing delimiter on our installed hardware," Ungermann says. "Things like grounding can be changed without changing the very expensive Ethernet controller boards."

Bob Metcalfe, president of 3Com Corp., Mountain View, Calif., and the developer of Ethernet when at Xerox, says endorsing ECMA standards does involve small concessions by Ethernet backers, but says he's happy to make them if they help bring about a single, worldwide carrier-sense-multiple-access/collision-detection (CSMA/CD) local-networking standard. "If admitting that concessions were made helps smooth some feathers and get the egos out of the way, then let's admit it," he says.

The Ethernet "Blue Book" specification and the 802 proposal are "about two degrees apart," says Metcalfe, adding, "Reality will not accept ECMA and 802 and Xerox, DEC and Intel being close but not identical."

Graube at 802 agrees that "close isn't good enough" in the standards world, and that it's likely 802 will move to accept the ECMA/Ethernet framing approach. Voting on the outstanding 802 draft was scheduled for last month, and some of the negative comments received probably addressed the one remaining difference between ECMA and 802. "The delimiter business is going to be resolved very shortly," Graube predicts.

Although the main attention on the ECMA standards and their endorsement focuses on the layer 1 and 2 Ethernet-related protocols, some of the supporting companies view the proposed standard at the level 4 transport layer as equally, if not more, important. (The level 3 networking layer, primarily involved with internetworking several LANs, is further from standardization.) Support for the transport protocol represents the first multivendor backing of such a higher level standard, and is happening despite the fact that several of the 19 endorsers have already developed their own proprietary higher level protocols.

These companies, including DEC, Xerox, Ungermann-Bass and 3Com, will continue to sell products using their existing transport-layer protocols, but will offer optional support for the ECMA standard. This standard is technically ISO's transport protocol Class 4 (ISODPXXX), which represents work done by ECMA, the American National Standards Institute and the National Bureau of Standards.

"One of the major points of the endorsement," says Philip L. Arst, manager of Intel Corp.'s Data Communications Systems group, "is that the companies have, in effect, said that they will support open systems. That's motherhood, but if you put money behind the motherhood, it makes it work." *—Dwight B. Davis, with contributions from Keith Jones*

INTEL UNIT WILL DEVELOP LOCAL-NETWORK PRODUCTS

Intel Corp., Santa Clara, Calif., is gearing up to develop hardware and software products for local-area networks through a new Data Communications Business Unit. Managed by Philip L. Arst, formerly manager of the company's data-communications product line, the new unit will be funded by corporate money until its first products permit it to operate as a separate profit-and-loss center. Arst explains his unit will produce system-level products, not components or boards. The systems will be marketed exclusively to OEM customers, not end users. He says the level of software provided with the systems will be the characteristic distinguishing them from systems targeted at end users. A network interface unit from Ungermann-Bass, Inc., for example, provides complete software through the application level, Arst says. A similar device from Intel would include only software through the transport level, leaving the application-software task to the OEMs. Intel's first products from the business unit, expected by year-end, will be based on the baseband Ethernet specification, which the company supports. Future products could include broadband systems, Arst says, if OEM customers indicate a need for such units.

NEXT MONTH IN MMS

The feature article section of the September issue of Mini-Micro Systems will spotlight software: high-level languages and development systems. Three major profile articles will be included, detailing database packages for microcomputers, work-station furniture and portable operating systems for microcomputers.

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CIRCLE NO. 58 ON INQUIRY CARD

Gould S.E.L.'s 32/8780 mini challenges mainframes

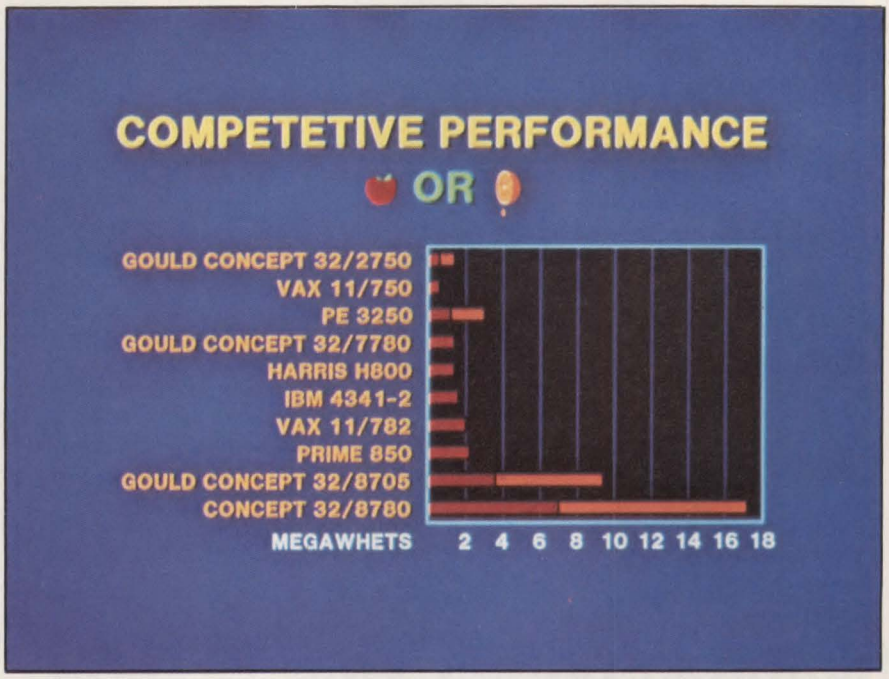
The most recent challenge to mainframes from a superminicomputer comes from Gould S.E.L., which has launched what it bills as one of the most powerful 32-bit minicomputers on the market, a closely coupled dual-processor system the company says will perform in the range of an IBM Corp. 3033 mainframe.

By combining the 10K emitter-coupled-logic technology of the SEL Concept 32/87 (MMS, July, 1981, p. 15) with the dual-processor architecture of the 32/7780, the Fort Lauderdale, Fla.-based company has introduced a system said to deliver 6.6 Whetstone million instructions per sec. and that can be optimized by SEL software tools to operate at 17.4 Whetstone MIPS.

A basic configuration of the Concept 32/8780—deliverable this month—is priced at $395,000 and includes 2M bytes of main memory, an eight-line asynchronous communications processor, a CRT console, a 300M-byte disk, a 75-ips, 800-/1600-bpi tape drive, a floating-point accelerator, a 600-lpm printer, Gould's MPX 32 real-time operating system and ANSI 78-compatible FORTRAN.

The 8780 is aimed at off-loading or replacing mainframes in S.E.L.'s traditional markets, including simulation, energy (both resource exploration and utilities management) and industrial automation. In new bids, the 8780 is expected to compete against mainframes in situations in which multiple 8780s would replace single mainframes.

In the industrial/scientific superminicomputer market, the 8780 is positioned to challenge what S.E.L. estimates to be Digital Equipment Corp.'s 50 percent market share—largely with the VAX-11/780—as well as Perkin-Elmer Corp.'s model 3250. S.E.L. hopes to expand its presence with the 8780 into the CAD/CAM market and others, says director of market development at the company, John Hughes.



A measurement of Gould S.E.L.'s Concept 32/8780 abilities in executing FORTRAN statements *against computers in the minicomputer class. The red bar denotes standard performance measurements, while the orange shows optimized performance numbers, when available. Source: Gould S.E.L.*

The 8780 supports 2M to 16M bytes of interleaved 64K-bit RAM and, in its initial release, as many as 96 terminals and eight disk drives ranging in capacity from 32M to 600M bytes each. With an optional second I/O processor and a disk processor, eight more drives can be attached. The dual-processor architecture features twin ECL-based CPUs, one of which functions as an internal processing unit, handling compute-bound tasks. The two processors are linked via a 75-nsec.-cycle-time internal bus. Each processor has a 32K- or 64K-byte cache memory and a 64K-bit-wide floating-point processor. The two processors do not automatically back each other up (the IPU is restricted to nonprivileged instructions, while the CPU executes the entire instruction set), users can instruct either processor to function as the CPU via a key switch.

Like the other members of the two-year-old Concept family, the 8087 is constructed around the SelBUS, a priority-based polling network that links various elements within the cabinet. The bus operates at 26.7M bits per sec. Each of as many as 24 devices on the bus have as much as 500K bytes of memory. An Advanced Micro Devices, Inc., 2901-based I/O processor tied to the SelBUS and operating at 1.5M bps manages I/O.

The 55-in.-high, dual-bay cabinet

includes a 38-slot CPU chassis, the 38-slot IPU chassis and an eight-slot I/O chassis. Add-ins include a second 32K-byte cache board with an ECL-based controller, priced at $30,000, and 1M-byte memory boards, priced at $16,500, but scheduled for a price cut.

In addition to the 8780, the company has introduced the model 8750, which has the same performance characteristics of the earlier uniprocessor 8705, but can be upgraded to an 8780 with an IPU option priced at $100,000.

The 8780 shares the MPX 32 operating system used in the rest of the company's lineup. Supported languages include FORTRAN 77+, Jensen-Wirth standard Pascal and ANSI 74 COBOL and BASIC. Cal Shoemaker, Gould S.E.L.'s vice president of marketing and sales, says the company is expected to add UNIX as a program-development aid by September. In addition, the company plans to support C and Ada, but does not provide timetables for that release.

The company has continued to grow at a 30-percent annual rate after racking up sales of $130 million in fiscal year 1981, and will add new products every six months. Company president Shelly James says the company is "trying to patch up some of our weaknesses." He notes that these include shortcomings in user friendliness and application software.

—Geoff Lewis

MOTOROLA ALTERNATE-SOURCES BUBBLE MEMORIES

Intel Corp. and Motorola, Inc., have announced what they term the first alternate-source agreement for 1M-bit bubble-memory technology. Under the agreement, the companies will jointly develop two smaller 1M-bit devices based on Intel's 7110 1M-bit bubble-memory architecture. While the first will equal the 7110 in performance, the second will have half the access time and twice the data rate (200K bits per sec.). The two companies also will adopt a low-height, leaded package for the new memories that is under development at Intel, and is similar to the one Motorola manufactures. To provide component-level interchangeability, Intel will provide Motorola with design and compatibility data so that Motorola can produce peripheral chips for the three bubble memories. For upgrades, the companies are standardizing on a common and compatible 4M-bit bubble chip set. The first memory is expected to be shipped in the second quarter of 1983, and the higher performance device will be available by the end of next year. The agreement is expected to accelerate the growth of the bubble-memory market.

Motorola brings VME to U.S.; Mostek, Signetics ready, too

Motorola, Inc., has introduced to the U.S. a family of single-board computer products designed to the VME backplane bus specifications announced last year in Europe with MC68000 second-source vendors Signetics/Philips and Mostek Corp. (MMS, December, 1981, p. 16). The move is part of an effort to make the VME bus a worldwide standard.

Announcement by the Phoenix semiconductor and system vendor of its VMEmodule product line and an accelerated delivery schedule comes sooner than expected, say Motorola officials, a response to the strong demand for the hardware from U.S. customers, including industrial-automation, control-system and small-business-system makers.

Product manager Jeff Gorin says the company had initially planned to bring the products to the U.S. by the end of the year, but "with some development breaks internally, we pulled it together," he says.

VME bus products are based on Motorola's MC68000 microprocessor and are built on metrically sized Eurocards with inherently reliable pin-and-socket (DIN) connectors. Among the hardware Motorola will deliver to U.S. customers are a monoboard computer, two RAM boards, an IEEE 488 board and a variety of peripheral and I/O controllers. Chassis, card cages and backplanes are available as well.

Gorin believes VME will further strengthen the MC68000's market position because its 16- and 32-bit data and address lines take full advantage of the processor's performance. "Customers can take existing 16-bit systems and move to 32-bit systems without changing architectures," he says. Additionally, Gorin says, the bus's mechanical size and connector scheme are attractive.

Motorola's partners in the VME pact, Mostek and Signetics, have also experienced demand for the products from their U.S. customers. Frank Bruns, Mostek's VME head, says, "Interest is strong. There's pressure to set pricing" for the hardware. The Carrollton, Texas, company has not stepped up production of the boards, Bruns says, but it is ahead of schedule. Three boards will be ready next month—a single-board CPU, a serial I/O board and a RAM board. Four more are planned for year-end delivery, Bruns says, adding that a small VME prototyping system is in the works as well.

For its part, Signetics, which did not reveal its product lineup when the joint venture was announced,

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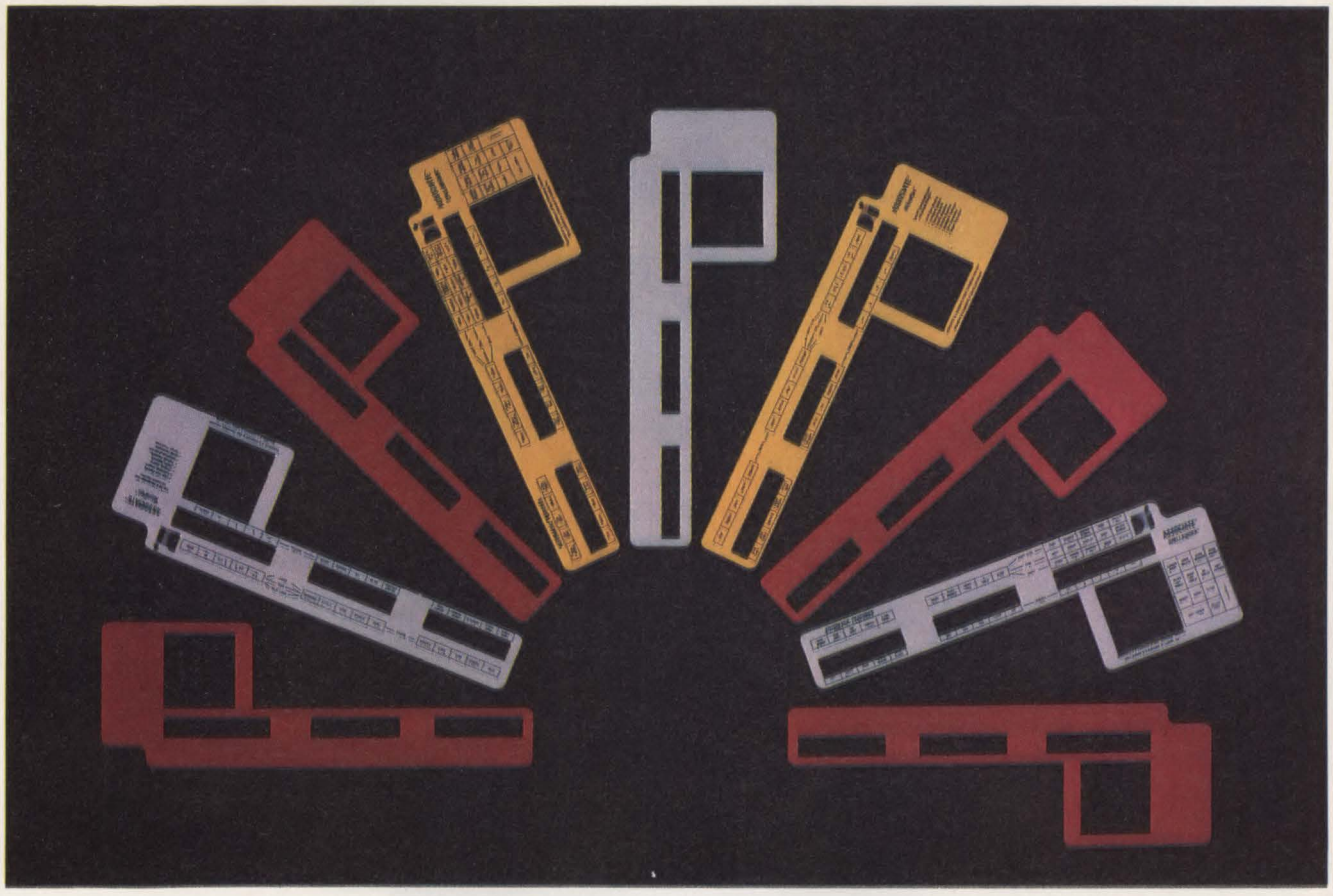

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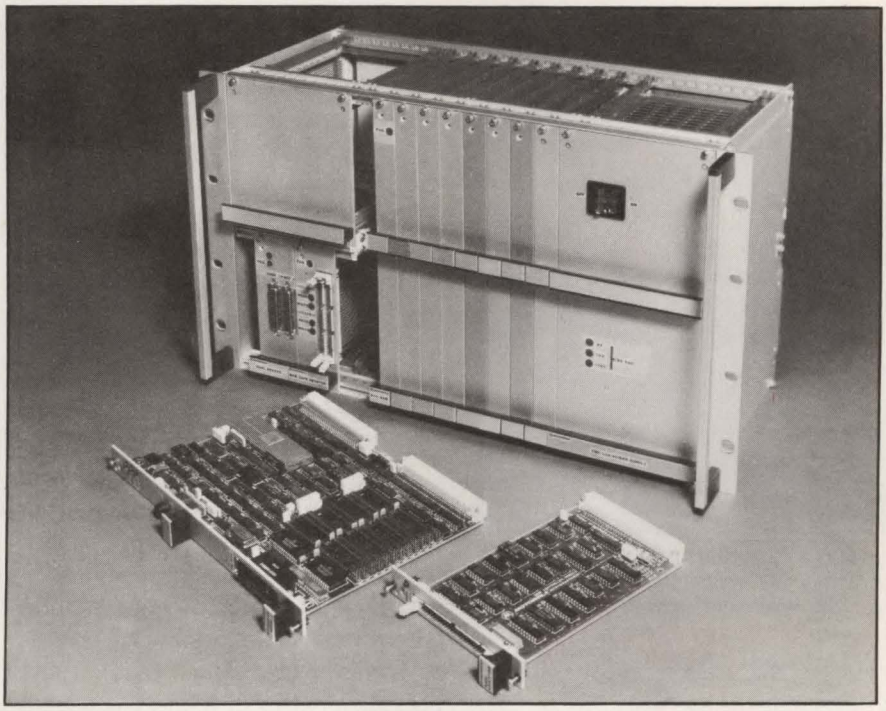
expects to introduce hardware this month or next, close to the Sunnyvale, Calif., firm's original schedule. A company spokesman says four boards will be announced, including a CPU and a 256K-byte RAM board, plus a disk controller board and a system controller board.

Motorola's U.S. entries are essentially identical to those introduced in Europe, with one significant difference. To the 68000-based CPU board, Motorola has added a feature that allows the VME board to talk to the company's Versabus-based Versamodules, a family of products built on 9¼-1×14½-in. cards (MMS, October, 1980, p. 55). Called the I/O channel, it is a buffered extension of the on-board processor bus and allows I/O transfers at a 2M-byte-per-sec. rate, regardless of the activity on the VME bus.



Motorola's VMEmodules *are available in single- or double-width Eurocards.*

Software support is available via Motorola's RMS68K real-time executive and Versados disk operating system. Development languages for VME boards on Motorola's EXORmacs development system include Pascal and FORTRAN compilers, a macroassembler and a symbolic debugger.

In quantities of 25, the price for Motorola's 68000-based single-board CPU is $1440. The 256K-byte RAM board sells for $1780. Motorola began delivering samples of the boards last month.

—Larry Lettieri

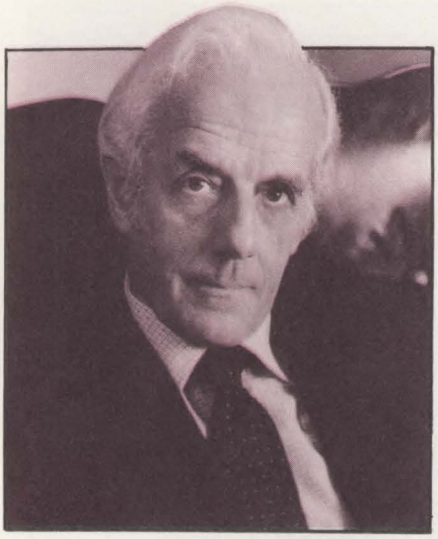
Nova-compatible market is losing its vigor

The estimated $30-million market for Nova-compatible hardware, born four years ago because of demand that Data General Corp. would not or could not satisfy (MMS, September, 1978, p. 96) has never boomed, and some observers say it may be dying. Part of the problem is DG's practice of restricting its RDOS operating system to use only on DG machines. Now, with a 12-year-old Nova architecture and instruction set, competitors in the Nova-compatible market must face the fact that the market for Nova emulators can't live forever. "There's just not a lot you can do with the Nova architecture," says Mike Stoddard, director of systems software at Tustin, Calif.-based Interactive Business Information Systems, which sells operating systems for Nova-compatible machines. "The instruction set is primitive, and the machine has only four registers, two of which are eaten up with the program counter and the index register. And being able to directly address only 64K limits what you can do even with memory mapping."

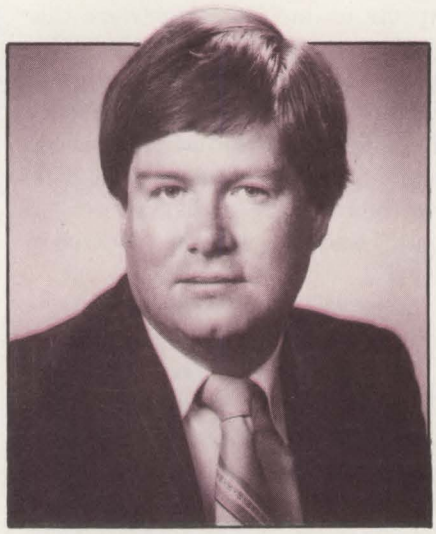
The IBIS strategy centers on a portable operating system that gives Nova-compatible hardware OEMs an upgrade path to minicomputers from Digital Equipment Corp, IBM Corp. or Honeywell Information Systems without sacrificing their investment in software. The key to this portability is that more than 85 percent of the new IBIS operating system, Advanced Interactive Operations System (ADIOS), can be compiled as either Pascal or Ada.

A similarly portable operating system is also reportedly in the works at Tustin-based Dynamic Concepts, Inc.

Further evidence of the deteriorating market for Nova-compatible computers is the plight of market leader Point 4 Data Corp. The



Bytronix president Norman Clark *says his customers will decide his company's path out of the Nova-compatible world.*



Point 4's potential is in p-code portability, *says vice president of marketing John Mather.*

Irvine, Calif., firm recently laid off 22 percent of its work force and reorganized its management. Sales of its Nova-compatible minis, which account for 90 percent of revenues, have not measured up to expectations. The company blames the lack of sales on a sluggish economy, rather than on the Nova architecture. Vice president of marketing John Mather believes that Point 4's customers will stay with the Nova for at least another five years. But the company is hedging its bets.

"No computer manufacturer can reasonably believe its current architecture is going to be satisfactory forever," says Mather. "And although being Nova-compatible has been an important factor in the success of Point 4, we're looking in new directions."

Mather says one such direction involves microcoding some unused Nova instructions to implement primitives of Pascal p-code in firmware. One of the p-code environment's strengths, he says, is software portability that would provide a pathway to more powerful architectures. "We have p-code applications running in-house," says Mather, "and we're doing a lot of our future development around the p-machine."

Although Point 4 planned to introduce UCSD Pascal at the recent National Computer Conference, says Mather, recent events have delayed those plans. Norman Clark, president of Fullerton, Calif.-based Bytronix, also foresees a trend away from Nova architecture.

"Obviously, a 12-year-old concept

THE LEGAL BATTLE CONTINUES

In 1979, an anti-trust suit began in a San Francisco U.S. district court in which 7 plaintiff companies—Digidyne Corp., Fairchild Camera and Instrument Corp., SCI Systems, Bytronix Corp., Data Compass Corp., Keronix Inc. and Ampex Corp.—contended that Data General Corp.'s practice of requiring licenses of its RDOS operating system for use only on DG CPUs is unlawful.

Ampex settled out of court after presiding Judge William Orrick declined to issue a summary pre-trial judgement; terms of the settlement were never disclosed. Four other plaintiffs also reached secret out-of-court settlements before the trial began, leaving only Fairchild and Digidyne opposing DG.

Judge Orrick had ruled before the trial that DG's actions satisfied two of three requirements necessary for proving the alleged anti-trust violation: 1) that DG tie the sale of software with the sale of hardware and 2) reaped substantial economic benefit thereby. The issue for the jury to decide was whether DG possessed sufficient economic power in the market to restrain trade appreciably.

After 10 weeks of testimony, which followed 19 months of pre-trial activity, and the filing of more than 600,000 pages of discovery documentation, the jury deliberated for seven days before finding DG guilty of restraint of trade in June, 1981.

Fairchild and Digidyne were reportedly seeking a combined $100 million in damages, which could have been tripled under federal law. But before the trial moved to the penalty phase, Judge Orrick voided the jury verdict in an opinion released in October, 1981. The jury's decision had supported the plaintiff's contention that the relevant market was restricted to computers executing the Nova instruction set. In overturning that decision, Orrick ruled that "the only reasonable definition of the relevant marketplace is the market for general-purpose minicomputers and microcomputers."

Digidyne has appealed Orrick's ruling; that appeal is scheduled to be heard in U.S. District Court next spring. If Digidyne wins the appeal, the way would be clear for a new trial.

Of the original seven plaintiff companies, only Bytronix and Digidyne remain active in the Nova-compatible market.

Although DG declines to comment on legal expenses connected with the case, president Edson deCastro says that legal expenses contributed to a drop in operating margins from 13 percent to 10 percent during the first quarter of 1981.

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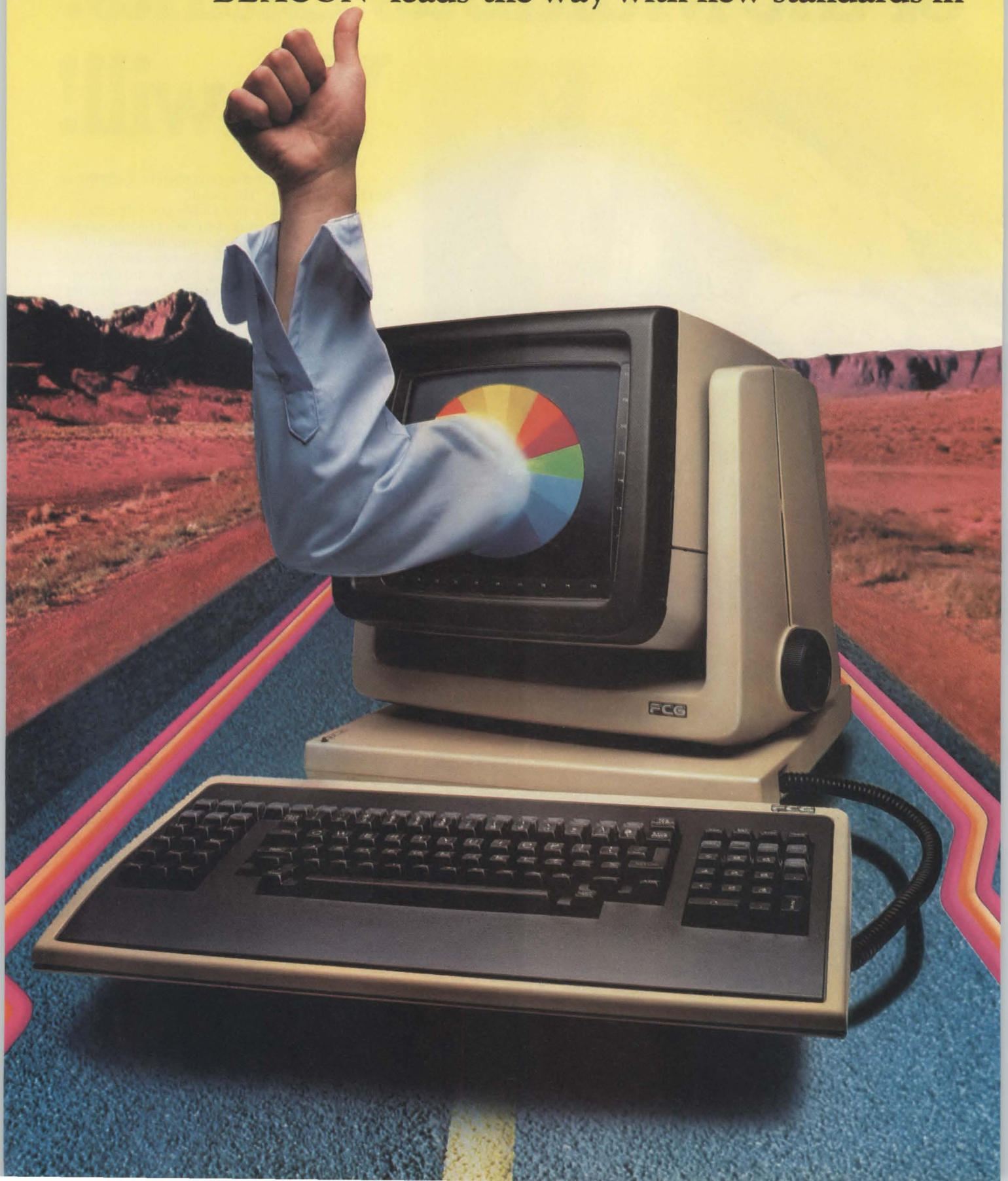

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Other graphics features include: 640 x 480 resolution (standard); 6 memory planes with 256 colors—up to 32 usable at a time (16 in the graphics plane and 16 in the alpha numeric plane)—and 18 programmable function keys on the keyboard and another 18 on the display bezel.

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The human factors, or ergonomics, that make a computer personally comfortable played an integral part in the Beacon System's design.

The critical area of reducing eye strain and fatigue has been accommodated through the development of a screen image *twice as steady* as the image in other computer systems, including those that are advertised as "flicker free." For extra visual comfort, the brightness of the Beacon image is controllable at the keyboard, and an anti-glare filter reduces distracting reflections.

And Beacon's commitment to superior ergonomic design doesn't stop there. To avoid back strain, the monitor tilts, swivels, and uniquely adjusts 5.5″ in height. In addition, the keyboard is separate from the display and can, therefore, eliminate the sense of being tied down to the monitor.

Other hands-on features that make for greater comfort and productivity are: a three-degree adjustable tilt in the keyboard, a palm rest, tactile feedback, sculptured keys, and a dimpled home key in the function and numerical key clusters.

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CIRCLE NO. 55 ON INQUIRY CARD

is going to go away eventually," he says. He notes that several companies showed up at the Comdex show with 68000-based machines and UNIX, but trends aren't established overnight, and he will let customers determine if microcomputers are the next move. "Customers say, 'We're going to wait until things (in the microcomputer market) settle down.' When they do, Bytronix will take advantage of it."

Clark says DG encourages its Nova OEMs to migrate to the more powerful Eclipse family, a strategy Don McDougall, director of marketing for the technical products division, confirms (see "DG says there is no Nova-compatible market," left). The move to the Nova-compatible Eclipse instruction set was made more attractive by DG's recent introduction of two Nova upgrade products, the S/20 and S/120, which are based on the 16-bit microEclipse microprocessor that is said to bring 16-bit Eclipse minicomputer elements to microcomputers (MMS, April, p. 17). Clark says Bytronix may follow suit with an Eclipse emulator.

Bytronix may find, however, that Digidyne Corp., San Diego, has beaten it to the punch. "Our new computer, the 200 series, was designed to emulate the Eclipse product line," says Digidyne president Michael Brennan. "Even though it's aimed at the Nova 4X, the top of the Nova line, there's plenty of room in the firmware to accommodate the extra Eclipse instructions."

Brennan, however, doesn't think the move away from Nova will be necessary sooner than five years from now. "You can argue about what's a good instruction set, but with the bit-slice technology and clever microcoding, you can make computers run so doggoned fast, it doesn't matter how bad your instruction set is."

Two other companies that recently entered the Nova-compatible market, Integrated Digital Products, Anaheim, Calif., and Kurzweil Computer Products, Cambridge, Mass., agree that speed is the answer. Both claim to have products faster than anything else on the market.

But Brennan doesn't view the newcomers as Digidyne's real competition; that distinction belongs to DG. "Digidyne will remain totally DG-compatible," he says, basing that opinion on his belief that Digidyne will eventually win its suit against DG, freeing all RDOS software for use on non-DG machines. However, DG contests the Digidyne contention (see "The legal battle continues," p. 40).

"Digidyne is the only company totally positioned to take advantage of it," Brennan says. "The way I figure it, we currently match up with about $125 million of DG's business."

Digidyne hasn't bet everything on winning the suit, though, and Brennan says the company has recently purchased Minicomputer Systems' service organization and may eventually become more than just a hardware manufacturer.

"And if DG compatibility turns out to be unnecessary," says Brennan, "we've built a higher speed proprietary bus into the Series 200." It seems that even the strongest of Nova-compatibility supporters aren't locking themselves in.

—Kevin Strehlo

DG SAYS THERE IS NO NOVA-COMPATIBLE MARKET

"There is no such thing as a Nova-compatible marketplace," says Don McDougall, director of marketing for Data General Corp.'s technical products division. "No other firm's computers can legally run our operating systems. Therefore, they're competing with us more generally in the low-end, 16-bit computer market, the same way Digital Equipment Corp. does."

McDougall admits the situation would change if Digidyne had won its case, freeing the RDOS operating system for use on non-DG machines. But DG spokesmen believe Judge Orrick's ruling in DG's favor will stand, and McDougall points out it will remain in effect for several years, regardless of the ultimate decision.

Meanwhile, DG is basing its strategy on increased functionality and a better price/performance ratio while retaining Nova compatibility in upgrade products such as the S/20 and S/120 microcomputers, which are based on the microEclipse chip set.

As for the future, McDougall says, the market for low-end, 16-bit computers will be important factors 10 years from now. Although he sees the advantages of the 32-bit internal architecture of microprocessors such as the MC68000, he says Data General overcomes architectural disadvantages in its 16-bit approach with memory-mapping capabilities, a broad base of application software and an extensive distribution and service network.

VisiCalc developers have high hopes for new program

Legend has it that when VisiCalc developer Robert M. Frankston presented VisiCalc at the 1979 personal computing festival at the National Computer Conference, 20 people showed up—mostly staff and family. Only two outsiders listened to the presentation, but they walked out before it ended.

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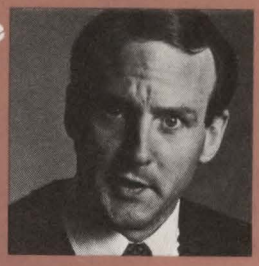

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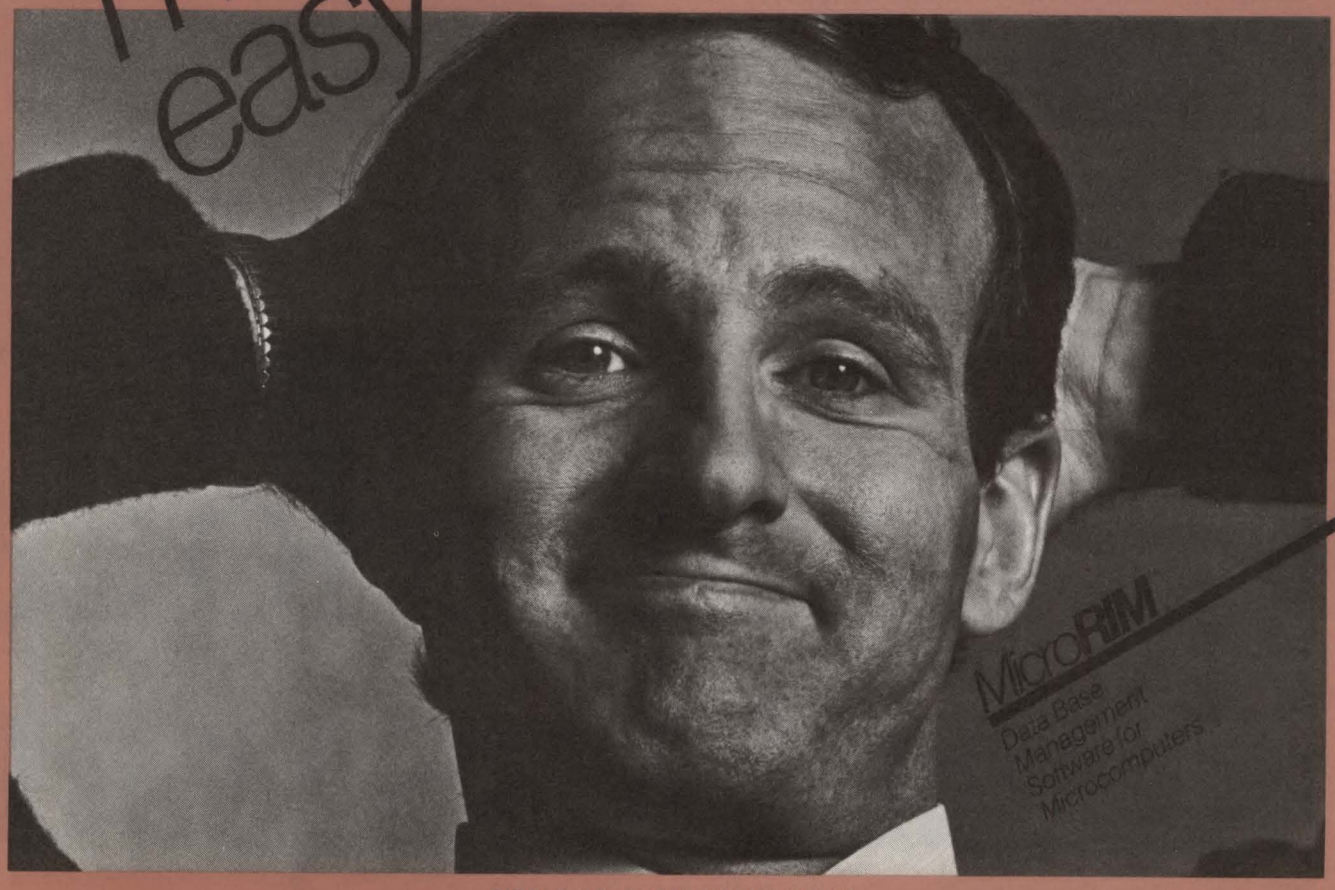

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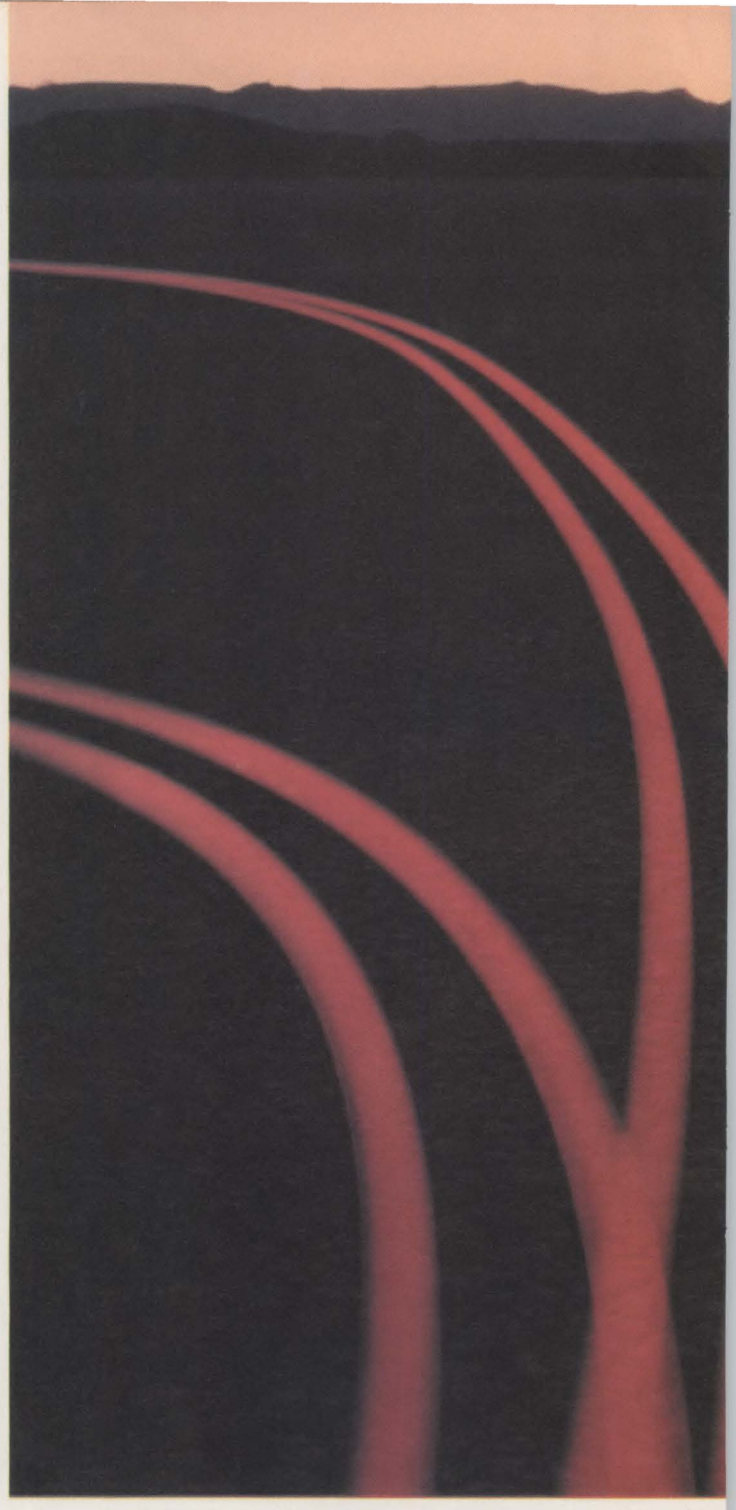

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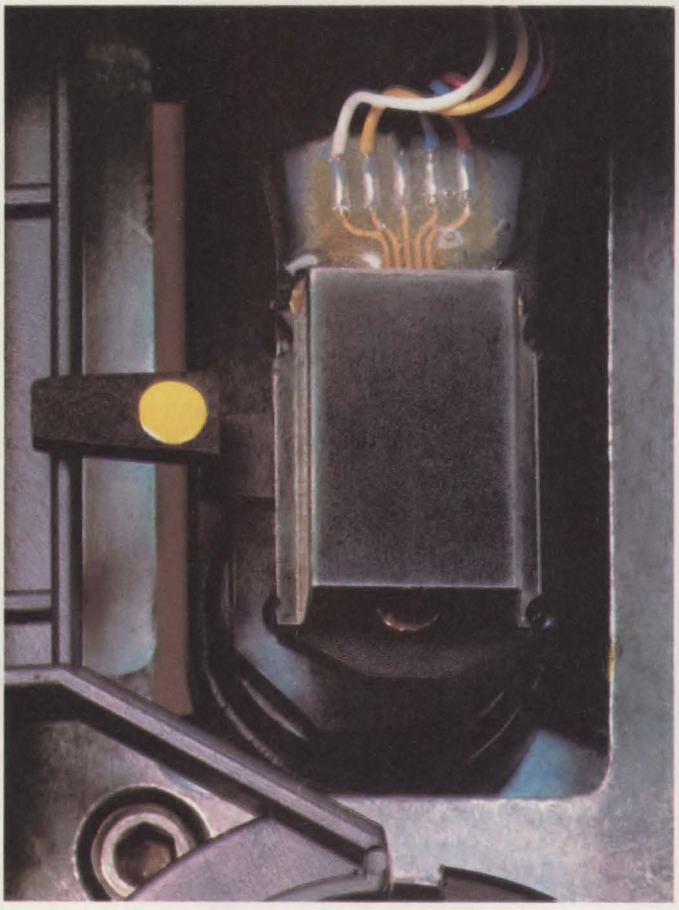
5¼ INCH FLOPPY HEAD EXPOSED

It's What's Not There That Counts

What a floppy disk drive doesn't have is sometimes more important than what it does have, industry sources report. The Remex PICO™ 48/96 tpi, 5¼ inch flexible disk drive doesn't have "tap-tap" problems, doesn't have asymmetry considerations and doesn't have settle time because the little drive is the first in the industry that *doesn't* have a head load solenoid. With the Remex PICO, the head is loaded directly onto the media when the drive door is closed.

For long periods of read/write inactivity, the spindle motor is shut off and can be reactivated quickly since the entire start process requires less than 200 msec. Since "tap-tap" of head load and unload is a contributor to media wear, Remex reduces this problem by eliminating the head load solenoid. No head load solenoid also means no problems associated with the magnetic flux from the solenoid—like asymmetry, and the inability of the head to read certain frequencies. And the new design significantly reduces access time due to the elimination of head settle. Head life is also increased.



Life Span Increased 10 Times

30,000 hours versus 3,000—the facts are in on the increased life of the brushless DC motor used in the Remex PICO™ 5¼ inch floppy disk drive as compared to the life of brush type DC motors found in other small floppys. The MTBF of the Remex PICO motor is 5 years. Since the motor is one of the parts which commonly fails on floppys (and is difficult and costly to replace), users anticipate longer drive life. The use of the brushless DC motor also eliminates belts from the drive motor assembly which means there is no improper belt seating to produce speed variations or friction-causing side loading.

Don't Get Your Head Caught In A Crunch

Flash! Remex PICO™ has taken the crunch out of floppys. The automatic-eject mechanism of the Remex PICO, which ejects the media with the release of the front door, doubles as an anti-crunch device for the unit's dual heads. When no diskette is loaded, the mechanism holds the heads apart virtually preventing "micro-chipping" of the delicate head material.

Proud Papa Delivers

96 tpi is a lot like the weather. Everyone talks about it but not many do anything about it. Remex, on the other hand, is making the sun shine for OEMs. The first to introduce a 96 tpi drive in a SLIMLINE,™ ⅔ size form factor, Remex is delivering Remex PICO™ drives for a wide variety of applications.

Remex International

Good news travels fast! The full range of Remex products is available worldwide through local distributors. Information on the location of international distributors can be obtained through the Remex Headquarters. Factory certified service is also offered on a regional basis.

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bridge, Mass., confidently introduced the second major product for the firm in a room packed with attentive listeners.

The product that follows VisiCalc is TK!Solver, a semi-custom program that can be tailored by filling in pre-defined models for mechanical engineering, investment-management and analysis and education applications. The $299 basic product will initially be used with the Apple Computer, Inc., Apple II and the IBM Corp. personal computers. Applications for the basic program are priced at $50 to $100.

The company touts TK!Solver as a package that will become as important to the computer industry as did VisiCalc. Whether such confidence is appropriate will be proven over time as the newcomer's performance is measured. Company founders and "magic-blackboard" authors Frankston and Daniel S. Bricklin, now president and executive vice president/chairman, respectively, have high hopes for the product, and are planning a new 30,000-sq.-ft. facility in Wellesley, Mass. "So much for two guys in an attic," says Frankston, referring to the early days of the VisiCalc team.

One big change for the company is its marketing approach. While VisiCalc is marketed by publishing house VisiCorp, which changed its name from Personal Software, Inc., in part to reflect its identity with VisiCalc, Software Arts will go it alone with producing, marketing and supporting TK!Solver.

TK stands for tool kit, the internal company designation for the product, explains Frankston. The first in a series of professional tools, TK!Solver, like VisiCalc, is an interactive program. Frankston says that it is geared for non-programmer engineers and business people, and will be easier for such users to handle than FORTRAN or BASIC programs or programmable calculators, the methods it's aimed at replacing.

Milos Konopasek, *a North Carolina State University professor and consultant to Software Arts, Inc., originated the TK!Solver concept for the textile industry, and helped Software Arts implement it on a personal computer for other applications.*

To use the product, operators type equations, enter values and press an action key to get the solution to a problem. In real-estate mortgage calculations, for example, the user gives the computer an equation that defines the relationship between the principal, the interest rate, the monthly payment and the term of the loan. Given three known values, TK!Solver can calculate the fourth.

An important feature of the program is that it allows the computer to store mathematical relationships and empirical (observed) data so that equations need not be reformulated when using programming-language parameters. Built-in functions include sine and cosine to net present value and internal rate of return, and answers displayed as numbers, tables or graphs. The program also automatically converts units of measure-

COMSHARE OFFERS $50 VISICALC LOOK-ALIKE

Launching a marketing program called "Calc Wars Just Ended," Comshare Target Software, Ann Arbor, Mich., has released a $50 VisiCalc look-alike called PlannerCalc. The product joins a list of Calc-like products including SuperCalc, MagicCalc, MicroPlan and MultiPlan, according to Comshare. Company group vice president Donald J. Devine says the low introductory price is intended to focus attention on the quality of the package, which competes with products priced from $200 to $300.

PlannerCalc is written with English commands. The company says it operates on IBM Corp., Xerox Corp., NEC Information Systems, Apple Computer, Inc., Digital Equipment Corp., Zenith Data Systems, Vector Graphic, Inc., and Tandy Corp. personal computers. While available for use only with the CP/M operating system, other operating-system support is forthcoming this year, the company says. PlannerCalc is available through computer dealers.

ment, such as inches or meters. TK!Solver supports Software Arts' DIF file format program, allowing data to be interchanged with other programs, including VisiCalc.

TK!Solver was designed by senior software engineer Seth Steinberg, from concepts originated by North Carolina State University professor Milos Konopasek, also a Software Arts consultant. The original product was geared for use in the textile industry, and would work off of ports with a mainframe. Steinberg and Konopasek worked for almost two years to get the product implemented on a personal computer.

The basic program principles translate from textiles to other professional and business disciplines, and Software Arts intends to produce a series of TK!Solver application packages for use with the basic TK!Solver program. Each application package will contain several pre-defined models to solve problems in a given field, such as financial applications.

For example, analysts typically must search through a 3- to 4-in.-thick standard reference for information on interest rates, says Katherine Joseph, an investment analyst with a major insurance firm, who produced the TK!Solver package for finance. She says that without the program, analysts typically rely on expensive time-sharing services or on estimates. She likes TK!Solver because it enables her to perform variations of a problem without rearranging individual formulas. Using a calculator for the same type of problem, she explains, requires that data be entered in a rigid format to get answers one at a time. "You lose the idea of the whole of what you are working on," in getting single answers, she says.

"Solving problems with a calculator is slow and prone to error," says Software Arts consultant John Sofia of the Massachusetts Institute of Technology. Sofia developed a mechanical-engineering package for use with TK!Solver. It can be used to determine the flow of liquids through pipes, detect the heat loss from a furnace or discover why windows fall out of a well-known insurance-company building in Boston.

George Blakeslee, head of the Weston, Mass., High School Science Department, sees TK!Solver in much the same way as VisiCalc developer Bricklin, who modeled the spread-sheet product for his needs at Harvard Business School. Blakeslee calls the package the "slate board for the kid of the '80s," pointing out that the education package has no restraints, and frees teachers to guide rather than provide all knowledge. Students learn by trial and error.

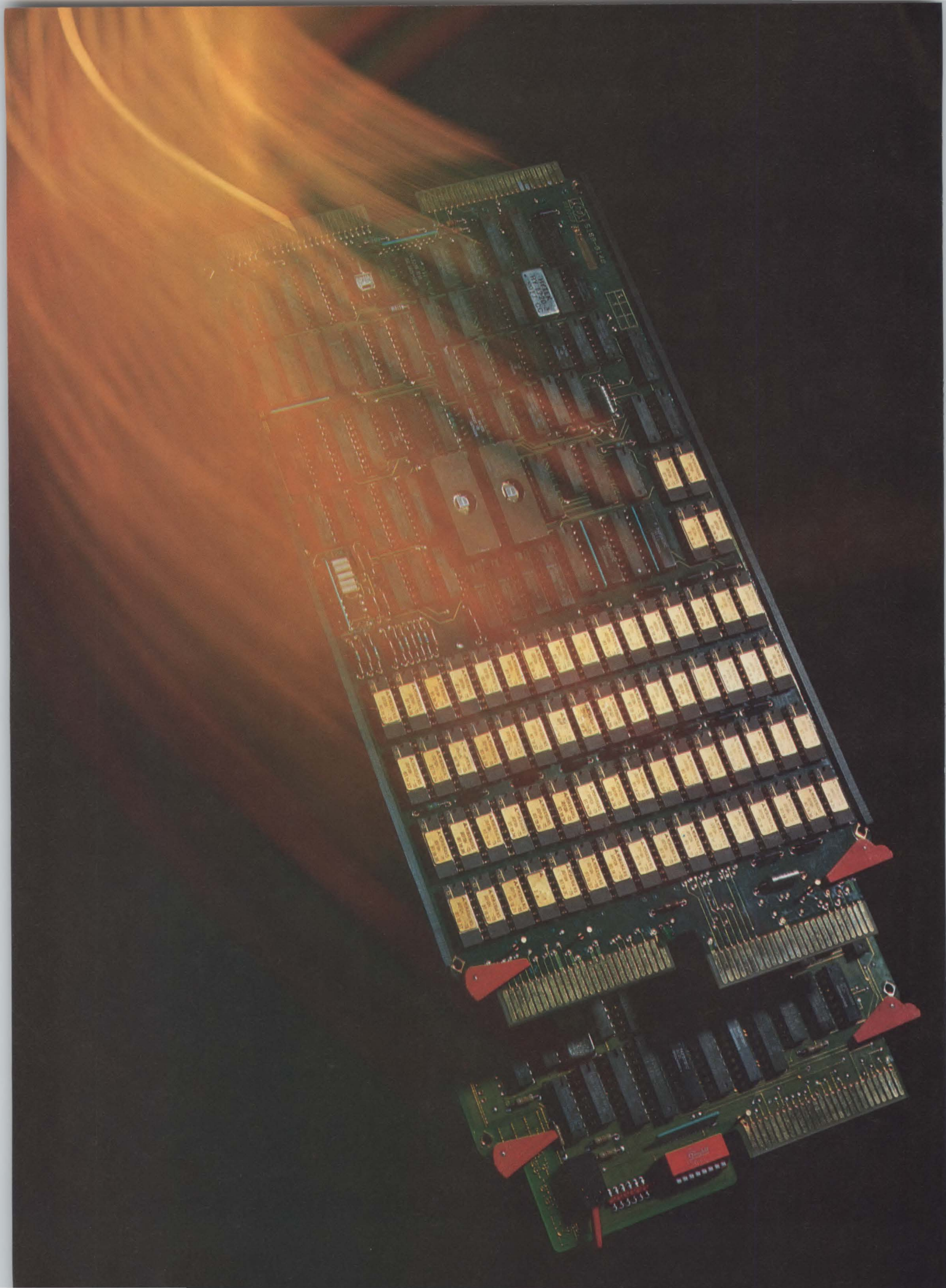
TK!Solver and the application packages for the Apple II and IBM computers will be available this year. Versions for other personal computers will be released shortly thereafter. A support journal for users will also be available. The product will be sold to distributors, who in turn will sell it to retail outlets.

—L. Valigra

APPLE SELECTS RCA SERVICE FOR ITS OEMS

Apple Computer, Inc., has chosen RCA Service Company's Data Services unit as the certified third-party supplier of on-site maintenance for Apple's OEMs and value-added resellers and their customers. The Cherry Hill, N.J., service unit has more than 450 trained field representatives, and will offer hardware maintenance from more than 180 locations in the U.S. and Puerto Rico. Software diagnostic support is also part of the deal. Some maintenance features include spare-parts availability at field and regional RCA offices, on-site module exchange, 24-hour coverage, and free on-site maintenance during the initial machine warranty period. RCA says there are more than 100 Apple and dealer-based OEMs and value-added resellers to service. Those include major manufacturers that adapt Apple's products for specialized industrial and scientific applications.

If you're looking for an OEM microcomputer with real-time software, we've got one that's just your speed.



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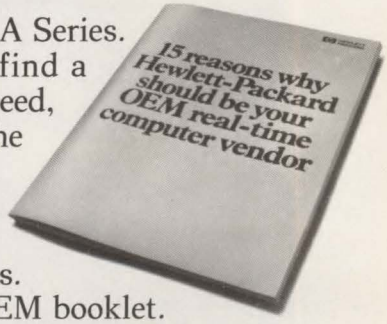

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CIRCLE NO. 71 ON INQUIRY CARD

Charting the industry's progress through NCC

(A historical look by MMS staffers at the computer industry's evolution.)

This year marked the tenth anniversary of the annual computer-industry mecca—the National Computer Conference. Nine years ago, when the joint spring and fall conference first merged into one gala at the New York Coliseum, about 200 exhibitors jammed into 70,000 sq. ft. of space. The American Federation of Information Processing Societies, which manages the show, hoped to draw a record crowd of more than 25,600. This June in Houston, the show attracted about four times that, or more than 96,000 visitors, to some 680 exhibits in 320,000 sq. ft.

Mini-Micro Systems staffers, some of whom have attended the show since its inception, have compiled a historical perspective of the changing players and technologies over the past 10 events.

Evidence of the IBM Corp. plug-compatible market decline showed as minicomputers became a more significant part of the 1973 show, acting as a harbinger of the numerous minicomputers and small systems to appear in the following years.

In 1973, Digital Equipment Corp. and many in a field of about 80 minicomputer manufacturers essentially were OEM "iron" houses. Computer Automation, Inc.'s two-board Alpha 16 system typified such iron. A 16-bit processor was on one board, and 4096 words (8192 bytes) of core memory was on the other. The system was sold with a primitive assembler and editor, and a teletypewriter-like operating system, notes Willian Sweet, vice president for marketing and sales at the company's Irvine, Calif., Naked Mini division, the company's only division in 1973.

The Naked Mini division remained the mainstay of Computer Automation until 1977, when the company acquired third-party software and added the SyFA interactive distributed-processing system to its inventory. That year and again in 1978, the company was the "darling of Wall Street," Sweet says, with pretax profits between 19 and 24 percent on revenues of $43 million and $61.3 million in the two years, respectively.

The company and many others in the mid-range minicomputer market are lagging this year in the face of the recession, competition from microprocessor-based systems on the low end and 32-bit superminis on the high end and strong pricing pressures.

SMALL BUSINESSES HOPE TO GET MORE R&D FUNDS

The U.S. House of Representatives has overwhelmingly approved—by a 353 to 57 vote—a Small-Business Innovation Development Act, signaling a reversal of what supporters say is a long-standing government bias against small companies. The legislation calls for a modest shift in federal R&D funding toward small businesses. The largest federal agencies (those 12 with annual R&D budgets exceeding $100 million) must establish grant programs for small firms with concepts for developing new technologies. Based on a prototype at the National Science Foundation, the legislation is expected to benefit many scientific, electronic and other high-technology firms. Small companies receive only 3.5 percent of the annual U.S. R&D budget of $40 million, says Ann Eskesen, chairperson for the Smaller Business Association of New England. About 1 percent more in federal R&D funds now will be diverted to small businesses, provided both the Senate and President Reagan approve the action.

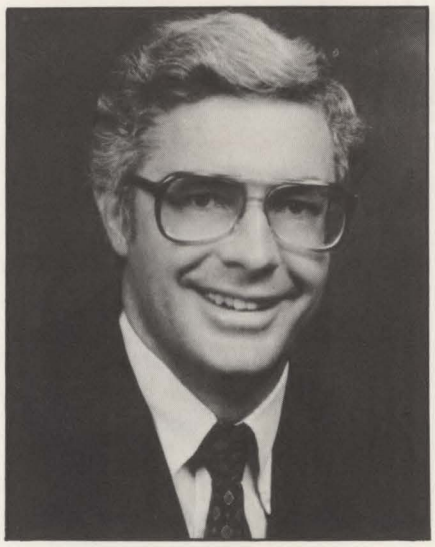
PRO-LOG RELEASES SUBSYSTEM, SOFTWARE MODULE

Monterey, Calif.-based Pro-Log Corp. recently introduced its first hardware and software products from the system and software group it formed four months ago. The move marks an expansion beyond the mainstay STD card and PROM programming products the company has been marketing. The first hardware from the group, called the model 702 STD Disk Pak, combines an STD bus system with two slimline 8-in. floppy-disk drives. The product is priced at less than $4000, and will be available in September. The floppy drives together store as much as 3.2M bytes. Winchester-disk drives may be the company's next step, says product marketing manager Mike Campo. The 702 subsystem is aimed at markets that require mass storage, such as data collection, process control and automatic test equipment. Along with the 702, the company revealed a utility software module called the memory directory. Priced at $750 as an outright buy, the software is available as a copyrighted notebook in which the user is given detailed instructions about how to customize the entire 4K of software, if needed. The module, Pro-Log's first software offering, will be followed by other utility packages. The memory directory includes menu creation, disk management, ASCII conversion, ASCII character editing and frame input editing functions. From the menu, users can format a disk; seek a track; read, write or display a sector; and load and execute. The package will be available in September.

Data General Corp., Westboro, Mass., one of the fastest growing companies, is feeling competitive tugs in its ever-widening product line. In the early 1970s, DG's success was riding strongly on the company's Nova computer line, and by 1973, DG was readying Eclipse minicomputers. The company has since introduced hundreds of products, a half-dozen Eclipses (including 32-bit versions) and four generations of Novas, says executive vice president Herbert J. Richman.

In 1973, with PDP-8 developer and DG president Edson D. de Castro hot on its trail, DEC already had moved to its next-generation product, the PDP-11. That was the heyday for the PDP-11/45 and the large DEC System 10, says Andrew Knowles, vice president of DEC's small systems group.

"The PDP-11/45 was the fastest and biggest real-time machine around," notes Knowles. Hardware on that level then included a 256K RAM, a 5M-byte removable disk pack, an interactive multifunctional keyboard, modems, auto dialers, acoustic couplers, CRT terminals and high-density floppy-disk drives.



Lear Siegler started the dumb-terminal price war with its ADM-3 in 1975, *and was one of early terminal manufacturers to offer strong margins to third-party marketers. "We took manufacturers' reps who were making 15 percent and offered then 50," says president Phil Shires of the campaign initiated with the single-board ADM-1 terminal.*

The PDP-11/45 marked many firsts for DEC, including the use of bipolar LSI and MOS memories, TTL and multilayer boards. It also had perhaps the first cache memory on a mini.

The changes at DEC also indicate the progress made in small systems marketing. Three years before the first NCC, DEC president Kenneth Olsen ordered a response to the IBM System 3, and assigned much of that task to Ed Marinaro, now president of Compu/Think, Sunnyvale, Calif. Marinaro recalls the result—a DEC Datacenter prototype built around the PDP-8 minicomputer. By 1973, DEC offered a DP-11-based DATAsystem 500 through OEMs. Prices ranged from $30,000 to more than $100,000, and by 1974, the packaged system brought the company $15 million to $20 million yearly in business. This year, DEC's crowded NCC booth sported three personal computers, none of which lists for more than $10,000. DEC projects sales of about 100,000 units in the first year from these products, which could produce as much as $300 million in revenues.

The personal computers are DEC's

NCC BECOMES MORE INTERNATIONAL

Visitors to the National Computer Conference in the 1970s could have been forgiven for assuming that no computer industry existed beyond the shores of the U.S. The European industry was represented by a handful of companies, while the Japanese contingent, so much in evidence now, was virtually nonexistent.

This year's NCC saw nearly 20 Japanese companies, many with prominent booths, and about the same number of European firms, some of them divisions of such large corporations as Siemens, Olivetti, Racal and Plessey. The Japanese lineup this year was a "Who's Who" of that country's industry, incuding Fujitsu, Hitachi, NEC, Mitsubishi, C Itoh, Epson and Okidata.

The experience of two Scandinavian firms that appeard at NCC in the early days underline some of the radical changes in the industry over the last decade.

Sweden-based Facit highlighted paper-tape punches and readers, its most important products by 1973. This year, a diverse family of printers dominated the product line. Stellan Horwitz, vice president and general manager of the Facit Data Products division in Stockholm, estimates that tape products these days provide only about 20 percent of his division's $60 million sales worldwide.

Nearly one-third of total sales come from the U.S. now, says Horwitz, partly the result of acquisition in 1979 by Facit's parent company, Electrolux, of U.S.-based printer builder Dataroyal, whose sales operations are now combined with those of Facit in the U.S.

Norway-based Tandberg Data has seen its original parent company go bankrupt and a majority takeover by Siemens of West Germany since it first appeared at the NCC. It has dropped its ½-in. tape-drive products since then, but launched a cartridge streamer for Winchester backup. The most significant development has been the evolution of Tandberg's CRT-terminal family. In the early 1970s, the terminals were unremarkable in design and less important in sales than Tandberg's tape products. Today, they address that sector of the market that demands ergonomic design.

—Keith Jones

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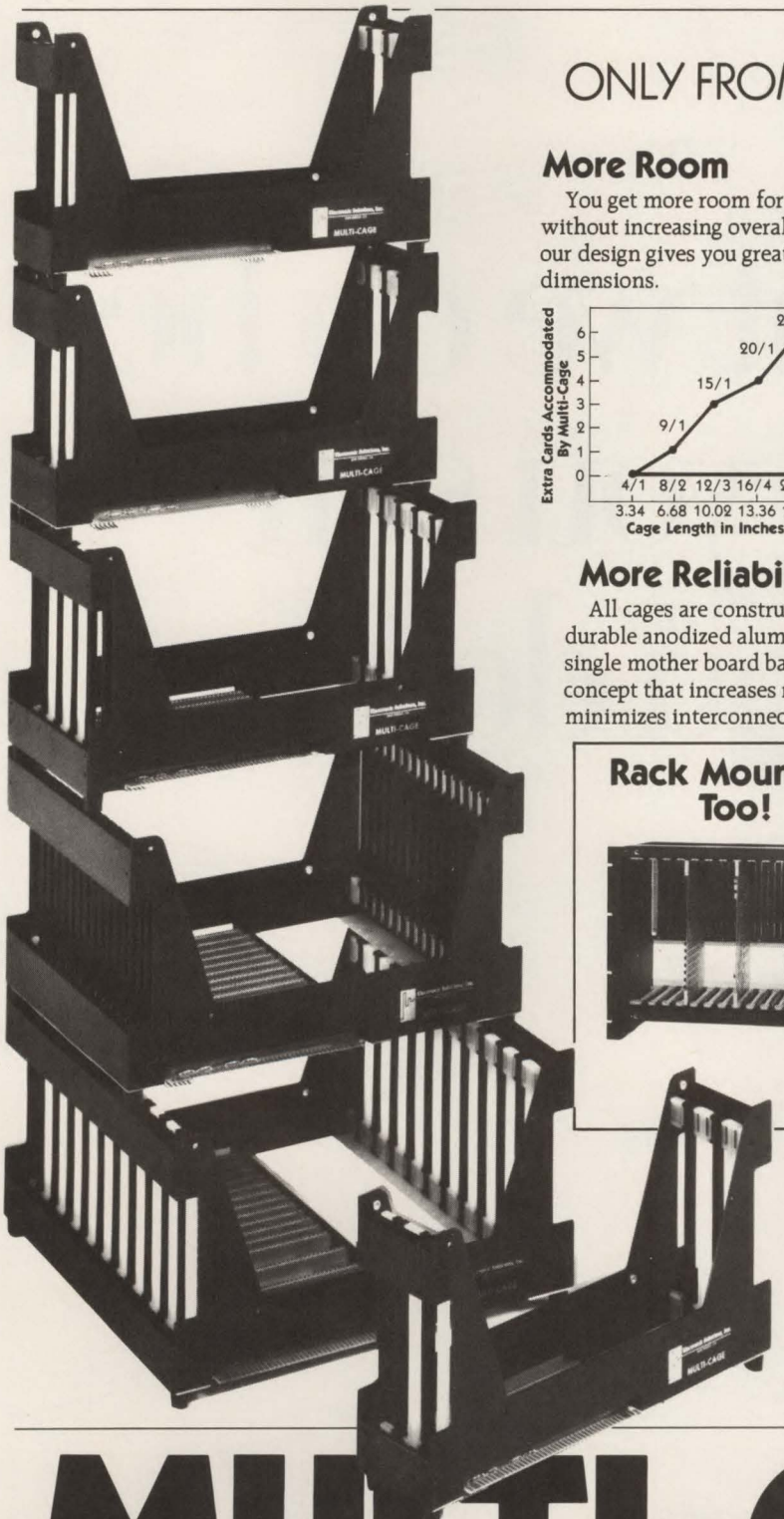

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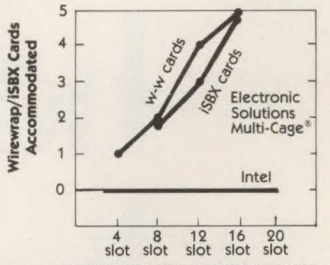

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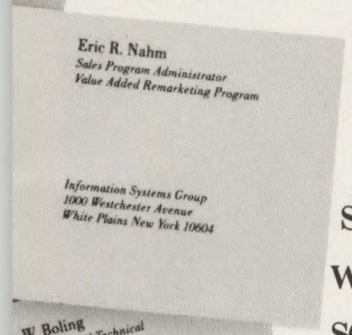

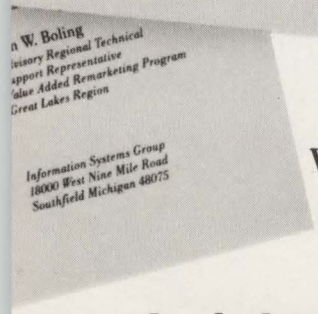

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I market application solutions to the following industries:

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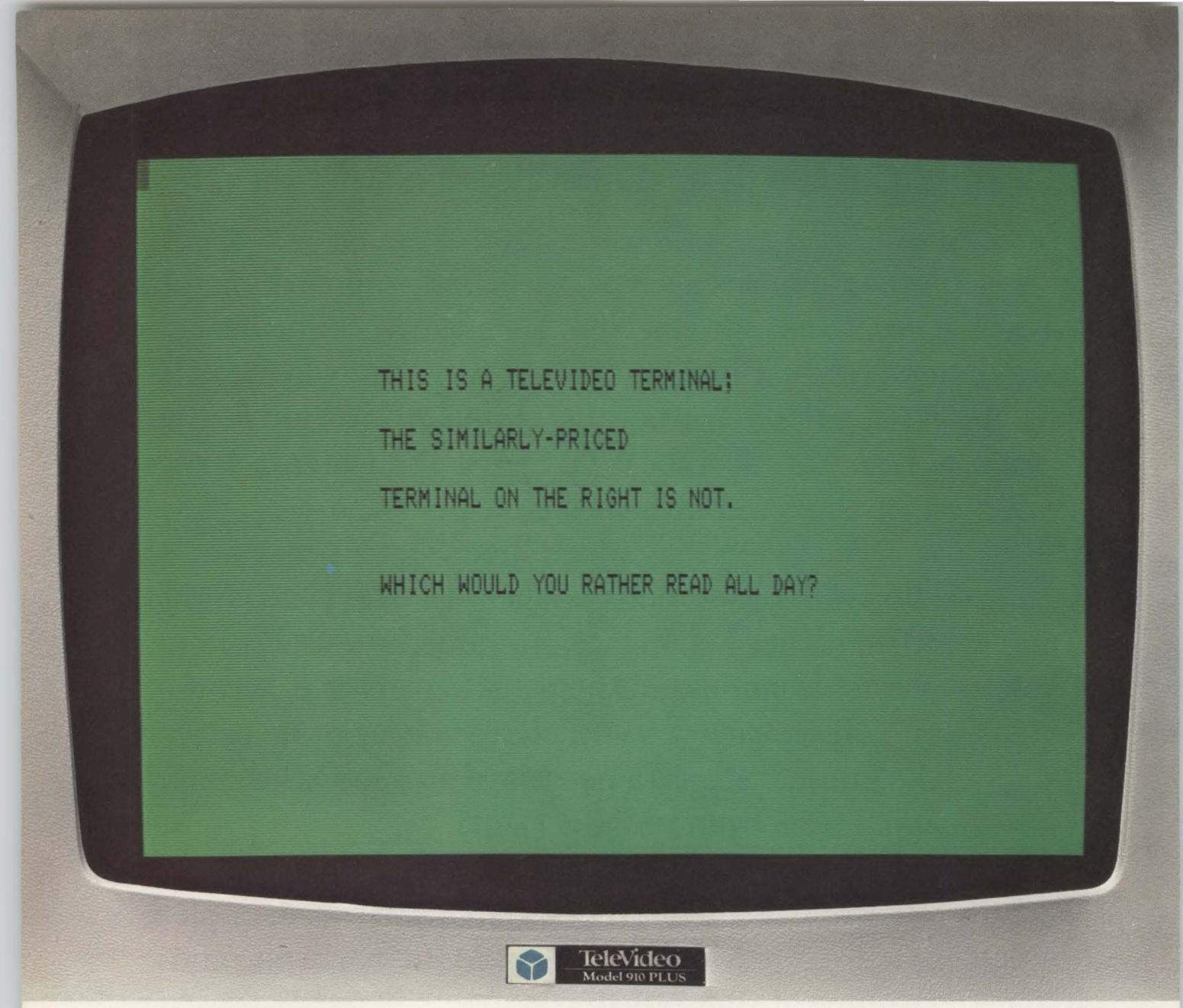


Unretouched photos—identical condition
Screens not actual size

Which would you

Our competitor on the right claims high resolution. But what about that glare? The washed-out background? And the black and white screen? It's enough to give you a headache.

The TeleVideo terminal on the other hand, with its finer character dot matrix, sharper background contrast, and a black-on-green non-glare Panasonic screen, is much easier on the eyes.

Obviously.

Every TeleVideo terminal has just four basic modules. Each module is the best that can be made.

Every screen, keyboard switch, power supply and video module on every TeleVideo terminal is identical. For the same high reliability. And same ease of service.

None of our competitors can say that.

If you order 200 terminals today, we can ship them tomorrow. If you order 500, we can still ship them tomorrow.

And if you order 1,000, well, maybe you'll have to wait a day or two.

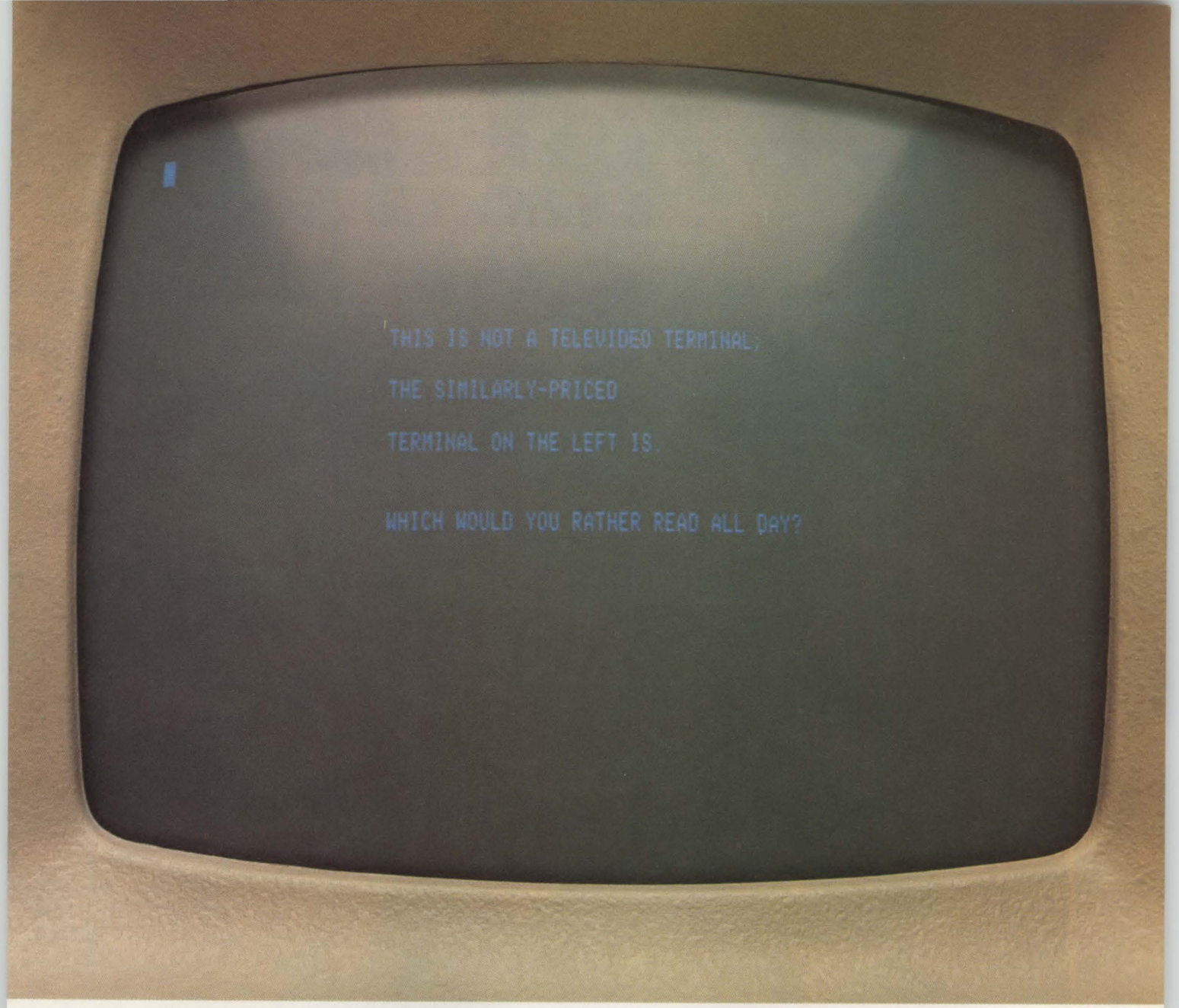

The 920C


The 910 PLUS

We put our terminals through five bad days so you'll never have even one bad day.

Our terminals are designed to withstand heat up to

California Santa Ana 714/557-6095; Sunnyvale 408/745-7760; Georgia Atlanta 404/255-9338; Texas Dallas 214/980-9978; Illinois: Chicago Area 312/351-9350; Mass.



rather read all day?

155°F and shocks that simulate being tossed in the back of a truck. And before any terminal reaches you, every major component goes through a five day series of thermal and power-on cycling tests.

The result?

The highest reliability rate in our industry.

TeleVideo sells 50% more terminals a month than our nearest competitor.

Three years ago, TeleVideo shipped its first terminal. Today, we're the number one independent terminal supplier.

One reason is because our advantages are clearly visible.

8 hours a day.

For more information call, toll-free, 800-538-8725. (In California, call 408-745-7760.) Or call your nearest TeleVideo sales office.

TeleVideo®

All TeleVideo terminals can be serviced by your nearest GE Instrumentation and Communication Equipment Service Center.

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Boston 617/668-6891; New York/New Jersey 201/267-8805; United Kingdom West End Surrey 44-9905-6464.

Pertec's TrakStar™

...a new family of 8-inch Winchester drives.

35, 67, and 84 Megabyte capacity for the systems of the 80's.

Proven design innovations make Pertec's TrakStar family of 8" Winchesters a must-see drive for business and word processing OEMs. Available now, TrakStar delivers the high performance, capacity and reliability OEMs are looking for in a compact, low-cost package.

TrakStar models offer capacities of 35, 67 and 84 megabytes so you can select the right size drive for your specific needs . . . economically, without compromise.

TrakStar offers ANSI standard interface to provide ease of integration, using industry-supported controllers. The rotary voice coil positioner, hard/soft sectoring and an 8-inch floppy form factor are part of TrakStar's unique combination of features that set it apart from the others.

Heads, disks and positioner are in the clean sealed section, with an unsurpassed 25,000 hours MTBF. The field-replaceable electronics are located outside of the sealed section, so that down time is virtually eliminated.

TrakStar is the proud result of Pertec Computer Corporation's commitment to perfecting technology. And it has a lot more to offer, because it's backed by the industry leader in OEM customer support.

For the full story, write for the new TrakStar literature. Pertec Computer Corp., P.O. Box 2198, Chatsworth, CA 91311, or call (213) 999-2020. In Europe, contact Pertec International, 10 Portman Road, Reading, Berkshire RG3 1DU. Tel. 734-582115.

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SUBSIDIARY OF TRIUMPH-ADLER

You and Pertec ...the OEM Partnership

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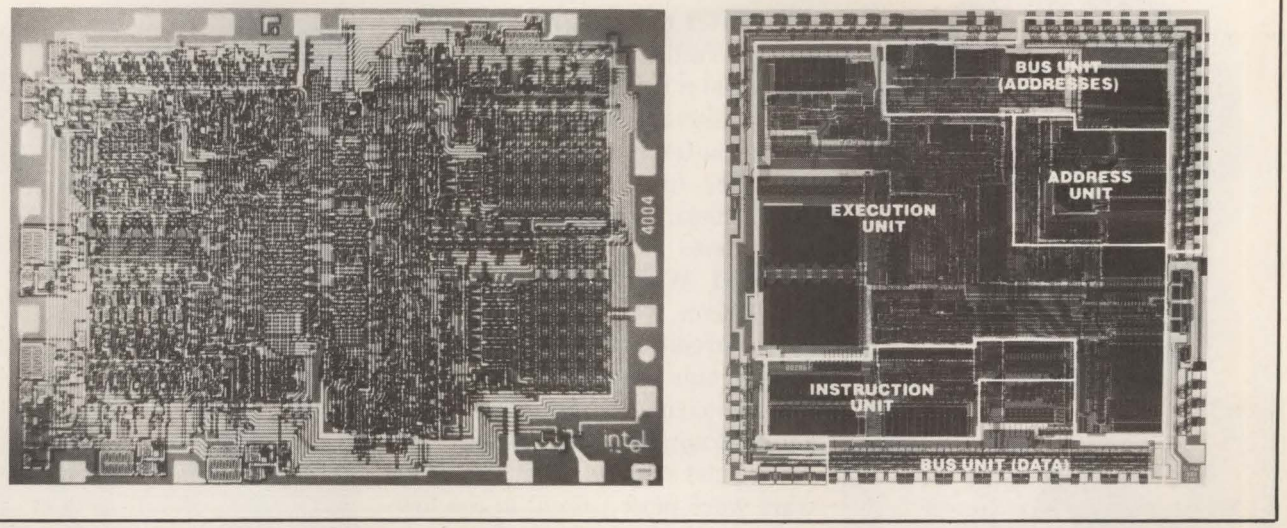


A comparison of two Intel microprocessors *shows dramatically how far that technology has come. The first microprocessor on the market, the 4004 (left) housed 2300 circuits. The new iAPX 286 microsystem (right) houses 130,000 transistors and enables addressing of as much as 1G byte of memory per task.*

response to a radically different market force. In the intervening years, microprocessors enabled companies such as Vector Graphic, Inc., Altos Computer Systems and Cromemco, Inc., to build small systems for around $10,000. Even more significantly, these manufacturers' products have been challenged by $2000 personal business computers.

The inspiration for much of this activity came from Apple Computer, Inc., which quickly moved from hobbyist to business marketing. Since it began shipments in 1977, Apple has grown at a breathtaking pace, racking up more than $264 million in sales in the first half of this year.

Another major phenomenon in the personal-computer market—which may reach $4 billion by 1985—is the evolution of creative marketing channels. In 1973, when few packaged small systems were seen at NCC, Microdata Corp. and others had the novel idea of selling to small businesses through small businesses. Thus, computer dealer marketing was born.

Microcomputers owe much to microprocessor developers, whose consistent work has made more power available in smaller packages. One of the strongest legacies came from Intel Corp., which was a $66-million company with 2500 employees at the end of 1973. Two years earlier, the company released the 4004, the first microprocessor, a dramatic example of how dense chips have become. It housed 2300 circuits, while one of Intel's latest products, the 16-bit iAPX 286, houses 130,000.

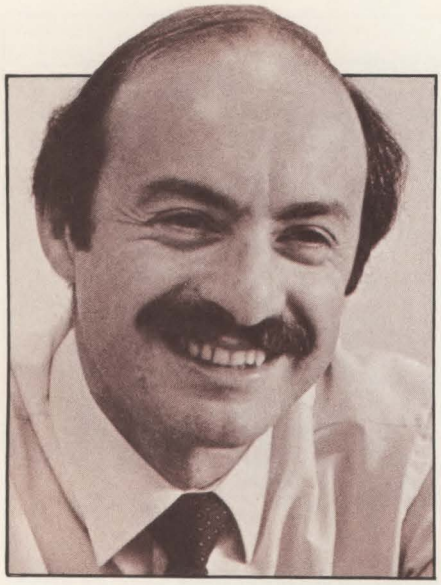
The 8008, the 4004's 8-bit kin, had been announced by 1973, and Intel was readying the 8-bit 8080, which would prove to be the fledgling industry's pacesetter.

At the 1974 NCC, Intel exhibited its small microprocessor line, plus development tools and memory products. "There wasn't much in the way of microprocessor products," says Les Vadasz, Intel's senior vice president and director of the corporate strategic staff. By year-end, however, 19 microprocessors had been introduced. By 1976, more than 50 processors were available from several sources. Intel now has several hundred products ranging from microprocessors to systems.

The semiconductor microprocessor market has grown phenomenally from $5 million in 1973 to $667 million in 1981, according to market-research firm Dataquest, Inc. That figure is expected to reach nearly $1.5 billion in three years.

Another fast-paced industry, especially in the past few years, is moving-head disk drives. Worldwide shipments from all vendors are estimated to hit nearly $1.5 billion by the end of 1982, up from approximately $400 million five years ago, says Jim Porter, Mountain View, Calif., industry analyst and publisher of *Disk/Trend Report*.

Sales of OEM moving-head disk drives for minicomputer-based systems were just getting off the ground 10 years ago. In 1973, IBM was readying a new class of disk drive, the two-spindle model 3340, which became familiar by its code-name Winchester. "In 1973, IBM packed 60M bytes into that drive," recalls Newark, Calif.,



Les Vadasz, *Intel's senior vice president and director of the corporate strategic staff, notes that Intel's legacy to the microprocessor industry includes the 8-bit 8080, as well as a product line that has grown from 19 microprocessors in 1974 to several hundred products ranging from microprocessors to memory to systems.*

industry analyst Andrew Roman. "Meanwhile OEM vendors were struggling to cram 10M bytes of storage onto an IBM 2314-technology, 14-in. disk cartridge."

The 3340's follow-on, the 3350, may have been the most successful drive ever built, and it set a technology pattern that dominates fixed drives to this day.

Critical to the development of the OEM market, recalls Porter, was establishment of an elaborate, highly developed infrastructure of vendors that supplied standardized media and heads for suppliers of 3340 and 3350 plug-compatible drives. This infrastructure later enabled small companies to develop OEM Winchester drives without a heavy up-front investment to design and manufacture those components.

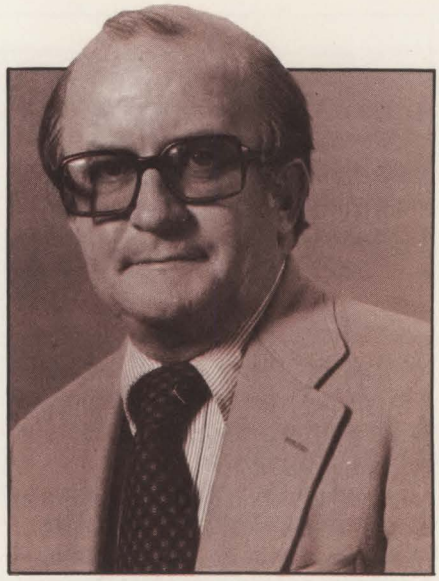
Low-end 14-in. drives introduced by Shugart Associates and Century Data Systems, Inc., in 1978 were followed by a rush of 8-in. devices a year later. Before they had a chance to cool off in the market, 5¼-in. Winchester drives arrived in 1980. As a result, this year's NCC evidenced a decline in shipments of 14-in. drives. Meanwhile, 8-in. drives continue to grow, but not at the rates first touted when they were shown in large numbers in 1979. Sales of 5¼-in. drives have exploded. While a little more than 1000 drives were shipped in 1980, Porter predicts that 146,000 will be shipped this year.

Other computer peripheral markets did not stand still as the disk-drive market grew. Industry price wars were most painful in the low-end matrix-printer business, in which market leader Centronics Data Computer Corp. was quickly bumped out of its top position by newcomer Epson America, Inc., based in Japan. Anadex, Inc., retreated to more fully featured mid-range printers before it could be pushed out of the low end. In 1979, the $995 model DP-8000 80-column dot-matrix printer strongly launched the company into the peripherals arena, says Kenneth Matthews, Anadex vice president of sales.

Printer prices have since plummeted. "I was selling our DP-8000 printers to distributors for about $625—almost 50 percent more than Epson," Matthews recalls. The DP-8000 is almost out of production now.

Leo McGarry, Dataproducts Corp.'s director of marketing, also points to prices as evidence of a dramatic change in his market. "A 300-lpm printer in 1962 cost about $19,000. Today, it would cost $3500." The reasons for the price drops are the use of chips in place of mechanical moving parts and higher production runs, and a gradual change from drum to band printers.

Price is a key issue in the terminal market as well. In 1973, market leader Beehive International Corp.



Andrew Knowles, *vice president of DEC's small systems group, notes that, while the PDP-11/45 was the fastest and biggest real-time minicomputer of its time, its hardware capabilities have come full circle and now can be had on small, inexpensive microcomputers.*

—then a $3-million-a-year company known as Beehive Medical Electronics, and now a $40-million-a-year company with more than 400 employees—offered the Mini-Bee glass teletype for around $1500 and the SuperBee editing terminal for about $3000, says Beehive's vice president of marketing John MacPhail. Comparable products today sell for three times less, he says, as a result of the lower cost of microprocessors and semiconductor memory compared to the TTL components terminals were built around then. Since 1973, more than 30 companies have been shaken out of the dumb-terminal market.

A contributing factor to the shakeouts was the NCC '73 introduction from then-tiny ($300,000 in annual revenues) Lear Siegler, Inc., of the single-board ADM-1. Its list price of $1695 was not unheard of, but Lear Siegler president Phil Shires says its margins were.

"We took manufacturers' reps who were making 15 percent and offered then 50," says Shires, "so it

really took off." Then president and co-founder Lee Falco says more than 100,000 ADM-1s were sold.

Lear Siegler landed the first blow in the dumb-terminal price war when it announced it had broken the $1000 list-price barrier with its extensive "dumb terminal, smart price" ad campaign for the ADM-3 in 1975.

An event of comparable significance was the 1979 entry ito the editing terminal market of TeleVideo Systems, Inc., with a "smart" unit that had the same code structure as the dumb ADM-3A but was priced $50 lower.

TeleVideo's vice president of marketing Steve Tatum says his company began the trend of offshore manufacture of subassemblies that lowered prices.

Tatum joins a number of other terminal industry executives who cite the 1976 introduction and subsequent success of DEC's VT-100 editing terminal—and the resultant slew of VT-100 emulators—as the decade's most significant event in the terminal industry, partly the result of the VT-100's modular, ergonomic design, 132-column format, aesthetics and ANSI-standard code. In 1973, the boundary between processing functions and communications functions was fairly clear, and the latter function was far from being a high priority. This year's settlement in the AT&T antitrust case, giving the communications giant new freedom to enter information-processing markets, however, crystallizes the merging of the communications and processing disciplines that has been under way for several years (see "AT&T begets American Bell, swiftly hails network service," p. 17).

One market that has taken off only recently is that of local-area networks, which were hardly even conceived of in 1973. Ethernet, probably the best-known LAN

scheme today, was first designed by Xerox Corp., Stamford, Conn., in 1975, and the first products were introduced in 1980.

For Xerox at the 1973 NCC, communications products were nonexistent. Over the years, Xerox flirted with long-distance satellite communications via its ill-fated XTEN program, but today, the company's main communications focus is office automation. NCC is more oriented to the computer room than to the front office, says Larry A. Spelhaug, manager of marketing services for the Office Products Division, noting, "Every company addressing the office at NCC now has some sort of communications capability."

—Edited by Lori Valigra. Reported by Larry Curran, Dwight B. Davis Larry Lettieri, Geoff Lewis, Nancy Love, Kevin Strehlo, John Trifari, Lori Valigra.

MINIBITS

GENERAL AUTOMATION TO MARKET HITACHI MICROS

General Automation announced its intention to enter the burgeoning microcomputer market and—like Burroughs Corp., NCR Corp. and Control Data Corp. before it—disclosed that it will do so through OEM agreements. The Anaheim, Calif.-based minicomputer veteran is expected to purchase $50 million worth of Hitachi-built microcomputers through 1987. The systems are being supplied by CIE Systems, the eight-month-old small systems marketing arm of the giant Japanese trading firm, C. Itoh, Ltd. The Motorola 6800-based systems will be shipped to General Automation in the third quarter and include single- and multi-user configurations supporting PRO-IV, a Data Technical Analysts "codeless" application generator (MMS, January, p. 28). The system also supports Regulus, a UNIX-compatible operating system, and UNIX System III, which is also slated for General Automation 900 series minis (MMS, June, p. 62).

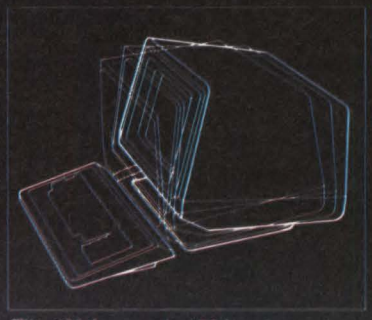
COMPUTERLAND BUYS 10,000 BABY BLUES

ComputerLand Corp. has purchased 10,000 Baby Blue CPU Plus boards from Xedex Corp., N.Y. Retail value of the purchase is more than $6 million. Baby Blue boards make the IBM personal computer compatible with most CP/M programs. The board plugs into one slot on the PC's chassis. Eight-month-old Xedex designs and produces hardware and software and markets software under licenses from other firms. The company expects to do a healthy business with Baby Blues, hoping for more than $15 million in orders by the year-end.

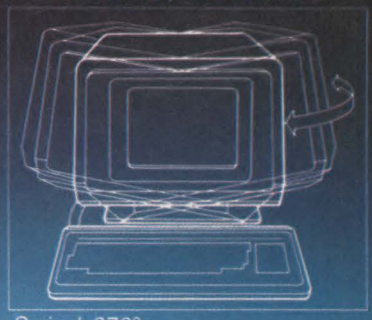
FIRST SOFTWARE TOOLS FOR INTEL'S 286

Intel Corp. has begun deliveries of a software-development package and one of three high-level languages for its iAPX 286 microsystem introduced in March (MMS, April, p. 52). These represent the first software support for the hardware. The iAPX 286 development package, a set of tools aimed at designing multitasking systems, contains a macroassembler, program linkage utilities, a symbolic debugger and a system simulator. It is priced at $5000. Intel is also offering PLM-286, Pascal-286 and FORTRAN-286 for the processor. PLM-286 is available now and is priced at $3750. FORTRAN and Pascal will be ready early next year.

VISUAL presents ergonomic elegance and high performance in a low-cost terminal.



Tilt: 10° forward, 15° backward



Swivel: 270°

$695 list

The VISUAL 50 represents a new approach in low cost terminals. Although it costs drastically less, it offers the features you expect from the high priced units.

For example, the VISUAL 50 enclosure is ergonomically designed in light weight plastic and can easily be swiveled and tilted for maximum operator comfort. A detached keyboard, smooth scroll, large 7 × 9 dot matrix characters and non-glare screen are a few of the many human engineering features normally offered only on much higher priced terminals.

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.

And you're not limited to mere emulation. As the chart shows, the VISUAL 50 has features and versatility the older, less powerful low cost terminals simply cannot match.

The price of the VISUAL 50? Only $695 list. Call or write for full details on the latest in the industry's finest line of video terminals.

Service available in principal cities through Sorbus Service, Division of Management Assistance, Inc.

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

VISUAL **See for yourself**

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540 Main Street, Tewksbury, MA 01876
Telephone (617) 851-5000. Telex 951-539

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Calendar

AUGUST

15-18 Second International Computer Engineering Conference and Exhibit, San Diego, Calif., sponsored by the Computer Engineering Division of the American Society of Mechanical Engineers, 345 E. 47th St., New York, N.Y. 10017, (212) 644-7100.

16-17 An Analysis of CAD/CAM Applications Seminar, Washington, D.C., sponsored by the National Computer Graphics Association. Contact: NCGA, 2033 M. St., N.W., #300, Washington, D.C. 20036, (202) 466-4102.

17-19 1982 Business Equipment Show, San Francisco, sponsored by the San Francisco Chapter of the Administrative Management Society. Contact: Emma Lee, General Chairman, AMS-SF, 900 Chestnut St., #404, San Francisco, Calif. 94109, (415) 776-4875.

18-21 Asian Computer & Business Equipment Expo, Hong Kong, sponsored by the Cahners Exposition Group. Contact: Cahners Exposition Group, 222 W. Adams St., Chicago, Ill. 60606, (312) 263-4844.

25-26 Computer Graphics for the Communications Arts, Chicago, sponsored by the National Computer Graphics Association. Contact: NCGA, 2033 M. St., N.W., #300, Washington, D.C. 20036, (202) 466-4102.

26-27 Microprocessor/Computer Control of Hydraulic Systems Seminar, Milwaukee, Wisc., sponsored by the University of Wisconsin-Extension. Contact: John M. Leaman, Department of Engineering & Applied Science, University of Wisconsin-Extension, 929 Sixth St., Milwaukee, Wisc. 53202, (414) 224-4189.

SEPTEMBER

8-10 Eighth International Conference on Very Large Data Bases, Mexico City, Mexico, sponsored by the International Federation for Information Processing, the VLDB endowment, Institut National de Recherche en Informatique et Automatique, le Chesney Cedex and Colegio de Postgraduados. Contact: VLDB Conference, P.O. Box 2245, Saratoga, Calif. 95070, (800) 722-2339, or (408) 374-7270.

8-10 International Symposium on Electromagnetic Compatibility, Santa Clara, Calif., sponsored by IEEE, EMC-S. Contact: Evangelos Tonas, EMC Symposium, P.O. Box 70577, Sunnyvale, Calif. 94088-4577, (408) 743-6027.

9-10 DPMA Conference and Business Exposition, Tampa, Fla., sponsored by Pinellas, Polk and Tampa Chapters of the Data Processing Management Association. Contact: Stan Allen, Chairman, Tampa Chapter, DPMA, P.O. Box 2045, Tampa, Fla. 33601.

14-15 "Requiem for Paper: The Voice & Electronic Mail Explosion" Seminar, sponsored by The Yankee Group, P.O. Box 43, Harvard Square, Cambridge, Mass. 02138, (617) 542-0100. Also to be held Sept. 28-29, Sunnyvale, Calif.

14-16 WESCON '82 High-Technology Electronics Exhibition and Convention, Anaheim, Calif., sponsored by Electronics Conventions, Inc. Contact: Eileen Algaze, Communications Coordinator, ECI, 999 N. Sepulveda

THE FIRST AND LAST WORD IN LETTER-QUALITY OUTPUT: SPINWRITER™.

There's only one word for a comprehensive printing system in the letter-quality office printer/terminal market: Spinwriter. NEC's Spinwriter 3500 Series includes ten models—all of which bring new dimensions to letter-quality printing.

With each Spinwriter 3500, you get the benefits of a superior, medium speed 35 CPS print mechanism plus more.

Ten Totally NEC-built Forms Handlers. Of all printer companies, only NEC designs and manufactures its own comprehensive family of forms handlers. All of them are user-changeable, to handle *all* your forms quickly and easily. There's a single-sheet feeder that's user-upgradeable to add a second bin or envelope feed. There's also a cut-sheet guide, a bi-directional tractor, demand document tractor with tear bar and copy separator, manual inserter and bottom feed.

Remarkable Uptime Standards. Standards which have made the Spinwriter a legend. A 3,000-hour MTBF—more than *two years* between failures! And no preventive maintenance or routine lubrication. Ever. And, with only 3 easy access major spares, MTTR is reduced to only 15 minutes!

Word Processing Assist. To simplify use, the terminal can perform WP tasks like automatic bi-directional printing, automatic proportional space printing, auto-justification, line centering, automatic bold and automatic shadow printing. In all of Spinwriter's many type styles, in thimble print elements of up to 128 characters.

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The Spinwriter 3500 Series. Reliable, quiet, compact, flexible, and easy to use. From NEC. The first—and last—word for better letter-quality output.

NEC

NEC Information Systems, Inc.

NEC Information Systems, Inc.
5 Militia Drive, Lexington, MA 02173

☐ Have a representative call me.
☐ Send me more information on the Spinwriter 3500.

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Title Telephone

Company

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Calendar

Blvd., El Segundo, Calif. 90245, (213) 772-2965 or (800) 421-6816.

15-17 LAN '82: Local-Area Networks Conference, Los Angeles, sponsored by Information Gatekeepers. Contact: Information Gatekeepers, Inc., 167 Corey Rd., Brookline, Mass. 02146, (617) 739-2022.

19-23 Ninth World Computer Congress, IFIP '83, Paris, France, sponsored by the International Federation for Information Processing. Contact: Program Committee, IFIP '83, IBM T.J. Watson Research Center, P.O. Box 218, Yorktown Heights, N.Y. 10598.

20-24 COMPCON FALL '82, Washington, D.C., sponsored by the IEEE Computer Society. Contact: COMPCON FALL '82, P.O. Box 639, Silver Spring, Md. 20901, (301) 589-3386.

20-24 The International Symposium on Subscriber Loops and Services, Toronto, Canada, sponsored by the IEEE. Contact: John D. Fahey, General Committee Chairman, Fl. 22, 393 University Ave., Toronto, Ontario M5G 1W9, (416) 599-6264.

21-23 International Technology Exposition, San Francisco, sponsored by Control Data Corp. Contact: W.M. Shaffer, Control Data Corp., 8100 34th Ave., S., Minneapolis, Minn. 55440, (612) 853-5748 or (800) 328-1870.

21-25 International Business Equipment Exhibition, Jakarta, Indonesia, sponsored by the Indonesian Government. Contact: Jeff Wolf, TMAC, 680 Beach St., Suite 428, San Francisco, Calif. 94109, (415) 474-3000 or (800) 227-3477.

OCTOBER

5-7 NEPCON CENTRAL '82, Rosemont, Ill., sponsored by the Cahners Exposition Group. Contact: Cahners Exposition Group, 222 W. Adams St., Chicago, Ill. 60606, (312) 263-4866.

11-14 Information Management Expo & Conference, New York, sponsored by Clapp & Poliak, Inc. Contact: Clapp & Poliak, Inc., (800) 223-1956.

13-15 Non-Impact Printing Technologies Database Access Meeting, Andover, Mass., sponsored by Advanced Technology Resources Corp. Contact: ATR Corp., 6256 Pleasant Valley Rd., El Dorado, Calif. 95623, (916) 626-4104.

18-22 Distributed Computing Systems, Miami/Fort Lauderdale, sponsored by IEEE Computer Society. Contact: IEEE, 1109 Spring St., Suite 300, Silver Spring, Md. 20910, (301) 589-3386.

NOVEMBER

3-5 Scan-Tech '82, Dallas/Fort Worth, Texas, sponsored by the Material Handling Institute, Inc. Contact: William P. Hakanson, Management Executive, the Material Handling Institute, Inc., 1326 Freeport Rd., Pittsburgh, Pa. 15238, (412) 782-1624.

Want reliable power for office electronics without costly special wiring?

Just plug in a Sola.

With minicomputers, terminals, word processors, disk memories and high-speed printers, you often get instructions to put in a "dedicated" power line. But, instead of breaking through walls, cutting trenches in floors, laying special conduit, pulling lots of wire and adding more breakers and switchgear to get reliable power, why not simply plug a portable Sola Power Protector into the outlet that's already there?

Dedicated lines can add anywhere from $1200 to $8000 or more per machine, even in new construction. For a fraction of that cost, a Sola Micro-Minicomputer Regulator not only replaces the dedicated line but does what dedicated lines can't do. It raises and lowers voltage to compensate for line fluctuations and brownouts. It blocks out electrical noise, and destructive power dips or surges. Our new Mini-UPS goes one step further. Its built-in battery maintains power when your electric utility fails. This keeps your electronics running smoothly until your generator comes on line. Both units are available in 60 Hz or 50 Hz.

Dedicated lines, at best, minimize power disturbances that are caused by other equipment in your building. Sola Power Protectors guard you against all kinds of power line disturbances regardless of where they originate. Check this chart to compare effectiveness.

	spikes and faults	dips and surges	line noise		Brownout	Blackout
			common-mode	transverse mode		
	momentary sharp voltage peaks or split-second power outages	short-term high or low voltages due to load start-up or shut-down	Unwanted voltages or frequencies due to bad grounding, switching, or radio-type interference: line-to-ground interference	line-to-line interference	Planned voltage reductions in response to high demand	Total loss of line power
Dedicated Line (with dedicated ground)	some, internal only	some, internal only	some, internal only	some, internal only	No	No
Ultra-Isolation Transformer	No	No	Yes	No	No	No
Sola Micro-Minicomputer Regulator	Yes	Yes	Yes	Yes	Yes	No
Sola Mini-UPS	Yes	Yes	Yes	Yes	Yes	Yes

Don't go through another day risking electronic malfunction due to unreliable power. Talk to your local Sola Electric representative or distributor. Or contact Sola Electric, 1717 Busse Road, Elk Grove Village, IL 60007. (312) 439-2800. We're the people who invented power protection 50 years ago.

The Power Protectors

A UNIT OF GENERAL SIGNAL GS

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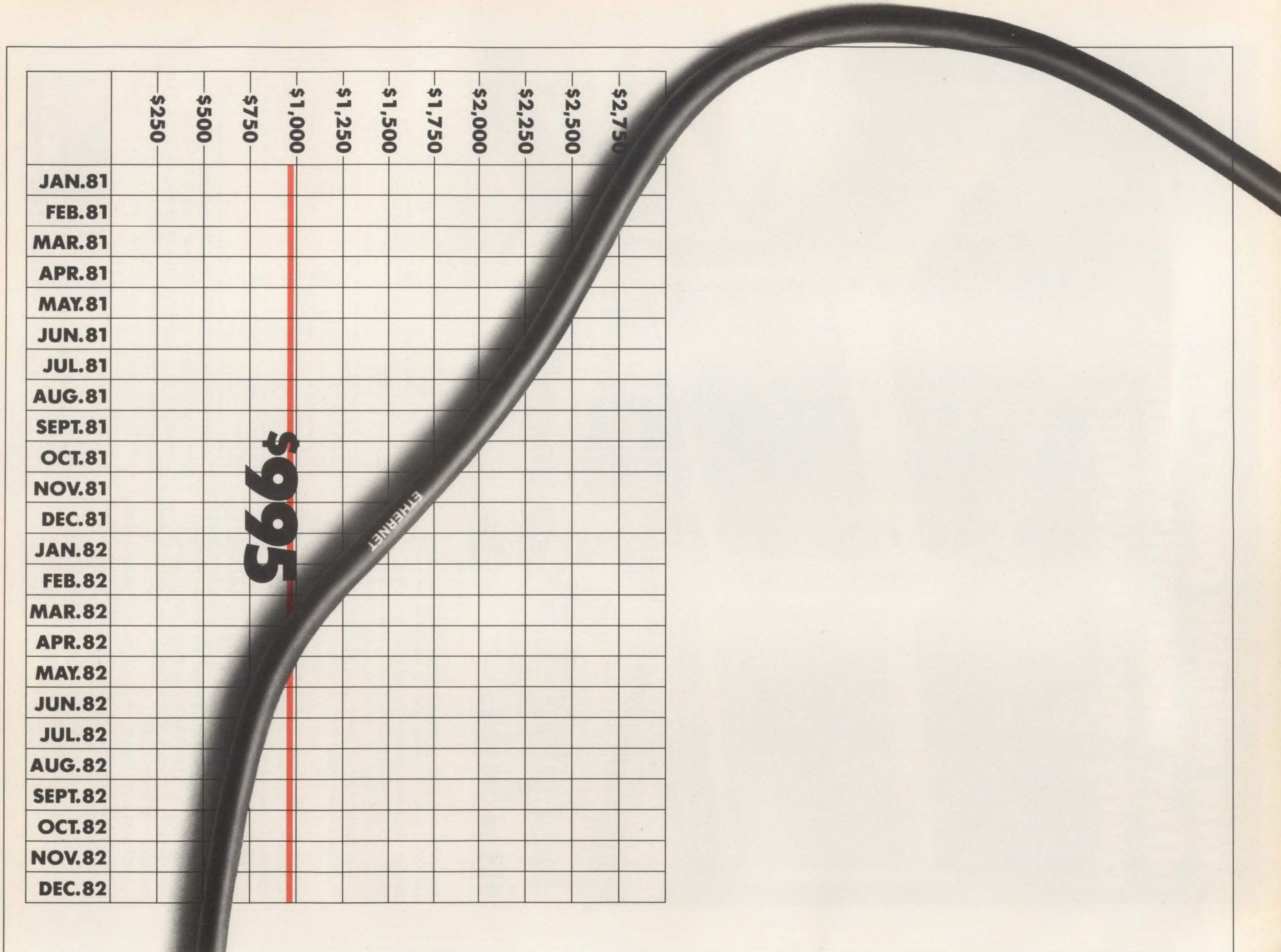

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ETHERNET

Until today, you probably couldn't afford to Ethernet your microcomputers. Now you can't afford not to.

3Com announces another first: a Multibus Controller for less than half the cost of any comparable Ethernet product on the market.

Now you can connect an IEEE 796 compatible Multibus micro or workstation to an Ethernet local computer network for just $995.* That buys you the controller, transceiver and cable. At that rate, your customers won't be asking you about networking. They'll be demanding it.

We brought about this price breakthrough by continually driving the learning curve in Ethernet communications. This commitment to Ethernet system development will leverage your investment in high-level software. So, if you want to build up a lead on the competition, join 3Com now for the long ride.

Our new Controller consists of a single board which plugs into the Multibus. It transmits at 10 Megabits per second and has 6K bytes of dual-ported read/write memory. Naturally, it conforms to the Digital, Intel, Xerox (DIX) Ethernet specifications.

This latest step forward in bringing computers and people together is just one of many such advances from 3Com. We were the first to deliver DEC mini Ethernet controllers. The first to provide UNIX networking application software. And the first to make Ethernet an economic reality for minis and micros.

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MMS 8/82

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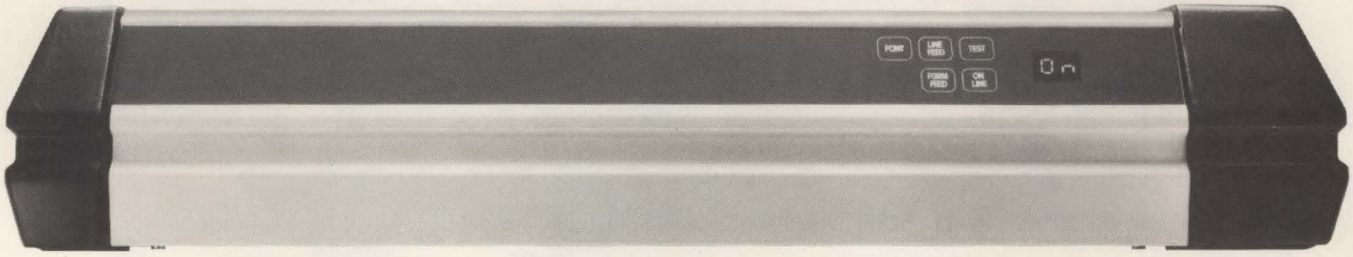
The OEM Ethernet Company

CIRCLE NO. 121 ON INQUIRY CARD

IT'S TIME YOU PUT YOUR NAME ON THE LINE.

Introducing the new GE 3000 family of printers.



When you put your name on this line of printers, you'll find the GE 3000 family is the best idea you ever had.

At GE, we've developed a very basic philosophy . . . when an OEM speaks, we listen. It sounds simple, but just try talking to other suppliers.

The new GE 3000 family of serial printers is the perfect example. Compact, lightweight, and functionally styled, these tabletop matrix printers are specifically engineered for the OEM supplier.

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GENERAL ELECTRIC

CIRCLE NO. 60 ON INQUIRY CARD

Vector Graphic's growth plateau, major reorganization coincide

Vector Graphic, Inc., which reached 25 million in annual sales only five years after it began corporate life in a spare bedroom, must overcome its growing pains if it is to remain a force in the small-business-systems market.

"Vector will not survive if growth flattens out," says Lore Harp, chairman and co-founder of the Thousand Oaks, Calif., microcomputer-systems manufacturer. Despite a flat fourth quarter, however, Harp is confident that the infusion of new management, the shipment of the new Vector 4 Z80-/8088-based system this month (see "Dual-microprocessor microcomputer boosts 8-bit software," p. 187) and a decentralization drive will have the company thriving again by early 1983.

With Vector, the word "thrive" is relative. Results for Fiscal year 1982 indicate a respectable 50 percent or more growth in net sales. But that's a far cry from the 181-percent annual rate Vector achieved from 1977 through 1981, and irrelevant in light of an unprofitable fourth quarter that left 1982 earnings at the 1981 level.

Harp blames the downturn on the weakness of the economy, but it coincides with a major company reorganization. Dr. Bob Harp, former Vector chairman and the designer of the products that fueled the company's meteoric growth, has left Vector for nearby start-up Corona Data Systems. Jim Alexander and Robert Wickham, vice presidents of sales and marketing, respectively, resigned from Vector recently, and international and domestic sales were consolidated under industry veteran George Sebestyen. The company's R&D arm has been trimmed and put under the direction of new vice president of engineering Andy Reichert, formerly of Micom Systems. And Harp has turned over most of the daily operation of Vector to Honeywell veteran Fred Snow, the company's new president (MMS, July, p. 64).

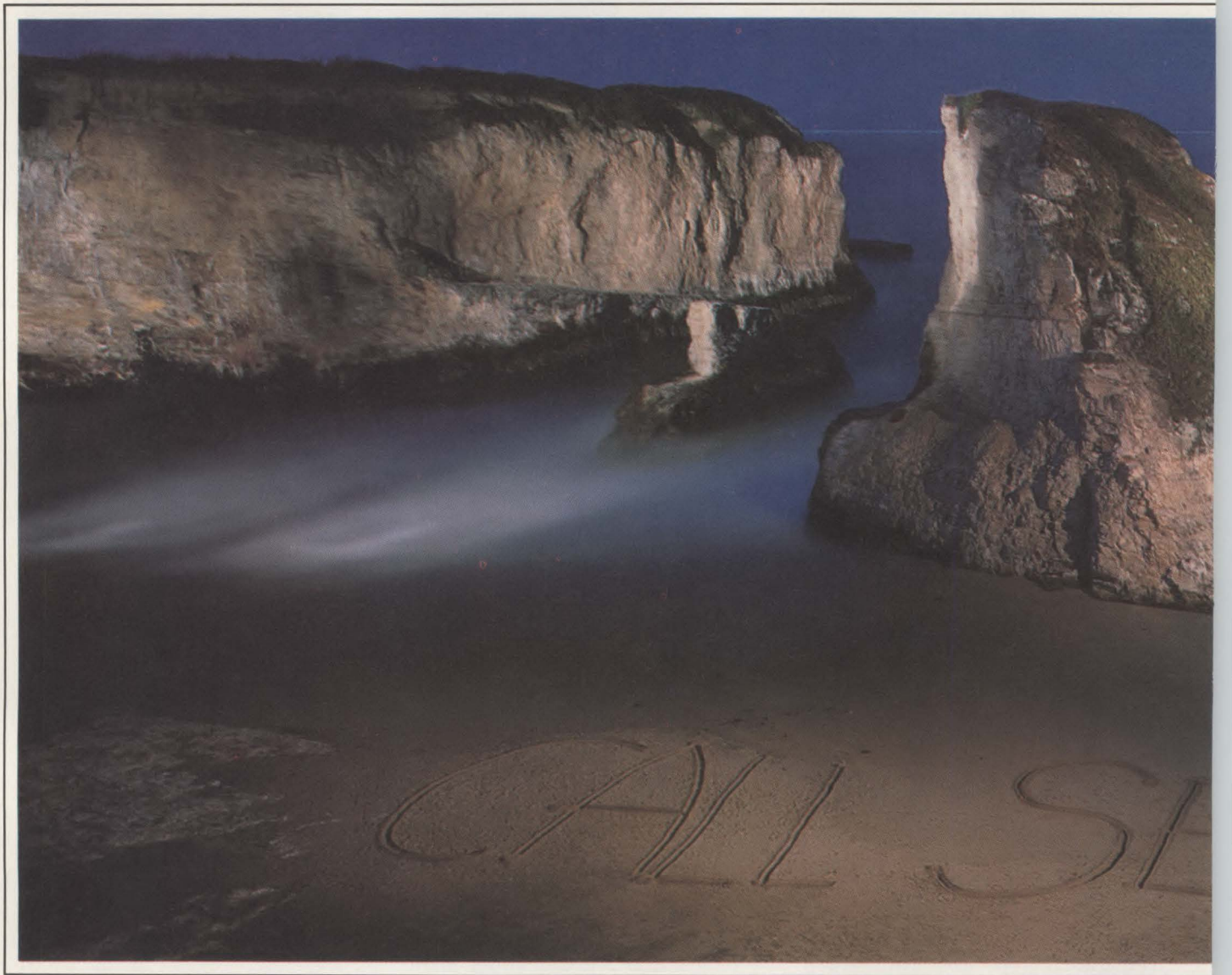
Vector co-founder Lore Harp: *"Vector will not survive if growth flattens out." The one-time rapid growth of the company has tapered off, and Vector is undergoing massive corporate*

"There is a critical stage between $30 million and $50 million in annual revenues where a company's management structure changes, where policies and procedures change, and you see a major transition in the kind of people you have to bring in," says Harp. Senior vice president Carole Ely, co-founder of Vector with Bob and Lore Harp adds that not everyone will be able to make the transition.

Harp says the reorganization will allow her to concentrate on long-range planning and on her role as transmitter of Vector's corporate philosophy and goals. The human resources sector and the vice president of finance Tom Harincar will continue to report to her, at least initially. "I'm still at the helm," she says.

It is apparent, however, that Harp must relinquish control to Snow if she expects him to stay with the company. "It's not my nature to turn in my time card and ask for next week's assignment," he says. Part of his charter is to use the experience he gained establishing Honeywell's ISO distribution in Europe to "make a big push there," he says. But domestically, he is stepping into a game in progress, inheriting a number of recently introduced programs that Harp calls "the groundwork for future growth."

You don't have to
to get competitiv



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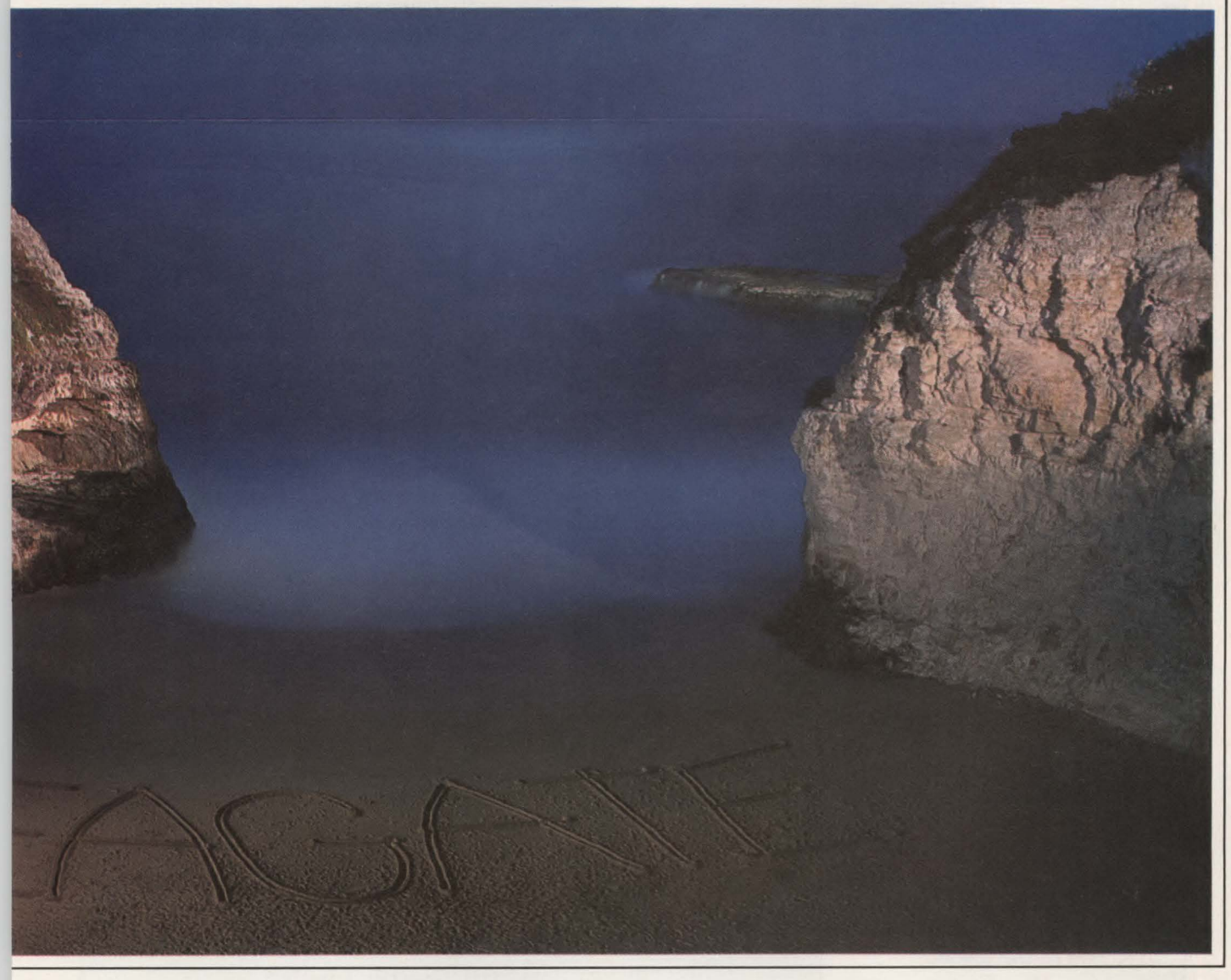

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CIRCLE NO. 117 ON INQUIRY CARD

These programs include a service agreement with TRW, a flooring plan financed through Westinghouse Corp., a plan allowing Vector dealers to lease or sell machines, the establishment of four regional offices, introduction of field training for dealers and video training for end users, a recent doubling of the sales force in the field and the intention to go from 450 to 1000 dealers by mid-1983.

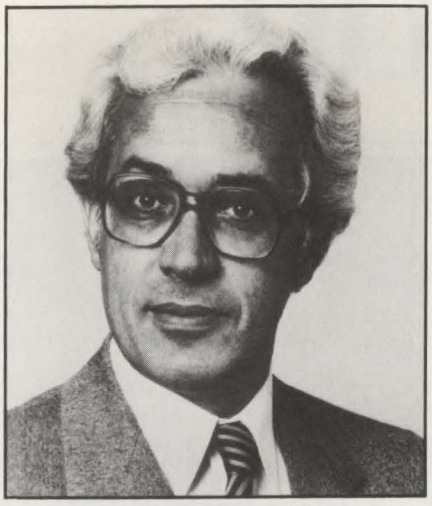
Snow plans to scrutinize this activity carefully, however. Although Harp is firmly committed to increase the number of dealers to 1000, Snow says, "I'd be pleased with a much smaller number of larger dealers." And despite Harp's feeling that Vector must gain market share," Snow says, "We're not in it for growth's sake."

Several unnamed analysts suggest that Vector's business plans have been predicated on steep growth rates, and that cash-flow problems will result if sales don't climb. The analysts also say that increased competition from such recent entrants as Digital Equipment Corp., IBM Corp., Hitachi and NEC Information Systems will make growth in the small-systems market difficult, given Vector's internal turmoil.

But Harp says Vector will do very well against the new competition. "They'll be looking back at how we set up our distribution channels," she says. "We're the model."

Harp sees the Fortune 1000 market as a primary target for growth. Our new machine is really well-suited for the office environment—with the features and ergonomics needed to compete in that market," she says.

Several southern California dealers who handle Vector and competing products echo Harp's enthusiasm for the Vector 4, saying it is well-aimed at the market between



Vector's new president, Fred Snow: *"It's not my nature to turn in my time card and ask for next week's assignment." He feels he must be given free rein to control the new Vector.*

the single-user Apple III and multi-user systems from Altos and others. "The Vector 4 looks like a long-awaited salvation for Vector," says John Grambo, owner of the Apple dealership in Orange, Calif.

Ironically, however, the introduction of the Vector 4 may have contributed to poor fourth-quarter results. "Vector announced the new machine in May and began an advertising campaign, even though they weren't planning to ship 4s until August," says one dealer. "Most customers decided to wait for the Vector 4; meanwhile, the company was bugging us about why we weren't ordering Vector 3s."

As if they didn't have enough problems, Vector recently announced another—the discovery of a $600,000 inventory shortage that may further impact earnings. A tip in March led to the filing of charges against a ring of company employees, who have reportedly confessed to the theft of $24,000 in systems, and Harincar says the recent discovery may be related to the inventory shortage. Vector's insurance company has been informed of the shortage, he says, but at press time the police were not involved. The transitional state of the company is a factor in the inventory shortage as well, Harincar says. Because Vector is switching to an automatic inventory system, he says, it is difficult to determine what items are missing.

Despite the gloom, Harp says her enthusiasm for the job is no less than when she was an entrepreneur wrapping boards in the bedroom. She says things will pick up in the first quarter. "My role is to expand the company and position it for growth," she says. "I'm the chairman, and I fully expect Vector Graphic to become a $200-million company before I step down."

—Kevin Strehlo

INTEL, BURROUGHS ENTER IC MANUFACTURING AGREEMENT

As a result of a recent Burroughs Corp. decision to concentrate on design and prototype wafer fabrication in lieu of high-volume wafer manufacturing, the systems supplier has entered an agreement with semiconductor manufacturer Intel Corp. Under the terms of the agreement, Burroughs will design, prototype, assemble and test proprietary circuits. For its part, Intel will become Burroughs's high-volume manufacturing source for proprietary metal-oxide semiconductor ICs. Also as per the agreement, Burroughs will receive technical information to aid it in designing Intel high-performance MOS- and complementary HMOS-compatible processes.

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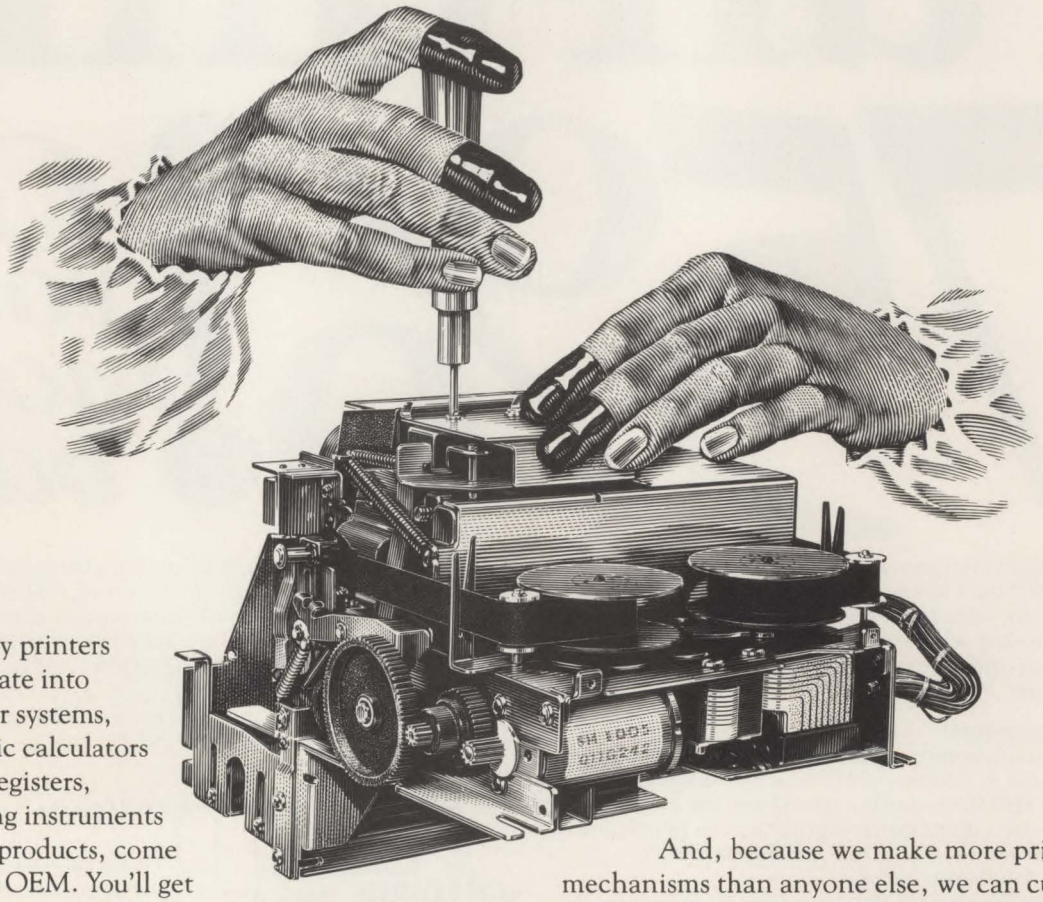

If you buy printers to integrate into computer systems, electronic calculators or cash registers, measuring instruments or other products, come to Epson OEM. You'll get the most reliable printers in the world with the custom features and colors you want, and we can deliver them at a lower cost than many standard units.

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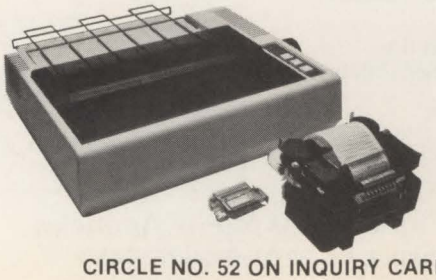

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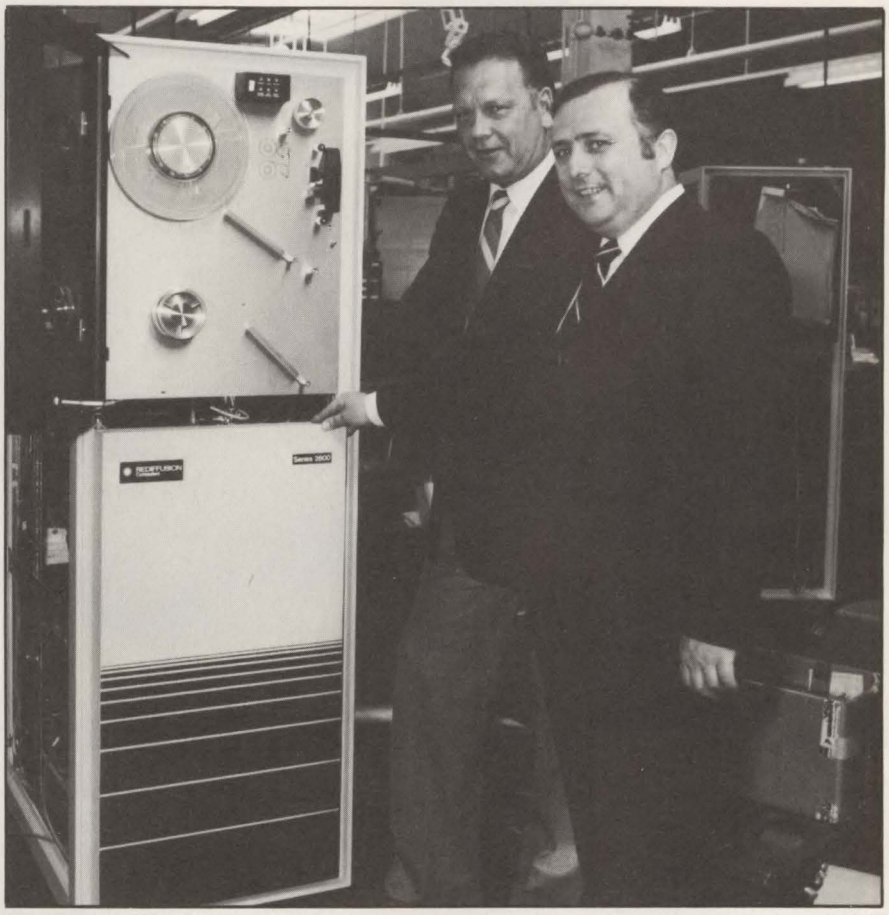
CIRCLE NO. 52 ON INQUIRY CARD

Innovative office technology en route from England

Two English companies with innovative office technology are moving into the U.S. market. Rediffusion Computers, which claims to have supplied more private Videotex systems worldwide than all other vendors combined, has appointed Salt Lake City, Utah-based Blodgett Computer Information Systems, Inc., to handle its U.S. sales. The other firm, Office Technology, Ltd., is actively seeking "a major U.S. partner in the computer, communications or office products market" to build and sell its Information Management Processor, which integrates voice information with text and data in a multiterminal office system.

OTL, Winchester, England, launched IMP in Europe last October. Product marketing strategy manager Rob Remington explains that each work station digitizes and compresses a user's voice (through a telephone handset) and processes the voice information in much the same way as text. In this way, IMP can create "compound documents" with inserted voice annotations. In addition, the voice facility can be used for dictation and message store and forward. Remington notes that voice makes the IMP attractive as a work station for company executives.

IMP work stations use an Intel Corp. 8086 microprocessor and 128K bytes of RAM. Pulse-code modulation is employed for voice digitizaton. A complete IMP configuration links as many as 32 work stations in a star network with a central controller that supports as much as 640M bytes of shared-disk storage. The controller also supports local voice mail between work stations.



Rediffusion's R2800 Videotex systems *are configured around a company-designed 16-bit minicomputer controller based on the AMD 2901 bipolar chip set. Jack D. Blodgett (left) is president of Blodgett Computer Information Systems, Inc., which is selling Rediffusion's R2800 Videotex system in the U.S., and Mike Aldrich (right) is Rediffusion managing director and chief executive.*

Voice annotation facilities include the display of a small loudspeaker symbol anywhere in the text or graphics of a document indicating where a voice comment has been inserted.

IMP has already attracted the attention of West Germany-based computer manufacturer, Nixdorf, which is developing an office-system product based on the voice technology licensed from OTL. Remington says Nixdorf cannot sell its product in the U.S. for some time period under the agreement, but Remington does not reveal how long that is. He says OTL's U.S. plans call for its unnamed partner to ship at least 2000 IMP work stations during 1983-1984 and to have achieved annual shipment volumes of 10,000 units by 1985.

OTL used the recent Syntopican office systems show to demonstrate IMP and contact potential U.S. partners.

Meanwhile, the Crawley, England-based Rediffusion Computers, part of a major cable TV company, is moving from its tradi-

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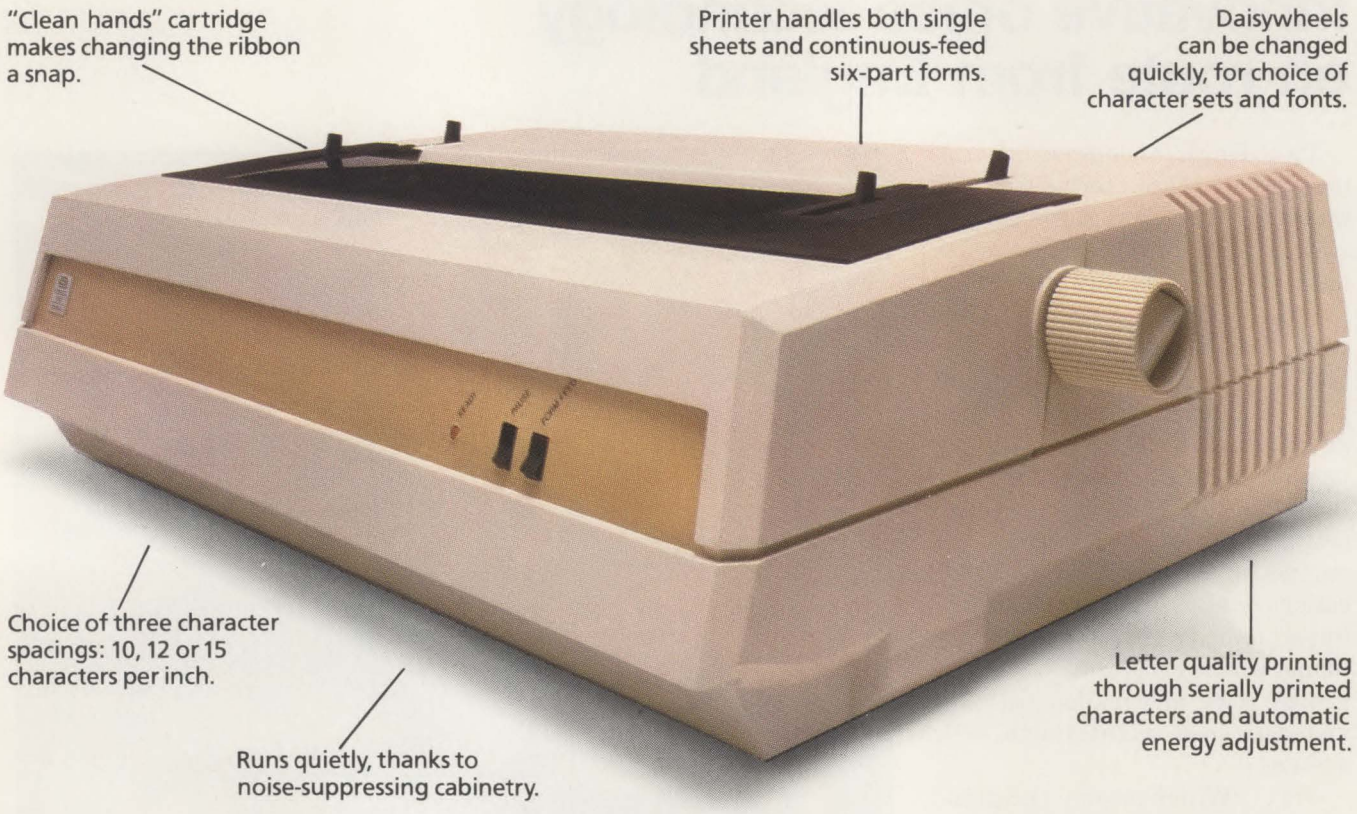

Attach your Series/1 to Control Data Letter Quality Printers.

Meet the letter quality printer that brings low cost and good-looking output to your Series/1: The Certainty® 410 Printer System from Control Data. It's the receive-only tabletop printer (just 45 pounds) that delivers quality copy at 55 characters per second.

First, this Certainty mini-peripheral combines state-of-the-art electronics with a direct drive system that boosts performance and cuts maintenance requirements. Second, you can select the character spacing (10, 12 or 15 per inch), line width (up to 198 characters per line) and line spacing (6 or 8 lines per inch vertically). So you can tailor your printed output to fit your needs neatly and precisely.

Your operator can change daisywheels quickly and easily; and ribbons can be changed in seconds, just by snapping in a new cartridge. Plus an optional forms tractor gives you bi-directional capability.

So this 410 printer is ready for immediate attachment to your Series/1 with RS232C interface. And it's available right now.

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CIRCLE NO. 30 ON INQUIRY CARD

IBM AIMS VIDEOTEX SYSTEM AT BUSINESS USERS

The IBM Corp. Series/1 Videotex System (SVS/1) program is aimed at organizations that want to establish private Videotex systems for sending and receiving text and graphics. The system can transmit internal mail, budgets, sales and merchandising information, travel schedules and bulletin-board notices, for example.

The system uses standard telephone lines to link IBM personal computers and television monitors with special adapters, or low-cost Videotex terminals, to data in a Series/1 computer. The system handles as many as 24 concurrent callers and a large number of intermittent callers.

SVS/1, also being marketed in the U.K., is similar in function to British Telecom's Prestel system. However, it includes additional features. The system uses an alphamosiac pattern, so that graphic images are made of a mosaic of small rectangular elements.

As many as 350,000 screens, or frames, of information, each consisting of 24 rows and as many as 40 characters of information, can be created, stored, edited and updated at editing terminals. About 99 security levels help protect confidential and sensitive information. The system automatically checks the security level of each frame before displaying it.

IBM's entry into a new market is usually a blessing, *and this time it may help force an agreement on an international Videotex standard. IBM's Series/1 Videotex System links IBM personal computers and television monitors or Videotex terminals to data in a Series/1 computer.*

Because SVS/1 operates under the Series/1 Event Driven Executive general-purpose operating system, it can run with other Series/1 applications or access them through user-written programs. Order-entry information, for example, could be passed between SVS/1 and another Series/1 program to update accounts-receivable records and generate invoices. Account numbers and delivery dates for shipments could be requested or validated.

With the SVS/1 announcement, IBM said that a single, worldwide, international Videotex standard would best serve the interests of users, the information-system industry and others. IBM intends to continue to participate in developing such a standard.

The first custom shipments of SVS/1 are scheduled to begin in December. A one-time license fee is $10,000.

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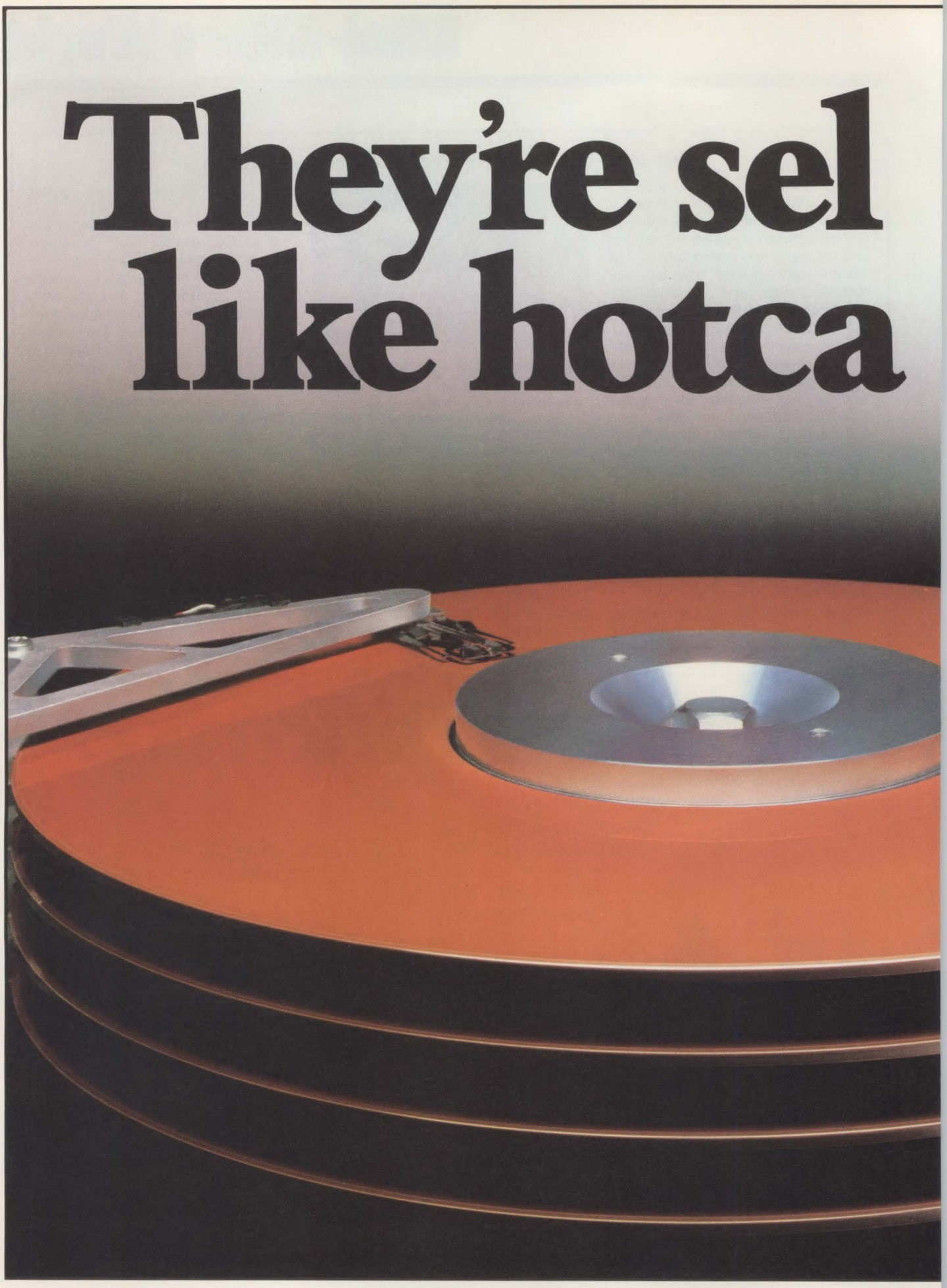

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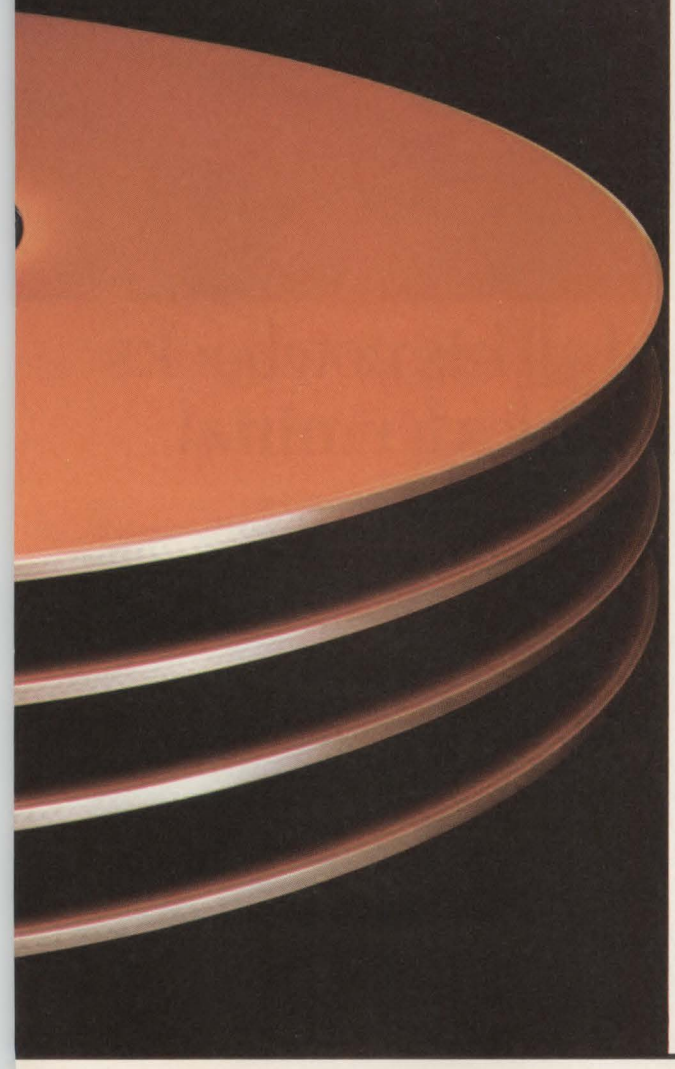

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We knew if we made a better 8" Winchester, you'd snap them up. Fortunately, we also had the good sense to design our Q2000 series so it could be manufactured just as quickly. We achieved this design goal several ways.

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As an OEM, you know there are some things you're better off not doing yourself. The same here. So we found the skilled suppliers who could make our parts and subassemblies to spec, further reducing our assembly time.

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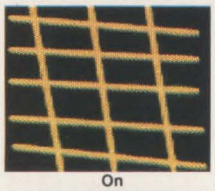
QUANTUM

Da Vinci would have traded all his notebooks for this new AED767 graphics terminal.

Today, Leonardo da Vinci's notebooks are priceless objets d'art. They also contain many unique engineering concepts, like the one shown above of the iron framework he designed to reinforce the head and neck moulds for 'Il Cavallo', the horse. Although da Vinci worked periodically on 'Il Cavallo' for 16 years, the gigantic bronze statue, which was to stand some 26 feet tall, never materialized.

AED 767's unique anti-aliasing feature



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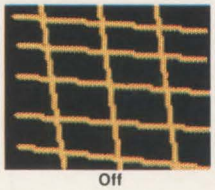

Off

Instead, his patron, the Duke of Milan, used the casting bronze for canons in a war against France.

But what took Leonardo many years to devise could have been achieved in mere hours with the help of AED's new 767 color graphics and imaging terminal. Available in desktop or 3½" high rackmount configuration, this new CAD machine has the kind of innovative features you'd expect only from AED. Features like built-in anti-aliasing (which virtually eliminates jagged lines common to raster-generated vectors). 1K x1K x 8 virtual address space. 768 x 575 pixel viewing window. Up-to-256 simultaneous colors from a palette of 16.8 million. A blue line reference grid that doesn't utilize video memory. Plus a refresh rate, adjustable from tv standard to flicker-free 45 Hz.

The AED767 gives you smoother drawings than any CAD station on the market—and at lower cost. So be a latter-day 'da Vinci' and use the best computer-aided design tool at your disposal. The AED767.

Advanced Electronics Design, Inc., 440 Potrero Avenue, Sunnyvale, CA 94086. Phone 408-733-3555 Telex 357-498. Outside California, Hawaii and Alaska call 800-538-1730.

All images shown taken from screen of AED767.

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CIRCLE NO. 16 ON INQUIRY CARD

tional market of large shared-processor data-entry systems into private Videotex configurations.

The company's latest product family, the R2800 series, comprises systems configured around a Rediffusion-designed 16-bit minicomputer controller based on the Advanced Micro Devices 2901 bipolar chip set. An R2800 configuration supports Rediffusion's Videotex Corporate Videotex Systems software, which shares a common database with the Advisor office-support system. Advisor provides text processing, document management, message transfer and an electronic diary, jotter, in tray and "wastepaper basket." The controller, which has as much as 1M byte of main memory and 600M bytes on disk, supports local or remote CRT terminals or Teleputers (Rediffusion-designed terminals combining Videotex with local processing under Digital Research, Inc.'s CP/M operating system).

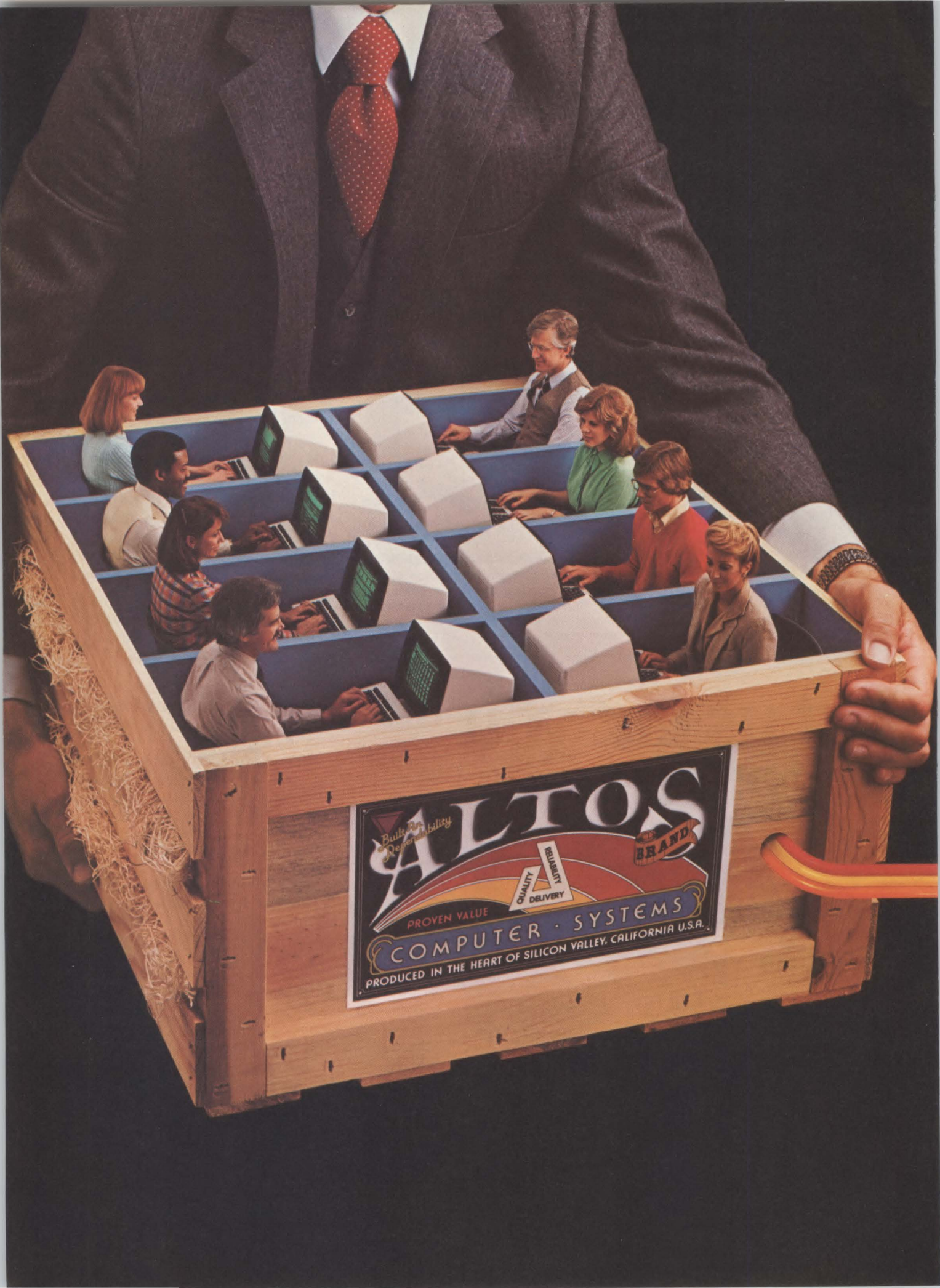
Rediffusion's U.S. agent, Blodgett, previously handled Nixdorf, Digital Equipment Corp. and Data General Corp. machines, but is now handling only Rediffusion systems. It will sell them through four main offices in New York, Chicago, Atlanta and Los Angeles. These offices support 40 nationwide local distributors called managerships.

Office Technology's Information Management Processor System's voice-input capability *enables users to create documents with voice comments inserted as annotations.*

Mike Aldrich, managing director of Rediffusion, expects the U.S. market for private Videotex systems to take off now that IBM Corp. has announced its plan to sell configurations based on its Series/1 minicomputers and personal computer in the U.S. (see "IBM aims Videotex system at business users," p. 83).

As on the Rediffusion systems, IBM's private Videotex software is functionally similar to Prestel, the public Videotex system operated by common carrier British Telecom. Noting that IBM's entry in the market is likely to place the seal of respectability onto private Videotex technology, Rediffusion's Alrich remarks, "It's like a papal blessing."

—*Keith Jones*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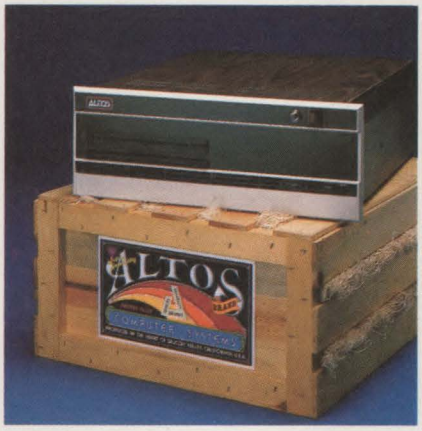

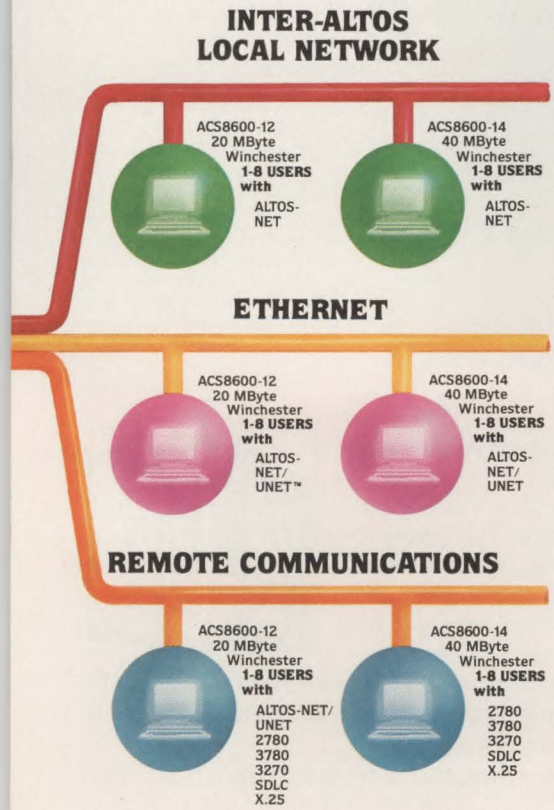

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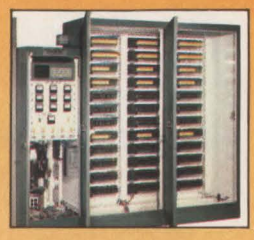

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CIRCLE NO. 40 ON INQUIRY CARD

Peripherals '82: new show just for peripherals, software

The International Peripheral Equipment and Software Exposition (Peripherals '82), the first show devoted solely to peripherals for minicomputers and microcomputers, will be staged Sept. 29, 30 and Oct. 1 at the Convention Center in Anaheim, Calif.

S. Henry Sacks, publisher of *Mini-Micro Systems*, which is sponsoring the show with the Cahners Exposition Group, says Peripherals '82 comes in response to the peripheral market's tremendous growth, projected at 25 to 30 percent this year alone. "In recent years, computer peripheral equipment has evolved into a separate and distinct discipline, as new technology continues to widen the scope of its importance and use in day-to-day business operations," Sacks says. "Peripherals '82 is the first specialized conference and exhibition of peripheral equipment and technology to focus on this growing market."

More than 100 companies will display their latest products, including terminals, printers, disk drives and peripheral controllers. Peripherals '82 will also feature 10 technical sessions dedicated to the technology involved in the evaluation, selection and application of peripherals.

Ergonomics will be the theme of the CRT-terminal sessions. Mel Rudin of Design Four, Los Altos, Calif., and Wim Selders of TEC, Inc., Tucson, will discuss the effects of ergonomics on CRT-terminal design. Rudin says he will propose additional design criteria to supplement those now considered as user-friendly, such as software improvements to eliminate excess function keys and complicated operating protocols, new alternatives in keyboard layout, thermally efficient electronics to decrease CRT-terminal size, tilted anti-eye-strain screens and detachable keyboards.

Peripherals '82, a new show strictly for minicomputer and microcomputer peripheral equipment and software, *will be held at the Anaheim (Calif.) Convention Center Sept. 29 to Oct. 1. More than 100 companies will display their latest products.*

Industry standards for small-computer software will be proposed by Paul E. Lecoq of Spokane Falls College (Wash.) "The lack of consistency in small-system software is retarding the growth of the industry," writes Lecoq. "It is difficult to build upon the successes of others when one must continually reinvent program elements that have been done time and time again. Meaningful standards would bring some order into the chaos and allow the industry to begin moving forward at a better pace."

In the same session, Charles Verboom of the Mare Island Naval Shipyard, Vallejo, Calif., will discuss distributed programming as "a controlled solution" to centralized MIS, and Stephanie Campbell of Real Estate Analysts, Newport Beach, Calif., will describe a customized cost-accounting software package that can be tailored to any small service business.

Disk drives will be considered during two sessions. In the first, backup systems for Winchester-disk drives will be explored by Robert Morris of Kennedy Co., Monrovia, Calif.; Tazz Pettebone of Data Peripherals, Sunnyvale, Calif.; and Paul Cochlan of Irwin International, Ann Arbor, Mich.

In the second session, disk-drive industry analyst Andrew Roman of Roman Associates, Newark, Calif., will look at the industry's future, exploring trends in floppy-disk drives and examining the market for small Winchester drives. Dr. Nigel D. Mackintosh of Century Data Systems, Anaheim, will discuss the advantages and disadvantages of different methods of evaluating disk-drive performance.

The first public disclosure of a five-year study of algography, a non-impact printing technology, will be presented by Evan Ragland of Algographic Corp., Atherton, Calif. Algography is "essentially a method of ionic-charge image production for subsequent printing on plain paper," Ragland says. He feels the technology has a bright future in line printing, office document retrieval and offset printing applications, and will be a low-cost competitor to laser and xerographic processes.

Other sessions will examine the evaluation and selection of peripheral equipment, software and operating systems to match the application. New developments in high-speed modems and multiplexers, serial printers and business graphics also will be explored.

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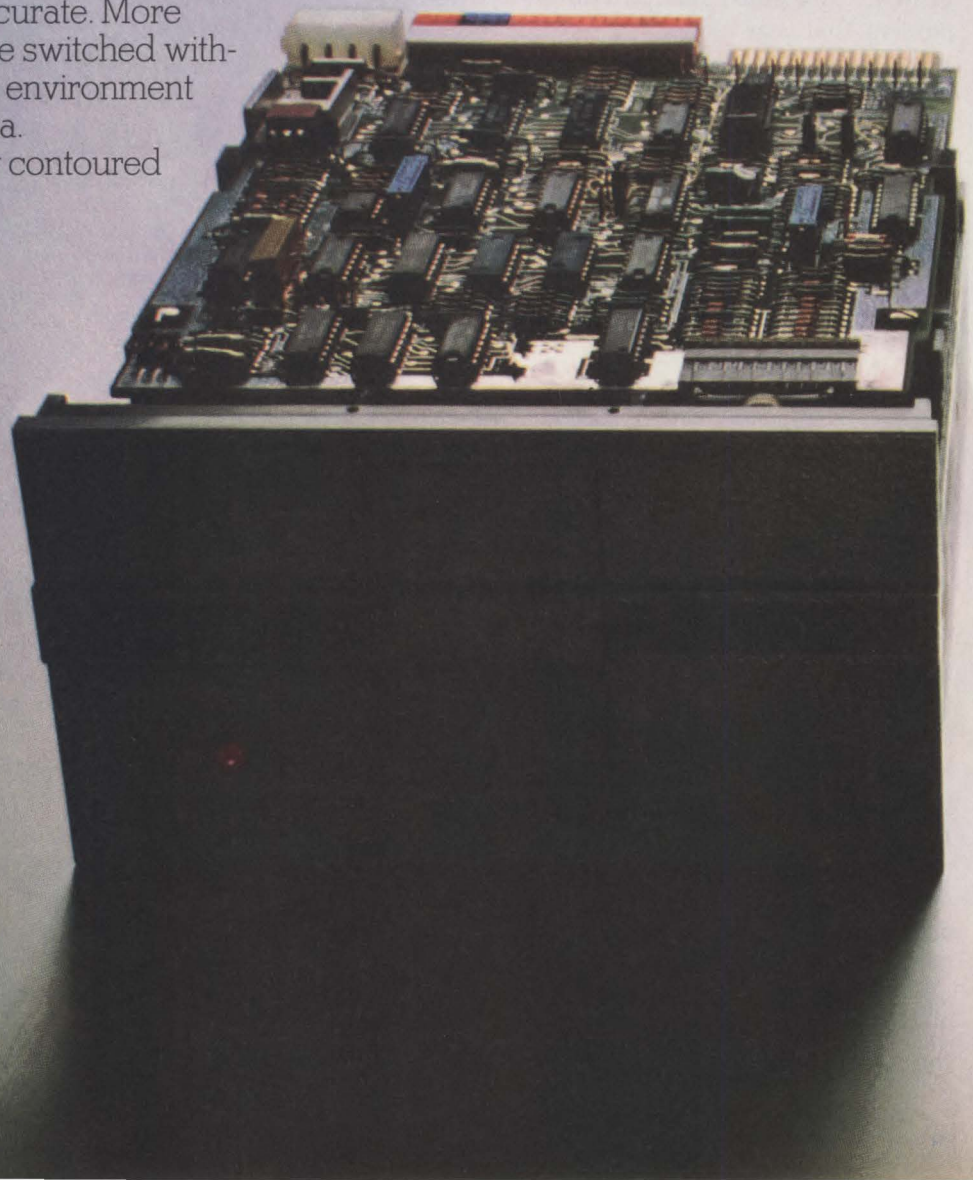

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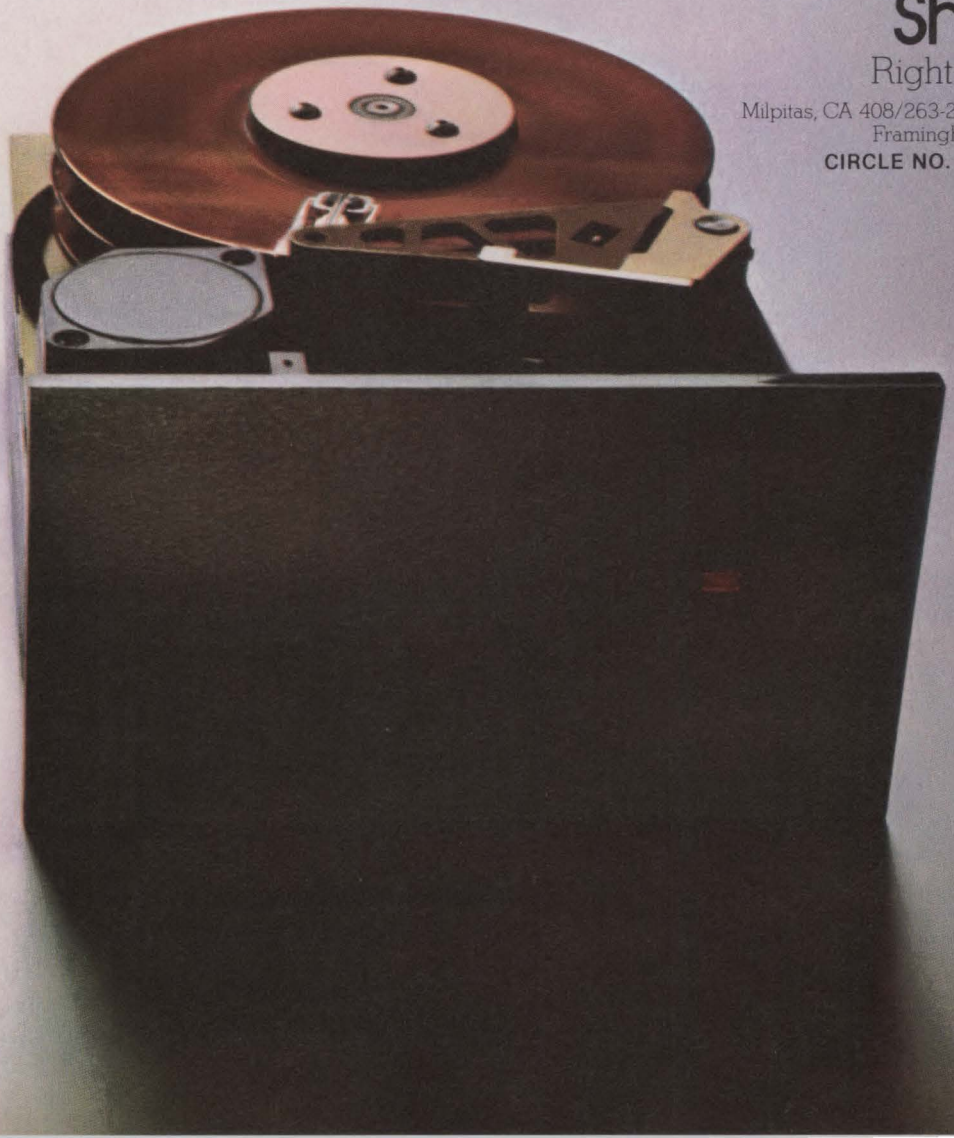

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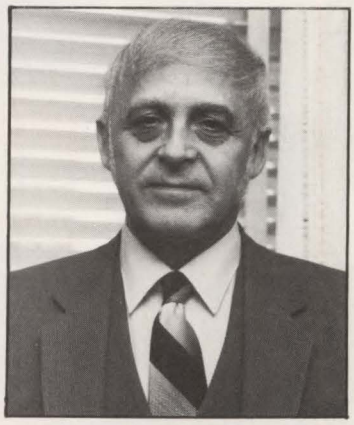
CIRCLE NO. 76 ON INQUIRY CARD

Publisher's Letter

Introducing a new magazine



In a few weeks, the first issue of *Business Computer Systems* (September) will be off the press. This new monthly magazine from Cahners Publishing Co., publishers of *Mini-Micro Systems*, is directed at users of business computers—systems that range from small desk-top units to minicomputers and small mainframe units.

Some of these users will be new to computing, and few will be in the "computer business," as such. The readers of *Business Computer Systems* have purchased their systems as management and decision-making tools. For them, computers are a means rather than an end.

An important distinction between the audiences of *Business Computer Systems* and *Mini-Micro Systems* is that *BCS* readers are all end users. They are not part of two important industry segments that make up more than half the *MMS* audience: minicomputer and microcomputer manufacturers (traditional OEMs) and third-party OEMs (system integrators).

For the new users, *Business Computer Systems*' goal is to make them smarter more quickly and to turn them into computing sophisticates.

For those with more experience, the magazine will provide information about new hardware, software and accessories that can help them make their systems more responsive to users' needs.

Some users will have reached the point of saturation with their original systems. For them, *Business Computer Systems* will provide the information they need to upgrade, whether with new performance-enhancing peripheral equipment or more efficient software. And, it will be a source of the data needed to select a new, more capable system.

The magazine will do its job through columns by experts, feature editorial, product evaluations, product surveys, book reviews, new-product coverage and other forms of editorial.

Because many of you are the developers of the systems the new magazine will cover, or sell subsystems integrated into them, you may be interested in *Business Computer Systems*' efforts.

For editorial information, contact either James Brinton, editor-in-chief of *Business Computer Systems*. Information about advertising is available through James Di Filippo, national sales manager.

S. Henry Sacks

S. Henry Sacks
Vice President/Publisher

SYSTEM 2800

another A MAJOR BREAKTHROUGH!

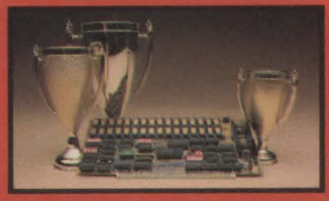
20 MByte Winchester Hard Disk with Tape Backup

The SYSTEM 2800, designed for business, industrial and educational applications, is now available with a 20 MByte Winchester Hard Disk and a 20 MByte Tape Drive for disk backup. Created to be innovative and competitive, the SYSTEM 2800 utilizes our existing line of field-proven and dependable "2nd Generation" S-100 Memory, Z80 Processors, Disk Controllers and Serial I/O boards.

As a family of expandable microcomputers intended for single and multi-user applications based on CP/M*, MP/M* and OASIS**, the SYSTEM 2800 contains many big system features. Outstanding characteristics such as FAST operation make it a clear market leader. In fact, the SYSTEM 2800 is one of the fastest Z80-based systems recently benchmarked by Interface Age magazine.

*CP/M and MP/M are Registered Trademarks of Digital Research

**OASIS is a Trademark of Phase One System, Inc.



Other featues include the capability to BOOT from any drive including the hard disk, and extensive error recovery. The error recovery prompts the user with detailed error messages and prevents system lock up, all too common to many other systems.

Designed for easy service, the SYSTEM 2800 comes with two 8-inch drives: a choice of single or double sided, double density floppies with up to 2.52 MBytes of formatted storage; 10 or 20 MByte Winchester hard disk; and 20 MByte tape drive for disk backup.

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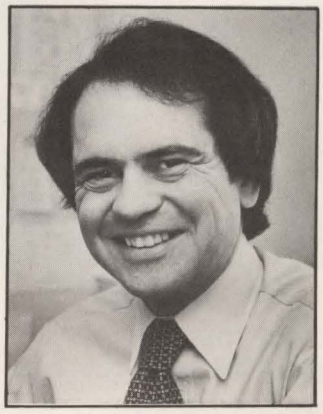
Lessons to be learned



It is too early to analyze what some in Northern California are already beginning to call Techscam, but some observations concerning the recent arrest of several Hitachi and Mitsubishi executives on charges of paying for stolen IBM Corp. trade secrets are in order.

Japanese computer companies are not the only ones that would like advance information on what IBM has under wraps at its San Jose facility—especially in the area of disk drives. There is a difference, however, between gathering competitive information and paying for manuals, tapes and other documents that may be stolen. That may be one lesson that could emerge from Techscam.

More damning to Japanese credibility in this country may be a more subtle lesson, however. Whether the executives charged in this case are ultimately found guilty or not is almost immaterial. Rather, Japanese computer companies here may have a hard time living down the fact that Hitachi and Mitsubishi executives failed to report to U.S. authorities that they suspected that an attempt was being made to sell them information that could have been obtained illegally from IBM.

Cries that over-zealous junior executives went out on their own and acted without top-level approval are an insult to one's common sense, given the dollars involved in the transactions reported so far. Cries that the FBI entrapped these poor unsuspecting Japanese executives have the same hollow, pathetic ring we have heard from U.S. representatives and senators caught up in Abscam. In the case of these executives—as in the case of the Abscam congressmen—if they suspected something illegal, at the very least, all they had to do was get up and walk away from the deal.

We hope the recent activities of Hitachi and Mitsubishi are not examples of commonplace Japanese business practices in this country, and that other Japanese computer companies insist that higher moral and ethical standards be observed.

Mini-Micro Systems suggests strongly, however, that this might be a good time for these other firms—as well as U.S. companies themselves—to re-examine their methods of doing business. They should be especially wary of making payments for competitive information, and should make it company policy not to use stolen competitive information—or information that they suspect is stolen. They should also make it standard operating procedure to immediately notify U.S. authorities in such cases.

John Trifari

John Trifari
West Coast Bureau Manager

Letters

MENTOR'S SIMULATION

To the editor:

Having just perused the June issue of *Mini-Micro Systems*, I read the article on Mentor Graphics with some concern ("Mentor enters CAE market with 32-bit networked system," p. 57).

The primary distinguishing feature of Mentor, which sets it apart from all other computer-aided engineering competitors, is the total integration of logic design/analysis functions. At the heart of the system is the Interactive Logic Simulator (SIM), which is immediately available with first customer shipments. I find it confusing that the copy first points out the existence of a SIM package, but then refers to its not being initially available.

There is a difference between the networking capabilities of Mentor and Daisy Systems. Each Mentor system is a dedicated, 32-bit CPU, which is linked to other nodes over a high-speed, coaxially connected communications network.

If I am not mistaken, the Daisy approach is a typical, host-based configuration. The overriding benefit is that Mentor prevents system performance degradation.

Melissa Waggener,
Account Executive
Regis-McKenna Public Relations
Portland, Ore.

(The editor replies: The Mentor story filed by Larry Lettieri, assistant West Coast bureau manager, was accurate. The confusion about the availability of the logic simulator was introduced during editing.)

MIPS-TAKES

To the editor:

We appreciate the problems of doing large-scale comparative performance charts, but there is an error in the one on p. 151 of your April issue, which we hope you'll not repeat if the occasion arises again.

The reference is to the HP 3000 Series 64. Your chart shows "0.5 to 0.7 MIPS—comparable to IBM 4341-10." HP claims 1 to 1.1 MIPS, and considers the machine comparable to the IBM 4341-11. If your source should doubt that claim, we'd like a chance to substantiate it. That change would alter your price-performance figure, but I can't offer a correction because we don't know precisely how the figure was reached.

One other matter is of substance: the maximum total disk storage is 6420M bytes, not the 1920M bytes shown in your chart. Your source probably was assuming 120M-byte drives; the machine will support 16 of the newer 404M-byte drives.

Of less importance, we'd like it noted that the computer can support two (not one) advanced terminal processors. APL is available only on HP 3000 Series III computers.

Ross H. Snyder
Hewlett-Packard Co.
Business Computer Group
Cupertino, Calif.

LOOKING AHEAD IN MMS

Be sure to watch for these editorial highlights in coming issues of Mini-Micro Systems:

- The October issue will survey memory systems.
- The November issue will include MMS's annual report on computer terminals.
- A technology and product review will be featured in the December issue.

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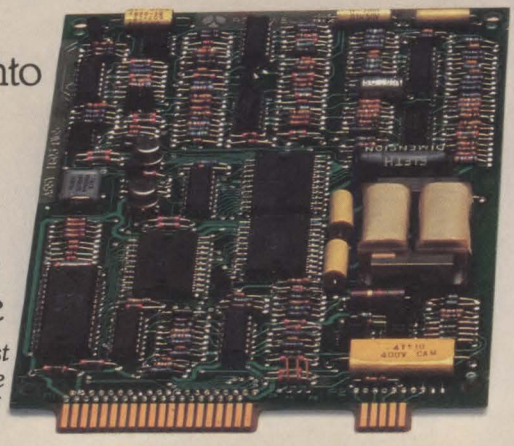

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DECnet and SNA—networks evolving from polarized cultures to common ground

By Dwight B. Davis
Associate Editor

Less than a decade ago, two events occurred that would influence computer-system networking more than any other developments. In 1974, IBM Corp., Armonk, N.Y., introduced its Systems Network Architecture, and Digital Equipment Corp., Maynard, Mass., began developing its Digital Network Architecture. The first DNA products, appearing under the DECnet moniker, were released two years later in 1976.

Neither SNA nor DECnet proved to be an immediate success. The early products offered very limited functions, and few computer users then felt comfortable with data-communications concepts. But IBM's and DEC's networking products have evolved rapidly, especially since 1980, and users became more sophisticated about data-communications issues and benefits. Today, both types of networks are well established, and prospects for each appear bright.

Although both SNA and DECnet were designed to meet the communications needs of two distinct groups —mainframe-oriented IBM customers and minicomputer-oriented DEC users—many companies today operate in mixed computer environments. IBM machines and software, including SNA products, tend to dominate the mixed environments in which they appear, and this fact has resulted in a large market for non-IBM equipment that can operate under SNA. DEC recently made a major step in this area, when it announced plans to provide a DECnet-to-SNA gateway product through which a certain amount of internetwork communications will be possible (MMS, June, p. 58). Such gateways will become more common as SNA continues to spread throughout the corporate world.

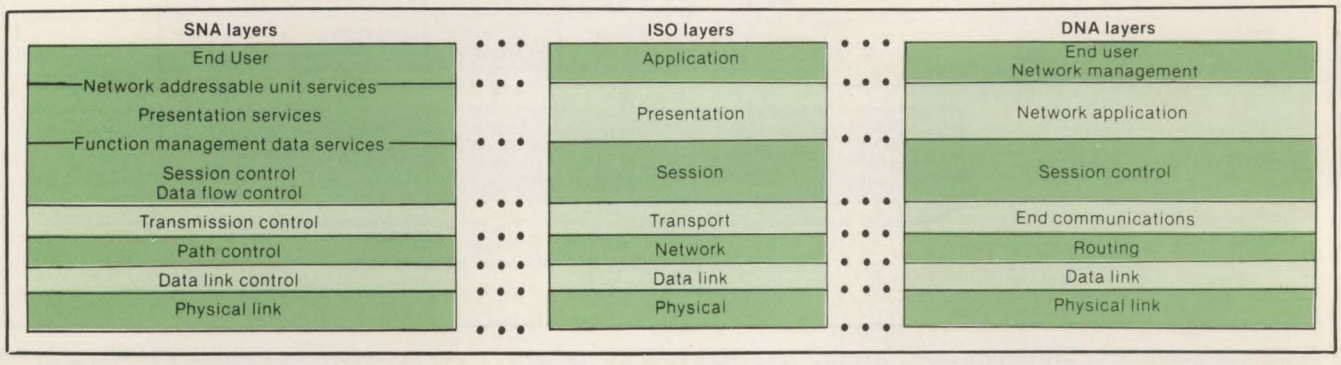
An International Data Corp. report issued in May, 1981, surveyed 200 sites that had 3705 front-end processors installed along with a 370/135 or larger IBM host. The Framingham, Mass.-based research firm found that of those sites, 51 percent ran under SNA. Projecting SNA usage for all U.S. sites owning a 135 or larger IBM processor—even those without a communications front end—IDC estimated about 22 percent of these sites ran SNA in 1980, and projected 45 percent would operate in SNA environments by 1985.

DEC, meanwhile, had more than 1500 computer nodes running under DECnet by the end of 1980. By the end of this year, sales are expected to surpass 6000 nodes. John Adams, manager of distributed systems marketing and planning at DEC, expects about 80 percent of the company's computers to be networked by 1990. A high percentage of these will be networked under DECnet products.

Common goals, different implementations

SNA and DNA were both developed before the existence of the now-familiar seven-layer networking architecture promoted by the International Standards Organization, and neither networking architecture corresponds in a one-to-one fashion to the ISO model (see chart, p.103). Along with the differences between the SNA and DNA architectures, the networks are also usually implemented in different configurations.

Despite these fundamental differences, SNA and



Both SNA and DNA are layered networking architectures, *although each was developed before the arrival of the International Standards Organization's seven-layer Open System Interconnection model. Even the ISO model does not have well-defined standards for its higher layers, so it's difficult to compare it directly to other architectures. The chart shows approximately how IBM's and DEC's networks correspond to the ISO model.*

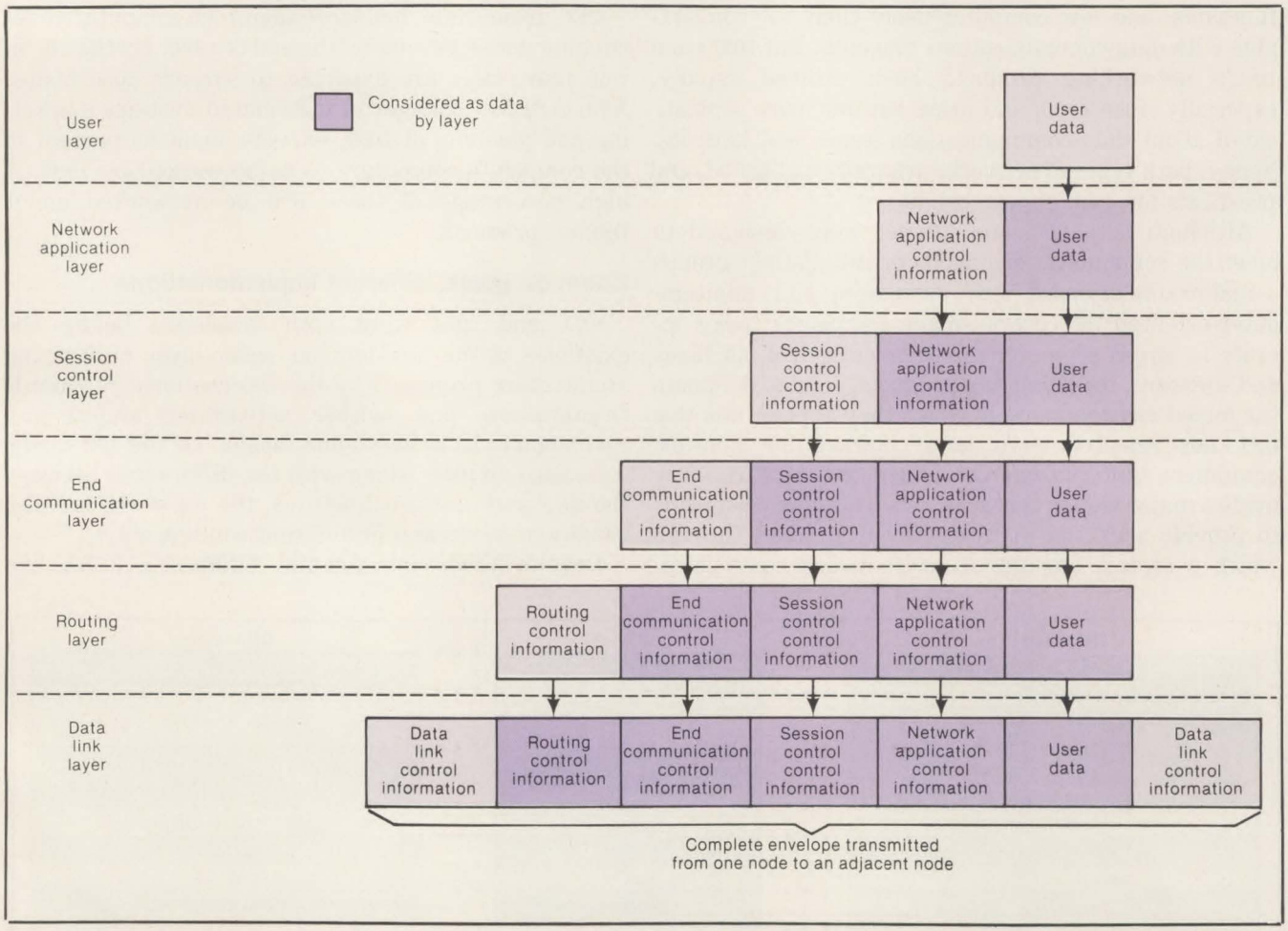
DECnet share many networking goals. Each is designed to provide a common user interface to the network, and network routing and management operations are meant to be transparent to the user. Both networks support many configuration topologies and various communications facilities and channels. Different applications and operating systems can run within each type of network, and both IBM and DEC designed the ability to be expanded and upgraded into their network schemes.

The differences that do exist between SNA and DECnet stem primarily from the difference between IBM's and DEC's traditional computer markets. "IBM started with a user base of very large machines in strictly centralized environments," says Howard Frank, president of research and consulting firm Contel Information Systems, Inc., Great Neck, N.Y. "When they built SNA, therefore, its first implementations were completely centralized networks. "DEC, on the hand, was coming from a small machine base. When you have a wide variety of small machines, it doesn't make any sense to have a central point of control because you don't have a big enough machine to handle it."

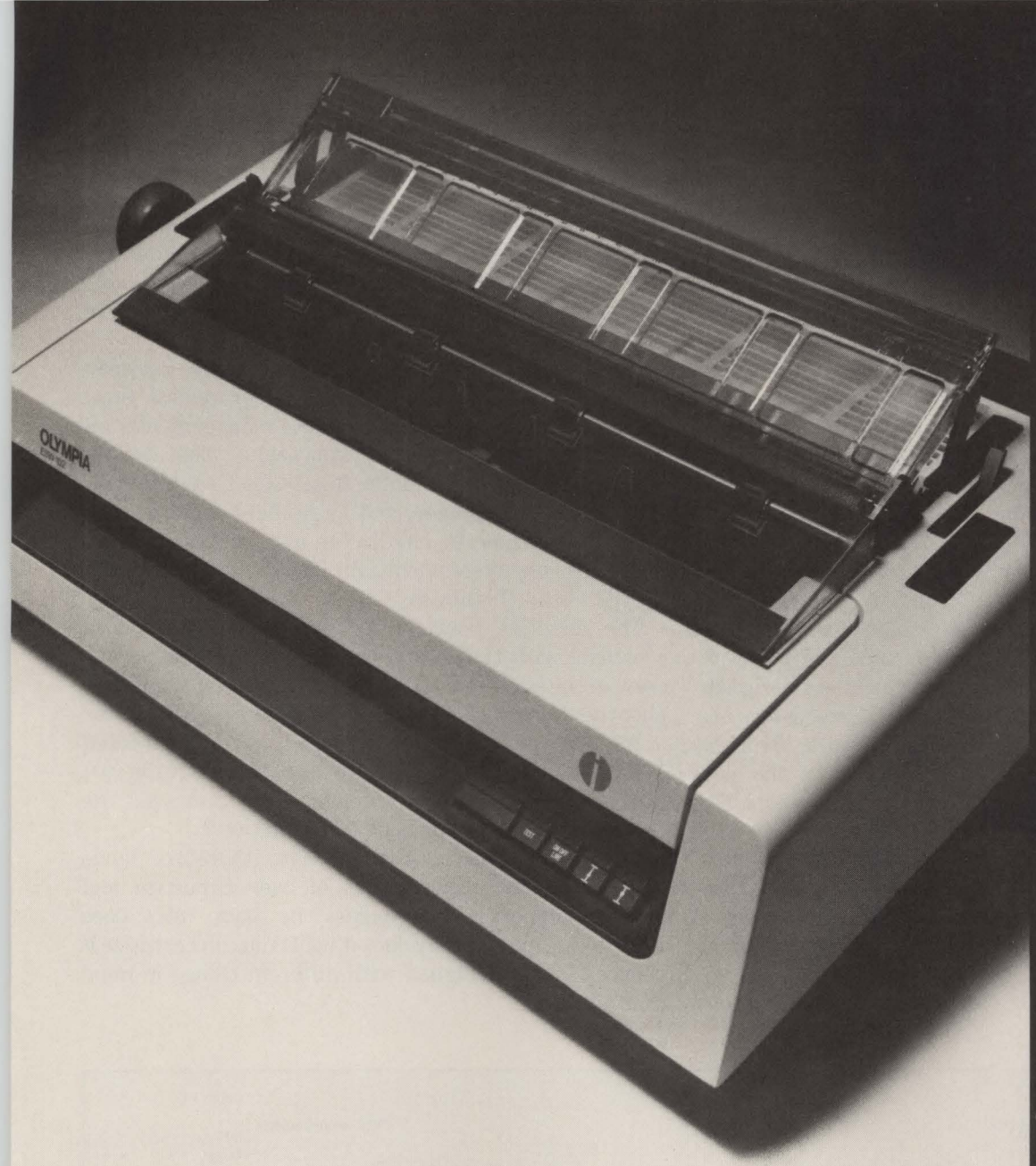
Mainframes and terminals

When SNA appeared, its initial implementations consisted of single-host networks supporting a large number of terminals. At first, IBM didn't offer support for multi-host SNA networks—although they now do—but there was little demand for such IBM networks. Even today, most SNA networks are thought to consist of a single mainframe holding one or more databases and primarily supporting terminal and remote-job-entry traffic.

Given this background, SNA was implemented in a hierarchical fashion, with many of the networking facilities residing in one or more centralized host computers. SNA networks can be broken into domains, however, each controlled and monitored by a set of SNA



This representation of the DNA layers *shows how each lower layer adds information to the user packet until it is completely enveloped by the Data Link layer. The complete packet leaves the source node and travels to the destination node, where each layer strips the appropriate information from the user data. If the packet must pass through adjacent nodes before reaching its destination node, it travels up to the routing layer of each adjacent node, which routes it back to the communications line and on to the next adjacent node. (Source: Digital Equipment Corp.)*



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components called a system services control point. Various IBM processors can contain SSCPs, including System 370s, 4300s, 8100s, System 34s and System 38s.

Frank says most SNA networks consist of just one SSCP, but that networks with multiple SSCPs managing distinct domains still rely on central control. "The SSCPs are not operating autonomously," he explains. "They talk back and forth to pass control from one central point to another." IBM's SNA users' manual also points out that the SSCP "interacts with other SSCPs and with one or more individuals whose job is to supervise the operation of the network."

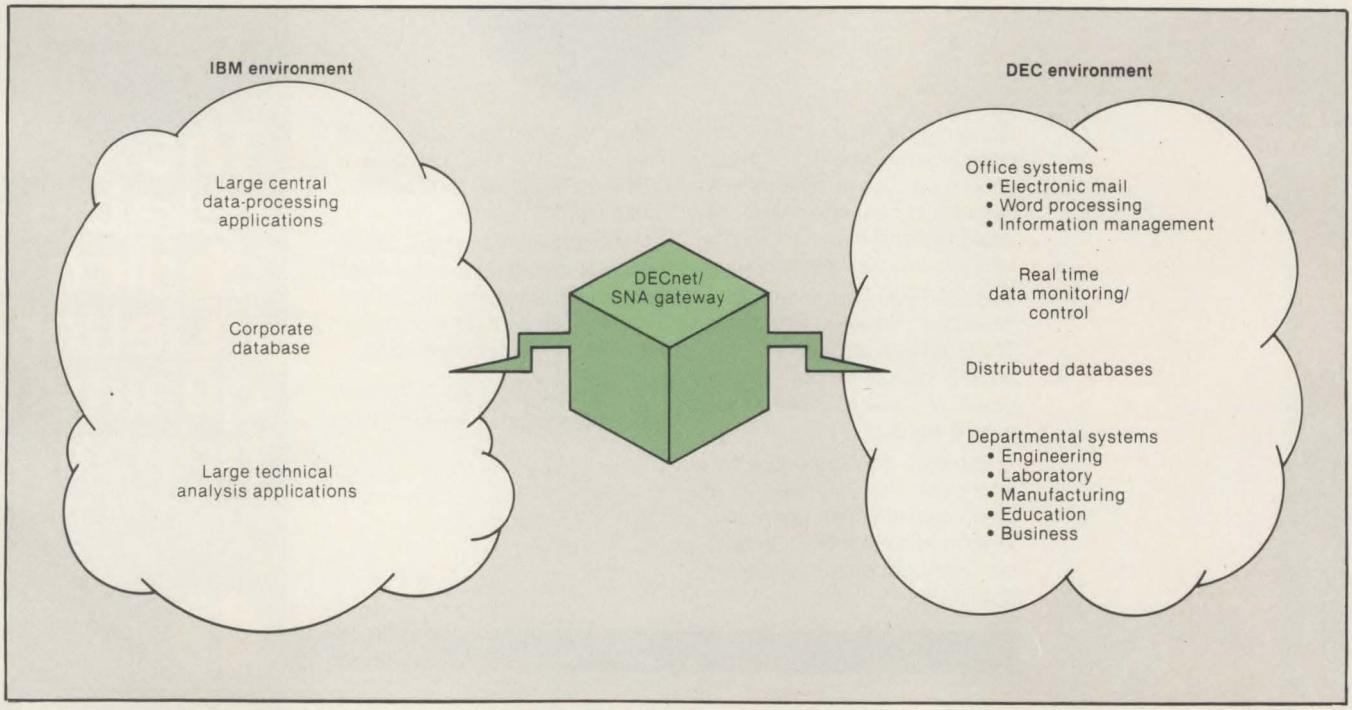
While SSCPs can reside in a fairly wide variety of IBM processors, other SNA facilities run only with the firm's larger machines, such as the 370s, 4300s and, in some instances, 8100s. Such facilities include the Network Communications Control Facility, which lets designated operators issue commands to the host processors in a multi-domain network, and the Network Problem Determination Application, which monitors the network and aids in fault determination and isolation. The large-machine requirements of these and other SNA facilities causes Dixon R. Doll, president of The DMW Group, Ann Arbor, Mich., to observe, "It's fundamentally true that minicomputers alone don't have access to the full routing or network-management facilities of SNA."

At DEC, "We always viewed every node in our network as fairly autonomous," says Larry Twaits, product manager for the recently announced DECnet-to-SNA gateway product (MMS, June, p. 58). As a result, Doll says, "DECnet is a true peer-to-peer approach to networking."

As an example of the operational differences between the peer-coupled DECnet and the hierarchical SNA, Twaits compares the centralized SNA management staff to the distributed DECnet approach. "The system manager for a VAX computer in a DECnet environment is probably an engineer, and he probably doubles as a network manager to handle his own communications links. So every system manager has a hand in managing the network," Twaits says.

The adaptive routing performed by DECnet also contrasts with the SNA approach, "where you want a crew in the back room to optimize traffic routing and to plan the fallbacks," Twaits says. "When you add a VAX to DECnet, you tell it about the wires that are connected to it, and it automatically goes out and sorts out the rest of the network and finds by some algorithm what the best path is to another node in the network."

DECnet's approach, Twaits says, therefore lends itself to a much lower level of user expertise and staffing support. Nevertheless, he says, "SNA does everything, and it really does it well. You can't criticize it because it was designed with different things in mind than DECnet."



DEC's view of typical SNA and DECnet environments, *which will be able to interface through DEC's planned DECnet/SNA gateway product. The gateway will operate as a function translator not as an exact protocol translator, because the protocol concepts of each network are too different to map into one another easily.*

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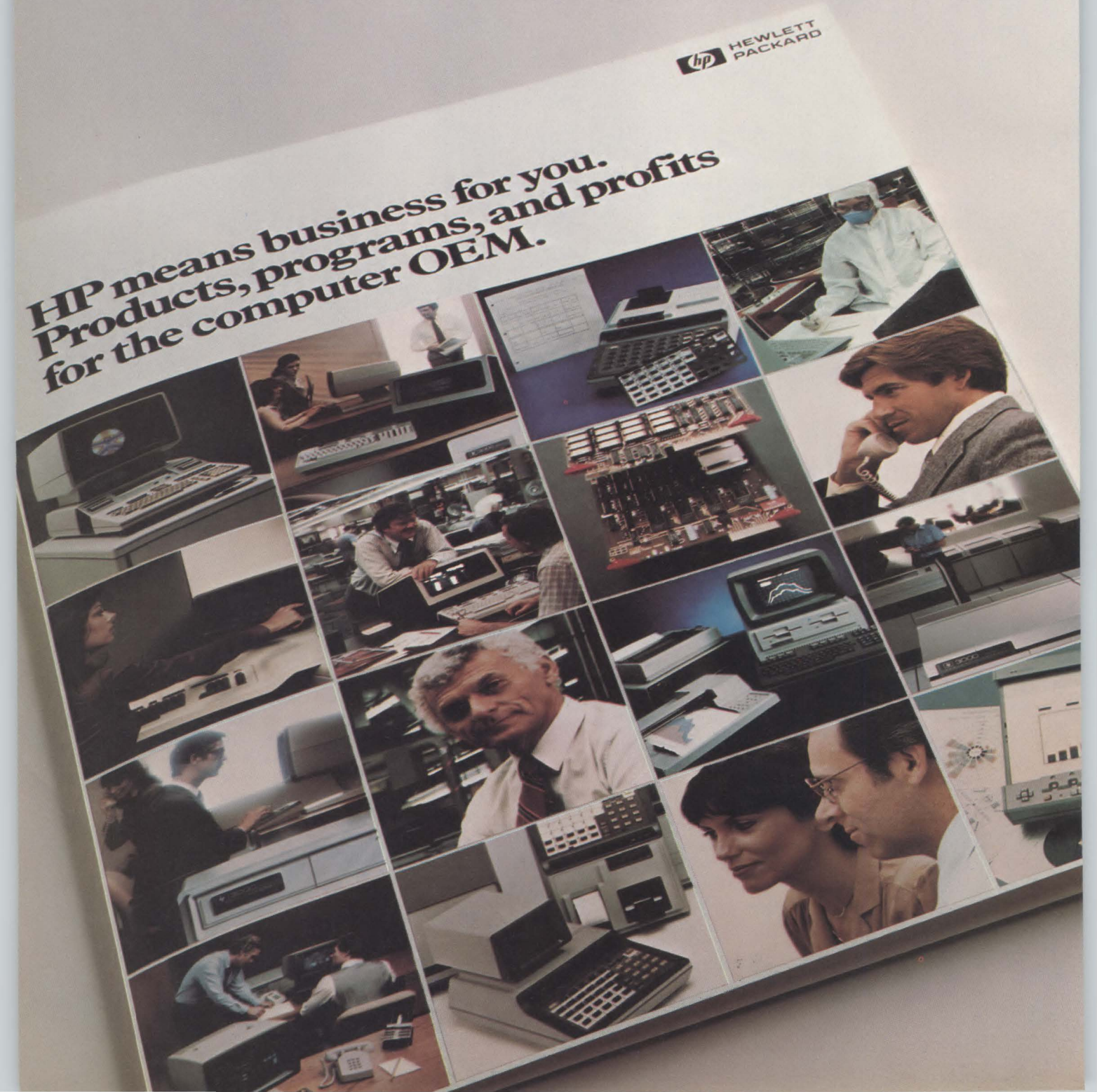

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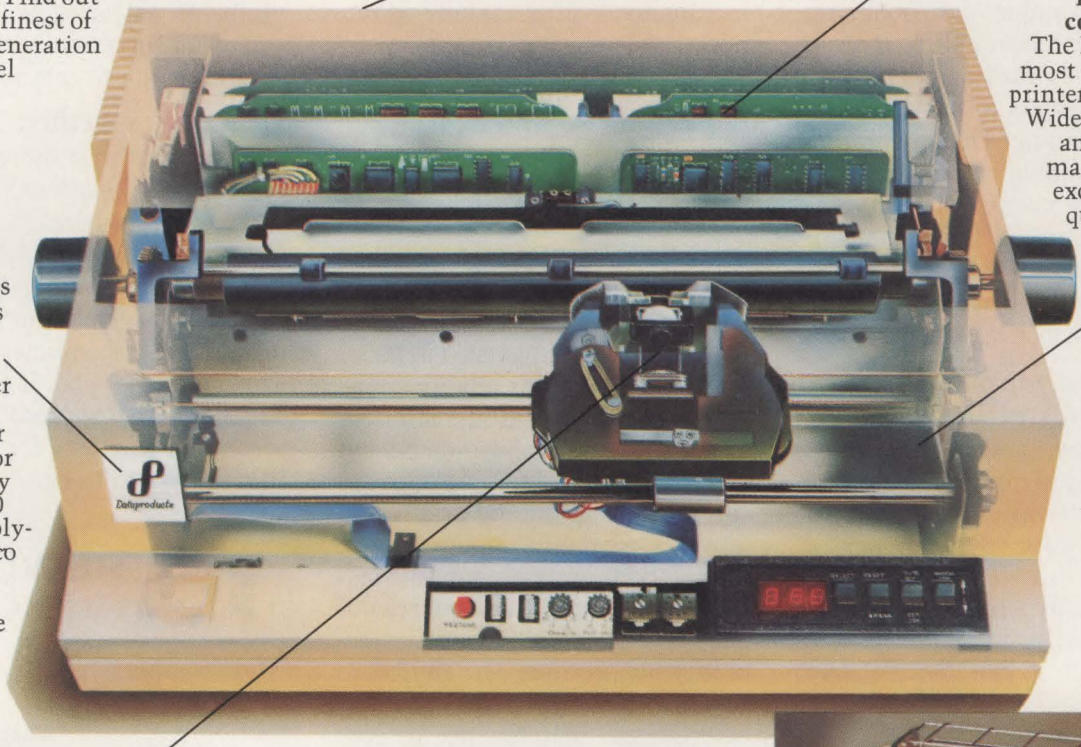

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Weak beginnings

Consultant Frank, a former SNA critic, says, "From its introduction through 1980 and 1981, SNA was really just a promise of a network," while noting, "DECnet also had very limited capabilities in those times." But, thanks to SNA's growing capabilities, "It's a very solid network structure for IBM's user base right now," he says. "Plus, it's the most sophisticated game in town."

Frank thinks SNA and DECnet are comparable in terms of their relative networking capabilities, but that SNA's strength surpasses DECnet's in terms of the applications the IBM architecture can support and access. In a sense, DEC tacitly confirms this in that it plans to build an SNA gateway product. IBM shows no intention of providing a gateway that will give SNA users access to DECnet.

Programs that run in the SNA environment essentially consist of those that handle network operations and those that help end users process information through the network. All these programs have a bewildering array of acronyms, such as the three access methods that route data between host storage and network I/O devices. These methods are Advanced Communications Functions (ACF) for the Telecommunications Access Method (ACF/TCAM), for the Virtual Telecommunications Access Method (ACF/VTAM) and for VTAM Entry (ACF/VTAME).

SNA supports at least six transaction-processing systems, including the Information Management System/Virtual Storage (IMS/VS), the Customer Information Control System/Virtual Storage (CICS/VS) and the Time Sharing Option (TSO). Beyond this, the network handles eight types of remote-job-entry programs, three host-resident programs that support programs running in other SNA nodes, programs that reside in IBM's 3705-II communications controllers and various network design aids.

Increasing distributed features

Although IBM has a rich bank of software accessible by SNA networking, the company realizes that the trend in computing is toward smaller systems, and the resulting networking trend is toward more distribution

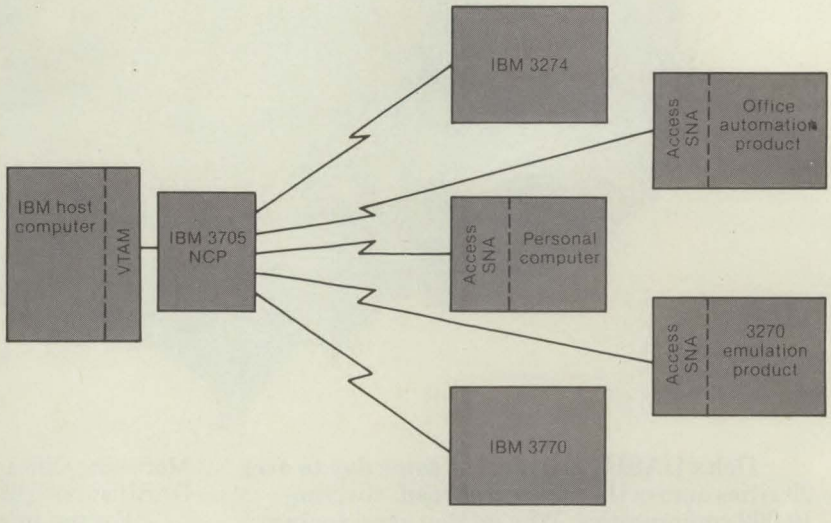
SOFTWARE PACKAGE GIVES OEMS ACCESS TO SNA

This September, Communications Solutions, Inc., Cupertino, Calif., will offer a software product that permits non-IBM computer products to operate in SNA environments. Called Access/SNA, the product will be targeted at OEMs, especially those with 16-bit microprocessor-based systems. However, CSI says the software, written in C, will be compatible with a wide range of minicomputers, microcomputers, intelligent terminals, distributed data-processing systems and office-automation products.

Access/SNA is essentially an off-the-shelf implementation of the SNA protocols used to support cluster controllers and terminals. It supports IBM-defined logical unit types 0, 1, 2 and 3. The software runs with either its own or the user's operating system, and the package can be segmented to run in multiple processors.

CSI believes OEMs will be able to use Access/SNA to develop products that compete with IBM products, such as the 3274/3276 information display system, the 3770 batch communications system, the 8100 information systems, the Displaywriter 5520 administrative system, the 6670 information distributor and the Series/1 minicomputer.

Pricing for a base license for Access/SNA is approximately $80,000 to $90,000. CSI also charges a royalty fee based on the volume of the OEM's shipments.



A theoretical SNA network *with an IBM host and 3705 front-end processor supporting various IBM systems and non-IBM systems, which are running Access/SNA software. (VTAM = Virtual Telecommunications Access Method; NCP = Network Control Program.)*

of networking facilities. SNA modifications reflect this trend, as the network moves from being strictly host-oriented to one that supports multiple different-sized computers.

SNA is still hierarchical in nature, says Frank, "because you can't maintain upward compatibility and start changing from the initial centralized approach very easily." But IBM offers some peer-to-peer protocols that let like levels of equipment communicate directly without a mainframe, says George Haskell, senior data-communications consultant at Communications Solutions, Inc., Cupertino, Calif. CSI offers a product that gives non-IBM products access to SNA environments (see "Software package gives OEMs access to SNA," p.111).

"These peer-to-peer protocols are implemented in devices such as the 5520 Administrative System and the 6670 Information Distributor (laser printer)," Haskell says. "While these devices don't emulate a host system, they do use a normal subset of SNA protocols to control the sessions." He expects to see more peer-to-peer type protocols from IBM, especially in office-automation applications in which accessing a host computer's programs or databases is not always required.

Although IBM offers more distributed-networking options, however, a network consisting strictly of IBM minicomputers would have access only to a subset of SNA's networking facilities. (The 8100 is an exception because multiple 8100s can communicate using many of the SNA programs). "From a purist point of view, where you have only minicomputers," Frank says, "a DECnet-oriented architecture is much more appropriate than an SNA-oriented architecture. If you have a large network of minicomputers, you really do want a peer-type relationship, not a hierarchical relationship."

But as everyone, including DEC, admits, the purist view is often not experienced in practice. Even companies with several minis often want to access mainframe databases and resources, which reside increasingly in SNA environments. DEC hopes to give its users the best of both worlds, with its peer-to-peer DECnet, soon to gain access to SNA. For its part, IBM seems content to reduce SNA's heavily centralized implementation gradually, while relying on its application dominance to bring both IBM users and IBM competitors into the SNA fold. ■

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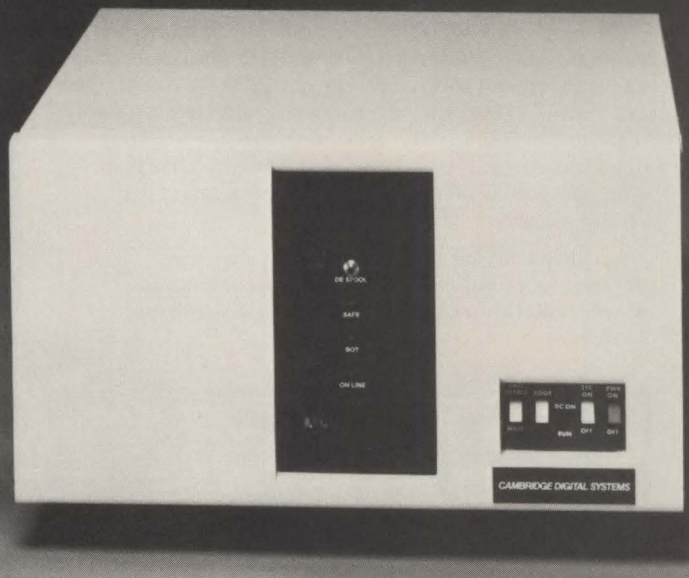


CIRCLE NO. 26 ON INQUIRY CARD

Diagnostics improve as computer systems proliferate

By Dwight B. Davis
Associate Editor

The ranks of computer users are rapidly swelling, and users are relying more and more on their computer systems to run portions of their businesses. With computer dependence growing daily, users now consider reliability—of components and systems—as the single most important equipment feature. When problems occur, users want their equipment repaired quickly and at a reasonable cost.

Vendors that service computer and peripheral equipment are also trying to hold costs down. This goal is not easily realized, however, in a business in which qualified service engineers are rare and the installed-equipment base is so large that service personnel making on-site calls can reach only a small number of users. Even if service people could visit sites whenever equipment failed, the cost of such service calls cannot often be justified when compared to the low purchase price of a malfunctioning unit.

To deal with these evolving market dynamics, equipment manufacturers are improving the diagnostic capabilities of their machines, and are providing the diagnostics to system users, not just to service engineers. In another approach, vendors are offering remote diagnostic capabilities with which central-site engineers can tie into user-site equipment and run fault testing over communications lines. Regardless of the diagnostic technique used, however, the goal is the same—to avoid unnecessary service calls and to expedite required service calls.

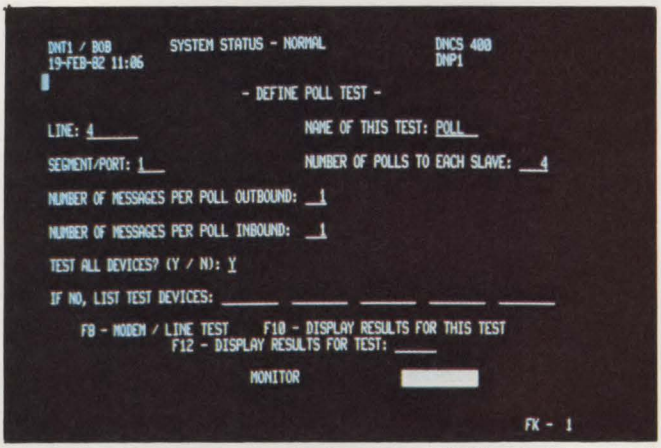
Increasing customer confidence

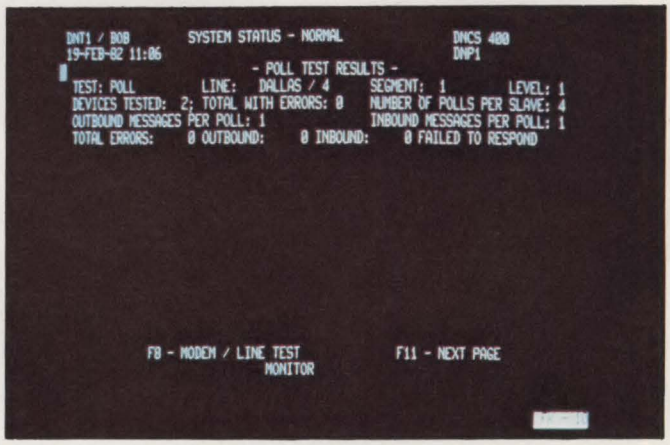
As dropping equipment costs permit less sophisticated users to purchase computer systems, diagnostics also give users confidence that their systems are operating correctly, says Dick Jaeger, manager of product support engineering and the acting director of engineering services at Data General Corp., Westboro, Mass. "A good self-test routine can give a customer 95- to 98-percent confidence that a device is functioning properly," he says.

By running self-test diagnostics, a user also gets indications of possible faults before initiating a service call. "From our standpoint, that's extremely valuable," Jaeger says, "because it gives the field engineers the opportunity to screen calls and make some pre-problem determination before they arrive on-site."

DG has the tools to develop remote assist/diagnostics, Jaeger says, "But we are still evaluating the particular implementation that we want to deploy." He points out several factors that must be considered before a company offers remote diagnostic services, including what size systems can best be served through this technique. Jaeger expects DG to complete its study of these issues by year-end, when the company will start its chosen implementation.

Meanwhile, DG's computers offer a wide variety of reliability/diagnostic features, says Mary Zak, product manager for the new S/120 system (MMS, April, p. 17). Many reliability features are built into the system's





Taken from the screen of a Codex Corp. DNCS network-control-and-management system, *these photos show a typical poll test on a network. The left screen is called by the operator to define the test parameters. In the poll test, the network's master modem sends a specified test message to its slave modems, which compare the received message with a like stored message. The same test is then run in the inbound direction. The right screen displays the results of a test in which no errors were reported.*

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CIRCLE NO. 116 ON INQUIRY CARD

Maintenance as a percentage of total system cost

Type of system	System	System cost	Maintenance cost	Maintenance as % of system cost
Mainframe/mini	IBM 4321	$85,000	$295/month $3540/year	4%
Small business computer	IBM System/34	$15,920	$159/month $1908/year	12%

As system costs drop, the percentage cost of maintenance increases significantly, *as The Yankee Group's "Field Service and Maintenance" report indicates. Therefore, as systems become smaller, less complex and more maintainable, it becomes less cost justifiable to pay for on-site service contracts, according to the report, which predicts diagnostics will play an important role in the evolving service environment.*

operating system, she says, "to help log the errors that the hardware diagnostics pick up. The systems are programmed to identify fatal errors, to let the system continue to run in the event of a non-fatal error and to allow good backup facilities, so you can go back and check where the errors were occurring."

Much of the S/120's diagnostic capability focuses on memory error protection and correction, Zak says. "The nature of 64K-bit RAMs creates continual soft errors in the memory, and we have to include protection features to continually correct these errors."

The S/120 is the first 16-bit product to incorporate memory "sniffing," which has been available on the 32-bit MV/8000 and MV/6000 machines. "Sniffing is performed by a single chip independent of the CPU," Zak explains, "and it checks the locations in memory at a rate of one location every 16 μsec. So it checks through the whole 0.5M bytes of memory every 4.2 sec."

Reliability is especially important for the S/120, she says, because the system often operates in capital-intensive applications, such as process control, in which processor downtime is very expensive. Commercial users of S/120 systems tend to be more tolerant of downtime because the computer is interfacing to a person, not a machine. "A person can go and do something else if the computer fails," Zak says. "If a machine is waiting for a response, it can't go and do something else." Zak points out that computer manufacturers must provide diagnostics suitable to their most computer-dependent applications.

Moving to microdiagnostics

At Digital Equipment Corp., Maynard, Mass., diagnostics have been evolving from a macro level in the PDP-11 line to a micro level in the newer VAX computers. "With microdiagnostics (written in microcode and run out of the machine's writable control store), you can control much smaller pieces of hardware with each test, and, therefore, you can isolate faults better," explains Barry Poland, diagnostic engineering supervisor at DEC. Macro instructions, on the other hand, may initiate a sequence of 40 or more micro instructions, and can thus isolate faults only at a much grosser level.

Because they can isolate problems to the chip level, microdiagnostics are typically used in manufacturing and repair situations, Poland says, not for calling out detailed faults to the user. The lowest level of fault callout on the VAX-11/730 (Nebula) is at the board level, and this is common of most customer-runnable diagnostics. Most immediate repairs involve board or module swapping, not discrete-component replacement, so there is little need for the customer to isolate problems down to the chip level.

All VAX computers have equivalent micro and macrodiagnostic capabilities, Poland says, but the 11/730 is the first to offer simple customer-runnable diagnostics (MMS, June, p. 32). Customers could run diagnostics in the other VAX processors, "but you had to go through a certain learning process before you could get anywhere with the diagnostics," Poland says.

"You can think of customer-runnable diagnostics (CRD) purely as an improved user interface. The intent of CRD is to get more customer participation in fault isolation, and off-load some of that work from field service. Because the Nebula is a smaller machine, there will be more of them out there, and the benefit of having the customer do some of the fault isolation is greater. The customer can relay to field service what the results of some tests were, and field service has a much better shot at fixing the problem on the first visit to the customer."

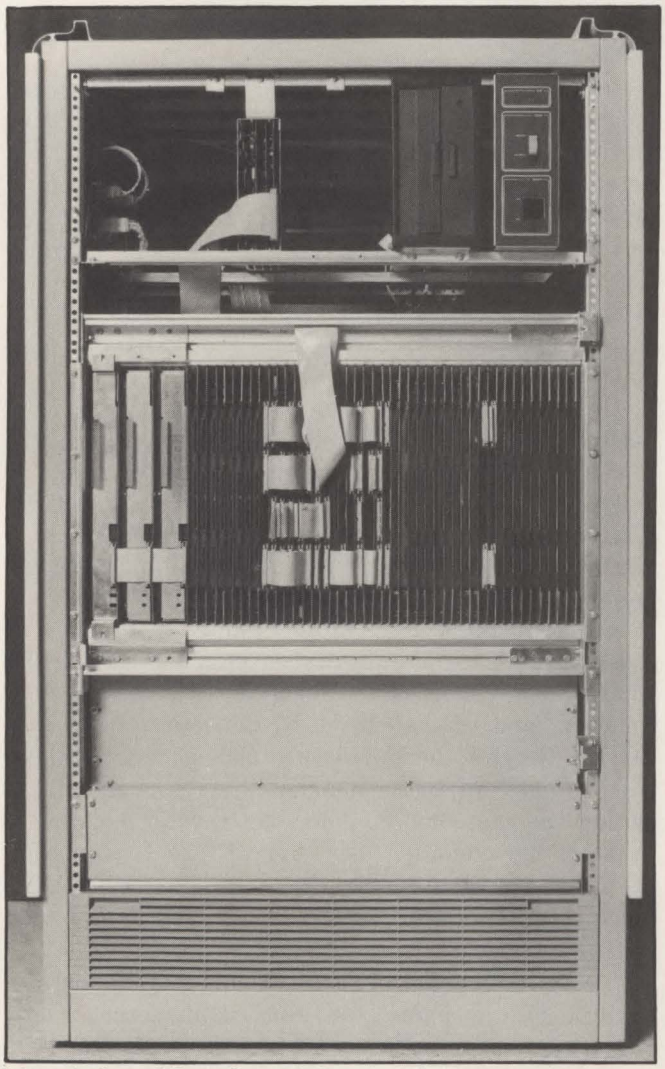
The 11/730 has auto-test and menu-test of diagnostics. Despite its name, auto test requires that a user plug a diagnostic tape cassette into the system and call up the test. Microdiagnostics first check the CPU then the devices interfaces, including an interface to an RL02 disk drive. The system then boots up to macrodiagnostics resident on the RL02 disk, and runs through a

complete macro test of the system kernel.

The menu test consists entirely of macrodiagnostics, and incorporates a menu prompt that gives the user several testing options. A "show-support" option indicates what equipment is running on the system, and a "test-all" command automatically tests all the equipment. A user can also run a test on any piece of equipment in the system. Each test results in a simple pass/fail indication on an operator's display screen.

Peripherals add diagnostics

Although the VAX-11/730 and other computers can run diagnostic tests on their attached equiment, the trend is to place more diagnostic capability in the peripheral equipment itself. "In the past year or two, there has been increased exploitation of the built-in microprocessors," says Eli Sheffer, director of marketing for the displays division at Applied Digital Data Systems, Hauppauge, N.Y. "We're trying to leverage all that excess power and use it in diagnostics."



Internal shot of Data General Corp.'s MV/8000 computer *shows the machine's diagnostic processor at the top of the unit, to the right of the diskette drives. Diagnostics for this CPU include a memory sniffing function, which is also available on the MV/6000 and the new S/120.*

The incentives for placing diagnostics in CRT displays, printers, disks and even personal computers are great because these devices are sold in numbers that make them approach commodity status. The number of units placed plus their relatively low costs make it difficult to justify on-site service calls. With diagnostics indicating problems at the board level, users can often bring boards to service depots for replacement or can maintain spare parts on-site and perform board swaps.

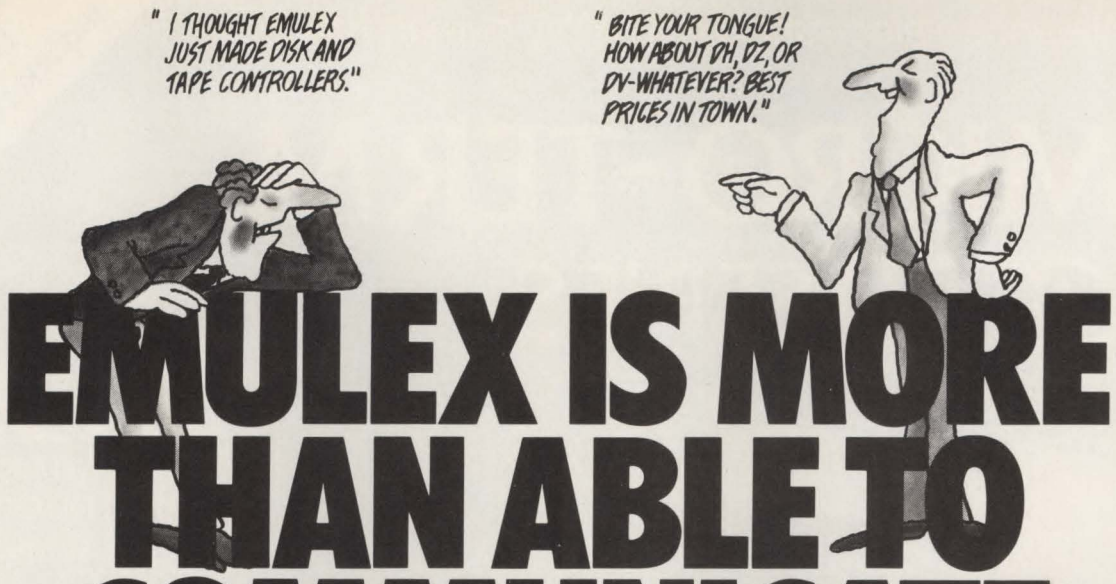
In the case of display terminals, the diagnostic task has become simpler over the years, says Sheffer. "In the past, diagnostics had to figure out which of maybe 30 boards was faulty," he says. "The situation is much more simplified now, since most of the new products have only one board or, at most, two or three." Diagnostics, therefore, must test just a small number of memory and logic boards, the power supply, the monitor, the keyboard and the interfaces between these modules.

Because it's fairly easy for diagnostics to isolate faults among this small number of modules, Sheffer says, the sophistication of one vendor's diagnostics over another's is measured in terms not of fault isolation, but of the confidence level the diagnostics provide. "This means the level of confidence one can reach in pinpointing a board as being faulty," he says. "Some companies say there's an 85-percent probability that what the diagnostics indicate is correct. Some will say it's only 50 or 60 percent."

Despite the need for diagnostics in commodity-level displays, Sheffer is not sure that customers are yet aware of the tests' importance. When he worked at a competitive display company, Sheffer helped analyze a terminal's life-cycle costs versus initial purchase price. "We found that the purchase price is such a small proportion of the overall life-cycle costing, that it doesn't make any sense for a rational buyer to even ask for the purchase price. You have to ask about the mean time between failure, the diagnostics, the costs to fix any problems, the mean time to repair and so on. Yet there are very few people who are fully aware of all those items."

Checking mechanical and electronic parameters

Printers and disk/tape drives, while gaining the same commodity status as displays, have a more complicated task than displays in isolating problems. Printers, disks and tapes all rely heavily on mechanical elements and



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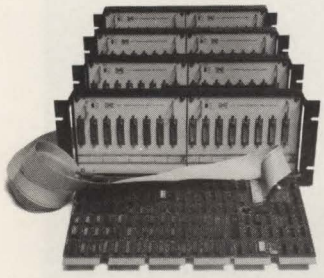

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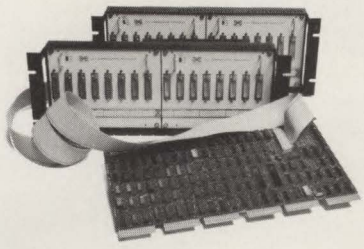

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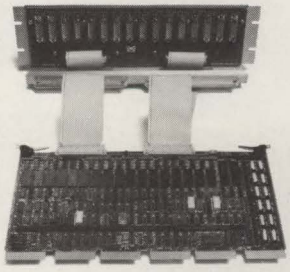

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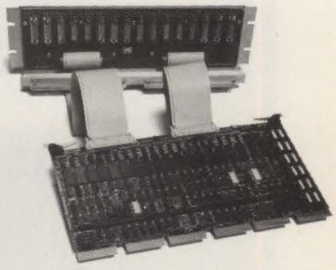

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electronic components. Mechanical elements are inherently less reliable than electronic parts, so these peripherals must regularly check their internal status.

In the case of printers, the most typical problems are operator related, says Clifford Jones, vice president of engineering at Dataproducts Corp., Woodland Hills, Calif. "Most of the things we're looking for are operator conditions such as paper or ribbon supply," he says. "There is much more operator interaction with printers than with CPUs or disks, and that makes way for more errors."

Printer diagnostics have progressed from board indicator lights that signaled positive or negative operation, through an output plug to which a separate service module could be attached, to numeric indicator displays on the printer's front panel. These displays are typically two-digit, and they display numbers that can be used with a look-up table to indicate fault conditions. Tally Corp., Kent, Wash., recently introduced printers with four-digit displays that scroll through statements of the problem. Jones says future printers may incorporate voice response to describe problem areas.

Although large, heavy-duty printers will always require on-site service, Jones says, users will get more involved in the repair of small units as purchase prices continue to drop and service costs continue to rise. He notes that the cost of more sophisticated diagnostics must be weighed against service-call costs and money lost when a printer is down.

Disks and tapes, like printers, function in part mechanically, and the drive manufacturers are increasing the resident diagnostic capabilities of these devices. The electronic controller portion of these drives can contain its own diagnostics, says Jack Olson, vice president of marketing at Western Peripherals, Inc., Anaheim, Calif. "It's becoming required for disk- and tape-drive controllers to do some form of self diagnosis virtually every time the system is powered up," he says.

Diagnostics integral to the disk and tape drives don't duplicate functions performed by the associated controller diagnostics, says Olson. "The diagnostics in the drive are oriented specifically to the troubleshooting of the device, and they essentially measure mechanical parameters. In the controller area, the diagnostics aren't aimed at repairing the controller, but at indicating that there is a fault, and showing where it may lie."

Maintaining communications networks

Some of the same factors that have fueled the need for better diagnostics—lower equipment costs and the resulting dispersal of computers and peripherals—have also fueled the growth in the data-communications industry. David Tolwinski, director of marketing for control systems at Codex Corp., Mansfield, Mass., says many users couldn't run their businesses without data communications. At the same time, he says, the users must rely upon several vendors to maintain their networks.

"Users rely upon the phone company to provide service to their lines, terminal vendors to support their terminals, modem vendors, front-end processor vendors and so on," Tolwinski says. "They've got this resource upon which their company is totally dependent, and they are alternately dependent upon all these vendors to keep it operational. So basically, the ultimate purpose of communications diagnostics is to manage vendor service levels for the user."

Codex's products incorporate two types of diagnostics, those that check the device itself and those that monitor the communications lines. Because telephone lines are notoriously unreliable, Tolwinski says, the analog diagnostics that measure such parameters as signal-to-noise ratio, phase jitter, non-linear distortion and frequency offset are especially important. "To manage the phone-company service level, you want to be able to go to them and say, 'Here's where the problem is, here's what my equipment shows the problem to be, and here's the data that substantiate it.'"

Codex and other datacomm firms ship communications equipment ranging from relatively simple moems to very complex multiplexers and network processors, and repair options vary accordingly, depending upon the sophistication of the malfunctioning device. Capable communications service engineers are even harder to find than computer/peripheral service personnel, and Tolwinski says diagnostic algorithms help offset this personnel problem. "It's a way of storing a piece of your design engineer in every piece of equipment that you send out," he says. ■

NEXT MONTH IN MMS

The feature article section of the September issue of Mini-Micro Systems will spotlight software: high-level languages and development systems. Three major profile articles will be included, detailing database packages for microcomputers, workstation furniture and portable operating systems for microcomputers.

Other editorial features will include:

- Fresh perspectives on languages and operating systems, including Ada, FORTH and UNIX.
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Process-control market expects more from graphics vendors than low price

By Frank Catalano
Associate Editor

As OEMs and system integrators begin their second decade of providing computer systems to the industrial process-control world, they are starting to make demands of the graphics-specialized vendors that supply the human interfaces for automated process-control equipment.

With more than 10 years of hands-on experience with color-graphics displays, system builders are now eyeing the products' price/performance rather than simply price.

The process-control industry was one of the first markets for color-graphics displays in the early '70s. By graphically depicting the real-time flow of a process and using color to warn operators of hazardous or abnormal conditions, the displays proved to be alternatives to the previously ubiquitous relay-logic interfaces consisting of walls of bells, lights and switches.

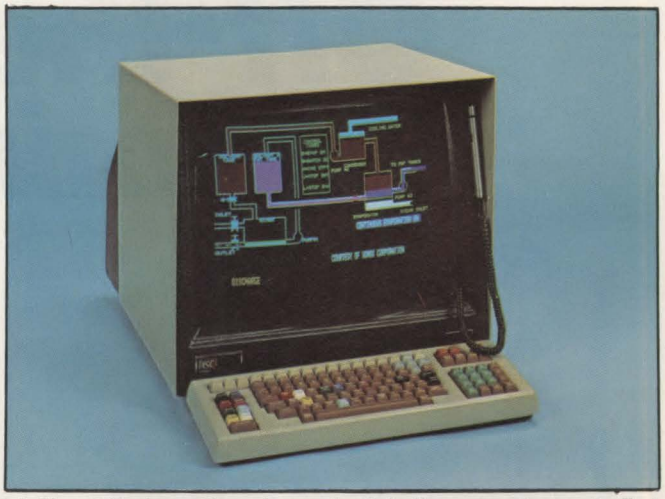
"Process control was a natural for the color-graphics industry," says David Deans, marketing vice president for Intelligent Systems Corp., Norcross, Ga., a leading supplier of displays to the process-control market. "Rather than running around checking a lot of gauges and valves, operators were able to use color-graphics terminals to graphically represent the flow of petroleum, for instance, through a distillation operation, even if that operation involved miles and miles of plumbing through a plant."

As color-graphic displays gained acceptance in the process-control industry, the number of graphics vendors entering the burgeoning market proliferated, as did the variety of products they offered.

Today, the market is at its peak. According to a study by Venture Development Corp., Wellesley, Mass., 13 percent, or approximately $35 million, of the $273 million spent on graphics displays in 1980 was for process-control equipment. Karen Abromowitz, an analyst with Venture Development, says that the process-control share of the total graphics market will decline to 9.8 percent by 1986. That share, however, will be worth $137 million and will represent about a 20-percent compound annual growth rate over the next five years.

Tony Glinkas, a marketing vice president for Ramtek Corp., Santa Clara, Calif., notes that process-control customers once considered color capabilities and low price the primary criteria in selecting graphics displays, but that system quality and reliability are now the overriding concerns.

"Now that users in the factory are starting to understand computers and are able to evaluate products on the market, the use of graphics displays in



Intelligent Systems Corp. is moving into the computer controlled high-end market *segment with the Intecolor/8001R dot-addressable display. With prices starting at $2995 for quantities of more than 100, the Intel 8080A microprocessor-based unit includes 5K bytes of ROM and 8K bytes of RAM.*

Aydin Controls is moving down into the low end of the process-control market *with the 5217CT character-oriented color terminal. With an optional floppy-disk controller, the unit functions as an intelligent programmable color-graphics display or as a full stand-alone microcomputer system. Prices start at less than $5400.*

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CIRCLE NO. 138 ON INQUIRY CARD

process control is no longer the cheap and dirty application that it was 10 years ago," he says.

David Winward, vice president of marketing for Aydin Controls, a Fort Washington, Pa., manufacturer of control products, notes that companies that bought inexpensive units found that those units often failed or that their displays lacked adequate resolution. "End users are beating process-control system integrators over the head with baseball bats and telling them that their inexpensive displays are no good," says Winward. "They want reliable devices with which they don't have overhead costs for maintenance, repair and replacement."

He adds that the reliability of the overall process-control system deteriorates if the interface to that system is unreliable. "A failure in a process-control operation could cost a manufacturer hundreds of thousands of dollars," Winward says.

Companies configuring graphics units into process-control equipment can select products from both general-purpose graphics vendors, such as Ramtek Corp. and ISC, and vendors whose product lines are directed solely to the process-control industry. The latter group includes Industrial Data Terminals, Westerville, Ohio, and Aydin Controls. Prices range from $2000 to $100,000, and sophistication ranges from simple graphics controllers to complete mass-storage-equipped work stations. Options include ruggedized

COLOR-GRAPHICS DISPLAYS PUT TO NUCLEAR APPLICATIONS

The nuclear-power industry will put a number of color-graphics displays to work in the coming months as interfaces to monitoring systems that alert plant operators of impending emergency conditions.

The Three Mile Island nuclear accident prompted the Nuclear Regulatory Commission to mandate nuclear generating companies throughout the U.S. to upgrade their monitoring systems and make them more visible and accessible to operators. Inadequacies of the monitoring system installed at TMI received partial blame for the failure of the plant staff to recognize reactor problems in their early stages.

System builders are designing new equipment with features that not only provide more vivid warnings of potentially hazardous conditions, but also allow operators to track a progressing problem more easily. William Pierce, a computer sicentist with Science Applications Inc., says that color-graphics displays play a major role in that equipment. SAI, a La Jolla, Calif., system house, was awarded two contracts to supply monitoring systems for Detroit Edison and Mississippi Power and Light.

The Detroit Edison system, which is installed at the new Fermi II nulcear power plant, includes a Systems Engineering Laboratories 3277 minicomputer CPU, a Varidyne Industries Inc. front-end A/D converter and Industrial Data Terminal Inc. 2310 color-graphics displays.

Three of those terminals are in the reactor control room, five are in a technical support center, and two are in an emergency operations facility 10 miles from the plant.

Sensors throughout the reactor facility take readings of about 300 parameters that indicate whether the reactor is operating properly. Those readings are stored in a look-up file for 20 min. and compressed into a 20-hour log file.

Variables feeding into the system are divided into five basic categories: pressure, power level, water level, temperature and radioactivity level. Real-time values from each category are compared to normal operating values and displayed on the terminal as color-coded bar charts—green indicating normal conditions; yellow, slightly abnormal; and red, hazardous.

Color-coded signal flags at the bottom of the screen indicate the safety status of areas of the plant, such as the reactor vessel, the containment area and the cooling tanks. By coordinating the bar charts with the flags, an operator can determine what problem is developing and trace it to its source. Should the pressure chart and the containment-area flag turn yellow, for example, the operator would press a function key and call up more detailed displays of pressure parameters in the containment area.

Other displays include a pictorial overview of the plant showing the operating status of various valves and pumps and a meterological display showing the direction in which escaped radioactivity would spread.

SAI's Pierce says that his company chose the IDT units primarily because those displays are industrially hardened, contain bubble memory and include bit-slice microprocessor technology. The bubble memory, he says, allows nonvolatile local storage of static background pictures, freeing the monitoring computer to process dynamic real-time data. Bit-slice technology, he adds, allows update speeds as much as three times faster than other microprocessor-based displays on the market.

"When you're working with so many changing variables in such a critical operation," says Pierce, "update speeds become an important consideration. We need to provide operators accurate and timely information."

Other considerations in the display selection are resolution and refresh rate. Pierce says that because operators look at the displays for eight hours a day, eyestrain and fatigue could occur if pictures are fuzzy, or if they flickered. The IDT 2310 has a resolution of 512 × 512 pixels and a refresh rate of 60 Hz.

Pierce says that, because the terminals are part of a system that is intended to operate for 30 or more years, price did not play a major role in the selection process. "We thought more in terms of functionality, reliability and performance," he says. "The long-term payoff is more important than the short-term savings."

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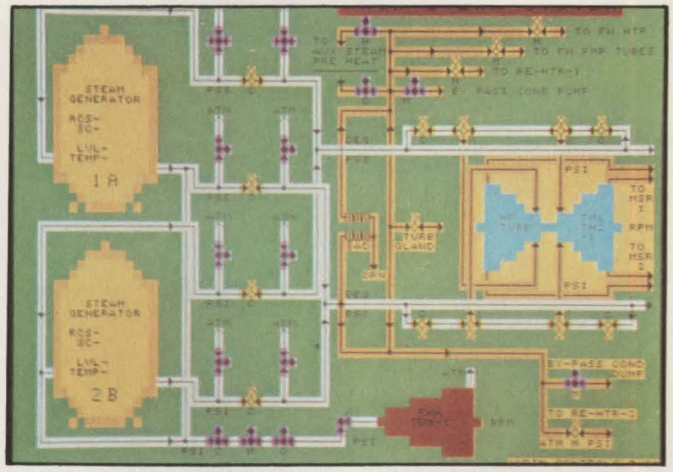
The ruggedized Industrial Data Terminals Corp. 2200 series display *includes bubble memory with as much as 256K bytes of nonvolatile memory. Prices for the display start at $11,500.*



Typical displays used in the process-control industry *provide operators a graphic representation of a process such as the flow of steam through a steam-power generating plant. Color is used to help operators distinguish between various stages of the process flow and to convey the operating status of each stage.*

enclosures, character- or pixel-oriented graphics and bubble memory.

The level of sophistication that system integrators and end users require of graphics displays depends on for which end of the process-control market their systems are targeted. On the high-end, the devices serve as interfaces to processes controlled by large mainframes or minicomputers, and on the low-end, to processes controlled by programmable controllers. While high-end systems usually monitor large-scale processes, such as power generation and transmission for a city, low-end systems monitor smaller processes within the overall scheme, such as the operation of one generating station.

Aydin's Winward says that his company has the majority share of the high-end process-control market, and ISC's Deans says that ISC dominates more than 80 percent of the low end.

Because of the many variables that must be presented simultaneously to an operator of a high-end system, Winward says, appropriate displays must do more than simply depict the flow of a process as a picture: they must graphically represent a series of processes as bar, flow, strip and pie charts. As a result, high-end displays are generally pixel-oriented, he says, and can generate random vectors, arcs, lines and circles. Such displays also require high-speed I/O capabilities because of the large amount of data that feeds into them.

Displays in the low-end market, however, are usually character-graphics machines that interface to programmable controllers. Because programmable controllers often lack intelligence, such displays require more intelligence for processing functions than their high-end counterparts.

Standard features of terminals used in either market segment include a 19-in. display screen and a 60-Hz refresh rate. "Quality- and reliability-wise, the requirements are universal for displays used in any process-control application," says Winward.

For the most part, graphics vendors in both ends of the market are selling their wares to OEMs such as General Electric Co., Westinghouse Corp. and Allen Bradley, and to large end users such as Dow Chemical Corp., DuPont Corp. and electric and nuclear power utilities.

Despite the wealth of products on the market, some system integrators such as Foxboro Corp. and Gould Inc.'s Modicon Division—two of the leading system suppliers to the process-control industry—still prefer in-house design and manufacture of the graphics displays that they incorporate into their products. Richard Shirley, director of human-interface research at Foxboro, says his company prefers to build most of its own graphics units as a means of maintaining control over products and guaranteeing software support. "Graphics technology is evolving so rapidly and new products are entering and exiting the market so quickly, that it becomes difficult to assure our customers that they'll be able to get replacement parts, maintenance and so forth from other vendors' display systems," says Shirley. "We guarantee our products for as long as five years, and even after we discontinue a product line, we still provide software support."

John McShane, vice president of advanced development at Aydin, says that Shirley's claim is valid, especially considering that some companies are entering the market with proprietary products. "Aydin maintains continuity of products in the sense that we've developed new lines with emulation capabilities of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Systems in Industry

previously released products," he says. "As result, there's no significant impact on our customers' software."

Besides support problems, both Gould Modicon and Foxboro spokespersons say that systems from third-party graphics vendors are not adequately ruggedized to operate in harsh factory environments. "Available commercial equipment is designed for computer-room environments," says Ravi Ghai, group marketing manager for distributed data systems at Gould. "Most cannot withstand temperatures over 60°C, shock, vibration, dust, electrical-noise interference and radio-frequency interference."

Both Aydin's Winward and ISC's Deans contend that their companies' products do not have to be industrially hardened because they are usually configured into process-control systems that operate in control rooms, separate from the factory floor.

But Foxboro's Shirley notes that even though the process-control systems that Foxboro supplies are intended for use in hazard-free environments, those systems still require industrial hardening. "One of our systems is operating in a control room of a paper mill," he says. "Air is pumped into the room from a mile away, and all sorts of elaborate measures are taken to assure a safe working environment for the computers. But just from opening and closing the door to the room, chemicals creep in, and discoloration can be seen on the displays."

One of the only graphics-specialized companies whose products are built to withstand harsh environments is Industrial Data Terminals. Bill Hayes, marketing and operations vice president of IDT, says the company's 2200 display terminal with bubble memory passed seismic testing last April by Babcock and Wilcox, the leading U.S. nuclear-power-plant builder. "One of the goals of the test was to operate our terminal to destruction while it was subjected to the highest amplitude and frequency of vibration on a seismic vibrating machine," says Hayes. "Even though the vibrating machine was the largest of its kind in the country, the terminal could not be destroyed."

Although Ramtek supplies only general-purpose color graphic terminals to the process-control industry, the company licenses Ocean Technology, Inc., Burbank, Calif., to sell a ruggedized version of the Ramtek 9400 display. That terminal, called the OTI 9400M, is aimed primarily at the nuclear-power and military markets.

Foxboro reexamines the display products on the market each time the company introduces a process-control system, Shirley says, and the company is not set in its decision to build displays in house. "The decision may change," he says. ■

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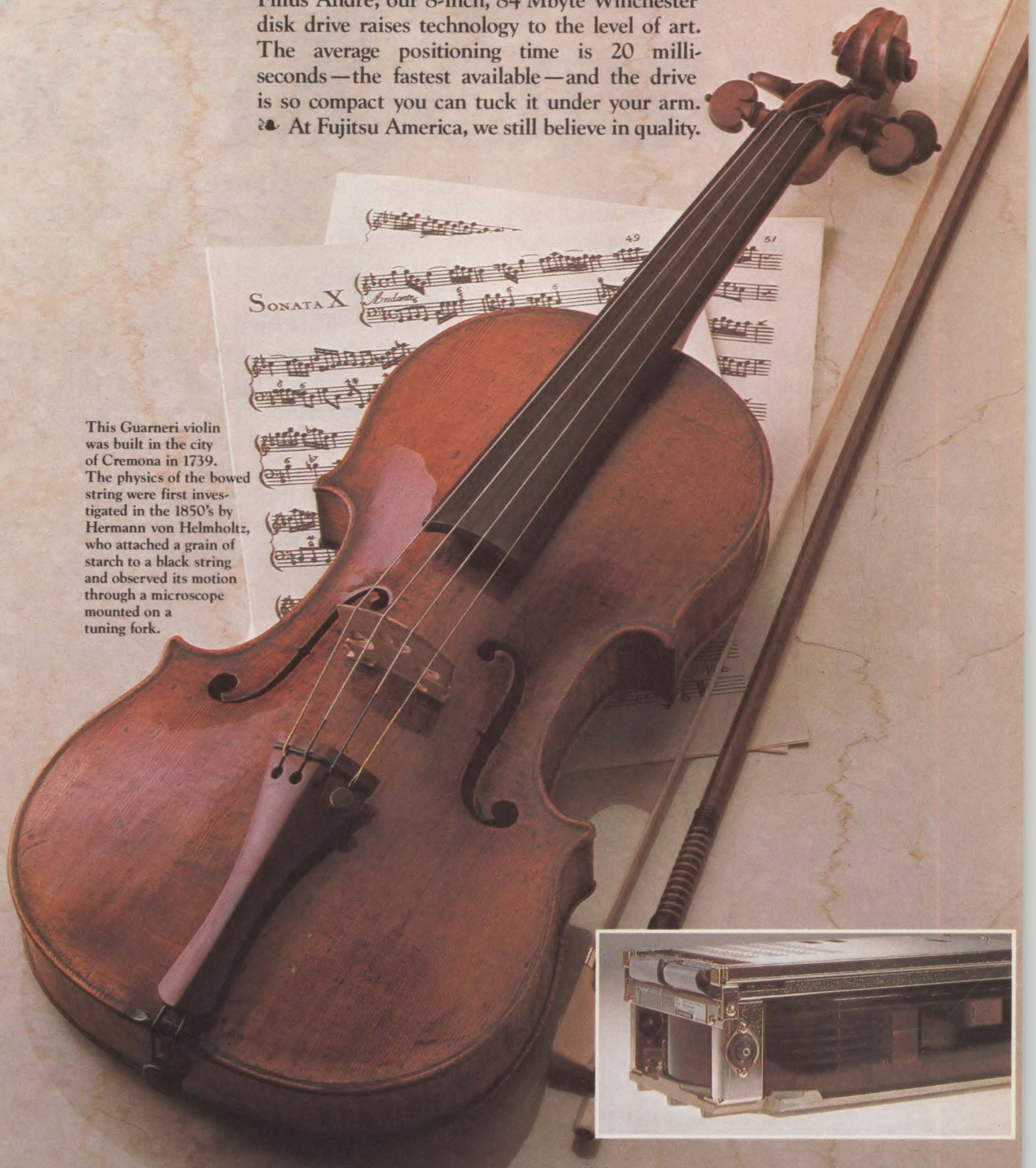

This Guarneri violin was built in the city of Cremona in 1739. The physics of the bowed string were first investigated in the 1850's by Hermann von Helmholtz, who attached a grain of starch to a black string and observed its motion through a microscope mounted on a tuning fork.

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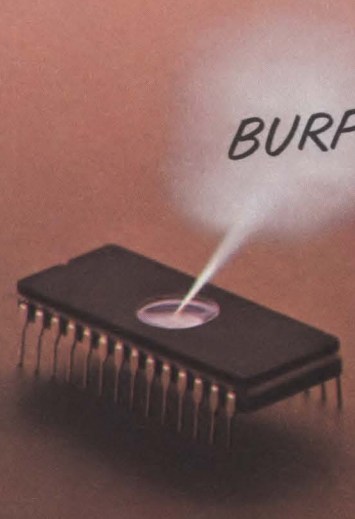

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CIRCLE NO. 103 ON INQUIRY CARD

OCR system solves automation problems

By Eric Lundquist
Associate Editor

Cognex Corp., a small start-up vision-system company in Boston, believes it has solved the problem of building an optical-character-recognition system that can withstand the rigors and requirements of a factory environment. Cognex's Dataman industrial vision system has other believers as well: Cognex has signed distribution agreements with Japanese trading company Marubeni Corp. and an unidentified U.S. firm, and IBM Corp. has purchased a system to read serial numbers on silicon wafers, which will help track the inventory and quality of semiconductor manufacturing.

In the past, OCR machines had problems when a character being read was less than pristine letter quality. In the industrial environment, where smudged, distorted and misplaced characters are frequent and parts rarely move perfectly down an assembly line, the problems of applying OCR are formidable.

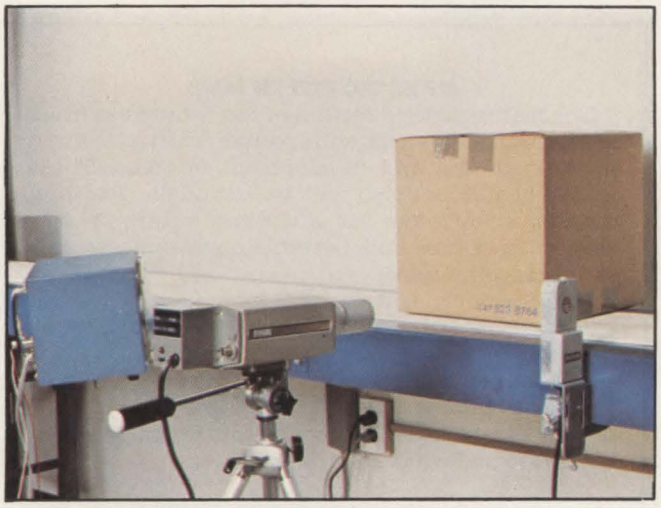
Based in part on algorithms developed during his research at the Massachusetts Institute of Technology, Cognex president Dr. Robert J. Shillman and his associates have built Dataman. The system operates at approximately 15 characters per sec., reads 0.020- to 20-in.-high characters and reads distorted characters. "If a man can read it, Dataman can read it," Shillman contends.

Priced at $30,000, it includes four hardware components: a Vidicon closed-circuit camera, a 14½- × 18-in. RCA monitor and touch-sensitive keyboard and a Digital Equipment Corp. LSI 11/23 processor with a 256K memory and two "frame-grabber" image-capture boards. (The company is considering another processor, possibly the Motorola MC68000, to reduce the system's price.)

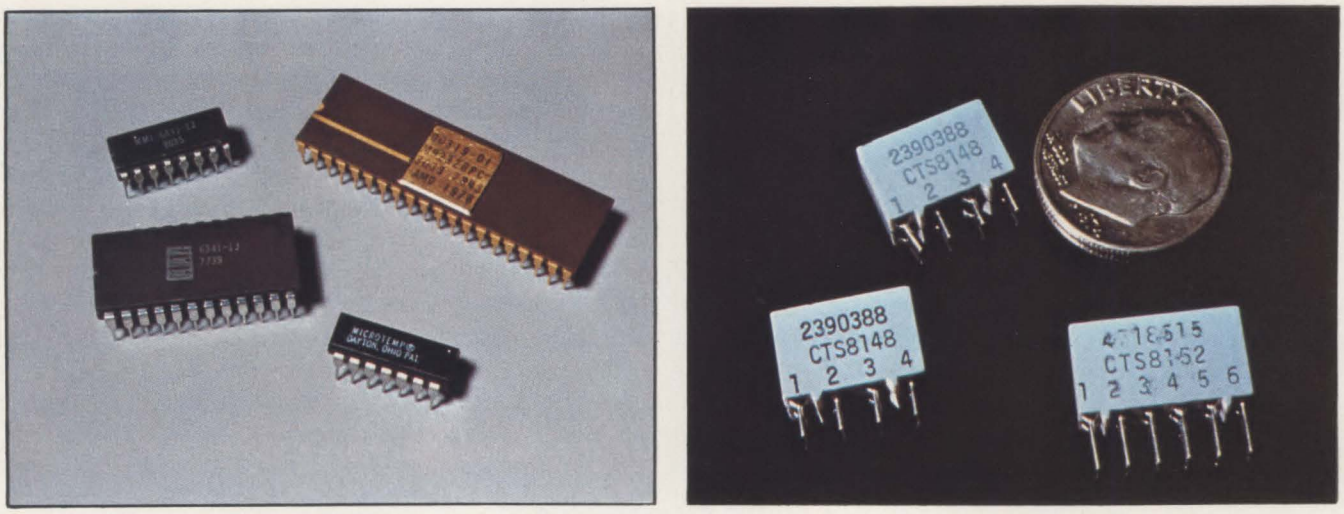
System software, originally written in Pascal, has been translated to DEC's Macro Assembler assembly language. Shillman believes that by incorporating the company's proprietary software on standard hardware components, Cognex can avoid potential production problems during the company's early development. Cognex intends to retain its manufacturing rights and does not plan to sell software rights, Shillman says.

Data locations can be read anywhere in the camera's field of view and can be oriented from 0 to 360 degrees. The system can also read touching, but not overlapping, characters. Font styles are burned into ROM, and new fonts can be installed by adding ROMs. Special lighting is not required. The system has an eight-level gray scale, rather than being strictly black and white. As a part passes the system's camera, the image is displayed on a display screen, and the system's reading of the numbers is displayed at the bottom of the screen. The numbers can be repeated to an operator using voice synthesis, or the information can be transmitted to another location or computer over an RS232 line.

Dataman dates back to the early '70s, when Shillman was working on a doctorate dealing with data entry and the man/machine interface. After a stint as an MIT professor, Shillman became an assistant professor of electrical engineering and computer science at Tufts



The Cognex Dataman system will be used with robots in a food-processing plant. *After the Dataman reads the labels of six flavors of packaged food as the packages go down a conveyor belt, a robot directs the packages to their appropriate pallets.*



Cognex has shipped its first Dataman system to IBM Corp. *for reading the serial numbers on silicon wafers to aid in keeping track of the inventory and quality of semiconductor manufacturing. In another application, a Cognex system will read serial numbers on PC-board components to determine if the components are in the correct position.*

University. Along the way, he worked as a consultant and helped the U.S. Department of Defense develop an OCR technology that could scan, read and translate Russian documents.

"Essentially, all previous (OCR) technologies rested on analyzing the geometry of characters and looking for pre-defined features that must be there," says Shillman. The letter A would be translated into a series of dots that would be matched against the image stored in the computer's memory. Problems would often develop when the character being read was malformed or the print surface was dirty. Shillman studied human eye movements and the process of human comprehension to determine how humans read characters and which parts of letters and characters carry the most important information. Shillman then developed algorithms that could translate those characteristics into a computer program and ultimately led to an OCR system that could distinguish letters even if a part is missing or blurred. "Dataman looks in the same place you would look. The application of OCR to industry required this type of breakthrough," says Shillman.

With the technological basis for Dataman in place, Shillman formed Cognex in December, 1980, and had the first prototype running in July, 1981. This June, the company received $1 million in venture capital. At that time, the company had eight employees including William Silver and Marilyn Matz, scientists from MIT's Artificial Intelligence Lab, who implemented the software, and Robert Piankian, who designed the hardware.

The company has a backlog of 30 orders and has shipped its first system to IBM. Applications include a project with Unimation Inc. for a food-processing company. In that application, six intermixed flavors of packaged food go down a conveyor line. The Cognex system reads each package's label to determine flavor, and Unimation robots direct the packaged boxes to appropriate pallets. In another application, a Cognex system reads serial numbers of PC-board components to determine whether the components are in the right position and are right side up.

Other applications include inventory monitoring, material handling, quality assurance and automated manufacturing. Dataman reads printed, etched, stamped, embossed and inscribed characters that match their backgrounds such as numbers stamped on tires. ■

NEXT MONTH IN MMS

The feature article section of the September issue of Mini-Micro Systems will spotlight software: high-level languages and development systems. Three major profile articles will be included, detailing database packages for microcomputers, workstation furniture and portable operating systems for microcomputers.

Other editorial features will include:

- Fresh perspectives on languages and operating systems, including Ada, FORTH and UNIX.
- Manufacturers' views on software portability.
- Close looks at MP/M-86 and MS-DOS.
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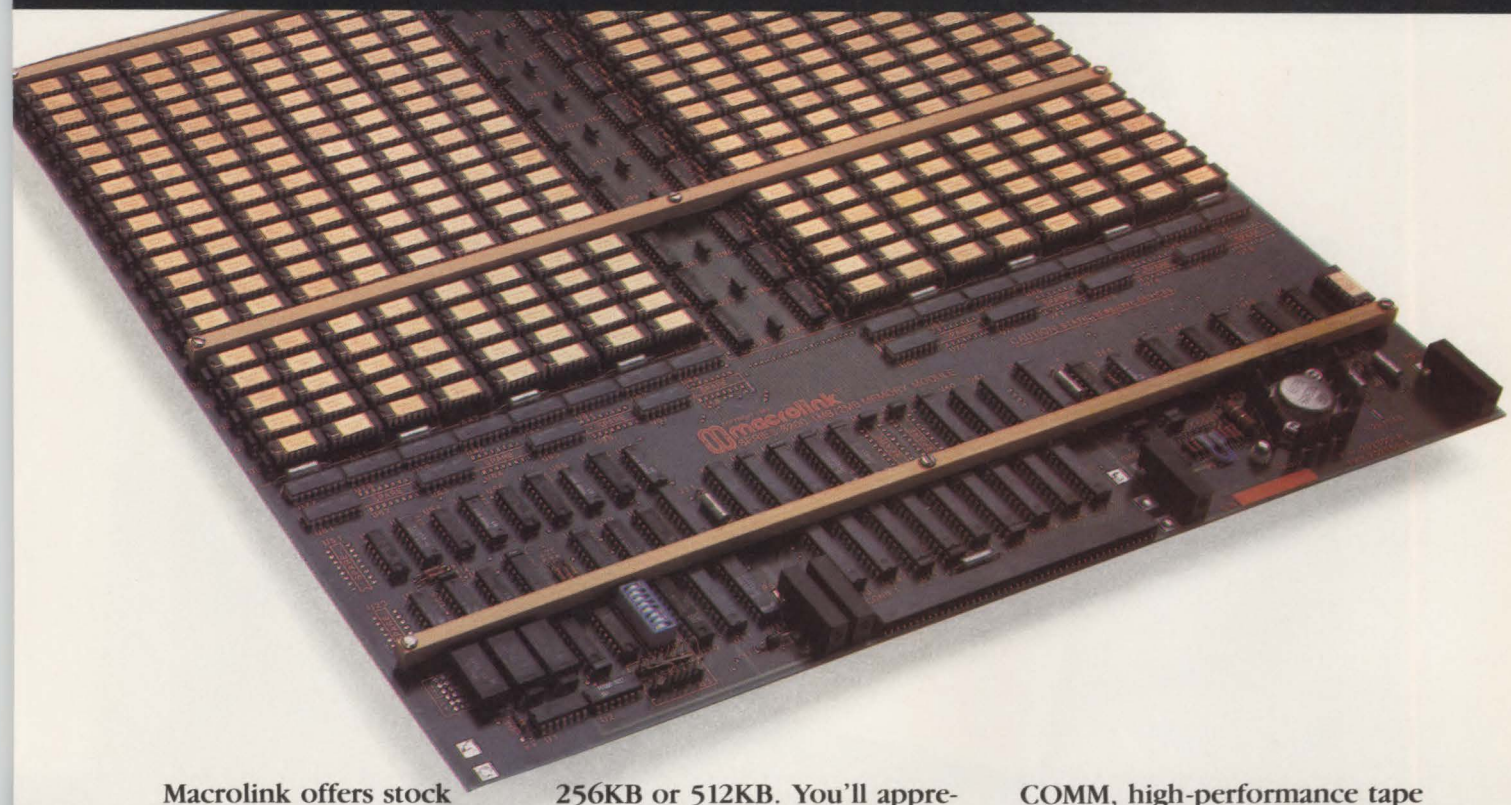

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Test system predicts drill wear

By Eric Lundquist
Associate Editor

An Intel Corp. 8748 microprocessor has been teamed with an acceleration meter at the National Bureau of Standards, resulting in a less-than-$500 test system, called Drill-Up, that predicts drill breakage and stops a drilling operation before damage occurs.

The system uses an acceleration meter mounted on a work piece to analyze changes in vibration resulting from variations in drill speed. The system also warns of possible breakage, solving the problem of delay caused by broken and jammed drills. The NBS's research results are available on a nonexclusive basis. One company is attempting to develop the drill-wear test system into a commercial product, says Donald S. Blomquist, group leader with the NBS. The bureau has several projects aimed at integrated factory systems.

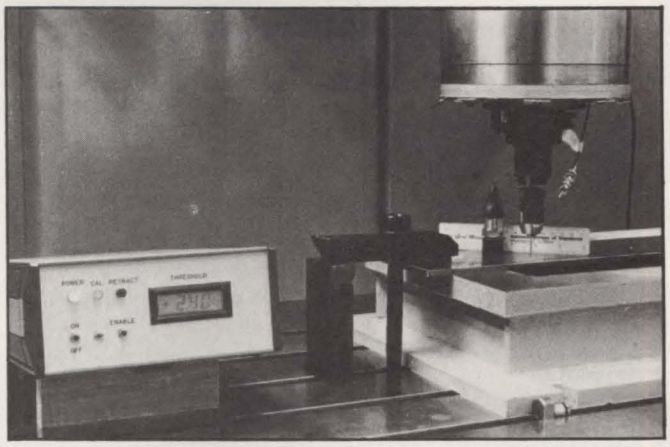
At the NBS's machine shop in the Fabrication Technology Division, the system predicted in 49 of 50 cases that the drill would fail two to 20 holes before the actual failure. As part of the testing procedure, more than 15,000 1-mm. holes were drilled with only a single drill failure, occurring when the system was inadvertently disabled.

The Drill-Up system, initially described in a publication of the Society of Manufacturing Engineers, uses components priced between $300 and $500, depending on the amount of metering desired, Blomquist says. The system essentially measures the amount of vibration in a work piece and compares those measurements to a specified threshold. When the threshold is exceeded a given number of times, the system is alerted and stopped. The system is limited to constant-speed, constant-feed drilling systems. Changes in drill speed presage drill breakage, Blomquist says.

A piezoelectric accelerometer mechanically coupled to a work piece picks up drill vibrations transmitted through the work piece. The possibility of a drill's breaking is determined by formulas based on time-domain analysis of the accelerometer signal. A calibra-

tion routine automatically adjusts to the normal amplitude or range of the signal. "Large amplitude accelerations synchronous with the drill rotation, have been found to be indicative of improper cutting. It has also been found that these accelerations may be caused by a dull drill or by ineffective lubrication. In most cases, drill breakage occurs in a short time if either of these conditions is allowed to continue," state Blomquist and Kenneth W. Yee, an electronics engineer with the NBS, in an SME technical paper.

As described in the SME technical paper, operation begins as the accelerometer responds to vibrations generated in the drilling operation. The accelerometer's signal is amplified and transmitted to one input of an analog comparator. The comparator's reference voltage is supplied by a digital-to-analog converter driven by the 8748's automatic calibration routine. Signals that exceed the threshold generate a pulse that is in turn applied to an input of the microcomputer, which is continually monitoring the input for a pulse. When four sequential pulses caused by over-threshold signals are found, the system puts out a signal called "Up-Z," which actuates a relay connected to a retract button, stopping the numerical control machine program.



The NBS tool-wear sensing system *rests on a machining center bed. The accelerometer, magnetically mounted to the work piece, is just to the left of the 1-mm. diameter drill.*

The Intel 8748's calibration routine allows the system to adapt to the signal strength of the accelerometer automatically, based on a level determined by the operator. When the normal drilling level is found, the system transmits the value to the D/A converter. ■

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The success of the DS180 in a very competitive market did not happen by accident; rather through our sensitivity to the needs of the industry. This sensitivity we carry through research and development, production and quality control and finally, to after sales support and service.

Recently we introduced new enhancements to make the DS180 printer even more versatile. Dot addressable raster scan graphics produces output of computer generated charts, maps and graphs at a resolution of 75 x 72 dots per inch. Variable horizontal pitch selection allows printing at 10, 12 or 16.5 characters per inch plus double wide printing at 5, 6 or 8.25 characters per inch. The expanded 2K FIFO print buffer handles a full CRT screen dump at up to 9600 baud without delaying the host system. We also offer transparent mode for isolating communications problems, and for APL users, the dual ASCII/APL character set option.

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- Vertical Tabs
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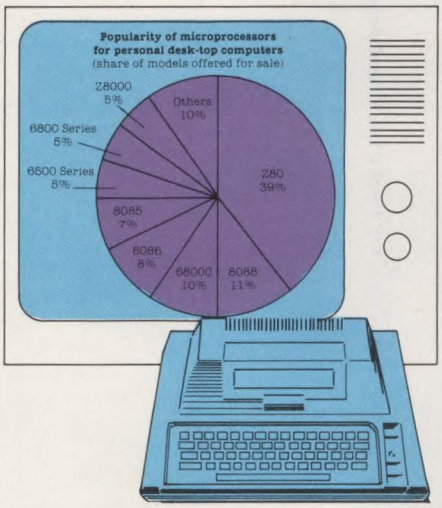
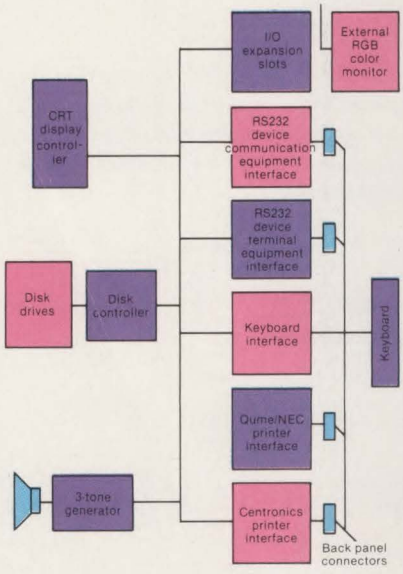


PRODUCT PROFILES: Ever more powerful single-board computers are making systems integrators' lives easier. By creating new applications and better serving existing ones, SBCs will command a larger part of a microcomputer market that forecasters say will grow at 59 percent annually to reach $11 billion by 1986. Thanks to development in 16-bit microcomputers, bus configurations, high-capacity RAMs and peripheral-controller and arithmetic-support chips, some SBCs challenge the power of multi-board minis. For a comprehensive survey, see the article on **p. 147** . . . Anyone who still has doubts about the immediacy or scope of the personal-computer revolution should have been at the 1982 National Computer Conference. That more than 40 manufacturers should exhibit more than 60 products to serve a $2-million annual market growing at 30 to 60 percent is not remarkable. But the similarity of their offerings definitely is. Together these products define a new generation of personal computers, which is profiled beginning on **p. 165**.



MICROCOMPUTERS: A new microcomputer from Vector Graphic combines the 8-bit software compatibility of the Z80 with the processing power of the 16-bit 8088 microprocessor. The Vector 4 supports 8- and 16-bit operating systems, with processor-swapping and time-shared memory schemes to boost processing speed and graphics capability. An in-depth look at the Vector 4 begins on **p. 187** . . . The new 16-bit microcomputers are widely held to be grown-up versions of 8-bit microcomputers. While true, this veiwpoint overlooks a significant aspect of 16-bit machines: functionally, they can often replace larger 16- and 32-bit minicomputers, not just 8-bit micros. For an explanation, see **p. 191** . . . A microcomputer in a process-control application must pit its digital tools against a decidedly nondiscrete real world. The development and testing of such systems present a special problem: the processes to be controlled, with their widely ranging variables, are not often easily duplicated on the designer's bench. Hybrid microcomputers, detailed on **p. 199**, solve the problem by incorporating analog functions to simulate continuous, real-time processes. These added functions convert a microcomputer into a process-control applications-development laboratory.

APPLICATIONS: The personal computer's potential in laboratory automation has been limited by a lack of I/O hardware that can be directly accessed by high-level language. Cyborg Corp.'s new integrated system for automated acquisition and control, with its LabSoft programming language, converts the Apple II to a personal laboratory work station. See **p. 205** for an explanation . . . The analysis of underground rock formations is crucial to mining, drilling and storage applications. Unanticipated instabilities in a formation can quickly turn a multimillion-dollar effort into a worthless rock. Serata Geomechanics, a California mining consulting firm, has found a minicomputer to be the most cost-effective way to analyze information for its clients' projects. See **p. 225** for an interesting look at an interesting application.

The 100mm Winchester. Removable. Half Size. Half Price. Full Performance.

It's here. Winchester capacity and performance at half the size, half the price. And yes, available in removable or fixed disc drives.

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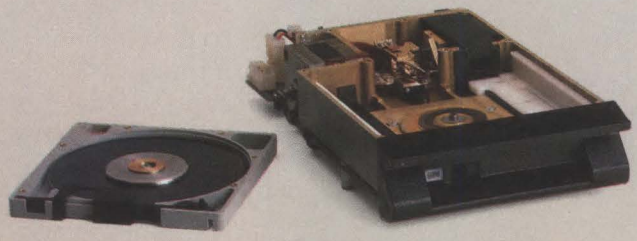

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PRODUCT PROFILE:
SINGLE-BOARD MICROCOMPUTERS

SBCs: small but capable

PATRICK KENEALY, Associate Editor

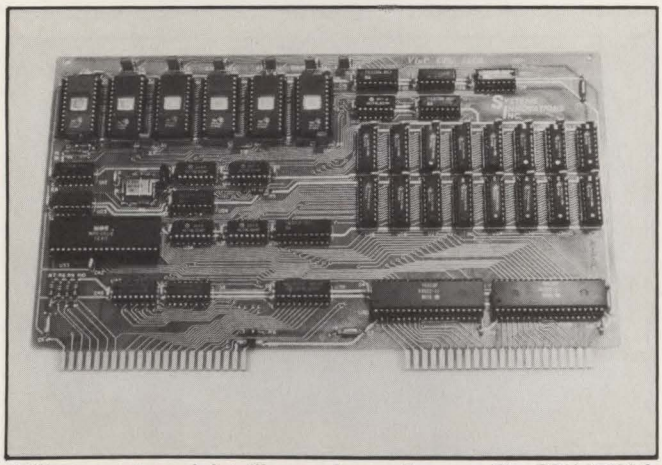
Denser chips put more functions on fewer boards

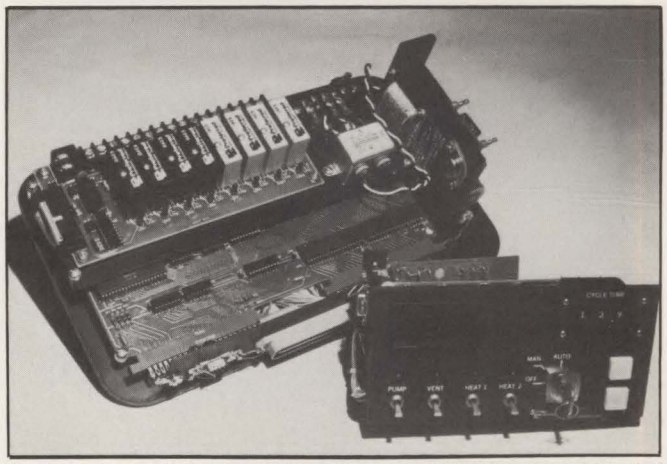
Ever more powerful single-board computers are making system integrators' lives easier. By creating new applications and better serving existing ones, SBCs will command a larger part of a microcomputer market that Creative Strategies International says will grow at 59 percent annually to reach $11 billion by 1986. Thanks to development in 16-bit microcomputers, bus configurations, high-capacity RAMs and peripheral-controller and arithmetic-support chips, some SBCs challenge the power of multi-board minis. Using fewer, more powerful chips than before, SBCs are still shrinking, and their compact form factors, low price and greater reliability are encouraging designers to put them into new and varied end-user products.

Putting more hardware on a board

The 8-bit processors are still most popular, but 16-bit chips are quickly gaining. Many boards use a 16-bit processor for computation and a second, 8-bit processor for I/O. Popular 8-bit SBC chips include the NSC800, Z80, Z80A, 6502, 6809, 8085, 8085A and 8088. For 16-bit SBCs, LSI-11, LSI 4/11, TM990/102, TMS9900, 68000 and 8086 processor chips are most popular.

SBC memories are larger than ever. Boards contain user-configurable assortments of RAM, ROM and EPROM. RAM capacities frequently top 128K, and





SBCs can put much intelligence in small space. *The CPU 65/08 from Systems Innovations, Inc. (left), features a 6502 microprocessor, 24K of ROM/EPROM, 8K of RAM and 40 I/O lines, including two shift registers, four counter/timers and 14 levels of interrupt. Even so, it fits into a compact piece of process-control equipment (right).*

The 8-bit processors are still most popular, but 16-bit chips are quickly gaining.

ROM/EPROM capacities average roughly 32K. Some SBCs come with large memories soldered in place, but more and more vendors use socketed memories to give themselves pricing flexibility.

Even more amazing than the amount of memory encountered on new SBCs is the number of secondary functions now performed on the same single board (Fig. 1). New SBCs control 24, 40, 72 or more I/O lines and offer on-board RS232C, Centronics parallel and SDLC and HDLC interfaces. They provide programmable baud-rate generators, timers, interrupt control, memory mapping, real-time clock/calendars and space for optional arithmetic and floating-point co-processor chips. The Advanced Micro Digital Corp. Super Quad SBC features an integrated single- and double-density floppy-disk controller; many others will soon.

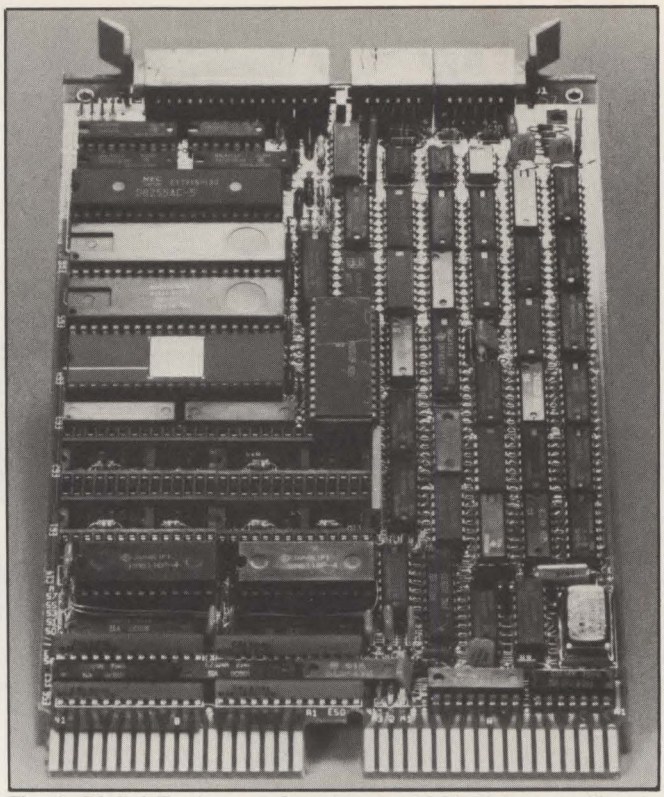


Fig. 1. Digital Equipment Corp.'s new 16-bit Falcon *typifies the small, powerful new SBCs. It measures only 8.5 × 5.2 in. and uses an LSI-11 bus interface. The board contains 4K bytes of RAM; sockets for as much as 32K bytes of PROM or additional RAM; two serial I/O lines; 24 lines of parallel I/O; a 50-, 60- or 800-Hz line time clock; and a T-11 CPU. It sells for $521 in quantities of 100 and is sold through industrial distributors.*

Software and bus developments

Two secondary influences also shaping SBC developments are so-called silicon software and new bus configurations. Increasing on-board memory capacities have encouraged vendors to put software as well as hardware into their SBCs. ROM-based monitor software

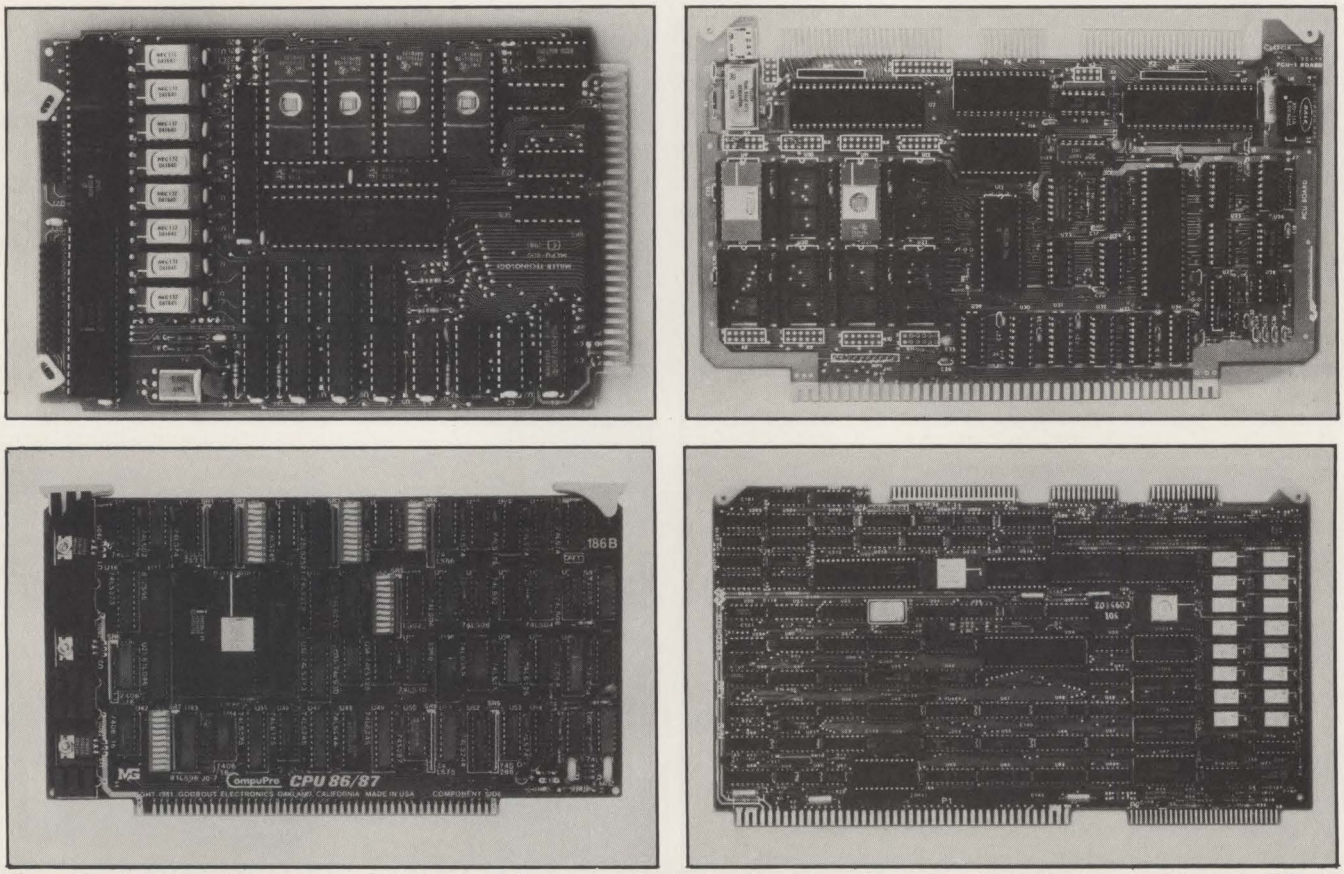


Fig. 2. Single-board microcomputer form factors *follow many industry-standard bus configurations. Clockwise from top left are the STD bus MCPU-800 from Miller Technology, the EXORciser bus PCU-6800 from Phoenix Digital, the Multibus MSC 8009 from Monolithic Systems and the S-100 bus 8086/87 from Compupro.*

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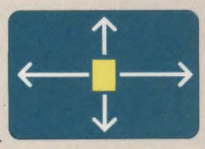


Which kind of editing operation is quickest to execute and easiest on the eyes of the word processing user?

a) Full screen editing allowing for easy cursor movement around the screen?

b) Moving the cursor around by doing a line count?

c) Editing on the bottom line of text only?

2 DOCUMENT LAYOUT

Whatever document format you choose. . .you want to see what the finished article will look like. Should you. . .

a) View it on the screen as it would come out of the printer?

b) Run it through a pre-processor to see what it looks like and then if you like it, print it?

3 KEYSTROKES

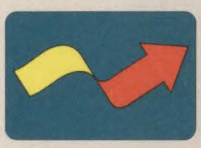
Using a well designed w-p system, how many keystrokes should it take to execute the most often used w-p functions?

a) One easy stroke with no codes?

b) Two or more with complex w-p codes?

c) Three or more?

4 FLEXIBILITY

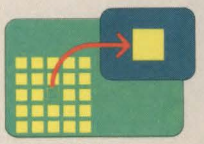


As the business manager of your company, you would like to find w-p software that you can tailor to your company's specific needs. Should you. . .

a) Look for w-p software that allows you to change and add menus, and change function keys?

b) Write your own custom software?

5 RETRIEVAL

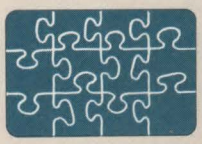


If you want to retrieve information quickly from a large database, which w-p software should you choose?

a) One that can access a particular record by going to it directly?

b) One that searches through all the records on the database sequentially until it finds the right one?

6 COMPATABILITY



As a manager of MIS, you want a w-p system that can be integrated with any other DEC compatable application software. Should you choose w-p software with. . .

a) ASCII formated files?

b) Software which requires non-printing characters in it's file system?

7 MATH

Your company has a number of financial applications and is looking for a w-p package with math capabilities. Should you choose. . .

a) On screen calculating allowing for editing, storing and recall of equations, calculations integrated with your word processing applications?

b) Software where the math capabilities are tied to the list processing module?

c) A separate math package?

THE ANSWERS:

If you answered "a" to all of the questions above, go to the top of the class. Chances are that you already use **LEX-11** or are about to buy it. You know that **LEX-11** is the **ONLY** word processing software that combines these advanced features. . .and more. . . in one software package.

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CIRCLE NO. 49 ON INQUIRY CARD

Two secondary influences shaping SBC developments are so-called silicon software and new bus configurations.

is the rule rather than the exception for new SBCs, many of which offer on-board real-time multitasking operating systems. Intel Corp. and Digital Research, Inc., are working on a "CP/M chip" that could have revolutionary impact on the SBC market and the microcomputer market as a whole.

Industry-standard bus configurations are numerous and getting more so. Popular standards include Multibus, STD bus, S-100 bus, EXORbus, VERSAbus, LSI-11, Nova and TM990, and each requires a different SBC form factor (Fig. 2). With at least as many proprietary bus configurations available, designers often pick a bus based on its multi-vendor and market support rather than on its price/performance or design merits.

The recent joint development of the VME bus configuration by Mostek Corp., Motorola, Inc., and Signetics/Phillips may encourage other vendors to collaborate on bus standards before going into production. Preventing the multi-vendor competition for "standard status" that has plagued the 5¼-in. diskette-drive industry should reduce vendor risks and increase system designer choices.

The product tables

Our product table was adapted from one that ran in the March 31, 1982, issue of our sister publication, *EDN* magazine. *Mini-Micro Systems'* version describes the CPU, bus configuration, memory, ROM-software and secondary functions of each SBC to substantiate the trends noted in this overview. Space limitations require that both *MMS* and *EDN* limit each manufacturer to two entries. Consequently, we asked each vendor to present only its "latest and greatest" offerings. Despite this imposed limitation, the diversity of the minor and major manufacturers' products is apparent. System integrators' SBC selection process isn't getting any shorter, but it's getting more rewarding. ■

NEXT MONTH IN MMS

The feature article section of the September issue of Mini-Micro Systems will spotlight software: high-level languages and development systems. Three major profile articles will be included, detailing database packages for microcomputers, workstation furniture and portable operating systems for microcomputers.

Other editorial features will include:

- Fresh perspectives on languages and operating systems, including Ada, FORTH and UNIX.
- Manufacturers' views on software portability.
- Close looks at MP/M-86 and MS-DOS.
- A look at a new, low-cost 32-bitter that uses new hardware and software architectures.

SINGLE-BOARD MICROCOMPUTERS

Manufacturer Model	Bus	Processor	On-board memory (bytes)	ROM software	Price	Notes	Circle no.
Ackerman Digital Systems							**316**
ADS 6809	S-100, IEEE-696	6809	2K ROM	Adsmon monitor standard; Ads BASIC, $50; video driver, $30	$450	all memory, I/O completely relocatable	
Adaptive Science Corp.							**317**
Module 590ATP	MODULAS ONE	6809	0		$329	comes with 6850 ACIA, 6840 timer/counter	
Advanced Micro Devices							**318**
95/4010	Multibus	8085A	0	Monoboard monitor optional		maps 1M byte of memory	
Advanced Micro Digital Corp.							**319**
Super Quad	S-100	Z80A	64K RAM, 2K ROM	monitor standard	$875	floppy-disk controller; 2 serial, 2 parallel ports	
Super Slave	S-100, IEEE-696	Z80A					
Applied Business Computer Co.							**320**
ASBC-65	EXORbus	6502	0	Aim-65 monitor optional	$230	76 programmable I/O lines; battery backup for 8K of RAM	
Applied Micro Technology							**321**
ST4102	STD	Z80A	8K ROM	monitor/BIOS standard	$495	AM 9519 provides interrupt control; 8255 handles parallel I/O	
Central Data Corp.							**322**
B1017	Multibus	Z8001	0	4K monitor, $120	$1045	9511 arithmetic processor optional	
Compupro Systems							**323**
CPU 86/87	S-100, IEEE-696	8086 standard, supplementary 8087 optional		8-level vectored interrupt controller, 3 interval timers and iRMX-86 kernel or CP/M-86 operating system standard	$695	available in 8- or 10-MHz versions; accommodates 8- or 16-bit words	
Computer Automation							**324**
LSI 4/11	MAXI-bus	LSI 4/11	128K RAM	floating-point firmware standard; 8K I/O initializer EPROM optional	$1600	piggyback option board ($1300) furnishes cycle-stealing DMA, high-speed I/O	
Creative Micro Systems							**325**
9609	EXORbus	6809	1K RAM, 6K ROM	system monitor standard	$595	provides 2 RS232 ports, 3 16-bit timers	
9619	EXORbus	MC68B09	2K RAM				
Cromemco, Inc.							**326**
SCC	S-100	Z80	1K RAM, 4K ROM	monitor, control BASIC standard	$585	serial interface, 5 programmable timers, vectored interrupts, 24 I/O lines	
Cubit, Inc.							**327**
6500-4	AIM-65	6502	4K RAM, 2K ROM		$235	72 user-programmable I/O lines, 5 timers	
Cybersystems, Inc.							**328**
HPC 1085	Cyberbus	8085	1K RAM		$162	offers DMA capability, diagnostic switches, status lights; buffered buses for driving external loads	
Data General Corp.							**329**
MBC/1	Nova	mN601	2K RAM	console debug/ diagnostics optional	$800	full-duplex communication with terminal via RS232 or current-loop interface	
Datricon Corp.							**330**
ACS-09-OEM	STD	6809	0	D-FORTH, $100	$249	provides false-start bit direction, programmable serial I/O	
ACS-12	STD	6800	1K RAM	D-FORTH, $100	$395		
Desert Microsystems, Inc.							**331**
DM-8887	STD	8088	0	EXEC88 multi-tasking executive, $195	$995	optional 8087 co-processor provides high-speed math functions; compatible with 8086 software	

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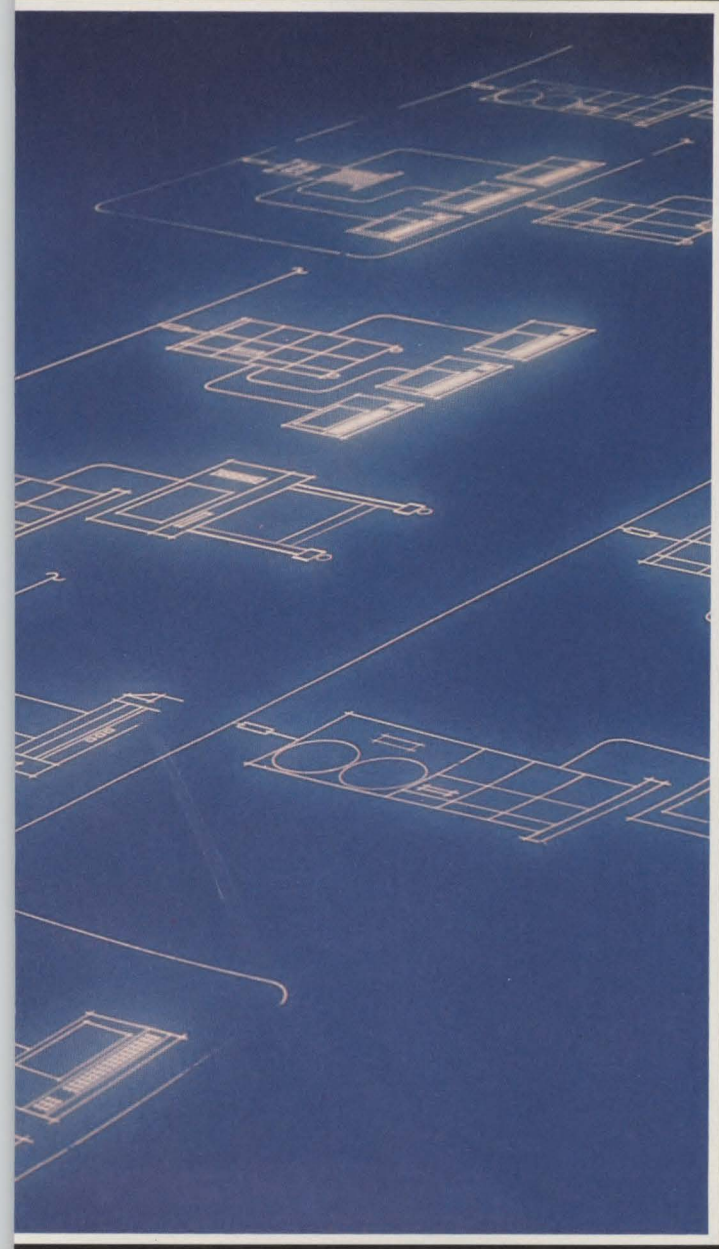

Today, the OEM with big plans is thinking Zilog's System 8000, the Supermicro. This is the breakthrough general purpose microcomputer that easily stands comparison with minis such as the PDP 11/70.† For $29,950, the System 8000 gives you 256 KB of ECC memory, a 24 MB Winchester disk and 17 MB cartridge tape back-up. It is available in both 8 and 16 user configurations, with up to 4 MB added memory and higher capacity disks.

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CIRCLE NO. 105 ON INQUIRY CARD

SINGLE-BOARD MICROCOMPUTERS

Manufacturer Model	Bus	Processor	On-board memory (bytes)	ROM software	Price	Notes	Circle no.
Digital Acoustics, Inc. DTACK 68000	proprietary	68000	4K RAM, 4K ROM	floating-point package standard	$695	attached processor operates with 6502 in PET and Apple μcs; 6502 controls normal bus	332
Digital Equipment Corp. SBC-11/21	LSI-11	T-11	4K RAM	KXT11-A2 development utilities optional	$521	provides PDP-11 instruction set, 24-line I/O	333
Distributed Computer Systems, Inc. DCS-86/12	Multibus	8086	0		$1200	3 RS232 ports, 24 programmable I/O lines	334
Diversified Technology CBC 800/216	Multibus	NSC800	16K RAM	interactive operating system, FORTH 79, monitor firmware, CP/M optional	$1488	complete CMOS design; consumes less than 1W	335
Dynamic Structured Systems DSZ-80	Multibus	Z80A	64K RAM, 4K ROM	bootstrap	$1295	comes with CRT controller, printer interface, RS232 channel	336
Enterprise Systems Corp. 10804	STD	6502	1K RAM		$355	32 programmable parallel latched I/O lines, 8 handshake lines; ACIA and baud-rate generator; all ICs socketed	337
Forward Technology, Inc. FT-68M	Multibus	68000	128K RAM, 2K ROM	monitor standard; FORTH real-time monitor optional	$2996	256K-byte version is $3495; 10-MHz version is $3995	338
FT-86C	Multibus	8086	4K RAM, 8K ROM	FORTH real-time monitor standard	$1595	affords 24-sq.-in. breadboard area; 2 serial interfaces provide sync or async communication	
General Micro Systems, Inc. GMS-6506	System-65	6502	4K RAM	6502 operating system optional	$489	interchange on-board GMS modules to build systems with 6502, 6802, 6809 or Z80 CPUs	339
Godbout Electronics CPU 86/87	S-100, IEEE-696	8086	0	80130 operating system firmware for 8087, iRMX-86 kernel, CP/M-86 optional	$675	operates at 10 MHz; 8-MHz version is $525	340
Heurikon Corp. MLZ-91A	Multibus	Z80A	64K RAM		$2495	all I/O devices dynamically mapped to CPU; optional GPIB interface handles 15 devices	341
Hewlett-Packard Co. 2106AK	proprietary	2901 bit slice	128K RAM		$2250	distributed-intelligence architecture; performs 1M instructions/sec.; runs same software as HP-1000; optional 1M-byte RAM board is $5000	342
Intel Corp. iSBC 86/30	Multibus	8086	128K RAM		$3800	2 iSBX connectors interface to Multimodules	343
iSBC 88/25	Multibus	8088	4K RAM		$1295	2 8-bit interfaces operate with Multimodule boards	
Intercontinental Microsystems Corp. CPZ-48000	S-100	Z80A	0		$1095	floppy-disk controller (single or double density), real-time clock, 2 sync and 6 async I/O channels	344

SINGLE-BOARD MICROCOMPUTERS

Manufacturer Model	Bus	Processor	On-board memory (bytes)	ROM software	Price	Notes	Circle no.
Lamar Instruments							345
Superkim	AIM-65	6502	4K RAM, 2K ROM	Kim-1 monitor standard; Apple II downloading routine optional	$475	EPROM resides anywhere in memory above 2000H; built-in interface handles audio-tape I/O	
Logical Devices, Inc.							346
QCB-9	S-100	6809	2K RAM, 2K ROM	Qbug debug monitor standard	$299	1 RS232 port, 2 parallel ports, 16 decoded address lines	
Measurement Systems & Controls							347
CPC-2810	S-100, IEEE-696	Z80A	0		$495	4 serial, 2 parallel I/O channels; 2- or 4-MHz operation	
Microbar Systems, Inc.							348
DBC68K-80	Multibus	68000	2K RAM		$2050	dual-bus architecture allows operation with zero wait states at 8 MHz; memory-management option is $900	
Midwest Micro-Tek, Inc.							349
PC-88/12M	Multibus	8088	64K RAM, 4K ROM	terminal monitor/debugger, CP/M driver standard	$1595	comes with dual-density floppy-disk controller, 22 programmable I/O lines	
Miller Technology							350
MC PU-800-03	STD	Z80A	64K RAM	2K monitor, $40; 2K BASIC, $55	$1175	24 I/O lines, serial interface	
M-80		Z80	128 RAM (2K RAM and 2K ROM optional)	M-80 monitor, Tiny BASIC standard			
Mizar Designs							351
MDI68CV	Versabus	68000	128K RAM, 8K ROM	MDI68DM debug monitor standard	$1260	parallel I/O brought to 34-pin connector	
VME8100	VME	68000	0		$610	provides RS232 port and strap-selectable bus priority	
Monolithic Systems Corp.							352
MSC 8007	Multibus	Z80A	32K RAM, 2K ROM		$1000	watchdog timer set to 10 msec. allows monitoring of program, system failures	
MSC 8009	Multibus	Z80A	32K RAM		$1196	on-board floppy-disk formatter/controller handles double-, single-density formats	
Mostek Corp.							353
MDX-CPU3	STD	Z80A	64K RAM, 2K ROM		$695	full-handshake RS232 port; buffered I/O; supports 16 software-selectable memory configurations	
VME-SBC		68000	16K EPROM, 12K RAM			8 byte-wide memory sockets standard	
Motorola Semiconductor Products, Inc.							354
Micro module 17	EXORbus	6809	0	monitor, debug, program linkage, RAM allocation optional	$495	parallel I/O compatible with Opto 22; 6840 satisfies counting, timing requirements	
VMO2	Versabus	68000	128K RAM		$3900	extend I/O channel (50-pin) to 50 ft. without performance degradation	
Mu Sys Corp.							355
Net/82	S-100	Z80A	128K RAM, 2K ROM	bootstrap loader, transfer protocol standard; MuDOS optional	$1995	floating-point processor, real-time clock; operates as network processor	
National Semiconductor Corp.							356
BLC-86/12B	Multibus	8086	32K RAM		$2000	dual-port RAM with lockout provides system security; 2 BLX connectors support expansion	
CIM-800	CIMbus	NSC 800	2K RAM	BLMX-80 operating system optional		CMOS circuitry with watchdog timer, 8 vectored interrupts	

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system 83 multi user multi tasking

CIRCLE NO. 45 ON INQUIRY CARD

The System 83/ provides the ultimate link between UNIX and the 68000 microprocessor on the IEEE 696/S-100 bus. The resulting blend is a multi-user, multi-tasking computer with incredible power and versatility.

THE SOFT POWER OF UNIX

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THE HARDWARE

An On-Board Memory Management Unit and a scatter-loading technique are used to allow efficient processing for multiple users performing multiple tasks. An interrupt-driven DMA disk controller speeds the system's throughput with up to 80 MB's of Winchester storage. An intelligent interrupt-driven I/O controller (with a 256 Byte FIFO buffer on input, and a DMA channel on output) takes the strain off the CPU for I/O, and eliminates any danger of lost characters. The 20-slot bus allows for expansion; • up to 3.3 MB's of directly addressable RAM • Multiple SIO4-DMA boards add four users per slot • Other S-100 peripheral cards may be added for system flexibility.

DUAL DELIVERS

The Dual System 83/ hardware has been designed from the ground up with the Bell UNIX operating system in mind. The System 83/ is no engineering pipe-dream; we've been shipping the power package since February 1982. So, if you've been looking for the missing link between UNIX and the 68000, search no further. For technical information, or a quotation, please call or write to:

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* UNIX is a trademark of Bell Laboratories and is supported on the DUAL System 83 by UniSoft Systems of Berkeley, Ca.

SINGLE-BOARD MICROCOMPUTERS

Manufacturer Model	Bus	Processor	On-board memory (bytes)	ROM software	Price	Notes	Circle no.
NEC Electronics USA, Inc.							357
BP-0186	Multibus	8086	128K RAM	monitor optional	$2595	optional arithmetic co-processor; 24 programmable I/O lines	
Nortek, Inc.							358
PCP-11E	LSI-11	Z80A	16K RAM, 4K ROM	FORTH-like operating system, programming language standard; remote bisync terminal package optional	$655		
Omnibyte Corp.							359
OB68K1	Multibus	68000	32K RAM	real-time, multitasking operating system with editor, assembler, linking loader, utilities: $1800	$1495	uses same I/O arrangement as Motorola MEX 68 KDM design module	
Percom Data Co., Inc.							360
SBC/9	SS-50	6809	1K RAM	Psymon monitor standard	$200	6802 μp optional	
Phoenix Digital Corp.							361
PC4-6800-08	EXORbus	6800	8K RAM		$750	features gate-array address map generation; 3 counter/timers, clock logic	
PCU-6809	EXORbus	6809	2K RAM, 2K ROM	MDB-6809 monitor debugger standard	$725	provides real-time clock/calendar	
Pro-Log Corp.							362
7880	STD	Z80A	2K RAM, 4K ROM		$175	10-msec. timer suits use as background timer or debouncer; 250-nsec. clock	
RCA Solid State Div.							363
CDP18S601	COSMAC	CDP1802	4K RAM			comes with crystal-controlled clock, power-on reset, expansion interface	
Rockwell International							364
RM 65	RM 65	6502	2K RAM	BASIC, FORTH optional	$190		
Smoke Signal Broadcasting							365
SCB-69	SS-50	6809	1K RAM, 2K ROM	MON69/69D monitor standard	$299	optional floating-point processor, 20K of EPROM/ROM, real-time clock	
SSM Microcomputer Products, Inc.							366
CB2	S-100	Z80	0		$344	extended address lines address more than 64K of memory	
Synapse Corp.							367
CPU-6805	C44	146805E2	1K RAM, 2K ROM		$325	CMOS computer with 8 analog inputs, 8 digital I/O lines; EPROM is power-switched for battery operation	
CPU-800	C44	NSC800	1K RAM, 2K ROM	interrupt handling routines	$425	NSC810 port chip supports 22 I/O lines; on-board voltage regulator has current limit and foldback at 200 mA; all-CMOS design with switched EPROM	
Systems Innovations, Inc.							368
CPU 65/08	AIM-65	6502	8K RAM, 2K ROM	MTM65 multi-tasking monitor standard	$255		
Texas Instruments, Inc.							369
TM 990/100MA	TM 990	TMS 9900	4K RAM, 4K ROM	Tibug monitor standard	$598	TMS 9901 provides programmable system interface	
TM 990/102		TM 990/102	128K RAM	TM 990/404 monitor standard	$1650	Pascal, Power BASIC, TMS W330R, real-time executive	

SINGLE-BOARD MICROCOMPUTERS

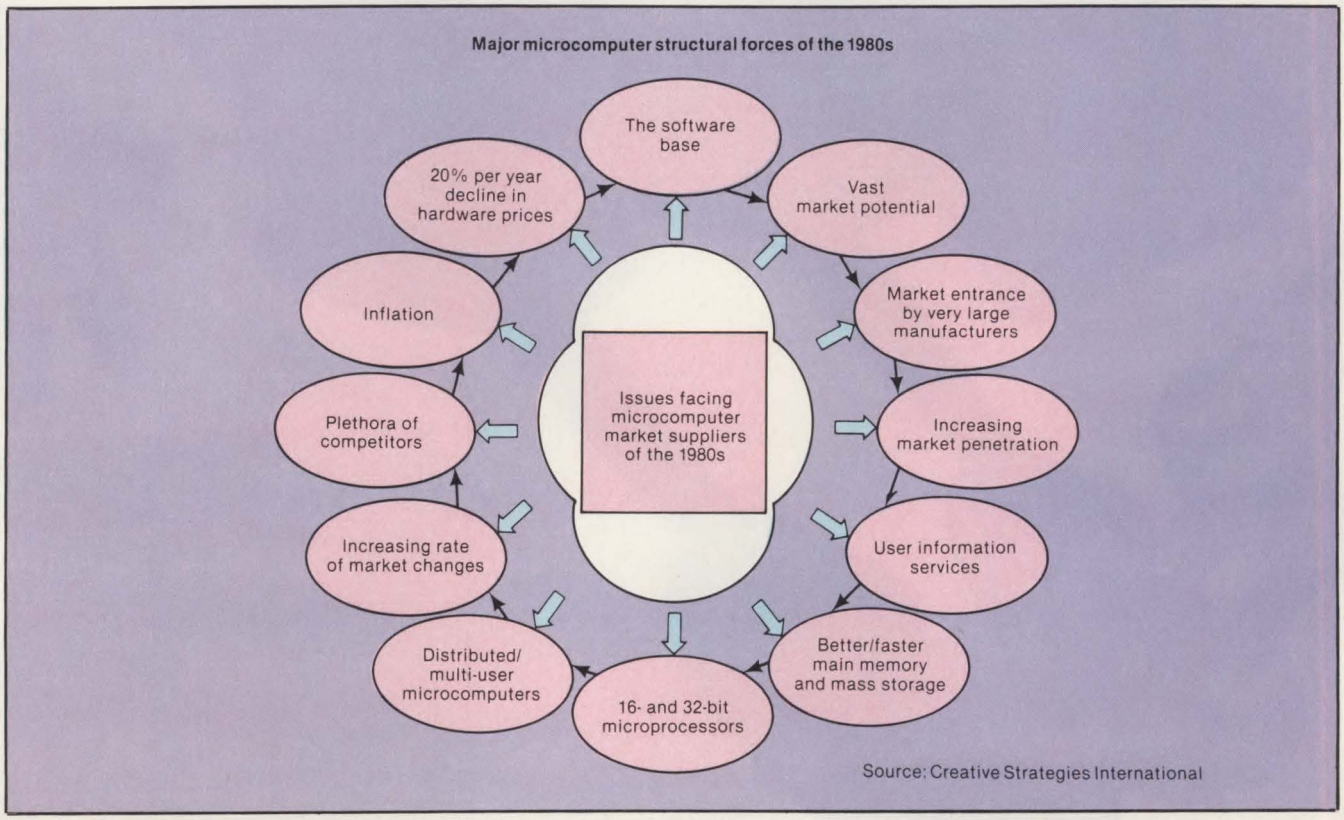
Manufacturer Model	Bus	Processor	On-board memory (bytes)	ROM software	Price	Notes	Circle no.
Transwave K-8073	STD	INS8073	1K RAM, 8K ROM	complete utilities firmware, Tiny BASIC microinterpreter standard	$388	real-time date clock, 24-line programmable I/O	370
Western Digital Corp. SKC 85	SAB	8085	0			includes 256 bytes of volatile RAM, 256 bytes of nonvolatile, battery-backed RAM; 22 parallel I/O lines	371
Wintek Corp. 6801	proprietary	6801	2K ROM	C-NET communications protocol, I/O handler standard	$199	8-bit D/A, 12-bit A/D conversion; 3-function timer; parallel I/O	372
Xycom 1860+		Z80A	1K RAM			2 full-duplex serial ports standard; floating-point, arithmetic units optional; model 1862+ features 8K RAM	373
1868+	proprietary	Z8001	12K RAM			500K-baud sync communication; operates as either master or slave in multiprocessor environment	
Ziatech Corp. ZT 7805	STD	8085A	0	monitor PROM with GPIB, serial drivers optional	$650	4 modem-control lines act as RS232 drivers; GPIB bus interface	374
Zendex ZX-80/05	Multibus	8085A	0	monitor on CP/M-compatible bootstrap optional	$550	3 ZBX sockets meet Intel SBX specifications	375

Personal computers: a new generation emerges

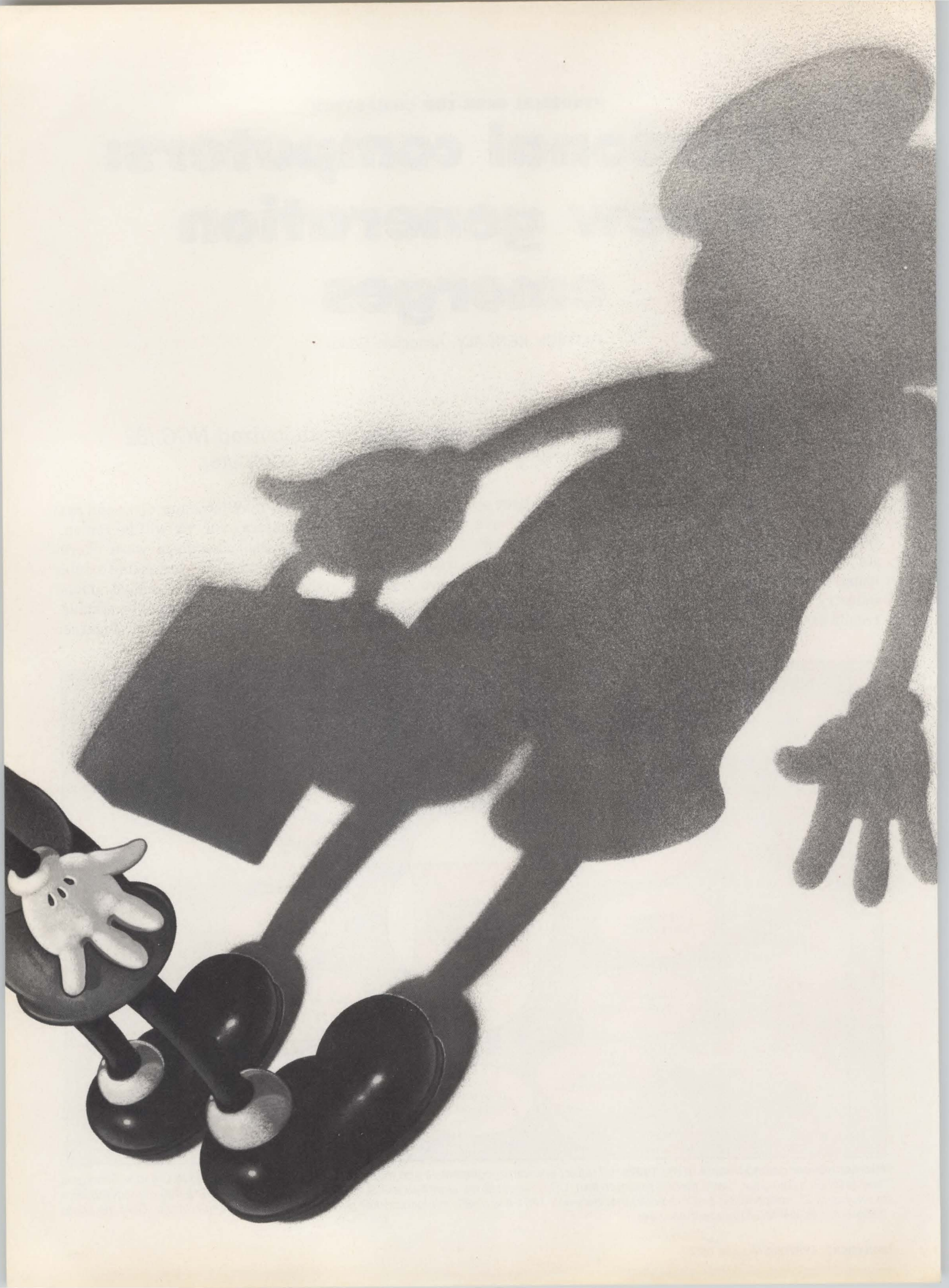
PATRICK KENEALY, Associate Editor

The integrated desk-top microcomputers that characterized NCC '82 have defined a new generation of personal computer

Anyone who still has doubts about the immediacy or scope of the personal-computer revolution should have been at the June, 1982, National Computer Conference. As usual, NCC was hot, noisy and crowded, but, as usual, the physical concentration of so many computer industry manufacturers in one place made industry trends easy to spot. Just as NCC '79 seemed dominated by CRT terminals, NCC '80 by Winchester disks and NCC '81 by matrix serial printers, NCC '82 will be remembered as the year personal computers were everywhere. That more than 40 manufacturers should exhibit more than 60 products to serve a $2-million annual market growing at 30 to 60 percent is not remarkable. The similarity of their offerings definitely is. Together



Microcomputer developments in the 1980s *will reflect economic, competitive and technological pressures, according to Creative Strategies International, a San Jose, Calif., market-research firm. CSI's recent study identified a U.S. market potential for under-$15,000 microcomputers in excess of 25 million units, and predicted that between 1981 and 1986, microcomputer performance levels will quadruple. Over the same period, prices will fall 20 percent per year.*



YES. YOU CAN BUY A UNIX SYSTEM FROM SOMEONE ELSE.

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And then take support. Because when it comes to UNIX, we have it all. Full software engineering support, UNIX software maintenance and even a software referral service for your OEM programs.

Fact is, of all those someones who offer UNIX, we're the only ones who support not only it, but you—with a field engineering force that'll back you up no matter what field you're in.

Not that we have to stop there. If you're serious about UNIX, contact us: Plexus, 2230 Martin Avenue, Santa Clara, CA 95050, (408) 988-1755. And we'll be glad to tell you about all the other no-nonsense advantages we offer.

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CIRCLE NO. 17 ON INQUIRY CARD

A personal desk-top computer provides stand-alone processing, storage and I/O for one user in a compact, desk-top or smaller package.

these products define a new generation of personal computer.

What's personal?

Personality, like beauty, is in the eyes of the beholder. The term personal computer means many things to many people, but recent introductions point to a consensus among hardware vendors that *Mini-Micro Systems* has firmed up into a working definition: a personal desk-top computer provides stand-alone processing, storage and I/O for one user in a compact, desk-top or smaller package. Unlike general-purpose processor plus stand-alone dumb-terminal systems offered by Cromemco, Inc., Vector Graphic, Inc., Ohio Scientific, Inc., and others, personal desk-top computers are designed primarily as single-user systems. Unlike the home computers sold by Atari, Sinclair Manufacturing Co., Texas Instruments Inc. and others, personal desk-top computers include significant memory and storage in their base models and support wide varieties of commercial, scientific and office-oriented software. Personal desk-top computers may be portable, but unlike the Sony Corp., Panasonic Co., Azurdata, Inc., and Sharp portables, desk tops don't sacrifice significant functionality for portability.

The more than 70 personal desk-top computers described in the accompanying table define a cohesive microcomputer submarket. The mean price of the units in the table is $4474, with a standard deviation of $2154. More than 70 percent of the units sell for between $2900 and $5500 (Fig. 1). Price is not part of *Mini-Micro Systems*' functional definition, but it is an important part of the market's competitive definition.

Basic hardware

All of the machines in our profile feature four main functional components: a processor with significant RAM, an alphanumeric keyboard, a multi-line (usually 80-column × 24-line) display and one or two integral storage devices.

Personal desk-top computers use a variety of 8-, 16- and 16-/32-bit microprocessors (Fig. 2). Zilog, Inc., Z80 processors are used in more than one-third of the units offered, and more than half are still 8-bit machines. Machines based on 16-bit Z8000, 8086, 8088, Digital Equipment Corp. LSI-11 and TI/9900 micros have emerged as a class separate from the low-end 8-bit micros, and recent introductions by IBM Corp., DEC, Wang Laboratories, Inc., and Commodore Business Machines underscore the growing popularity of 16-bit processors. Many "16-bit machines" are really dual-processor systems that use a 16-bit chip for computation and an 8-bit chip for I/O processing.

A handful of desk tops including products from Corvus Systems, Inc., C.I.E. Systems, Hewlett-Packard Co., Fortune Systems, Radio Shack and Wicat Systems use the Motorola MC68000 16-/32-bit microprocessor and achieve performance levels of roughly 1 million instructions per sec., much higher than 16- and 8-/16-bit machines.

Ninety-five percent of the desk tops provide 64K

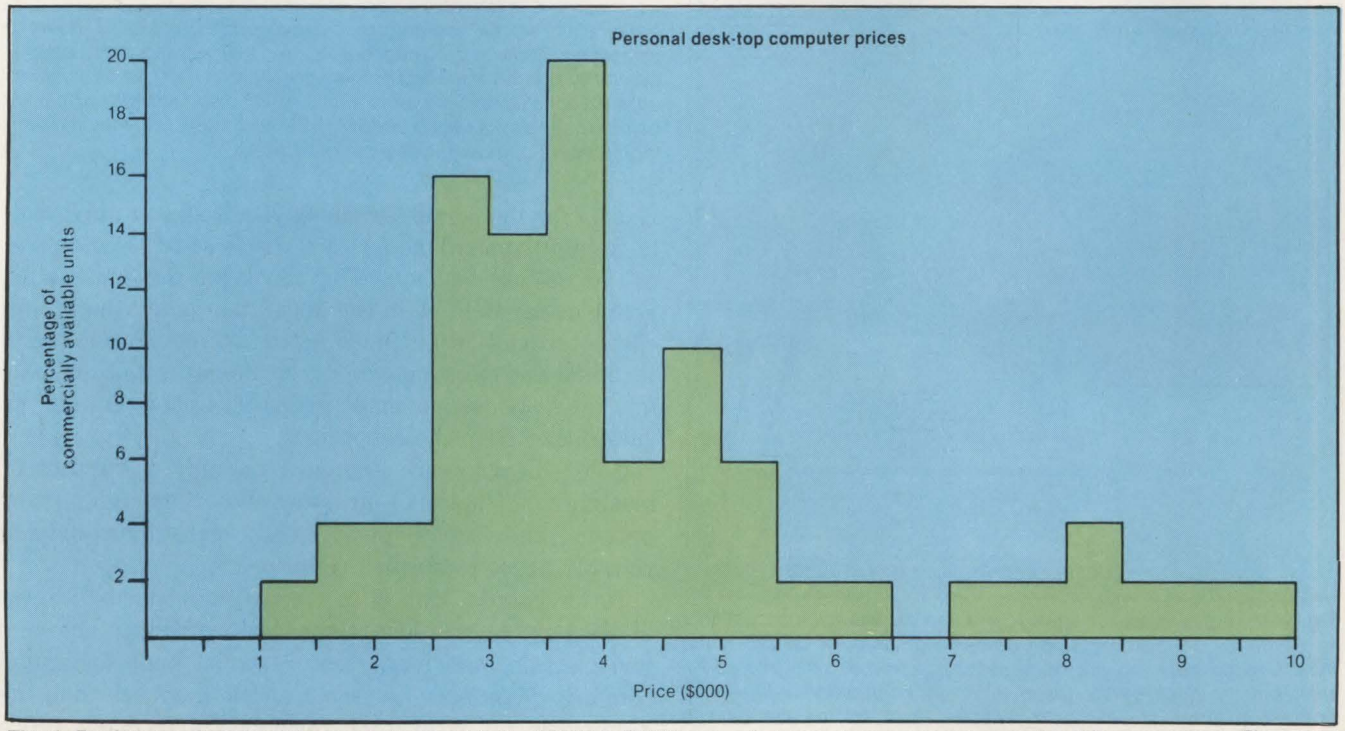


Fig. 1. Desk-top computer prices *are clustered in the $2500 to $5000 range between home computers and multi-user systems. The spread above should narrow even further as competitive pressures intensify.*

Many '16-bit machines' are really dual-processor systems that use a 16-bit chip for computation and an 8-bit chip for I/O processing.

bytes or more RAM in their basic configurations. Maximum memory capacities of 256K and 512K bytes are common, and a few of these single-user units address 1M byte or more of main memory. Off-line capacities, like memory capacities, are impressive and similar for most machines.

The 5¼-in. diskette is the preferred storage medium, although a few models use 8-in. diskettes, and some portable units use bubble-memory cartridges or micro-diskettes. Formatted capacities for the 5¼-in. diskettes range from 80K to 400K bytes. The 320K- and 160K-byte capacities are the most popular, but the lack of standardized 5¼-in. diskette formats has made software portability for the desk tops a problem. Eight-in. diskettes use much larger form factors, but thanks to their standardized format, reliability and 1M-byte-level capacities, they have made a comeback recently in new products from Radio Shack, Victor Business Products and NEC Information Systems, Inc.

The last two functional hardware components—the display screen and the keyboard—reflect the influence of ergonomic as well as electronic considerations.

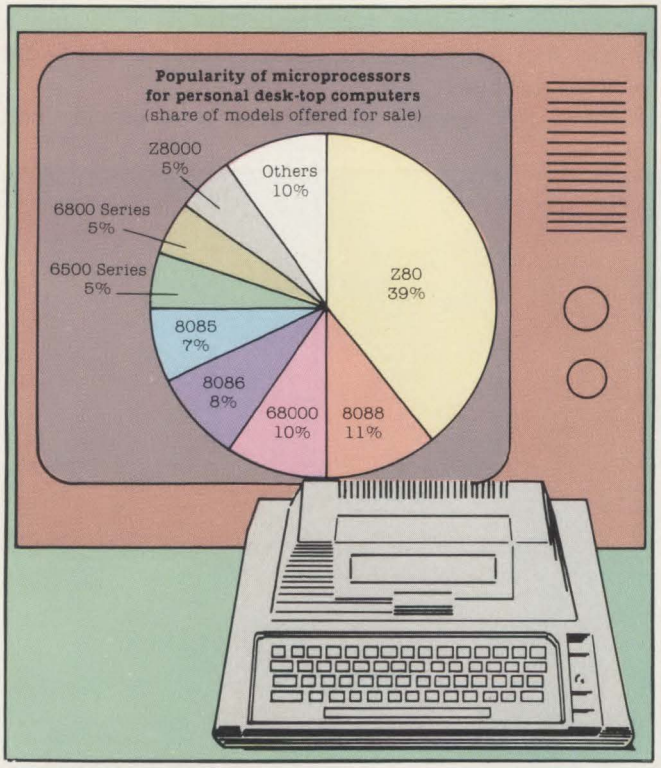
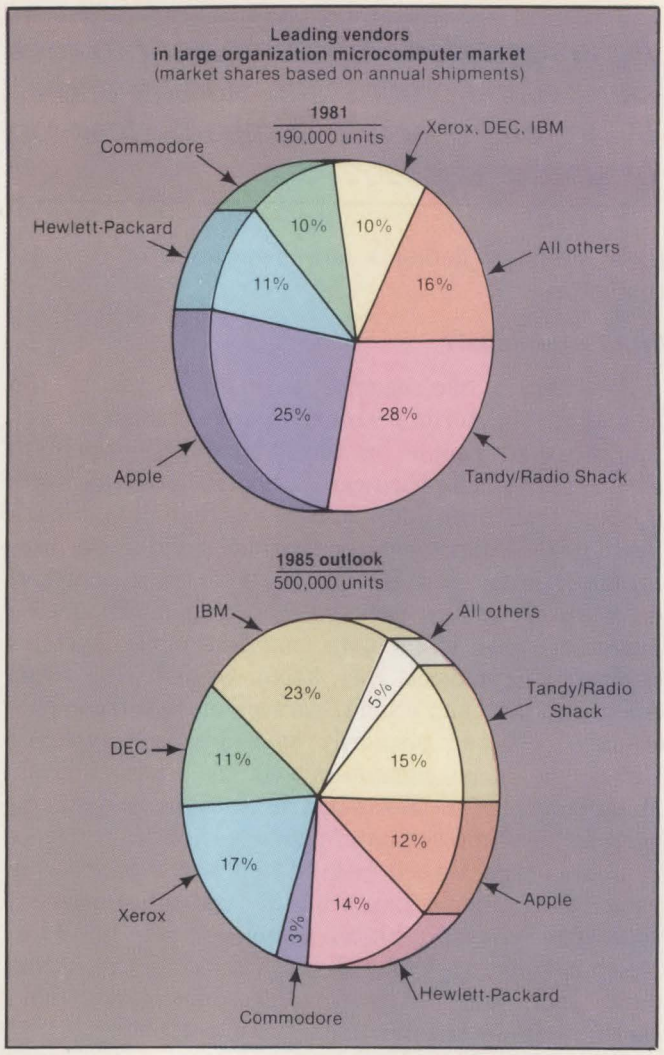


Fig. 2. Personal desk-top computers *use diverse microprocessors for 8-, 8-/16-, 16-/32- and 32-bit processing. Zilog's 8-bit Z80 is the most popular desk-top microprocessor in terms of units offered for sale, but the 6500 series (used in Apple computers) is the most popular in terms of units sold. Various 16-bit micros are gaining popularity in single- and multi-processor desk-tops, and the Motorola 68000 is emerging as the standard 16-/32-bit desk-top micro.*



Microcomputer market shares *for the large business market segment will reflect the growing involvement of corporate DP managers in the micro acquisition process. International Resource Development, a Norwalk, Conn., research firm, recently found that 80 percent of the DP managers it surveyed expected to develop selection criteria and buying policies for their companies' personal computer purchases. The DP managers' preference for direct sales organizations, familiar vendors and quantity discounts should please established vendors such as IBM, DEC and Xerox, but may threaten independent computer dealers and retailers.*

Except for the portables, displays are almost universally 12-in. (diagonal) models that display full 80-column × 24- or 25-line formats. Two-thirds of the units offer graphics capabilities in the 600 × 240 pixel range, and character legibility is much better than even last year's terminal and personal-computer displays. Enthusiastic market response has made green-phosphor screens the rule rather than the exception.

Color displays are standard on only a handful of machines but optional on many. Whether standard or optional, they usually provide eight or 16 colors and add roughly $1000 to a unit's retail price.

In keyboards, thin is in. Today's keyboards (almost all detachable) are low to the desk to reduce arm and wrist strain, and many feature wrist pads for added comfort. They provide better tactile feedback than the keyboards on most CRT terminals and many office typewriters and offer audible feedback and n-key

THE OEM-FRIENDLY COMPUTER. BEFORE WE BUILT IT, WE LISTENED.

We asked hard questions. Of you. Of your customers. We learned that the easier a system is to use, the better it is for OEM's. Because you have better things to do than hold your customers' hands.

Your customers wanted simplicity. BMC put everything in one package: The computer, with up to 256K RAM. Full ASCII keyboard and numeric keypad. 640 X 200 pixel-addressable RGB CRT with graphics capabilities in 64 colors and hues. An on-board workprinter. Dual, double-density 5¼" floppies. Or a 400 Kbyte floppy and 10 Mbyte hard disk.

They wanted bundled software. So we started with the only CP/M® Operating System that fully supports color graphics. Then we added Select™ Word Processing, SuperCalc,™ a mailing list manager, and the PEARL™ program generator. Plus BMC Extended Color BASIC and BASIC-80. Or, you can sell the system with your software alone.

Programs waiting for a system? Our 30 user-programmable softkeys make systems simple. Not only that, BMC's are cartridge programmable. And we can provide you with EPROM cartridges. It's cheap for you. Easy for them. And it makes an excellent sales feature: Plug-and-go.

One-supplier support. Color graphics printers, light pens, 16-bit μp, bi-sync communications equipment, you name it. Even multi-user capabilities. All from BMC. Plus nationwide third-party field service that assures your customers of help when they need it. And, our Hotline gives you a single toll-free number for technical support.

Ready when you are. The BMC computer is manufactured by one of Japan's leading electric and electronics companies. They've been in business for 103 years. And they're planning their bicentennial. Which means we'll be here as long as you need us.

We listen. You told us what you wanted. Your customers told us what they wanted. That's how we built BMC Business Computers. Our business is to listen to your business. And respond.

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CIRCLE NO. 123 ON INQUIRY CARD

SOMEONE WAS LISTENING.

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SuperCalc is a trademark of Sorcim, Inc.
PEARL is a trademark of Relational Systems, Inc.
CP/M is a registered trademark of Digital Research, Inc.

The display screen and the keyboard reflect the influence of ergonomic as well as electronic considerations.

rollover as well. Most keyboards offer numeric keypads and many dedicated and user-definable function keys. Some function keys are illuminated, some have removable keycaps, and others are dynamically labeled on the bottom row of the display screen.

The software story

The personal desk-top computer software story can be aptly labeled a tragedy, a comedy or a history, depending on hardware. The tragedy is the very serious scarcity of third-party or even vendor software for many of the 68000-based systems. The comedy is in trying to get software that fits both the processor and the diskette format for a single- or multiprocessor 16-bit system. The history is happy in that large numbers of off-the-shelf packages have been developed for all 8-in. diskette-based and many 5¼-in. diskette-based, 8-bit systems.

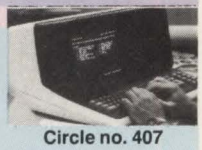
Third-party software vendors adapt their packages for hardware systems based on their perceptions of the current or future market share of those systems. Most hardware vendors have plenty of pre-adapted third-party or internally developed software ready when they announce their new systems, but other vendors—large (DEC) and small (Fortune Systems) alike—promise that software for their machines will be ready by the planned first shipment dates.

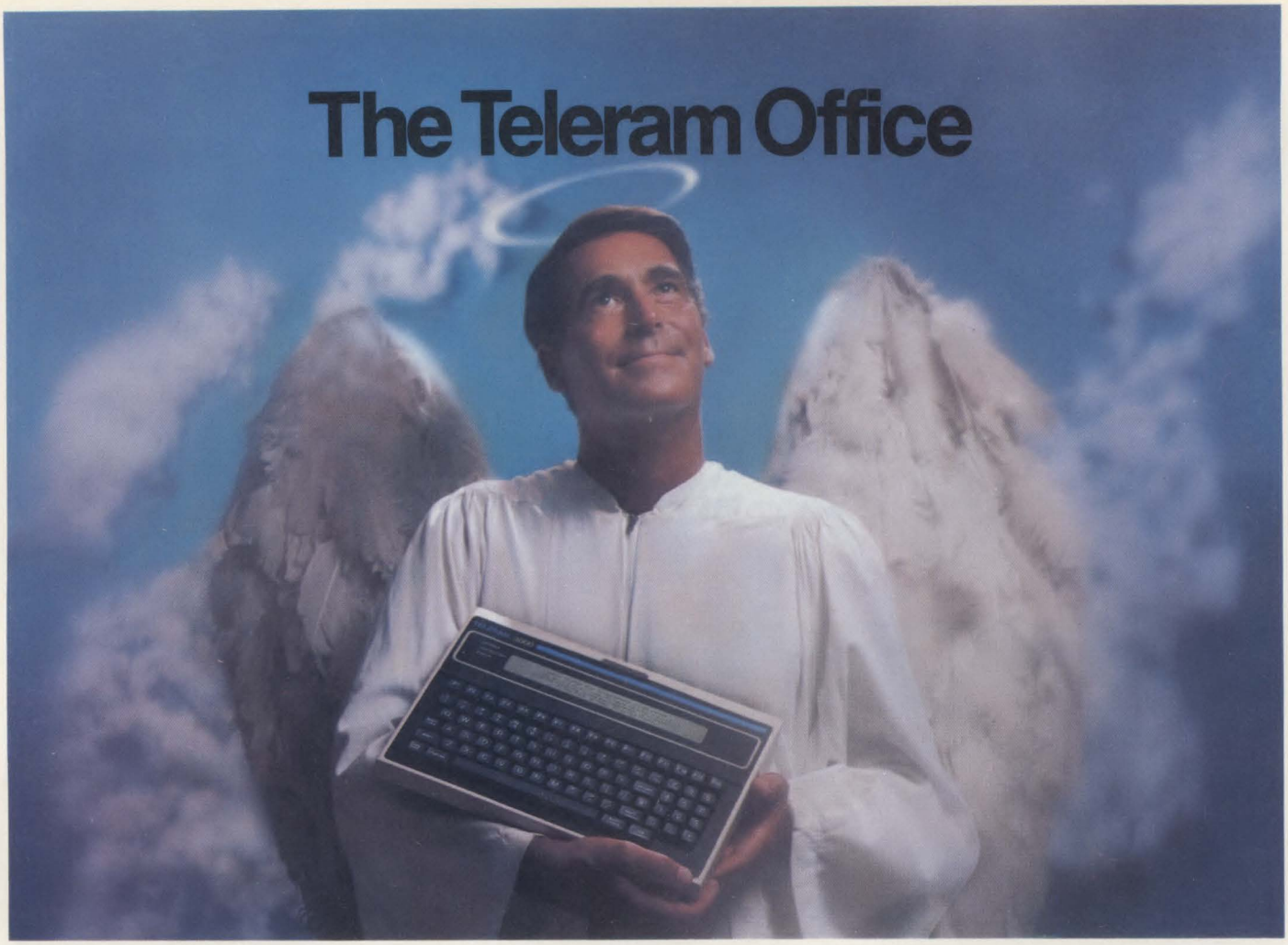
None of the manufacturers we've examined seem to be acting in bad faith, but even considering the existence of thousands of roughly standardized (CP/M-compatible) packages, software is not keeping up with hardware. The personal-computer market may spawn the software shortage analysts have been predicting for years.

Now that the NCC dust has settled, the software problems should be solved quickly. In CP/M and, to a lesser extent, MS/DOS, the industry has existing standards. They work well in the 8-bit world, and the 16-bit micro software problem is more one of adopting and formatting than beginning again. UNIX is emerging as a standard in the 68000-based world, and the general trend is for hardware and third-party software houses to work more closely together to their and the buyers' mutual benefit. Most 16- and 16-/32-bit machines are shipped with more than enough software to make them productive, and the freedom of software selection enjoyed in the 8-bit market should reach the 16-bit market by year-end. ■

PERSONAL DESK-TOP COMPUTERS

Manufacturer Model	Screen	Auxiliary Storage	Processor	Software	Price	Notes	
Apple Computer							
Apple II	12-in.; green standard; 40 x 24 format; upper-case only	2 5¼-in., 140K-byte diskettes	6502 with 48K- to 256K-byte memory	Apple DOS	$2420	price includes monitor, 2 diskette drives	 Circle no. 397
Apple III	12-in.; green standard; 80 x 24 format	2 5¼-in., 140K-byte diskettes	6502A with 128K- to 256K-byte memory	Apple DOS	$4264	price includes monitor	 Circle no. 398
Atari							
800	40 x 24 format			AOS	$3700		 Circle no. 399
BMC Computer							
if800	12-in.; green standard; 8 colors optional; 80 x 25 format	2 5¼-in., 400K-byte diskettes	Z80A with 64K- to 120K-byte memory	CP/M, MP/M, CP/Net, BASIC, FORTRAN, APL, COBOL, Pascal, Condor, Select, Pearl, Graf-it	$4170	integrated printer standard; 8-color version optional	 Circle no. 400
Canon USA							
CX-1	12-in.; green standard; 80 x 24 format	2 5¼-in., 320K-byte diskettes	6809 with 64K-byte memory	MCX, BASIC, Text Editor, CROFF	$4995		 Circle no. 401

Manufacturer Model	Screen	Auxiliary Storage	Processor	Software	Price	Notes	
CIE Systems							
680/10	12-in.; green standard, amber optional; 80 x 24 format	1 5¼-in., 10M-byte Winchester, 1 5¼ in., 500K-byte floppy	M68000 and 8085 with 128K-byte memory	UNIX System III, REGULUS, PRO-IV, VERSADOS	$5200	expandable into 4-user and multi-user CIE systems	 Circle no. 402
Commodore Business Machines							
BX128	12-in.; green standard; 80 x 25 format	2 5¼-in., 1050K-byte diskettes	6509 with 128K- to 256K-byte memory; Z80 optional; 640K-byte external memory optional	BASIC 4.0 standard; CP/M, CP/M-86, USCD Pascal optional		music synthesizer, IEEE interface	 Circle no. 403
BX256	12-in.; green standard; 80 x 25 format	2 5¼-in., 1050K-byte diskettes	8088 and 6509 with 128K- to 256K-byte memory; Z80 optional; 640K-byte external memory optional	CP/M-86, CP/M, USCD Pascal	$2995	music synthesizer, IEEE-488 interface	Circle no. 404
The Computerist							
FOCUS	12-in.; B & W standard; 80 x 24 format	2 5¼-in.; 320K-byte diskettes	6809 with 150K-byte memory	DOS, Editor, Macro Assembler, debugging monitor, compiled and interpreted BASIC	$3495		 Circle no. 405
Corvus Systems							
Concept	15-in.; B & W standard; 90 x 72 or 120 x 56 format		M68000 with 256K- to 512K-byte memory	Omninet network package, Edword, CP/M emulator, LogiCalc	$4995	a network work station that also functions as a stand-alone personal computer	 Circle no. 406
Data General Corp.							
MPT/100		2 5¼-in., 360K-byte diskettes	microNova with 64K-byte memory	MP/OS, BASIC, FORTRAN, Pascal, Editor, debugger	$5350	25M-byte Winchester disk, other DG peripherals optional	 Circle no. 407
Digital Equipment Corp.							
Professional 325	12-in.; green standard	2 5¼-in., 400K-byte diskettes	LSI-11/23 with 256K-byte memory	P/OS (RSX-11 subset), BASIC-Plus 2, FORTRAN, DIBOL, 75 application packages	$3995	color monitor, floating-point adapter, bit-mapped graphics, real-time serial/parallel interface optional	 Circle no. 408
Rainbow 100	12-in.; green standard, color optional	2 5¼-in., 400K-byte diskettes	8088 and Z80 with 64K- to 256K-byte memory	CP/M-86/80, Select, MBASIC, Multiplan, C, MS/DOS	$3245	5M-byte Winchester disk, color monitor, additional floppies optional	Circle no. 409
Professional 350	12-in.; green standard, color optional	2 5¼-in., 400K-byte diskettes	LSI-11/23 with 256K-byte memory	P/OS (RSX-11 subset), BASIC-Plus 2, FORTRAN, DIBOL, 75 application packages	$4995	telephone management system, 5M-byte Winchester disk, color monitor, floating-point adapter, bit-mapped graphics, real-time serial/parallel interface optional	 Circle no. 410



You can take it with you.

Because the all-new Teleram 3000 is the first truly portable personal computer that operates everywhere, a Teleram Office is anywhere. Wherever business wants or needs to be.

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Weighing less than 9 lbs. and hardly bigger than a 3" notebook, the Teleram 3000 is easy to take...in a standard briefcase. For operation anywhere on internal rechargeable batteries. For capabilities as powerful as desk top computers.

While others are stuck at their desks, take your Teleram Office home. Work on the way. In cars, planes, anywhere.

Leaving it behind.
Look at the spec's for the Teleram Office Station. For interface with networks and peripherals. Plus, cost-effective office pooling potential.


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In your office or out, the Teleram 3000. With non-volatile bubble memory up to 256kbytes. A standard-size keyboard. Flat panel display of 80 character lines. Standard CP/M* applications without modifications. More desirable features than hand-held and suitcase models put together. More versatility than any desk top.

The Teleram Office. The heavenly place and way to do business.

Specifications:

The Teleram 3000: 8 lbs.-13 oz. 13" x 9¾" x 3½"
Powered by 5-10 hr. internal battery, auto cigarette lighter or 110/220 VAC
Typewriter keyboard plus numeric/cursor keypad & 16 soft function keys
64k RAM/4K ROM
128k or 256kbyte non-volatile bubble memory
4-line x 80-character Liquid Crystal Display (LCD)
RS232C Interface (communications or printing)
CP/M 2.2® operating system

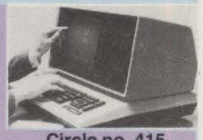
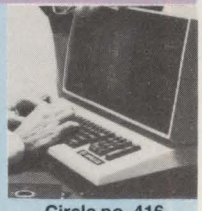
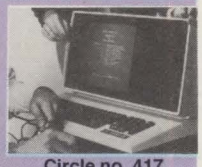
Expansion capabilities
Teleram Office Station which contains:
floppy disks and/or Winchester disk drive, text/graphics CRT display, additional bubble memory, networking and additional communication interfaces

TELERAM

Teleram Communications Corporation
2 Corporate Park Drive White Plains, N.Y. 10604
(914) 694-9270 TELEX 646658

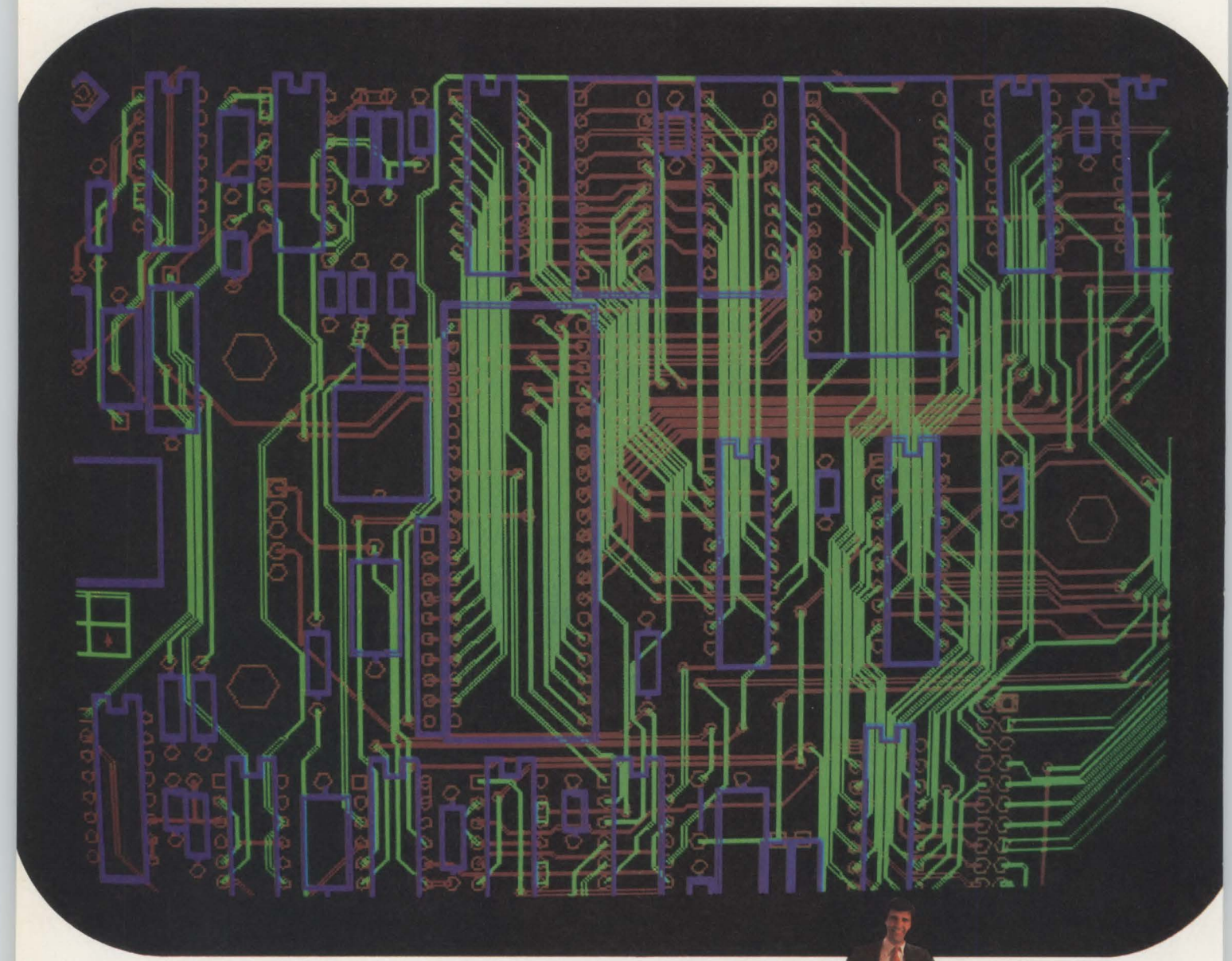
*CP/M is a trademark of Digital Research.

CIRCLE NO. 127 ON INQUIRY CARD

Manufacturer Model	Screen	Auxiliary Storage	Processor	Software	Price	Notes	
Digital Microsystems							
DSC-3/F	9-in.; B & W standard	2 5¼-in., 307K-byte diskettes	Z80A with 64K-byte memory	BASIC, COBOL, PL/1, FORTRAN, Pascal, Microplan, Wordstar, Select, Selector V, DBMS II, payroll, general ledger, payables and receivables packages	$3995	a portable, 30 lb. unit; can be integrated into Digital Microsystem's HiNet local-area network	 Circle no. 411
Durango Systems							
800 Series	9-in.; green standard; 80 x 24 or 64 x 16 format	2 5¼-in., 1M-byte diskettes	8-bit with 65K-byte memory	DX-85M, CSTAR BASIC	$8250 - $9950	includes integral printer, diskettes	 Circle no. 412
900 Series	9-in.; green standard; 80 x 24 or 64 x 16 format	1 5¼-in. diskette, 1 5¼-in. Winchester, 17M or 14M bytes	8-bit with 65K-byte memory	DX-85M, CSTAR BASIC	$11,000 - $14,000	integral solid-font (model 900) or dual-mode (model 900XR) printer standard	 Circle no. 413
Eagle Computer							
BC-1610	12-in.; green standard; 80 x 25 format	2 5¼-in., 800K-byte diskettes	8086 with 128K-byte memory	CP/M, MP/M, Oasis-16, XENIX, MS/DOS, iRMX-86, all IBM Personal Computer software	$5000	accepts 2 additional terminals under limited conditions	Circle no. 414
Eagle II	12-in.; green standard; 80 x 24 format	2 5¼-in., 390K-byte diskettes	Z80 with 64K-byte memory	Spellbinder, WP, UltraCalc, electronic spread sheet, B BASIC	$2995		 Circle no. 415
Eagle III	12-in.; green standard; 80 x 24 format	2 5¼-in., 800K-byte diskettes	Z80 with 64K-byte memory	Spellbinder, Accounting Plus	$5995		 Circle no. 416
Eagle IV	12-in.; green standard; 80 x 24 format	1 5¼-in., 7.5M-byte Winchester disk; 1 5¼-in., 780K-byte floppy	Z80 with 64K-byte memory	Spellbinder, Accounting Plus	$8995		 Circle no. 417
Eagle V	12-in.; green standard; 80 x 24 format	1 5¼-in., 15M-byte Winchester disk; 1 5¼-in., 780K-byte floppy	Z80 with 64K-byte memory	Spellbinder, Accounting Plus	$9995		Circle no. 418
Epic Computer Products							
PSI 8000	12-in.; green standard; 80 x 25 format	1 5¼-in., 10M-byte Winchester disk; 1 5¼-in., 616K-byte floppy	Z80 with 250K- to 1250K-byte memory; Z8000 or M68000 optional	CP/M, UNIX	$10,000 - $12,000	as many as 4 expansion terminals may be added; graphics capability optional	Circle no. 419
Fortin Electronics							
Fort 16	12-in.; 80 x 25 format	2 5¼-in., 800K-byte diskettes	8086 with 512K-byte memory	CP/M-86, XENIX, Micrel DBMS, BASIC, Pascal, FORTRAN, RPG, COBOL, PL/1, application packages		a dual 5¼-in. Winchester disk (8M bytes each) system is available	Circle no. 420

Hewlett-Packard on High-Performance Graphics

Now you can see the big picture, Simply by touching a button.



or 1/5000th of it.

The new HP color graphics terminal has so much power built right in that you can stop straining the resources of your CPU.

For instance, you can store a 2500 square foot diagram, look at the whole thing on the screen, then zoom down to less than a square foot of it. Without waiting for a host CPU to recalculate and transmit vectors.

In that respect, our new HP 2700 is almost like an electronic microscope. With the ability to build a picture using more than a billion addressable points, you can imagine what detailed images it can hold. And once they're defined, you'll have extraordinary graphics flexibility at your fingertips.

Creative graphics made easy.

We combined vector list and raster graphics technologies to give you the best of both high-quality color and sophisticated local graphics manipulation. And we've programmed a variety of high-level graphics functions in the terminal that allow you to pick, move, scale or rotate an object without tieing up the computer. Or your programmers.

Our optional graphics editing software saves you even more time and effort. It lets you edit any type of picture locally, from floor plans and bar charts to structural designs and PC layouts. Add our graphics tablet, and you can input drawings to the terminal, choosing different pen tips, area fills and line types. For presentation graphics, our Autoplot/2700 gets the job done fast. Again, just using local power.

Once you get the picture, you'll have plenty of ways to convert it to print. At HP, we make a broad range of color plotters and thermal or raster hard copy printers. And we provide an interface to support cameras, making it easy to take 35mm slides, instant prints and large photos.

Enough colors for Michelangelo.

Just think what he'd have created with the 4096 colors the HP 2700 offers! You can mix and match them, and display up to 16 at the same time. Selected colors can be stored in the terminal as a palette, then recalled with a single command.

Once the data has been entered in the terminal, multiple views can be displayed through as many as 255 'windows' on the screen. For example, a whole printed circuit design can appear in one window, and a detail in another.

Have it your way.

We designed the HP 2700 to be extremely adaptable for systems. In fact, we'll help you customize it with a wide variety of HP peripherals and interfaces.

You can get up to 992K bytes of graphic storage in the terminal, and add mini discs, printers and plotters. As we make them all, you'll find them easy to integrate. Since we also service them all, it's that much easier to keep them working together.

Its tremendous local power makes the HP 2700 ideal as a graphics system terminal. You can call up data, display it graphically, manipulate it locally, then send it back to the computer.

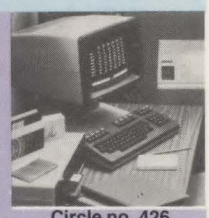
The best way to get the whole picture is by calling your local HP office for a hands-on demonstration. Or write for our brochure to Tom Anderson, Hewlett-Packard, Dept. 08144, 974 E. Arques Ave., Sunnyvale, CA 94086. You'll see how much experience HP has for you to draw on.

HEWLETT PACKARD

42202
HPT-150

CIRCLE NO. 67 ON INQUIRY CARD

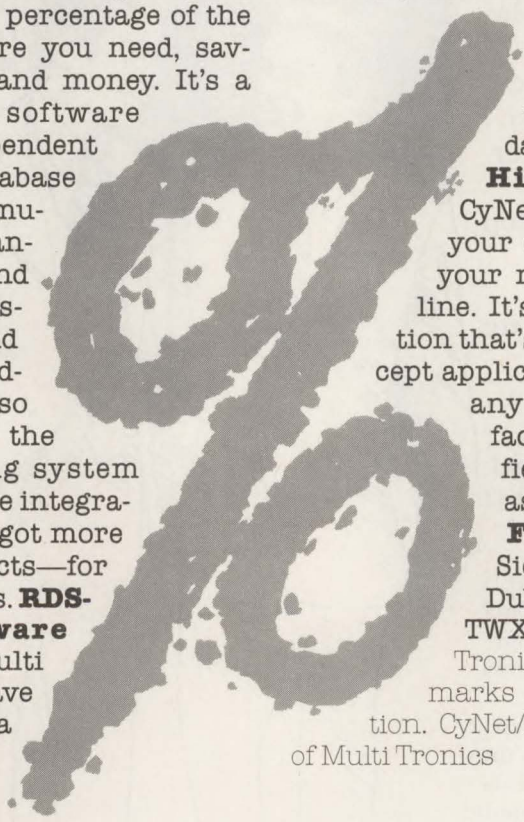
PERSONAL DESK-TOP COMPUTERS

Manufacturer Model	Screen	Auxiliary Storage	Processor	Software	Price	Notes	
Fortune Systems							
32:16	12-in.; green standard; 80 x 25 format	1 5¼-in., 800K-byte diskette; second diskette optional	M68000 with 128K- to 1M-byte memory	UNIX-based operating system, BASIC, COBOL, FORTRAN, Pascal, C, For:Word, Multiplan	$4995	supports 1-4 5¼ in. diskettes, 1-4 5M-/10M-/20M-byte Winchester disks, 1-4 8-in. disks; color monitor, bit-mapped graphics, Ethernet controller optional	 Circle no. 421
Franklin Computer							
ACE 100	no screen or monitor	4 5¼-in., 143K-byte diskettes	6502 with 64K-byte memory	Apple II-compatible	$1595	hardware-, software-compatible with Apple II, features upper-, lower-case character, numeric pad, VisiCalc keys	 Circle no. 422
Heath							
H-89	80 x 25 format	1 5¼-in., 160K-byte diskette standard; 2 external drives optional	dual Z80s with 48K- to 64K-byte memory	CP/M	$1925	sold in kit form; available assembled as the Z89 for $2895	 Circle no. 423
Hewlett-Packard Co.							
HP9826A, 9836A	7-in.	264K-byte, 5¼-in. diskette	M68000 with 64K- to 512K-byte memory	HPL, BASIC, graphics, Pascal	$8950	model 9836A ($11,950) features 12-in. screen, dual diskettes	 Circle no. 425
125 Series	12-in.; green; 80 x 24 format	2 external 5¼-in., 248K-byte diskettes	Z80A with 64K-byte memory	CP/M, VisiCalc, graphics, WORD 125, BASIC, LINK		other models feature higher density diskette drives or Winchester drives; integral thermal printer optional	 Circle no. 426
Hitachi of America							
MB-6890	12-in.; 16 colors	2 external 5¼-in., 80K-byte diskettes	6809 with 32K-byte memory	BASIC	$3395	foreign fonts, 640 x 200 dot graphics, peripheral device circuit boards, light pen optional	Circle no. 427
IBM Corp.							
5120	9-in.; 64 x 16 format						Circle no. 428
Personal Computer	12-in.; green standard, color optional; 80 x 24 format	1 5¼-in., 320K-byte diskette (second diskette optional)	8088 with 48K- to 256K-byte memory	CP/M, IBM DOS, BASIC	$3995	price includes 2 320K-byte diskette drives, green monitor, system unit keyboard; variety of IBM and third-party software, peripherals available	 Circle no. 429
Intelligent Systems Corp.							
Intecolor 3651	13-in.; multi-color; 64 x 32 format	single 5¼-in., 90K-byte diskette	8080A with 64K bytes RAM	FCS, DISK BASIC, 75 ISC packages	$3300	light pen, additional 5¼- and 8-in. diskette drives optional	 Circle no. 430

PLAYING THE PERCENTAGES

CyNet/RDS™: DEC-Compatible Software and Remote Hardware for SCADA System Integrators

In the competitive world of SCADA system development, meeting customer deadlines, budgets and expectations is the key to success. Now systems engineers and managers can be winners in that world with Multi Tronics' CyNet/RDS software and hardware package. **CyNet: Software That Gives You An Edge.** CyNet provides you with a healthy percentage of the foundational SCADA software you need, saving you development time and money. It's a FORTRAN-programmable software package with two interdependent parts: a central real-time database manager, and a coupled communications program that handles routine data acquisition and control chores such as message formatting, polling and error detection. It's standardized, debugged, and modular, so you can simply plug it into the PDP-11/RSX-11M operating system without complicated software integration. And that means you've got more time to spend on other projects—for a higher percentage of profits. **RDS-1600 RTUs: Field Hardware That Beats The Odds.** Multi Tronics' field-proven RTUs have a great record for precise data acquisition and communications in harsh environments. These workhorse units consist of a microprocessor-based transceiver/controller, trustworthy power supply, and pulse frequency/pulse duration, digital and analog I/O, serial and FSK communications, and memory expansion boards that can be tailored to do any SCADA job. Up to 256 RDS-1600s can be linked into a full-scale system that can beat the odds on downtime, and make a sure thing of system flexibility and data reliability. **CyNet/RDS: The High Percentage Move.** The CyNet/RDS combination can satisfy your customers' needs, and satisfy your need to improve your bottom line. It's the only available combination that's debugged, tested, ready to accept application code, and able to handle any industrial process control, factory automation or other field task. CyNet/RDS ... as close as you can get to a sure thing.



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MULTITRONICS

CIRCLE NO. 87 ON INQUIRY CARD

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The schedule for the 1982/1983 Series is:

Sept. 8, 1982	**Newton, MA**
Sept. 28, 1982	**Chicago, IL**
Oct. 11, 1982	**Westchester, NY**
Nov. 3, 1982	**Palo Alto, CA**
Nov. 8, 1982	**Denver, CO**
Jan. 20, 1983	**Orange County, CA**
Feb. 1, 1983	**Dallas, TX**
Feb. 3, 1983	**Houston, TX**
Feb. 28, 1983	**Atlanta, GA**
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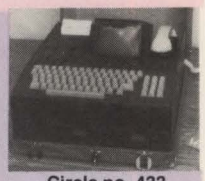
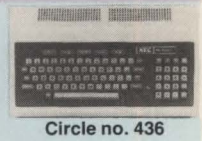
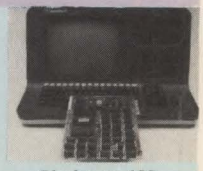
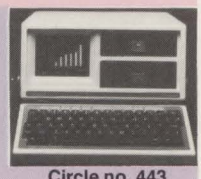
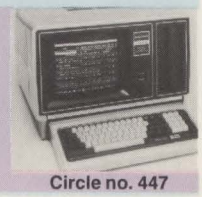
CIRCLE NO. 77 ON INQUIRY CARD

PERSONAL DESK-TOP COMPUTERS

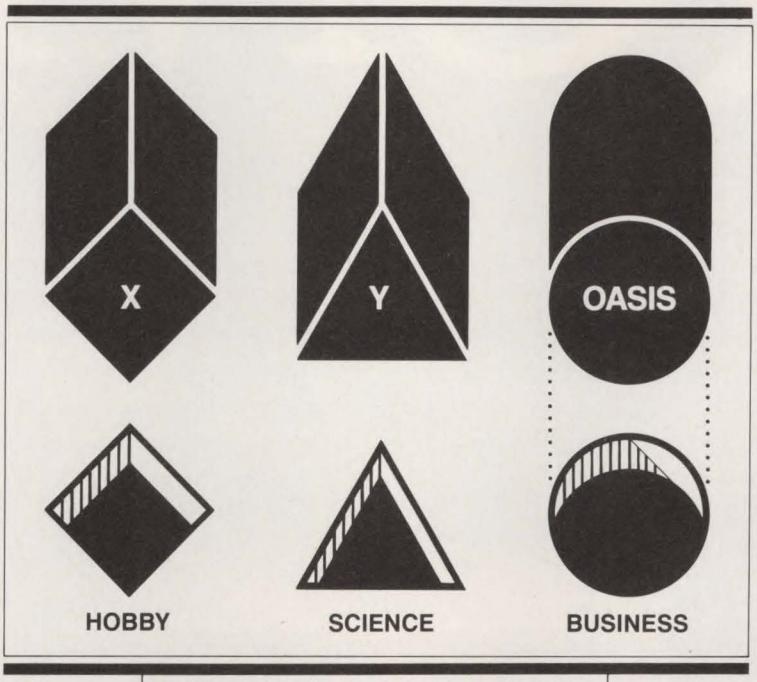
Manufacturer Model	Screen	Auxiliary Storage	Processor	Software	Price	Notes	
ITT UK Basildon							
3030	12-in.; green standard, color optional; 80 x 24 or 132 x 24 format	5¼-in. diskette	Z80A or 8088 with 64K- to 256K-byte memory	CP/M, MP/M, BOS, MicroCOBOL, Pascal, FORTRAN, MBASIC, WP packages, business-application packages		5M- to 60M-byte hard disks, 16-color display, graphics, light pen, foreign keyboards	**Circle no. 431**
Jonos							
Courier	9-in.; 80 x 25 format	2 3½-in., 322K-byte diskettes	Z80A with 64K-byte memory	CP/M	$2995	a 19½ lb. portable computer featuring 5 STD bus expansion slots; modem, analog, memory, graphics, CPU cards, integral 30-cps printer optional	 **Circle no. 432**
Micro Application Systems							
MAScot	5-in.; B & W standard; 40/64/80 x 20 format	2 5¼-in., 80K- or 160K-byte diskettes	6801 or 8086 with as much as 1M-byte memory	BASIC	$3999 - $9999	a portable computer featuring display, keyboard, dual diskettes, printer, modem	 **Circle no. 433**
Micro Source							
M6000P	9-in.; green standard; 80 x 24 format	2 5¼-in., 386K-byte diskettes	Z80 with 64K-byte memory	CP/M 2.2	$3900	a portable, 8-slot STD bus microcomputer; 8-in. diskette drive, color capability, 5¼-in. Winchester, M68000 processor upgrade optional	 **Circle no. 434**
NEC Information Systems							
Advanced Personal Computer	12-in.; green standard, 8 colors optional; 80 x 25 format	1 8-in., 1M-byte diskette (second diskette optional)	NEC (8086-compatible) with 128K- to 256K-byte memory	CP/M-86, MS/DOS, Accounting Plus, Benchmark, Microplan, dBase II	$3298	8-color model with 2 diskettes is $4998	 **Circle no. 435**
PC-8001A	12-in.; 8-color RGB; 80 x 25 or 72 x 25 format	2 5¼-in., 139K-byte diskettes	Z80-compatible with 32K-byte memory	N-BASIC	$3545	price includes keyboard, CPU, 2 diskette drives, RGB monitor, I/O unit	 **Circle no. 436**
Nissei Sangyo America							
KDS-7860	12-in.; monochrome standard, color optional; 80 x 25 format	2 8-in., 1182K-byte diskettes	8086 with 128K- to 512K-byte memory	CP/M-86, MS/DOS	$2700	color monitor, 10M-byte integral Winchester disks optional; marketed through large OEMs	**Circle no. 437**
North Star Computers							
Advantage 8/16	12-in.; green standard; 80 x 24 format	2 5¼-in., 360K-byte diskettes	8088 or Z80 with 128K- to 320K-byte memory	Graphics CP/M, GDOS/BASIC, ASP, MS/DOS	$4099	system with 1 5¼-in. diskette and 1 5M-byte Winchester is $5499	 **Circle no. 438**

PERSONAL DESK-TOP COMPUTERS

Manufacturer Model	Screen	Auxiliary Storage	Processor	Software	Price	Notes	
Advantage	12-in.; green standard; 80 x 24 format	2 5¼-in. diskettes	Z80A with 64K-byte memory	CP/M	$3599		 Circle no. 439
Olivetti							
M20	12-in.; white or green standard; 8-color optional	1 5¼-in., 320K-byte diskette (second diskette optional)	Z8001 with 128K- to 512K-byte memory	M20 BASIC-8000 (interpreted version of MBASIC), PCOS	$2965		 Circle no. 440
Ontel							
1505, 1507	12-in.; green; 80 x 25 format	2 5¼-in., 500K-byte diskettes	8085 with 16K- to 64K-byte memory	MDOS/80, HDOS/80, OPL, BASIC, FORTRAN, CIS COBOL, CP/M		1507 offers multitasking software	Circle no. 441
Onyx Systems							
Sundance	12-in.; green standard; 80 x 24 or 132 x 24 format	1 5¼-in., 6.7M-byte Winchester; 1 10M-byte, ¼-in. cartridge tape	Z80A with 64K-byte memory	CP/M, Oasis, COBOL, BASIC, Onyx business applications	$6995	Sundance II, a multi-user system, also available	 Circle no. 442
Ortrona							
Attache	5½-in.; green standard; 80 x 24 or 40 x 24 format	2 5¼-in., 180K-byte diskettes	Z80A with 64K-byte memory (plus 10K-byte dedicated graphics memory)	CP/M, Word Star, BASIC compiler, C, Charton, Pascal, FORTRAN, COBOL, FORTH, Valet	$3995	a 19½ lb. portable computer; DC power adapter, battery pack, accessory pouch optional; graphics and special character sets standard	 Circle no. 443
Osborne Computer							
Osborne 1	5-in.; green standard; 52 x 24 format	2 5¼-in., 102K-byte diskettes	Z80A with 64K-byte memory	CP/M, Word Star, Mailmerge, SuperCalc, CBASIC, MBASIC	$1795	a 24 lb. portable computer; battery pack, double-density diskette drives optional	 Circle no. 444
Radio Shack							
TRS-80 model 16	12-in.; green standard; 80 x 24 format	1 8-in., 1250K-byte diskette (second diskette optional)	M68000 and Z80A with 128K- to 512K-byte memory	TRSDOS, TRS-80 ARCNET, TRS-80 model II	$4999	slave terminals, hard disks, other peripherals available	 Circle no. 445
TRS-80 model III	12-in.; 64 x 16 format	2 5¼-in., 184K-byte diskettes	Z80 with 48K- to 64K-byte memory	TRSDOS, Radio Shack and third-party software	$2495	basic models (4K bytes) without diskettes sell for $699	 Circle no. 446
TRS-80 model II	12-in.; 80 x 24 format	1 8-in., 416K-byte diskette (3 external diskettes optional)	Z80A with 32K- to 64K-byte memory	TRSDOS, Radio Shack and third-party software	$3450		 Circle no. 447

For serious business microcomputing, only one operating system exactly fits.

Whether you're in business and do microcomputing, or in computing and sell to business, you'll like OASIS.* Not a hobby or scientific system warmed-over for business use, OASIS is the only operating system designed from the ground up for business.



SERIOUS BUSINESS COMES IN ALL SIZES.

Whatever your business need, OASIS has the operating system to match: 8-bit or 16-, single-user or the multi-user system that professionals tell us makes micros run like minis. And that's even truer now with new OASIS-16.** *(OASIS exact business fit #1: choice.)*

A SYSTEM IS ONLY AS GOOD AS THE BUSINESS PROGRAMS IT RUNS.

The acid test for any business operating system is the application software available to run on it. There's plenty for OASIS —for nearly any job.

And it's top quality, too, because our integrated tools are top quality—and there are more of them. Like a high-level BASIC Interpreter/Compiler/Editor/Debugger; ISAM/Keyed/Direct/Sequential Files; a smart Print Spooler; *Automatic* Record Locking (OASIS exclusives!); plus COBOL & 'C' Languages. These tools are mandatory for high-quality business application program development—ask any developer. *(OASIS exact business fit #2: high-quality application software.)*

PORTABILITY PROTECTS BUSINESS SOFTWARE INVESTMENTS.

OASIS is custom-fitted to manufacturers' hardware so application software developed to run on one OASIS equipped machine can also run on others—and is upwardly compatible from 8-bit OASIS Single-User to Multi-User, on up to OASIS-16. This kind of application software portability is exclusive with OASIS.

Device independence allows various printers and terminals to be used—with no modification to application software: OASIS *system* software compensates for differences. *(OASIS exact business fit #3: portability.)*

ACCURATE DATA & A SECURE SYSTEM REDUCE BUSINESS RISKS.

Data integrity—a challenge for any multi-user system—is insured by OASIS File & *Automatic* Record Locking. With it, normally all users can view a record at the same time. BUT, if the record is being updated by one user, other users are automatically denied access until the update is complete. That means data is always accurate and up-to-date. It's still another OASIS exclusive.

For system security, there's OASIS Logon, Password & Privilege Level. User Accounting keeps track of who used the system, when. *(OASIS exact business fit #4: data integrity/system security.)*

A FRIENDLY SYSTEM IS GOOD BUSINESS.

For user-friendliness, OASIS sets new standards. Example: the EXEC Job Control Language is so smart it walks users through their applications—and around the operating system.

With our 'HELP' feature, if you are unsure of the functions and options available, type 'HELP' and the command function title—OASIS displays the syntax and options available.

Of course it's all in your language—not computerese. *(OASIS exact business fit #5: user-friendliness.)*

AND, AND, AND...

Some of the best, most extensive documentation in the industry; a packed Application Software Directory; multi-level training; direct telephone support; worldwide sales & service; options like CONTROL Relational Data Base Management System and MASTERPLAN Financial Modeling Package; OASIS has it all. *(OASIS exact business fits #6 through #12.)*

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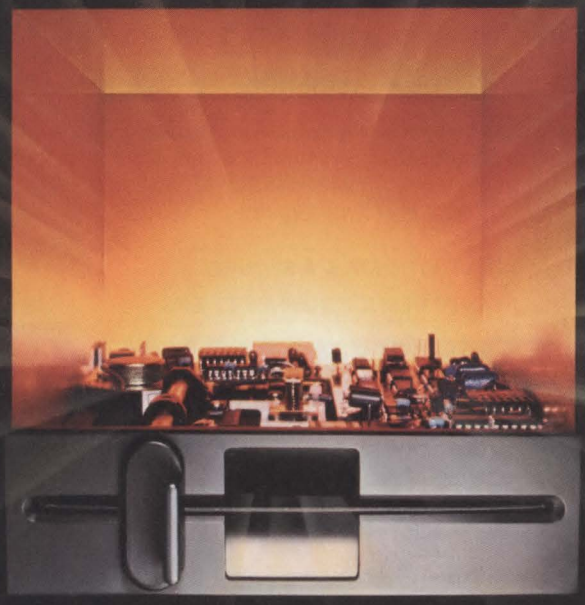

We shrank the drive and the price, but not the quality or capacity.

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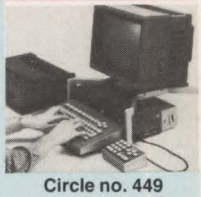
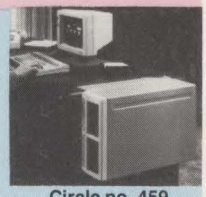
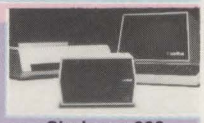
CIRCLE NO. 143 ON INQUIRY CARD

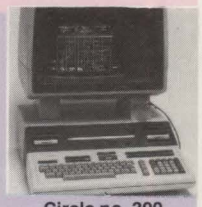
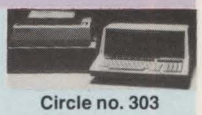
PERSONAL DESK-TOP COMPUTERS

Manufacturer Model	Screen	Auxiliary Storage	Processor	Software	Price	Notes	
SMC Computer							
CompuCase	4.7 x 8.3-in. plasma panel; orange standard; 40 x 12 format	2 5¼-in. custom diskettes	dual 8085 with 64K-byte memory	CP/M	$7995	a portable computer featuring integral display, 80-column printer, custom diskettes; sold primarily in large quantities	 Circle no. 448
Sony							
SMC-70	12-in.; green standard, RGB optional; 80 x 25 format	2 (optional) 3½-in., 280K-byte diskettes	Z80A with 64K- to 256K-byte storage; 8086 optional	CP/M, VisiCalc, Sony BASIC, CB80	$2950	price includes green phosphor display, dual microdiskettes; 6M-byte hard disk, high-density diskette, 256K-byte cache memory optional	 Circle no. 449
Systems Formulate							
Bobcom 80	12-in.; 8 colors; 80 x 24 format	1 32K-byte bubble memory cartridge	Z80 with 64K-byte memory	CP/M, BASIC	$2950	price includes RGB monitor, KBD/processor module, time-of-day clock, music and graphics macros, 8-in. diskette, 640 x 200 graphics resolution	Circle no. 450
Teleram Communications							
T-3000	8.25 x 1.1-in.; liquid crystal; 80 x 4 format	1 128K- to 256K-byte bubble	Z80L with 64K-byte memory	CP/M	$2795	a 9.75 lb. portable (lap-sized) computer with integral battery backup; 1-4 diskette drives (external) optional	 Circle no. 451
Televideo Systems							
TS/802	12-in.; green standard; 80 x 25 format	2 5¼-in., 500K-byte diskettes	Z80A with 64K-byte memory	CP/M, Word Star, Calcstar	$3995	TS/802H features 1 500K-byte diskette and 1 10M-byte Winchester disk for $7495; TS/802G features graphics capabilities	Circle no. 452
Texas Instruments							
Business System 200	12-in.; green, B & W or amber; 80 x 24 format	2 5¼-in., 600K-byte diskettes	TI 9900 with 64K-byte memory	DX 10 Micro, USCD p-System, COBOL (except on base model)	$6200	5¼-in., 5M-byte Winchester; 8-in. diskette drives optional	 Circle no. 453
Toshiba America							
T200	12-in.; green standard; 80 x 24 format	1 5¼-in., 280K-byte diskette (second diskette optional)	8085A with 64K-byte memory	CP/M, MBASIC, CBASIC			Circle no. 454
T250	12-in.; green standard; 80 x 24 format	1 1M-byte, 8-in. diskette (second diskette optional)	8085A with 64K-byte memory	CP/M, MBASIC, CBASIC, financial planning, general ledger, payroll, receivables packages			 Circle no. 455
EW-100	12-in.; green standard; 80 x 24 format	1 1M-byte, 8-in. diskette (second diskette optional)		CP/M, MicroPlan, Analyst		a word processor that runs CP/M software	 Circle no. 456
T300	12-in.; green standard (14-in. and colors optional)	1 5¼-in., 640K-byte diskette (second diskette optional)	8088 with 128K- to 512K-byte memory	CP/M-86, CBASIC		color display, 8-in. diskette drive, 5¼ in. Winchester drive, graphics functions	Circle no. 457

PERSONAL DESK-TOP COMPUTERS

Manufacturer Model	Screen	Auxiliary Storage	Processor	Software	Price	Notes	
Victor Business Products							
9000	12-in.; green standard; 80 x 25 or 132 x 25 format	2 5¼-in. 600M-byte diskettes	8088 with 128K- to 896K-byte memory	CP/M-86, MS/DOS, CIS COBOL, CBASIC, Pascal, FORTRAN, BASIC, COBOL, Victorwriter, Wordstar, Victorcalc, business applications	$4995	graphics resolution is 800 x 400	 Circle no. 458
Wang Laboratories							
Professional Computer	12-in.; B & W standard	1 5¼-in. 320K-byte diskette (second diskette optional)	8086 with 128K- to 640K-byte memory	MS/DOS, CP/M-80, PC Word Processing, PC Multiplan	$2695	can function as a Wang terminal; 5¼-in., 5M-byte Winchester disk optional	 Circle no. 459
Wicat Systems							
150 WS	12-in.; green standard; 80 x 24 format	1 5¼-in. 960K-byte diskette; 1 5¼-in., 10M-byte Winchester	M68000 with 256K- to 1.5M-byte memory	MCS, UNIX, CP/M emulator	$9450	a multi-user system with graphics capability, videodisk controller	Circle no. 460
LATE ADDITIONS							
Applied Digital Data Systems							
Multivision	80 x 25 format	800K-byte diskette	8085A-2 with 64K-byte memory	CP/M-compatible OS, inventory, WP, financial planning packages			Circle no. 288
Basic Four Information Systems							
S/10	12-in.; green standard; 80 x 24 and 132 x 24 format	2 5¼-in. 600K-byte diskettes	dual Z80s with 128K-byte memory	BB/M, CP/M	$5995	can be used as a stand-alone or with Basic Four System 210 through 810 computers	 Circle no. 289
BASIS, Inc.							
208/216		2 5¼-in. 390K-byte diskettes	Z80B (208), Z8000 or 68000 (216) with 128K-byte memory	CP/M (208), XENIX (216)			 Circle no. 290
108	12-in.; color or B & W; 80 x 24 or 40 x 24 format	2 5¼-in. diskettes	6502 or Z80 with 64K- to 128K-byte memory	Apple II-compatible; CP/M, Pascal, Apple DOS 3.3			 Circle no. 291
Callan Data Systems							
CD100M	12-in.; green standard	5¼-in. 600K-byte diskette	68000 with 256K- to 1M-byte memory	iRMX 86, FORTRAN, Pascal, PLM, COBOL, BASIC, UNIX, C, APL, Ada		5¼-in., 10M-byte Winchester disk optional	Circle no. 292
Datavue							
80	12-in.; green standard; 80 x 24 or 132 x 24 format	2 5¼-in. 500K-byte diskettes	Z80A with 64K-byte memory	CP/M, MicroPro packages, BASIC, COBOL		9 diskette- and disk-based configurations are available; memory expansions and graphics optional	 Circle no. 293

PERSONAL DESK-TOP COMPUTERS

Manufacturer Model	Screen	Auxiliary Storage	Processor	Software	Price	Notes	
Digilog Business Systems							
1000	12-in.; green standard	2 5¼-in. 350K-byte diskettes	Z80A with 64K-byte memory	CP/M standard; Turbo DOS optional	$3995	800K-byte diskettes, network operation optional	**Circle no. 294**
1500	12-in.; green standard; 80 x 24 format	1 5¼-in. 820K-byte diskette, 1 5¼-in. 5M-byte disk	Z80A with 64K-byte memory	CP/M standard, Turbo DOS optional	$7995	10M-byte version and network operation optional	**Circle no. 295**
1800	12-in.; green standard; 80 x 24 format	1 5¼-in. 820K-byte diskette, 1 5¼-in. 5M-byte disk	dual Z80As with 128K-byte memory	Turbo DOS	$9495	functions as stand-alone system or as 16-user network controller; 10M-byte disk version optional	 **Circle no. 296**
Digital Equipment Corp.							
DECmate II	12-in.; monochrome standard; 80 x 24 or 132 x 24 format	2 5¼-in. 400K-byte diskettes	6120 (PDP-8+) standard; Z80 optional, with 96K-byte memory	COS 310, DECmate II WP; CP/M optional	$3745	8-in. diskette drives optional	 **Circle no. 297**
Dynalogic Info-Tech Corp.							
Hyperion	7-in.; amber standard; 80 x 25 format	1 5¼-in. 328K-byte diskette (second diskette optional)	8088 with 256K-byte memory	MS/DOS Release 2 (IBM Personal Computer-compatible), BASIC, Multiplan, COBOL, FORTRAN, Pascal	$9800	a portable (20 lb.) unit with graphics standard; floating-point chip optional	**Circle no. 298**
Exxon Office Systems							
500 Series	12-in.; green standard; 80 x 24 format	2 5¼-in. diskettes		CP/M 2.2			 **Circle no. 299**
Hewlett-Packard Co.							
HP9845	12-in.; green standard; 80 x 24 format	2 cartridge tapes	16-bit with 56K- to 449K-byte memory				 **Circle no. 300**
HP-85	5-in.; green standard	1 cartridge tape				integral thermal printer	 **Circle no. 301**
HP-86	9-in.; green standard (12-in. screen optional)	1 5¼-in. 270K-byte diskette (second diskette optional)	64K- to 512K-byte memory	accounting, database, tax planning packages, CP/M, Word Star, Spell Star, Mailmerge	$2940	ROM operating system (48K bytes) standard; price includes 9-in. monitor, 1 diskette drive; thermal printer is $795	 **Circle no. 302**
HP-87	green standard; 80 x 24 or 80 x 16 format	1 5¼-in. 270K-byte diskette	32K- to 544K-byte memory	CP/M, BASIC, HP software	$3995	48K-byte ROM operating system, IEEE interface standard; price includes 1 diskette drive	 **Circle no. 303**

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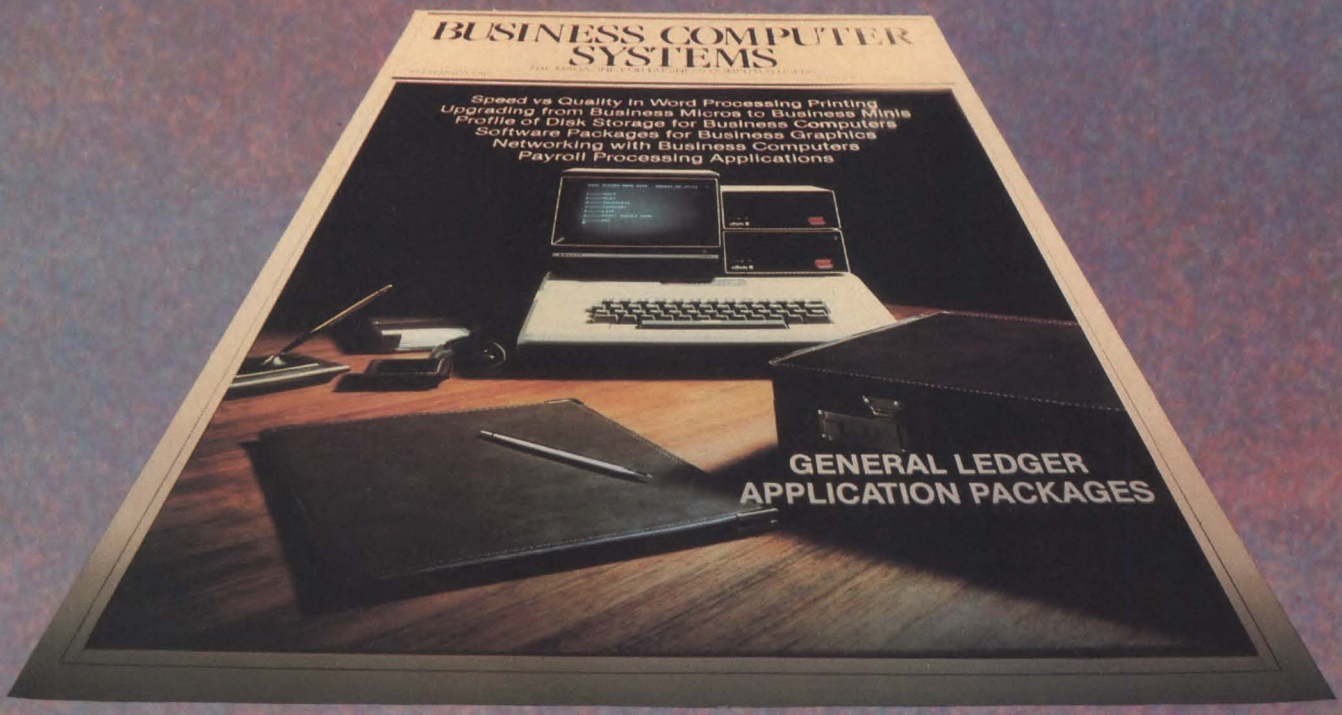

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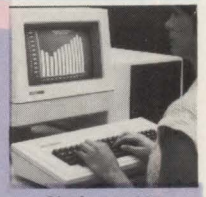
Manufacturer Model	Screen	Auxiliary Storage	Processor	Software	Price	Notes	
Intertec Data Systems							
Superbrain II	12-in.; B & W standard; 80 x 24 format	2 5¼-in. 350K-byte diskettes	dual Z80s with 64K-byte memory	CP/M operating system with Microsoft BASIC	$2495		**Circle no. 304**
Kay Computers							
Kaycomp II	9-in.; green standard; 80 x 24 format	2 5¼-in. 200K-byte diskettes	Z80 with 64K-byte memory	CP/M 2.2, SBASIC, Select, Profitplan, Utilyze standard; MBASIC, spelling checker optional	$1795	a 26 lb. portable unit; 5.5M-byte, 5¼-in. Winchester disk version is $4500	 **Circle no. 305**
Lanier Business Products							
EZ-1/Computereze	12-in.; green standard	2 5¼-in. diskettes		CP/M, 3270/SNA, EZ-TASK, Data Manager, BASIC II, Business BASIC, WP package, EZ-Spell			**Circle no. 306**
Paradyne							
PDS 270		2 5¼-in. diskettes		MS/DOS, BASIC, COBOL, FORTRAN, Pascal		a personal computer that functions as an IBM 3270 terminal	**Circle no. 307**
R2E of America							
System X	80 x 24 format			CP/M			**Circle no. 308**
Sharp Electronics Corp.							
YX-3200	12-in.; green standard; 80 x 25 format	2 5¼-in. 284K-byte diskettes	64K- to 112K-byte memory	Business BASIC		32K-byte standard ROM expandable to 72K	 **Circle no. 309**
Televideo Systems							
TS/1602	12-in.; green standard; 80 x 24 format	2 5¼-in. 368K-byte diskettes	8088 with 256K-byte memory	CP/M-86		7.5M-byte, 5¼-in. Winchester disk-based system also available	**Circle no. 310**
TRW-Fujitsu							
Affinity 16	12-in.; green standard; 80 x 24 format	2 5¼-in. 320K-byte diskettes	16-bit with 128K-byte memory	RM/COBOL, WP, BASIC, accounting, spreadsheet, graphics	$6000 - $10,000		**Circle no. 311**
Xerox Corp.							
820-II	12-in.; white on black standard; 80 x 24 format	2 5¼-in. 346K-byte diskettes	Z80A with 64K-byte fixed memory	enhanced CP/M	$3295		 **Circle no. 312**
820	80 x 24 format			CP/M	$3300		**Circle no. 313**
Zenith Data Systems							
Z100	12-in.; 8-color standard; 80 x 25 format	2 5¼-in. 320K-byte diskettes	8088 and 8085 with 128K- to 768K-byte memory	Z-DOS (version of MS/DOS/PC-DOS), CP/M standard	$5000	integral 5-slot, S-100 expansion chassis standard	 **Circle no. 314**
Zentec Corp.							
Series 2000	12-in.	1 5¼-in. 738K-byte diskette (second diskette optional)	8086 with 16K- to 1024K-byte memory (8087 arithmetic chip optional)	UNIX	$10,000 - $20,000		 **Circle no. 315**

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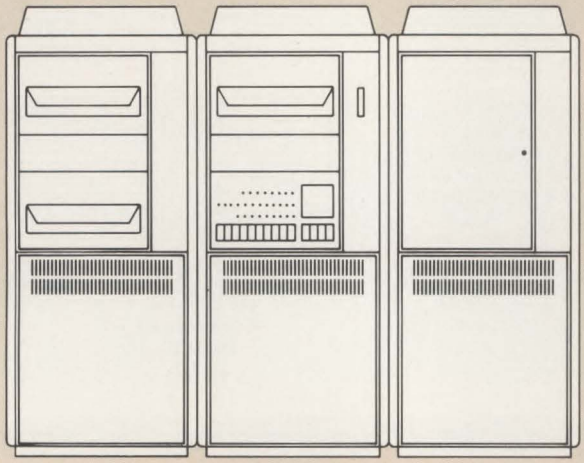

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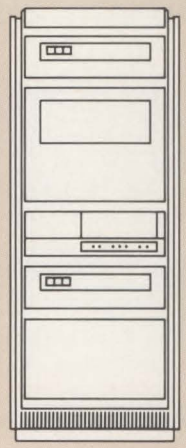

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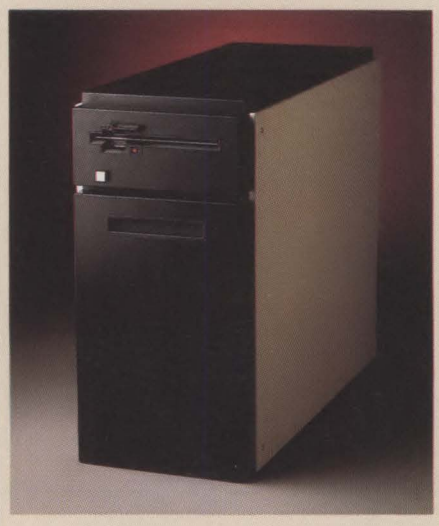

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Dual-microprocessor microcomputer boosts 8-bit software

ANDY REICHERT, Vector Graphic, Inc.

Microprocessors work together to give micro 8-bit compatibility with 16-bit power

A new microcomputer from Vector Graphic, Inc., combines the 8-bit software compatibility of the Z80 with the processing power of the 16-bit 8088 microprocessor. The Vector 4 supports 8- and 16-bit operating systems, with processor swapping and time-shared memory schemes to boost processing speed and graphics capability.

Dual microprocessors for compatibility

In its simplest operating mode, the Vector 4's Z80B handles all 8-bit tasks, maintaining compatibility with programs written for the CP/M 80 operating system. The 8088 provides higher throughput and greater memory capacity for 16-bit programs.

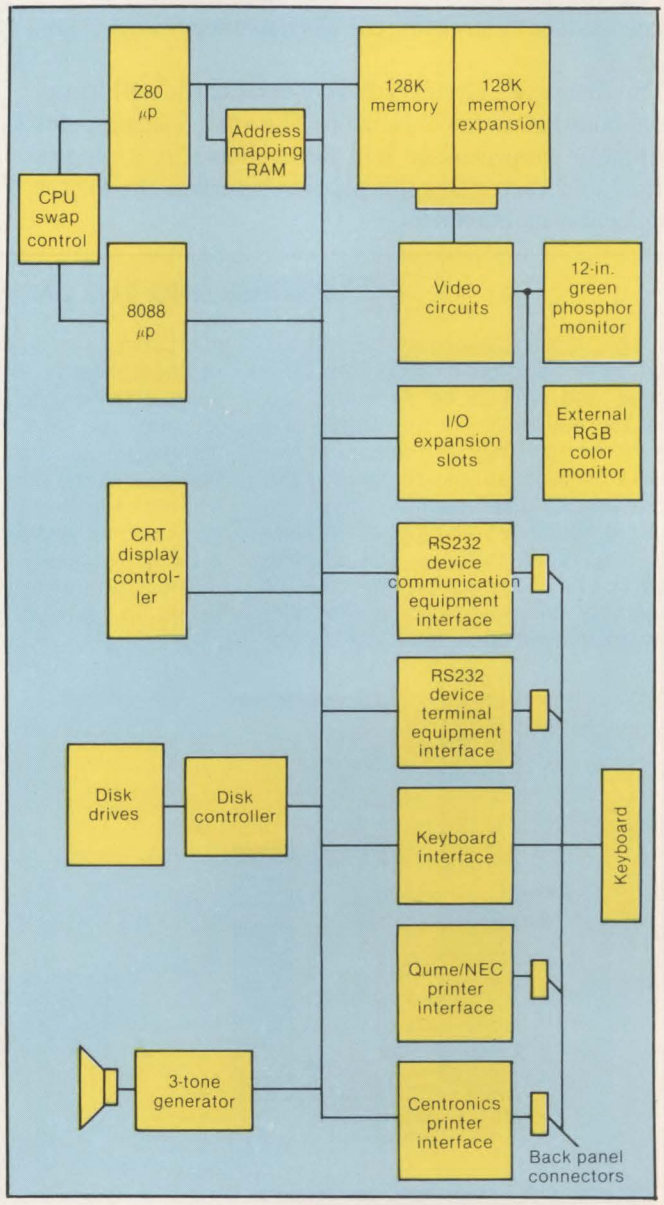
Either processor can request the other to execute code that can run faster on that type of CPU (Fig. 1). This CPU "swapping" applies the 8088's 16-bit power to 8-bit tasks and to programs written for the 8088. The Vector Graphic extended CP/M operating system has been modified to allow 8- and 16-bit operations to interleave down to the individual command level (Fig. 2).

Program utility	Time (μsec.)		Ratio
	Z80	8088	
Graphics processing	33.9*	2.32*	14.61
16-bit multiply	354	40.8	8.68
Block move	661	328	2.02
Block translate	1980	1507	1.31
Character search	220	136	1.62
Word shift	48.6	13	3.60
Bubble sort	4956	2406	1.91
Reentrant call	140	87.6	1.60
Average execution time			3.79

*in seconds

Source: Intel Corp.

Fig. 1. Comparison of Z80 and 8088 execution times *shows the speed advantage of the 8088. The Vector 4's Z80 passes many processing chores to the Z80 to increase throughput.*



Vector 4 architecture *consists of dual microprocessors with swapping control, as much as 256K of time-shared memory, display controller and peripheral interfaces.*

Either processor can request the other to execute code that can run faster on that type of CPU.

In addition to supporting CP/M 80, the Vector 4 supports four popular 16-bit operating systems: CP/M 86, MS/DOS, OASIS and XENIX. CP/M 86 is Digital Research, Inc.'s 16-bit version of 8-bit CP/M 80, while Microsoft's MS/DOS is the operating system used on IBM Corp.'s personal computer. OASIS, marketed by Phase 1 Systems, Inc., is proving popular in Europe, and XENIX is a UNIX-like operating system designed by Microsoft.

Main memory is time-shared between the CPU and a single-chip video display controller, so that the screen memory can reside anywhere in main memory. An address-mapping circuit enhances 8-bit operations by giving the Z80 access to all the main memory in 64K segments (see "Increasing the Z80's memory range," below).

The Vector 4's circuitry fits on one board, with three S-100 board slots for expansion. The 8087 floating-point arithmetic co-processor will be available as a plug-in option, and Vector Graphic plans to interface the Vector 4 to local-area networks.

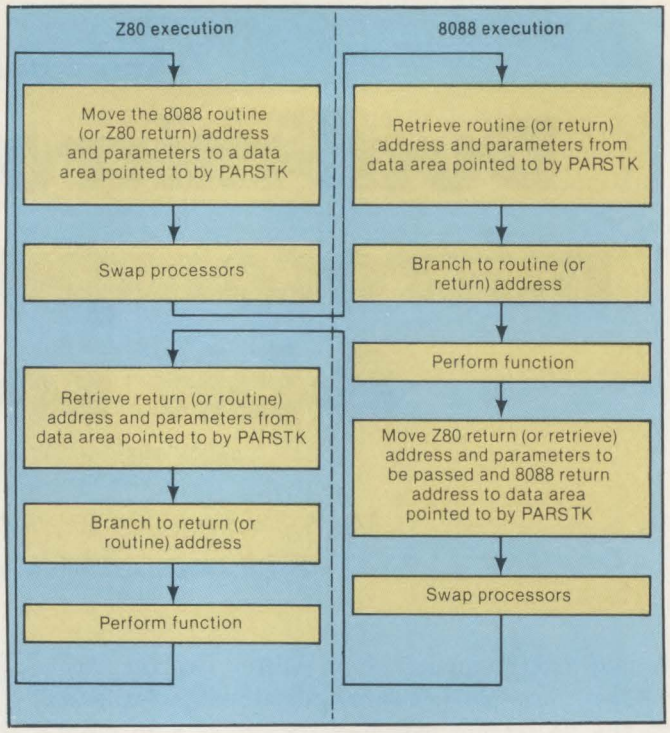
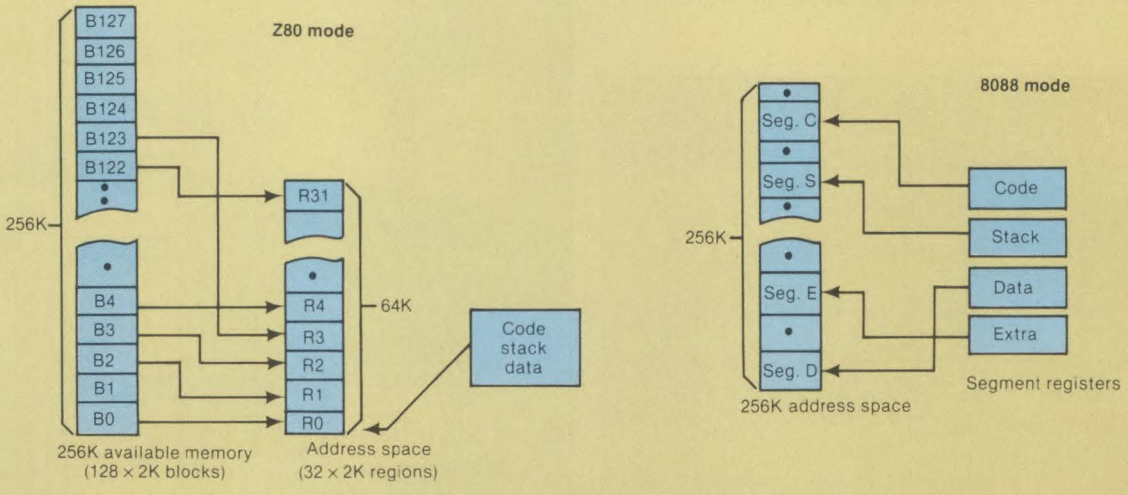


Fig. 2. Processor-swapping instruction sequence *allows the Vector 4's 8-bit Z80 and 16-bit 8088 microprocessors to pass processing tasks to the other. A parameter stack pointer (PARSTK) points to calling and return addresses in a parameter table before and after the swap, while a common stack allows recursive execution.*

INCREASING THE Z80'S MEMORY RANGE

The Vector 4 executes code at will on either its Z80B or 8088 CPU. The code and data to be executed can reside anywhere in the Vector 4's 128K or 256K memory space. In the case of the 8088, the contents of the processor's four segment registers are added to a 16-bit logical address to access the memory. The address generated depends on the type of memory access function performed: an instruction-code fetch, for example, causes the contents of the code segment register to be added to the internal 16-bit program code address for the duration of that access sequence. Similarly, a stack PUSH or POP causes the contents of the stack segment register to be added to the stack pointer address while the stack is being accessed.

The Z80B's address range is limited to 64K. To allow full use of all available memory space, the Vector 4 has a set of 32 external memory-mapping egisters selected in the Z80B operating mode. These registers transform the addressable space into 32 2K regions, with each region assigned to one of the available 128 2K blocks of main memory. The memory-mapping registers can be dynamically changed by I/O commands.



Z80 and 8088 memory-address schemes *allow both processors to access as much as 256K of memory in Vector 4. The 8088 mode (left) uses registers to define the base address of 64K segments in the 256K memory. The Z80's 64K addressable range is mapped in 2K segments throughout the 256K, and can be dynamically remapped to allow use of entire memory.*

Vector Graphic Vector 4 microcomputer *uses 8-bit Z80 and 16-bit 8088 microprocessors to support CP/M 80 and four 16-bit operating systems. Dual floppy drives or a floppy and a 5M-byte Winchester are mounted in base.*

Graphics and peripherals

Three types of 8- and 16-bit graphics are accessed under program control: the high-resolution graphics mode displays 640 horizontal × 312 vertical pixels on the green-phosphor CRT screen; the graphics mode displays either 160 × 312 pixels in 16 levels of gray scale or 320 × 312 pixels in four levels of gray scale; and users can plug in an RGB monitor for 160- × 312-pixel graphics in eight colors or 320- × 312-pixel displays in any four of the eight colors. Alphanumerics displayed on the 80- × 24-character screen use a 16 × 13 matrix.

The Vector 4 includes input/output interfaces for serial and parallel printers, modems, color display monitors and a detached keyboard. The system also incorporates a tone generator that operates under program control.

The model 4/20 provides two 630K floppy-disk drives, while the model 4/30 has a floppy drive and a 5¼-in., 5M-byte Winchester-disk drive. The disk drives are built into the base of the desk-top display / CPU module. The systems also communicate in IBM 2780/3780 and 3270 bisynchronous protocols. ■

Andy Reichert is vice president of engineering at Vector Graphic, Inc., Thousand Oaks, Calif.

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The CTS-300 is a completely integrated desktop microcomputer system. The single package contains the 68000, operating at full 8 MHZ, up to 1.5 megabytes of unsegmented memory, Winchester and floppy disk drives, and the CRT terminal with detached keyboard. All in a totally MULTIBUS-compatible architecture. The CTS-300 is a complete UNIX system that runs full ANSI standard FORTRAN-77, PASCAL and C.

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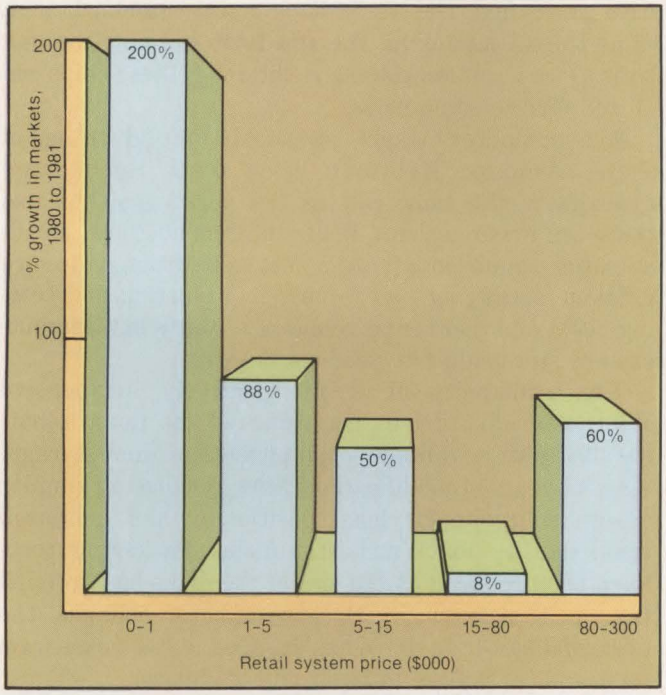
CIRCLE NO. 25 ON INQUIRY CARD

16-bit microcomputers reshape the OEM market

RON CONWAY, Altos Computer Systems

Hardware and software standardization gives micros mini-like capabilities at less than mini prices

The new 16-bit microcomputers are widely held to be grown-up versions of 8-bit microcomputers—more powerful, faster, having access to more on-line storage and enlarged multi-user capacity. While true, this viewpoint overlooks a significant aspect of the 16-bit machines: functionally, they can often replace larger 16- and 32-bit minicomputers, not just 8-bit microcomputers. And because the 16-bit micros price/performance ratio is better than that of minicomputers, OEMs and system integrators now can use 16-bit micros to replace minicomputers in many systems with fewer than 12 users.



Shift in computer market from 1980 to 1981 *favored low-end microcomputers selling for less than $15,000. The $15,000 to $80,000 range, in which minicomputers compete with multi-user micros, experienced the least growth.*

The 16-bit micro revolution combines elements of powerful LSI microprocessors, 64K memory chips and small, low-cost Winchester disks. In addition, the advent of powerful, standard operating systems enables users to migrate from one hardware system to another without leaving their application programs—a valuable advantage to both users and OEMs.

The standardization of these technologies is the key to the microcomputer's success. Custom-tailored minicomputer systems have a performance edge over micros, but at a much greater price.

The minicomputer's architectural prison

As 12-bit minicomputers evolved into 16- and 32-bit machines, manufacturers followed learning curves that led to cost reductions and improved performance. But manufacturers have been confined by their system architectures, hindering the incorporation of new technology.

A standard minicomputer architecture and standard operating system do not exist. Large makers such as Hewlett-Packard Co., Digital Equipment Corp., Texas Instruments Inc. and Data General Corp. have individually designed processors built with small- and medium-scale circuits. Memories are built with small chips and must be addressed accordingly.

This architecture resists change. A manufacturer cannot simply replace 64 1K memory chips with a single 64K chip: new boards are required, the addressing schema must be changed, and the system timing must be adjusted.

Alterations in a computer can mean changes in the operating system, and that means changing the compilers for the languages that the system supports. Minicomputer firms must maintain large software staffs to implement these changes, and the cost of the changes must be spread over the firm's limited

There is no standard minicomputer architecture.

customer base. A license to use the TI DX-10 operating system, for example, sells for several thousand dollars; operating-system licenses for micros typically sell for a few hundred dollars.

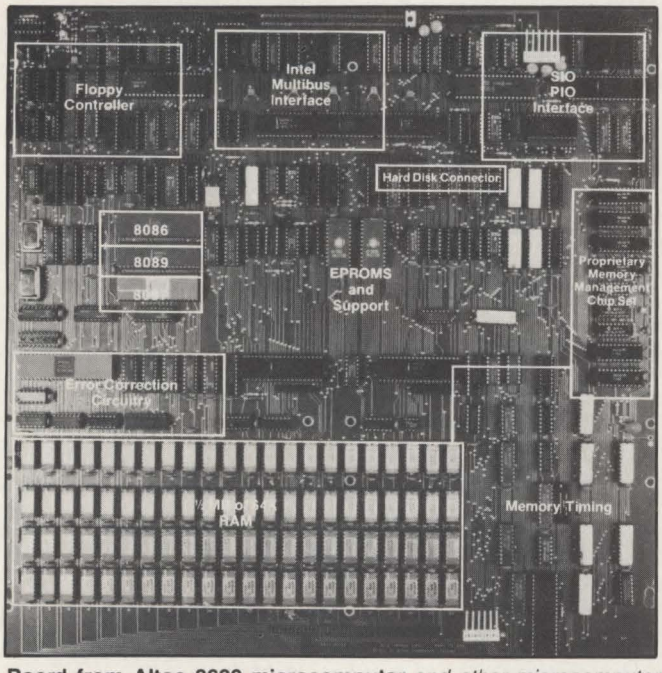
Micros built from standard parts

Microcomputer makers avoid the costs of developing proprietary chips and system architectures by assembling systems using standard, off-the-shelf products. Microprocessor chips are the functional equivalents of minicomputer processors at a fraction of the cost. And no real performance difference often exists for systems with fewer than 16 users.

The 16-bit microprocessors handle as many as 16 users. The limitation on these systems comes not from CPU speed, but from input/output operations. Small computer systems, whether mini or micro, spend most of their time on I/O—loading and unloading the screens, refreshing them, keeping the I/O ports open and sending data to disk.

Small computer systems are limited by how fast they can get information to and from disks, not by how fast they can process data. A typical business application program executes at about the same speed on a minicomputer, such as the DEC VAX or PDP-11, the TI 990 or the HP 3000, or on a micro, such as the Altos Computer Systems' 8600, despite the fact that the minis' CPUs are nominally faster.

Further, the micros' simpler architecture and smaller



Board from Altos 8600 microcomputer *and other microcomputer hardware is built around off-the-shelf microprocessors, memory, interfaces and other standard components. Minicomputers use more components of propietary design, making it difficult to adapt quickly to new technologies.*

internal support bureaucracy can adapt new technology as needed. Altos improved the I/O rate on its earlier models with the simple addition of a Z80 microprocessor dedicated to this function.

The Intel Corp. 8086 and the Motorola Corp. 68000 are the most popular 16-bit microprocessors. Business users lean toward 8086-based systems because there is more software available for them under Digital Research, Inc.'s CP/M-86 operating system. Engineers and scientists prefer the 68000, which is faster, addresses more memory directly (16M bytes versus 1M byte for the 8086) and has a more ordered instruction set, making compilers easier to write.

Because these are both off-the-shelf parts, however, manufacturers offer their customers a choice. Altos makes two versions of its 8600 series, one based on the 8086 and one based on the 68000.

The next generation of microprocessors will be even more powerful. The Intel 80286, for instance, will perform on-chip memory management, and the virtual-memory capability of the Motorola 68000/10 will allow it to run larger applications with larger arrays and more variables. Pipelining and cache memory will improve processing speed by allowing the CPU to store more instructions internally, necessitating fewer memory accesses.

These features are now standard in minicomputer CPUs, but microcomputer systems can simulate them in software, and manufacturers should have little difficulty in plugging the new chips into existing systems.

Memory prices come down

Paralleling the development of microprocessors has been the spectacular advance in on-board memory. Five years ago, the 1K RAM chip was standard; then came the 4K RAM chip, the 16K RAM and now the 64K RAM. Once a certain volume is obtained, these chips can all sell for the same price.

Microcomputer makers can quickly take advantage of these advances. Not only is 64 times the storage available at the same cost as five years ago, but also there are fewer sockets, fewer interconnections, smaller power requirements, less heat generation and more efficient packaging—all reducing production and testing costs and increasing reliability. Many minicomputers are still using five-year-old designs.

The availability of small, relatively inexpensive Winchester-disk drives has removed the minicomputers' last real advantage—inexpensive off-line storage. Several years of modifications have resulted in simpler design solutions for head positioning and increased track density for Winchester disks. Packaging costs have been reduced as the size of the disks has dropped from 14 to 8 to 5¼ in. Because of these changes, the price of a 20M-byte drive has dropped in two years from thousands of dollars to hundreds of dollars.

The inexpensive Winchester has helped put microcomputers into the business minicomputer market. Earlier 8-bit micros did not have the storage capacity to

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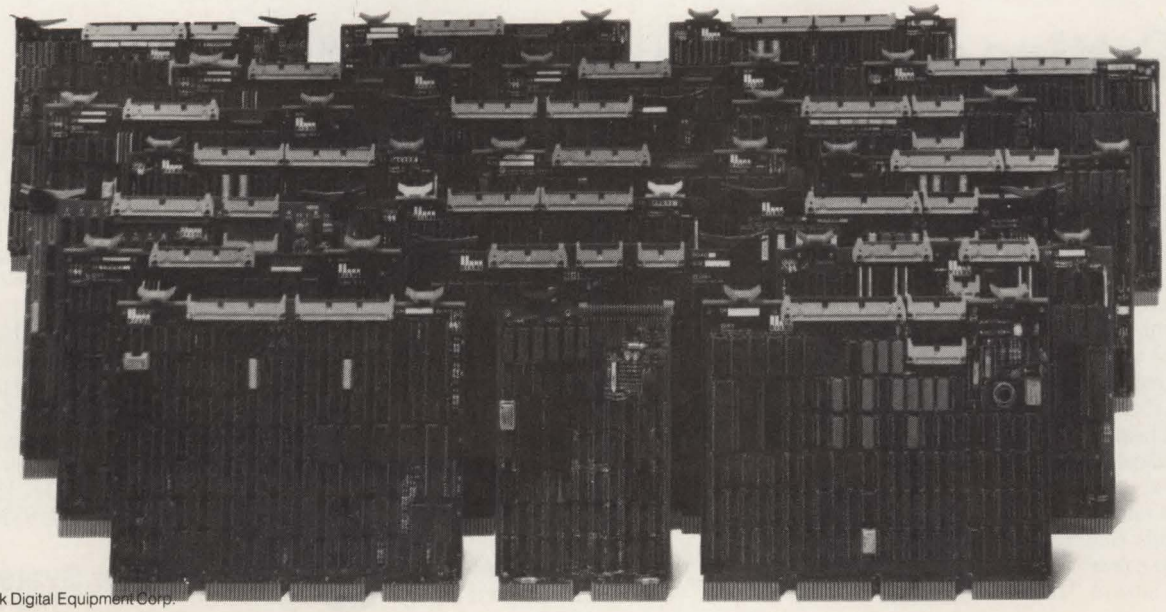

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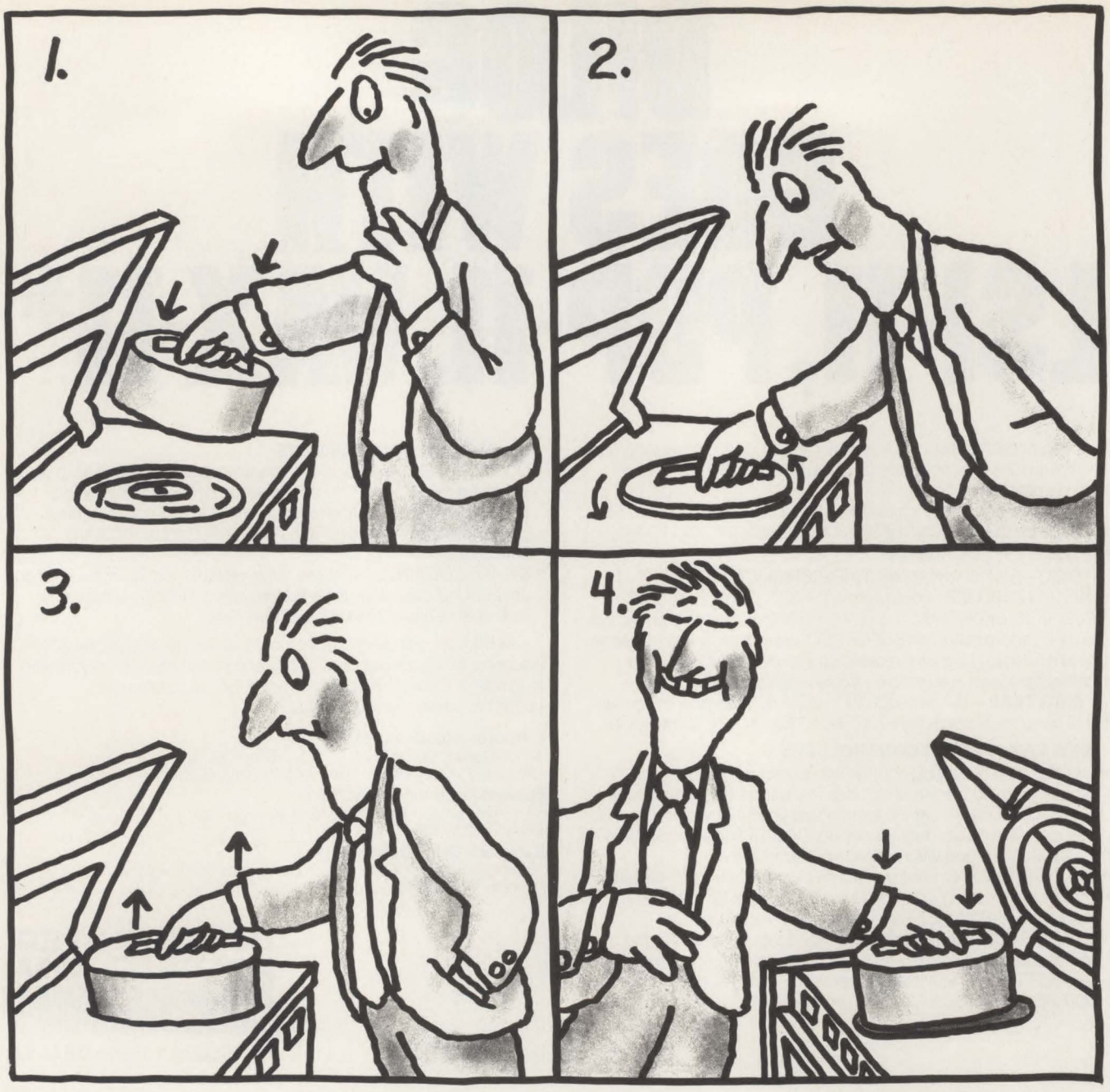

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Very quiet, in fact. Our design meets not only the NC55 quietizing standard for office environments, but even exceeds this standard.

We think of it as the Rolls Royce of disk drives. Quiet. Reliable. But with no price penalty.

We've been making removable-pack drives for 13 years—tens of thousands of them, and there's plenty more where those came from.

In fact, new assembly and test facilities have significantly increased our Trident production capacity.

No other manufacturer has achieved our level of reliability because no other can match our design, engineering, manufacturing and testing capability and technology.

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CIRCLE NO. 10 ON INQUIRY CARD

Advances in on-board memory have paralleled the development of microprocessors.

accommodate large databases, but with as much as 80M bytes of storage available, micros can store databases more appropriate to multi-user systems.

Microcomputers can even support large numbers of users by using networking. Installations can be limited to eight or so users, with other machines reached over a local network such as Ethernet. Again, standardization reduces costs. A proprietary networking circuit board once sold for $600 or more; by next year, Ethernet control chips are expected to be priced as low as $30.

The minicomputer makers' best response to the increase in microcomputers' capabilities is to provide microcomputer-based front ends and smart systems for improving disk-transfer rates. These useful technical advances are cost-effective only in systems with several users, and put the minicomputer in competition with large mainframes rather than micros.

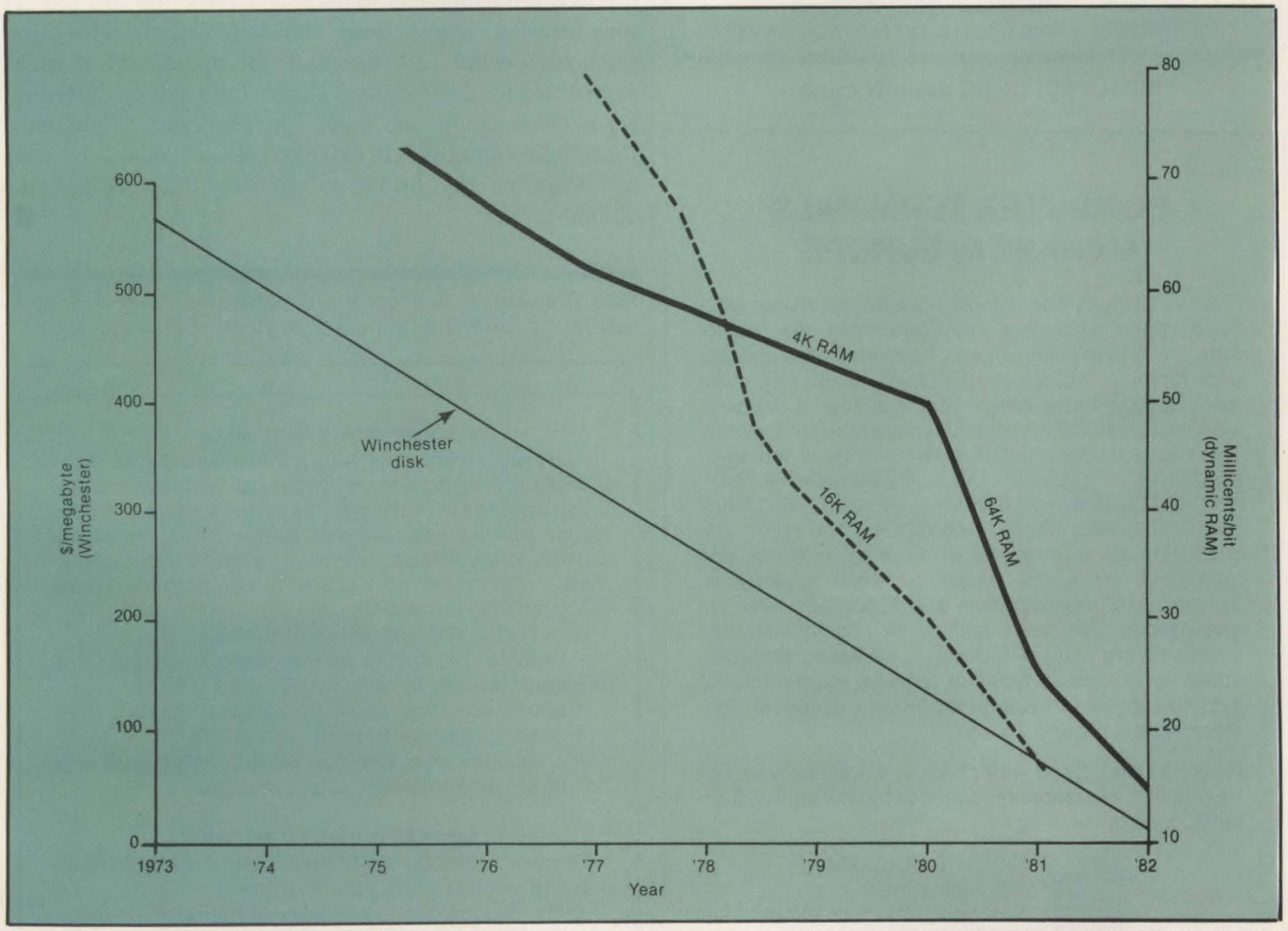
Standard operating systems

Proprietary operating systems have long been the bane of the user population. Effectively, the operating system is the system. Tied to a manufacturer's wares, users have had to accept that manufacturer's software or its look-alikes. If users wished to migrate to other systems, they could do so only at expense of abandoning their application software.

The use of standard components allows truly portable software, obsoleting the concept of a proprietary operating system. Microcomputer makers support users of 8-bit machines who want to move to 16-bit power by supporting 16-bit versions of standard multi-user operating systems such as OASIS and MP/M.

New users can also install more powerful standard operating system such as UNIX, which Bell Laboratories has been developing over the past decade. UNIX, a machine-independent operating system with some 200 utilities for program development, is tested and debugged in thousands of installations. It is a true multi-user system that runs programs sequentially and allows the information exchange between two simultaneous programs.

Because it was developed for computer sophisticates, UNIX has a reputation for being unfriendly. The meanings of its commands are not always obvious. But Altos and other manufacturers are developing friendlier front ends that will make the system much easier to



Decreasing memory and storage costs *have brought the microcomputer into more direct competition with minicomputers. Microcomputers can more quickly incorporate new generations of RAM than minicomputers with complex, proprietary designs, while inexpensive Winchester storage helps microcomputers compete in business applications.*

Minicomputer firms have joined the market as microcomputer customers.

use. The enigmatic commands are being changed, and menus are being developed to step users through unfamiliar territory.

The new OEM market

The traditional OEM market consisted of the system integrators and system houses to whch minicomputer manufacturers sold. Now minicomputer firms and office-system makers have joined that market as customers. Savin, Burroughs Corp., Lanier, NCR Corp., Addressograph and others are finding buying micros much less expensive than building them.

Time-sharing OEMs are also becoming customers rather than suppliers, renting microcomputers in place of dumb terminals. A user can handle daily transactions on-site, while generating reports and storing permanent data in a mainframe. Time-sharing companies cut communications cost and earn higher equipment rental fees.

Computer history is repeating itself in the OEM market. Minicomputer firms such as DEC, HP, DG and TI took market share from the mainframe, with the resulting decline in the mainframe operations of such companies as Univac, RCA Corp. and General Electric Co., which could not meet the challenge. Similarly, those minicomputer firms that cannot adapt to the challenge of the 16-bit micro may also drift into oblivion. ■

Ron Conway is executive vice president of sales and marketing for Altos Computer Systems, San Jose, Calif.

NEXT MONTH IN MMS

The feature article section of the September issue of Mini-Micro Systems will spotlight software: high-level languages and development systems. Three major profile articles will be included, detailing database packages for microcomputers, workstation furniture and portable operating systems for microcomputers.

Other editorial features will include:

- Fresh perspectives on languages and operating systems, including Ada, FORTH and UNIX.
- Manufacturers' views on software portability.
- Close looks at MP/M-86 and MS-DOS.
- A look at a new, low-cost 32-bitter that uses new hardware and software architectures.

LOOKING AHEAD IN MMS

Be sure to watch for these editorial highlights in coming issues of Mini-Micro Systems:

- The October issue will survey memory systems.
- The November issue will include MMS's annual report on computer terminals.

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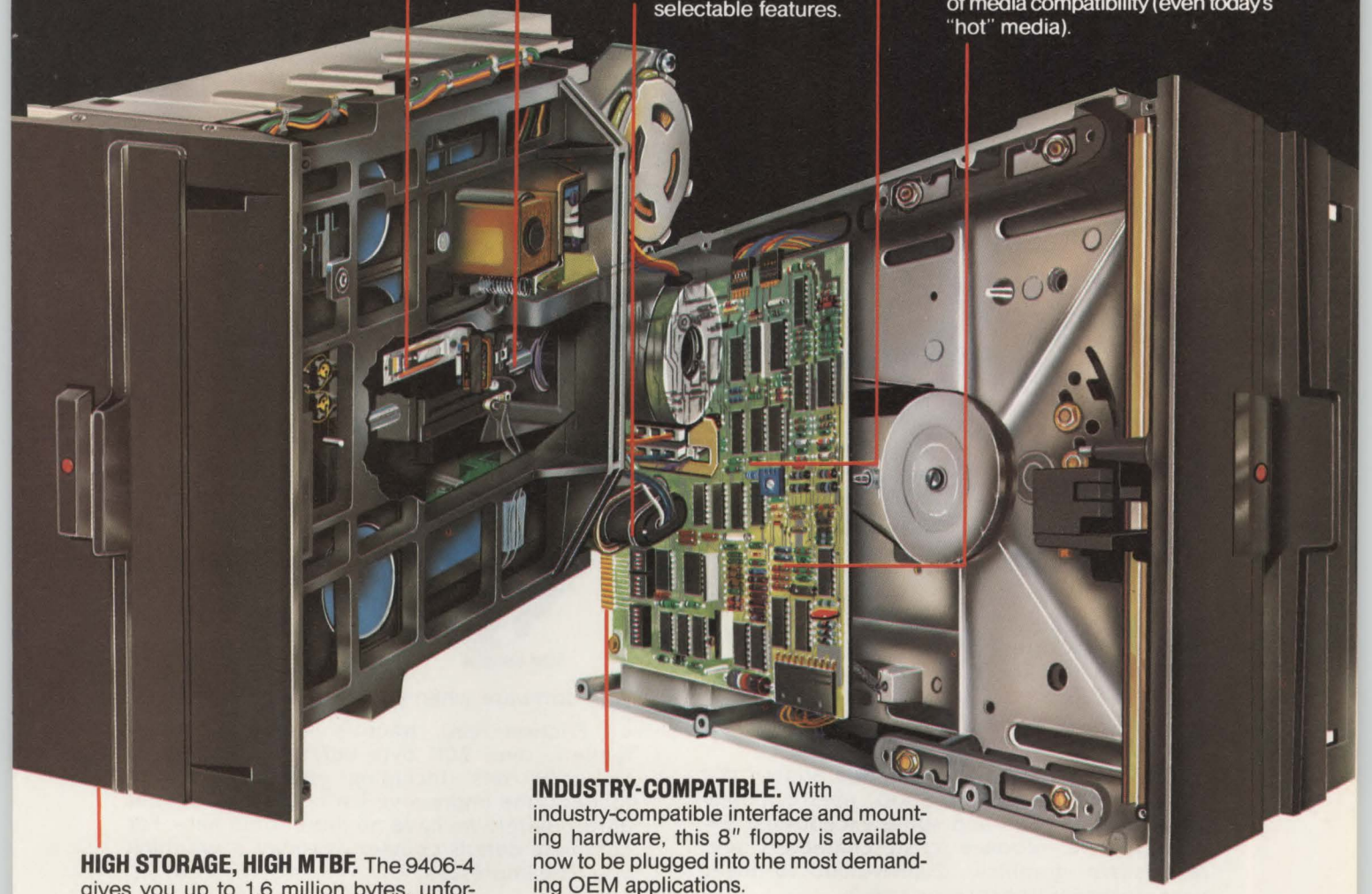

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Hybrid computer aids process-control development

RAY SPIESS, Comdyna, Inc.

Analog capabilities simulate real-time processes in developing microcomputer-based control and data-acquisition systems

A microcomputer in a process-control application must pit its digital tools against a decidedly nondiscrete real world. The development and testing of such systems present a special problem: the processes to be controlled, with their widely ranging variables, are not often easily duplicated on a designer's bench. Hybrid microcomputers solve the problem by incorporating analog functions to simulate continuous, real-time processes. These added functions convert a microcomputer into a process-control applications-development laboratory.

How the hybrid works

A hybrid computer combines a digital computer through a linking interface to an analog computer, in which voltages represent other physical variables. A general-purpose microcomputer can be converted to a hybrid by adding analog and interface units as peripherals. The Comdyna Microhybrid I (Fig. 1) is such a conversion unit, providing an analog-equipped interface, with or without a general-purpose analog computer, for attachment to a microcomputer's I/O port.

The Microhybrid I interface unit (Fig. 2) incorporates A/D and D/A converters, a multiplexer and several control and logic circuits, including comparators, gates and counters. Analog functions are programmed through patch-cord connections and switches, while the microcomputer handles most digital processing in normal fashion.

In typical hybrid operation, the analog computer generates analog signals. The microcomputer can convert these signals and process digital information. If the signals are simple enough, they can be handled

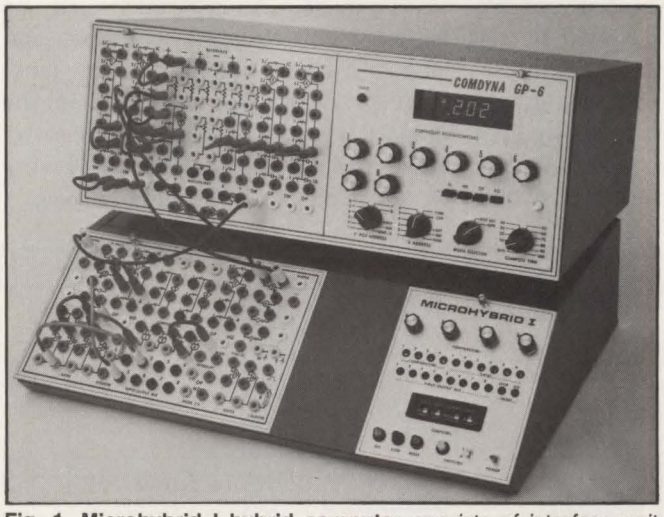

Fig. 1. Microhybrid I hybrid computer *consists of interface unit (bottom) and optional analog computer (top). The interface unit attaches to the I/O port of a user's microcomputer, combining digital and analog capabilities for process-control development. Analog functions are programmed with patch cords and panel switches, while digital processing is under program control.*

asynchronously, by logic circuitry in the interface. Comparators, gates, flip-flops and triggers can generate or modify single-bit binary signals, which in turn can be sent to the microcomputer, or used directly to operate switches that control the analog computer. The microcomputer can output information that is converted to analog signals to control the analog computer, or to generate single-bit signals to operate switches.

Process-control development

Hybrid computers are well-suited to simulate dynamic processes in process-control development, in that

By processing signals asynchronously, the hybrid can respond virtually instantaneously to many situations.

both analog and digital functions can be used under a single programming organization.

The choice of simulation methods is normally determined by the nature of the process to be controlled. Analog simulations excel where the behavior is an action/reaction response defined by a set of ordinary differential equations, while digital simulations best model behavior based on logic determinations, statistical interpretations of data and static calculations. A hybrid computer can simulate basically continuous behavior that includes the discontinuities of logic determinations, memory requirements, complex parameter calculations and empirical functions.

A hybrid-based process control simulation can be structured to resemble a real, microcomputer-based setup (Fig. 3). The hybrid can simulate the entire system—process and controller—for product development, or it can simulate the process or controller alone for testing.

These simulation capabilities offer advantages in process-control development. A controller can be exposed to a wide range of simulated conditions and perturbations, many of which would be too time-consuming, expensive or dangerous to set up in the laboratory. The simulation reacts to stimuli and control commands as would the actual process, allowing accurate evaluation of the controller's effectiveness.

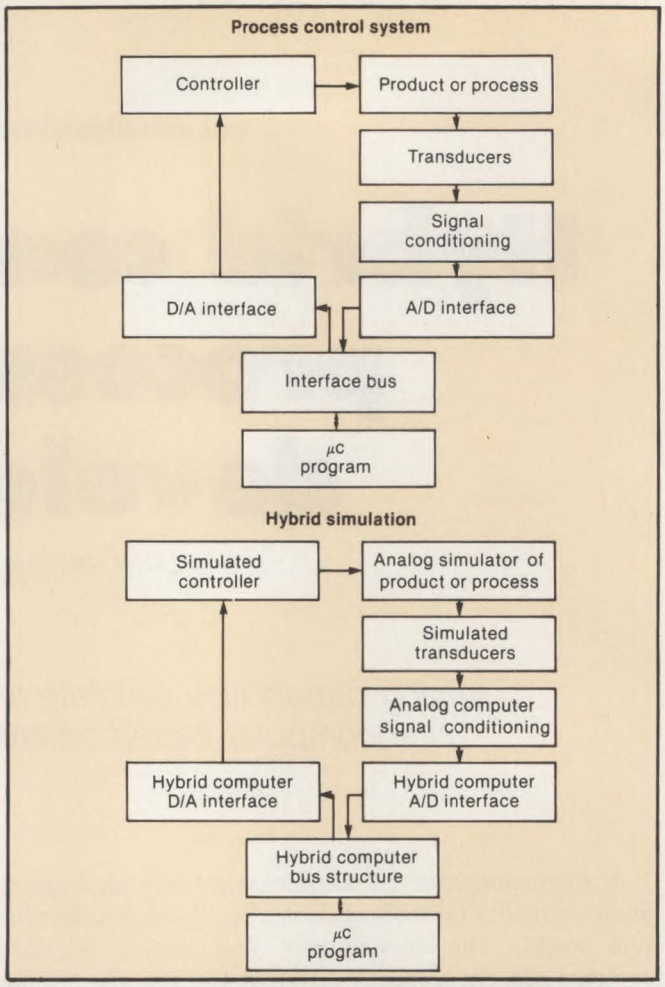

Fig. 3. Process-control system and hybrid simulation *are functionally identical. The hybrid can simulate an entire system for product development, or any part of it to test real products against simulated processes or simulated products against real processes.*

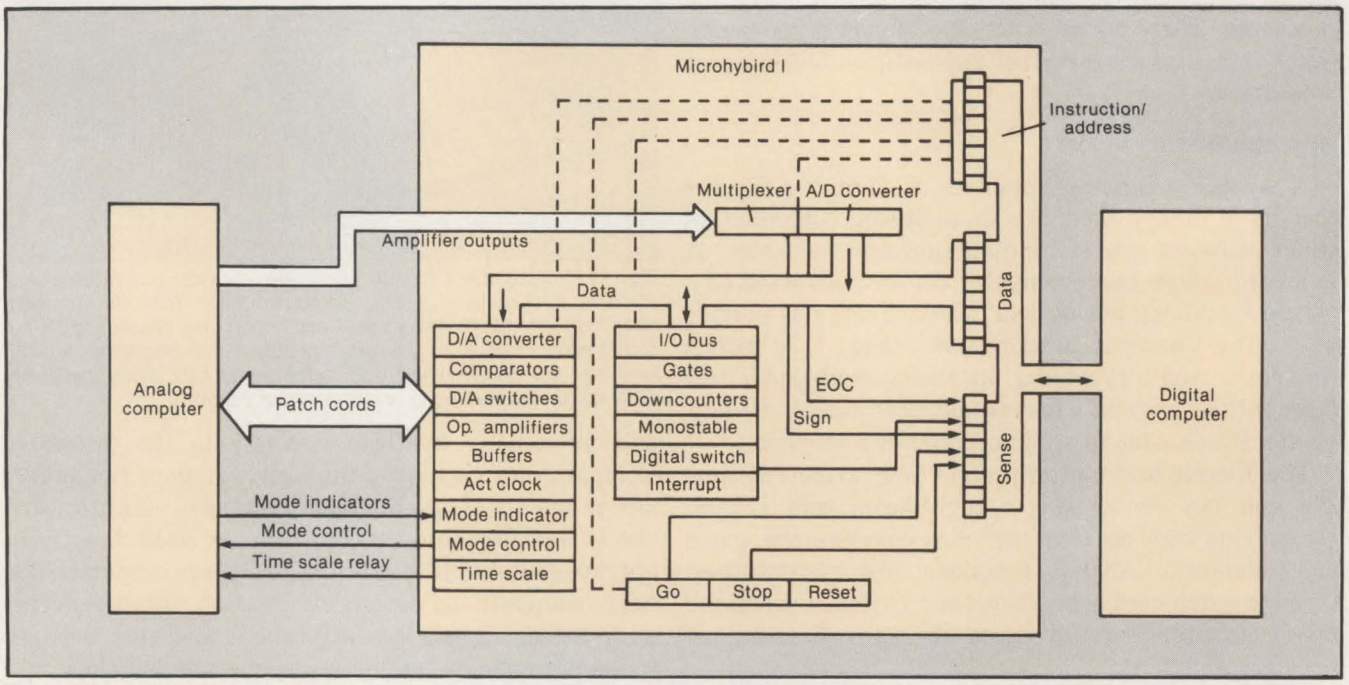

Fig. 2. Microhybrid I architecture *provides a linking interface between a user's microcomputer and an optional analog computer. Process simulations are programmed by patch cord on the analog computer, then sent to the interface, where the information is multiplexed and converted to digital data. Data can be handled by the microcomputer under central program control, or processed asynchronously by logic circuitry in the interface unit. Control information is then converted back to analog signals, and used to modify the analog computer's simulation.*

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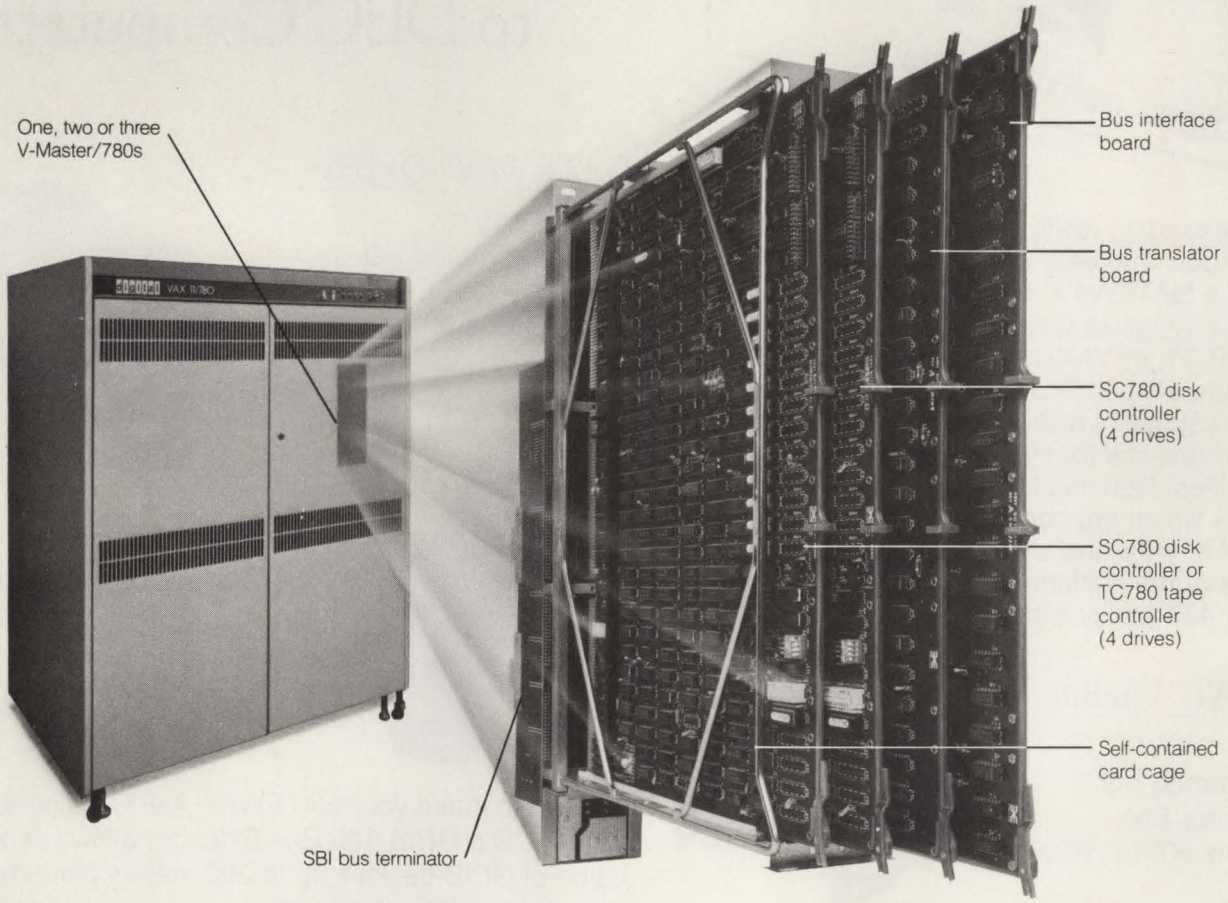

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- Programmed I/O
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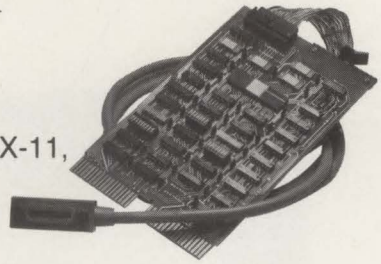
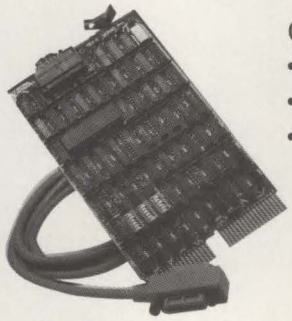
- Supports RT-11, RSX-11, UNIX





GPIB 11V-2
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- Supports RT-11, RSX-11, UNIX

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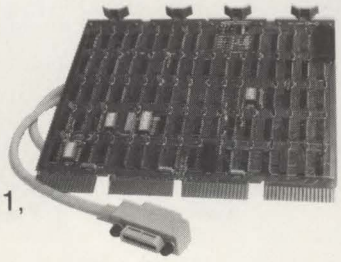

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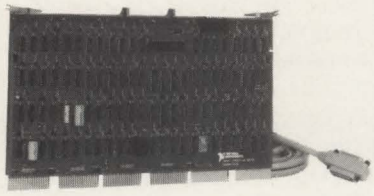

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Hybrid computers are well-suited to simulate process-control development, in that both analog and digital functions can be used under a single programming organization.

The analog and logic functions of the hybrid can control, as well as simulate, processes. If a process status depends on space or time relationships rather than on a clocked sequence, it makes sense to perform operations with asynchronous logic rather than a central program. It would be inefficient, for example, to digitize a liquid level measurement and run a computer routine to turn a pump off and on. By processing signals asynchronously, without sending them to the CPU, the hybrid can respond virtually instantaneously to many situations. In data-acquisition applications, analog techniques offer near-zero frame times and near-infinite variable resolution, avoiding problems inherent in microcomputer techniques.

The hybrid allows a generalized approach to control design. Working with general transfer functions rather than specific products or processes, natural systems with similar characteristics can use the same design. As process-control methods, techniques and designs become more applicable to general rather than specific models, they will be more readily adapted to future requirements. ■

Ray Spiess is president of Comdyna, Inc., Barrington, Ill.

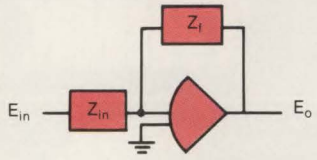
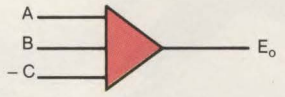
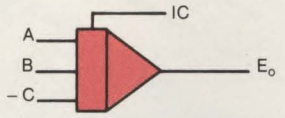
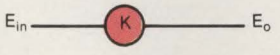
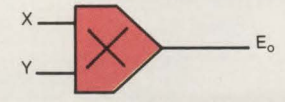
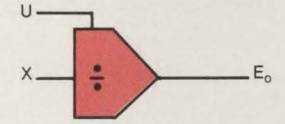
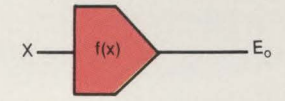
ANALOG COMPUTERS

Analog computers have been around for thousands of years. Until the first half of this century, engineers analyzed systems of gears and pulleys whose behaviors were mathematically "analogous" to more unwieldy systems of interest.

Modern analog computers use high-speed electronic circuitry to analyze physical and mathematical systems. The fundamental component of analog computers is the operational amplifier, which, depending on feedback elements, can add, multiply or integrate voltages (Figure). To analyze a system, variables must be translated into voltages, and the analog computer must be programmed to perform operations on the voltages corresponding to those in the equations describing the system.

Analog computers have taken a backseat to digital computers over the past 30 years, but are still well-suited for applications such as real-time simulation and the solution of complex, nonlinear differential equations. Despite its potential, the analog computer seems to be heading for obscurity. But the increasing popularity of hybrid computers may reverse this trend.

—DHF

Component	Symbol	Operation
Operational amplifier		$E_o = \frac{Z_f}{Z_{in}} - \frac{Z_f}{Z_{in}} E_{in}$
Summer		$E_o = -(A + B - C)$
Integrator		$E_o = -(A + B - C)\,d + -IC$
Attenuator		$E_o = -K E_{in}$
Multiplier		$E_o = -X \cdot Y$
Divider		$E_o = -\frac{U}{X}$
Function generator		$E_o = f(x)$ Empirical (straight line approximation) Log/antilog Sine/cosine

Analog computer components *perform operations on input voltage E_{in} or on sets of voltages, corresponding to mathematical operations. Output voltage E_o can be measured to obtain result. Analog computers can contain hundreds of these components for the analysis of complex systems of differential equations or real-time simulations.*

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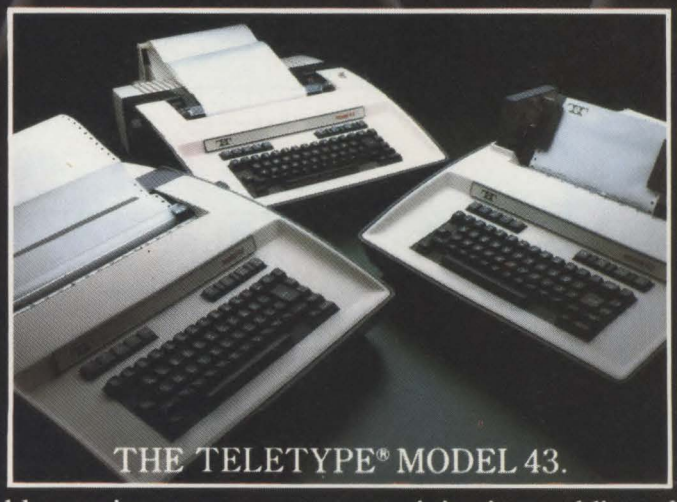

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CIRCLE NO. 124 ON INQUIRY CARD

Automating the laboratory with a µc

RICHARD CURTIS, Cyborg Corp.

Add-on hardware and programming language polish the Apple II's data-acquisition-and-control capabilities

The personal computer's potential in laboratory automation has been limited by a lack of I/O hardware that can be directly accessed by a high-level language. Most laboratory applications require a computer that can interact in real time with a variety of electronic and electromechanical devices. Cyborg Corp.'s new integrated system for automated acquisition and control, with its LabSoft programming language, converts the Apple II to a personal laboratory work station.

A µc for the lab

Much laboratory work consists of manual operations no more complex than those tasks being automated in the business world. The principal problem in implementing easy-to-use µc-based laboratory automation lies in the need to deal with a variety of input signals, specialized processing routines and output requirements.

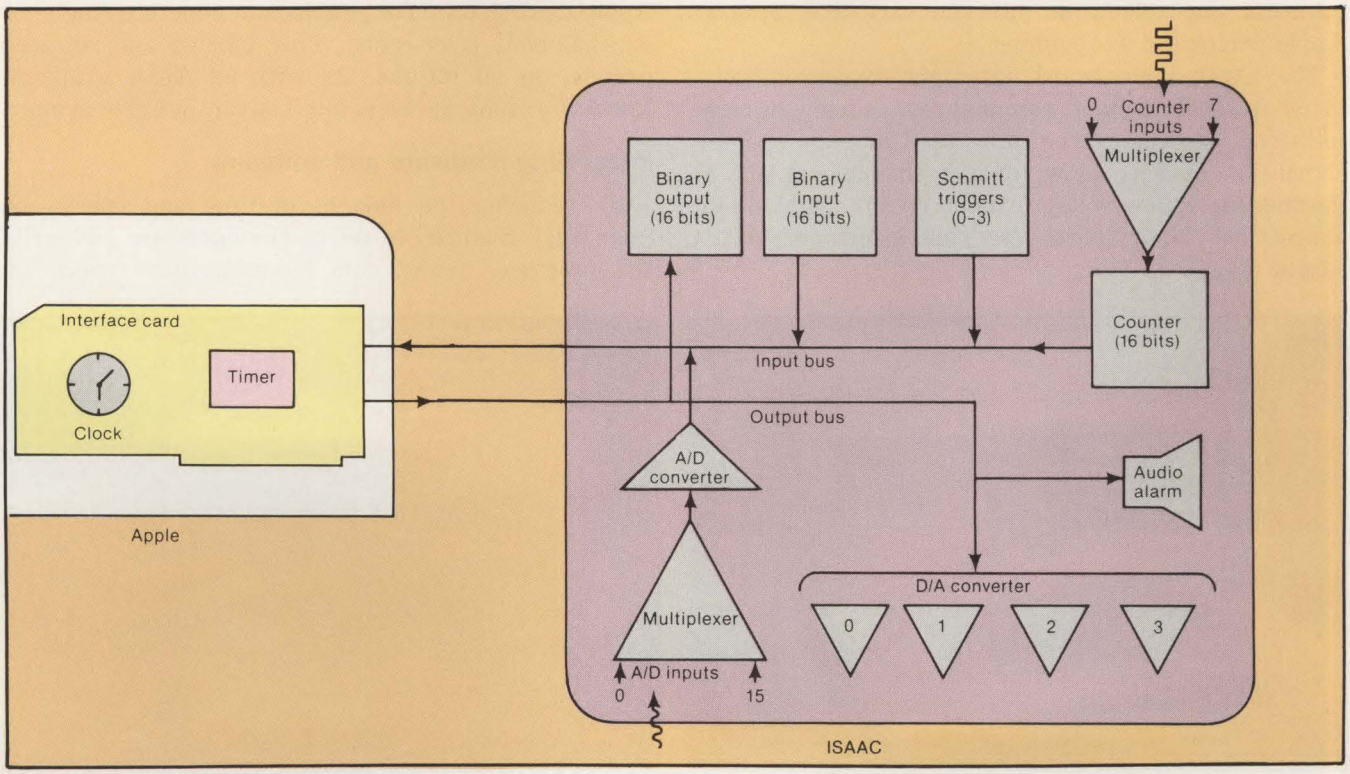


Fig. 1. ISAAC 91A hardware *includes a 16-channel multiplexer coupled to a 12-bit A/D converter, four 12-bit D/A converters, 16 bits of latching binary input and output, four programmable Schmitt triggers, a 16-bit counter coupled to an eight-channel multiplexer, and a software-toggled alarm tone system. The ISAAC/Apple interface card contains address-decoding hardware, a timer and a battery-backup real-time clock.*

The principal problem in implementing easy-to-use μc-based laboratory automation lies in the need to deal with a variety of input signals, specialized processing routines and output requirements.

The ISAAC system places a variety of I/O hardware under control of LabSoft, which specifies all I/O functions as part of a BASIC program, and incorporates a number of graphing instructions. The result is a moderately priced, integrated system for many laboratory applications. ISAAC sells for $3950 as an Apple Computer, Inc., personal computer add-on, and $6000 to $9000 with a 48K-byte Apple II and peripherals.

Hardware architecture

The ISAAC 91A consists of A/D and D/A converters, a multiplexer and a 16-bit I/O port (Fig. 1). The 12-bit A/D converter is coupled via a precision gain stage to a 16-channel multiplexer. The 16-bit I/O port provides handshake and control lines for each byte, and four discrete 12-bit D/A converters offer software-controlled analog voltage output. Four latching Schmitt triggers are set by front-panel knobs or an external source. Also included is a 16-bit counter coupled to an eight-channel multiplexer, a timer with 1-msec. resolution and a real-time calendar/clock with battery backup. A hardware audio alarm tone system completes the package. The system is housed in a 10- × 15- × 5-in. package and connects via cable to an interface card that occupies Apple peripheral slot number 3.

The ISAAC main board has eight expansion slots. Using optional I/O expansion modules, as many as eight additional devices can be integrated into the system. Expansion options allow for 144 channels of A/D or thermocouple (low-voltage) input ($850), eight 16-bit bidirectional binary ports ($325) and 36 channels of D/A output ($725).

All I/O connections are brought out to a distribution panel (Fig. 2) that plugs into a connector at the rear of the ISAAC chassis. I/O connections, all handshake and control lines, grounds and voltage sources are made at labeled screw-clamp terminals. The panel simplifies wiring and provides the option of having several distribution panels wired to the various experimental setups with which ISAAC is used.

LabSoft programming language

ISAAC hardware is linked with the Apple through LabSoft, an extension of Applesoft BASIC. LabSoft's 62 instructions are interpreted and executed as Applesoft instructions. LabSoft instructions are tailored to ISAAC hardware and to the general requirements of laboratory computing, but they retain the English-like mnemonics and syntax of BASIC. These instructions access each of ISAAC's I/O devices, reading or writing values in the form of Applesoft variables. An I/O function is usually accomplished with a single instruction: "& BIN," for example, reads a binary input; "& AOUT" writes an analog output. The ampersand preceding each LabSoft instruction integrates the instruction into Applesoft BASIC.

LabSoft's I/O instructions are complemented by a set of 16 parameters that specify channel number (C#), target variable (TV) and others. They can also be used to graph, mask or compare I/O values against user-specified values, or alter the values by an arithmetic function, all as part of a single command line.

LabSoft's graphing instructions format graphs and permit screen display of I/O values. LabSoft uses the Apple's extensive color graphics to generate single- or multiple-plot, color-coded, fully labeled and retraced graphs, on- or off-line. As with all Apple graphics, LabSoft graphs can be printed on any suitable printer.

Integrating hardware and software

By reducing the amount of time and specialized knowledge required to set up the hardware and write the program, ISAAC cuts lab-automation overhead.

ISAAC system allows Apple II to be used as a personal laboratory work station, *performing a variety of data-acquisition-and-control tasks. It is available as an Apple add-on or complete with 48K-byte Apple and peripherals.*

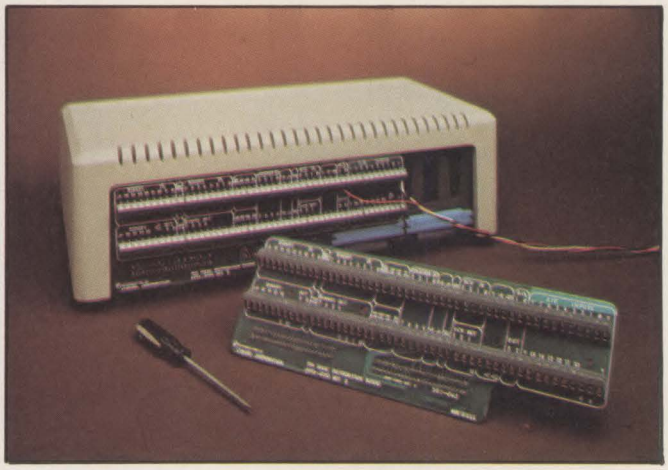
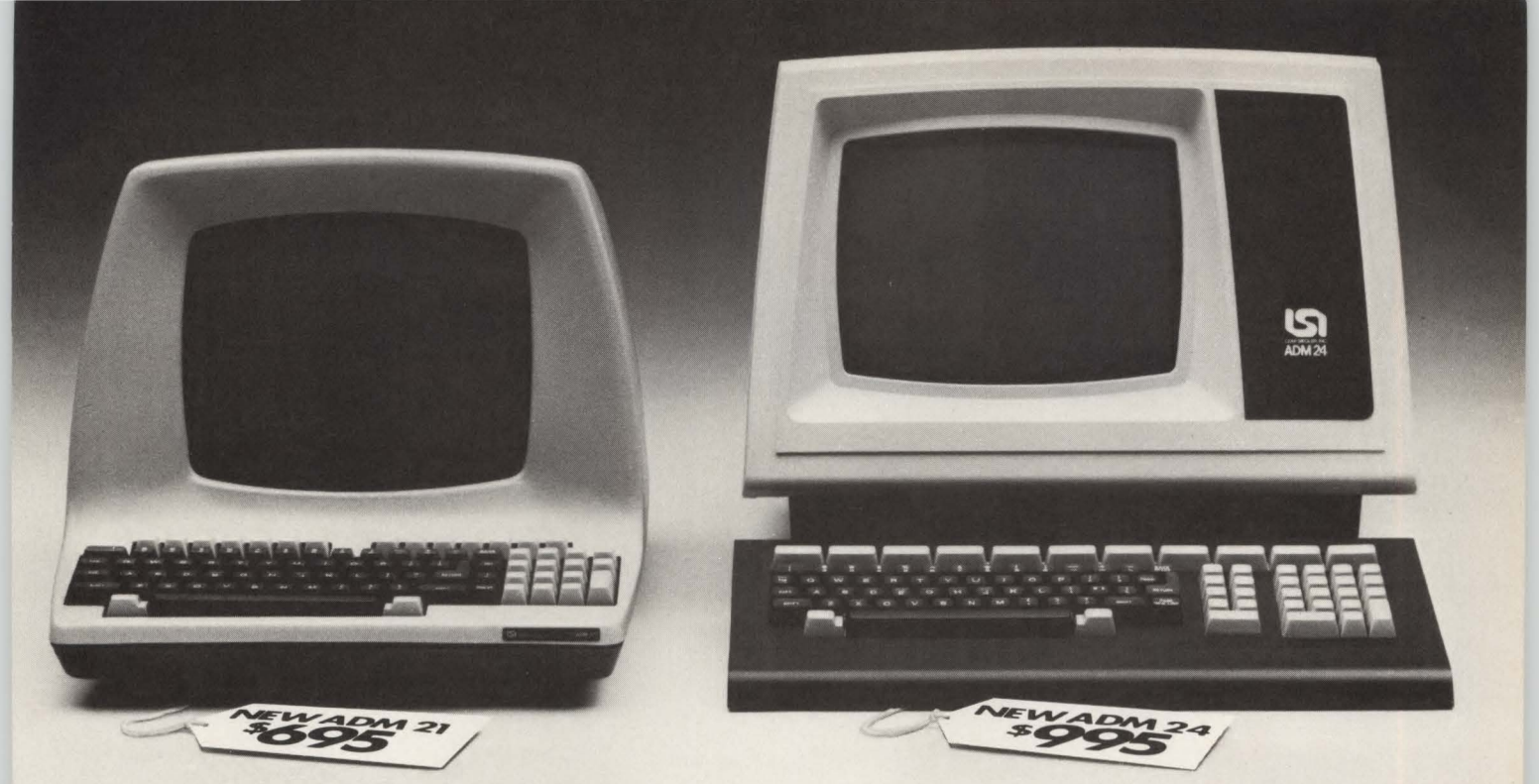


Fig. 2. Removable distribution panel *makes all ISAAC I/O connections, system voltages and grounds available on screw-clamp terminals. When ISAAC is used with several setups, a distribution panel wired for each one simplifies changes.*



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CIRCLE NO. 81 ON INQUIRY CARD

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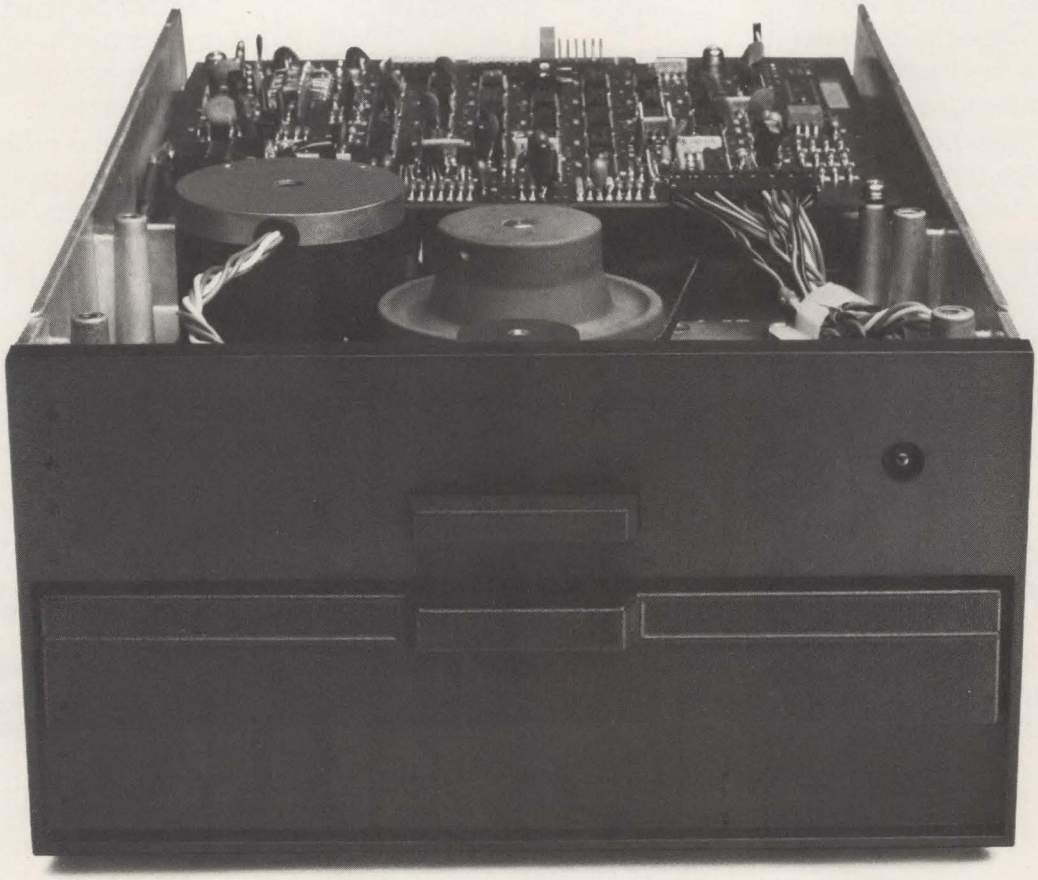

AND GO.

Archive is a perfect match for the back-up needs of Winchesters.

Floppy disk drives are less than ideal for Winchester back-up. They're slow. Easily damaged. And costly to operate.

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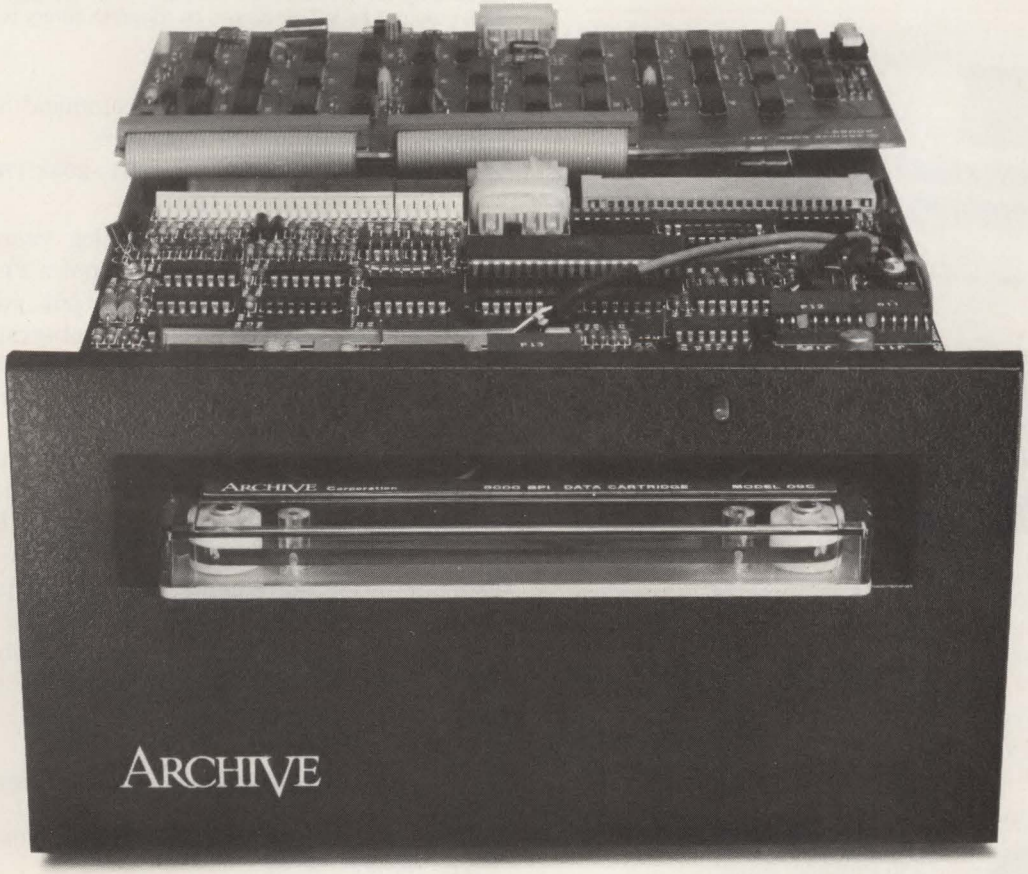

CIRCLE NO. 18 ON INQUIRY CARD

An instruction could be used to photograph an event, turn off a light, initiate a phone call or set off an explosion within a few microseconds of the analog input reaching the threshold value.

Once the proper connections have been made to ISAAC's distribution panel, all that's necessary to record an analog input (from a gas chromatograph, for instance) is to write a statement of the form: & AIN, (TV)=X.

The value of X, which in this case would be the chromatograph's output, may be dealt with in the same fashion as any Applesoft variable. A FOR...NEXT... or GOTO loop continuously reads the value of X. The addition of a (GA) parameter to the command line, along with two or three lines of LabSoft graphing commands, allows the changing values to be stored as data arrays, compared against other values and used in arithmetic operations.

Binary inputs can be read as binary or BCD data words or polled to report on the state of as many as 16 on/off devices. Analog signals can be input and summed for signal averaging. All I/O instructions can be executed as matrixes of specified numbers of sweeps at a specified rate, and most I/O instructions can be

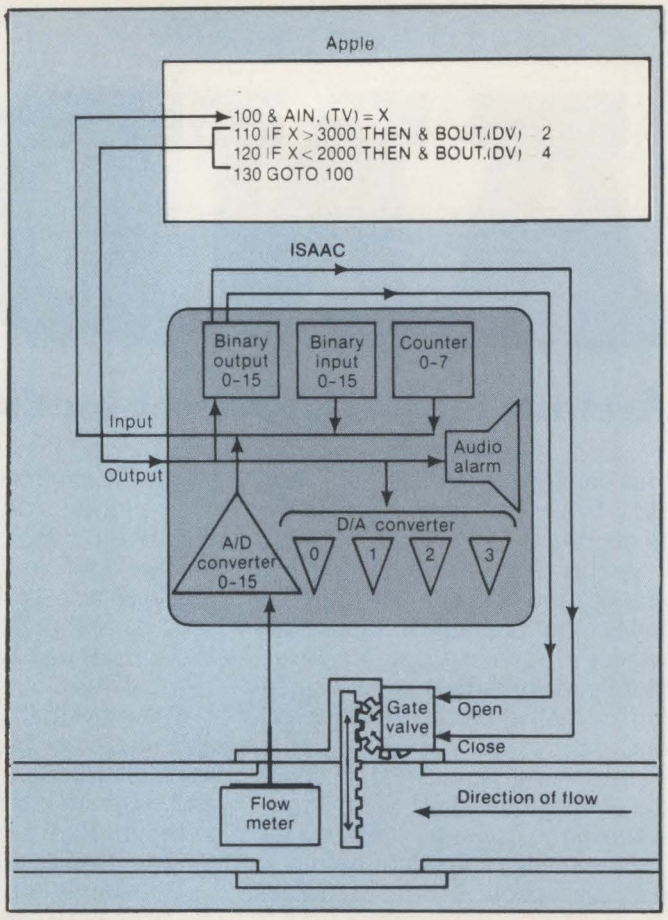

Fig. 3. A simplified flow-control application uses LabSoft's "& AIN" command *to read an analog value from a flow meter. Depending on the value of X, the gate valve is opened by toggling binary output bit #2, or closed by toggling binary output bit #3.*

included in a triggered I/O command structure. A command line using the structure

& LOOK FOR AIN, (TV)=X, (TH)=2048:THEN & BOUT, (DV)=2

would wait for an incoming analog value to reach a threshold (in this case 2048) then put a TTL high signal on bit #2 of ISAAC's binary output port. Such an arrangement could be used to photograph an event, turn off a light, initiate a phone call or set off an explosion within a few microseconds of the analog input reaching the threshold value (Fig. 3).

Hardware/software integration in the ISAAC system brings the software aspect of laboratory computing within reach of BASIC programmers. The standard ISAAC hardware allows the system to fulfill most common I/O requirements, and the expansion cards permit modular upgrades. A growing contributed library of LabSoft applications programs, when not applicable to a user's needs, can serve as a jumping-off point for development of new software. ■

Richard Curtis is manager of technical information at Cyborg Corp., Newton, Mass.

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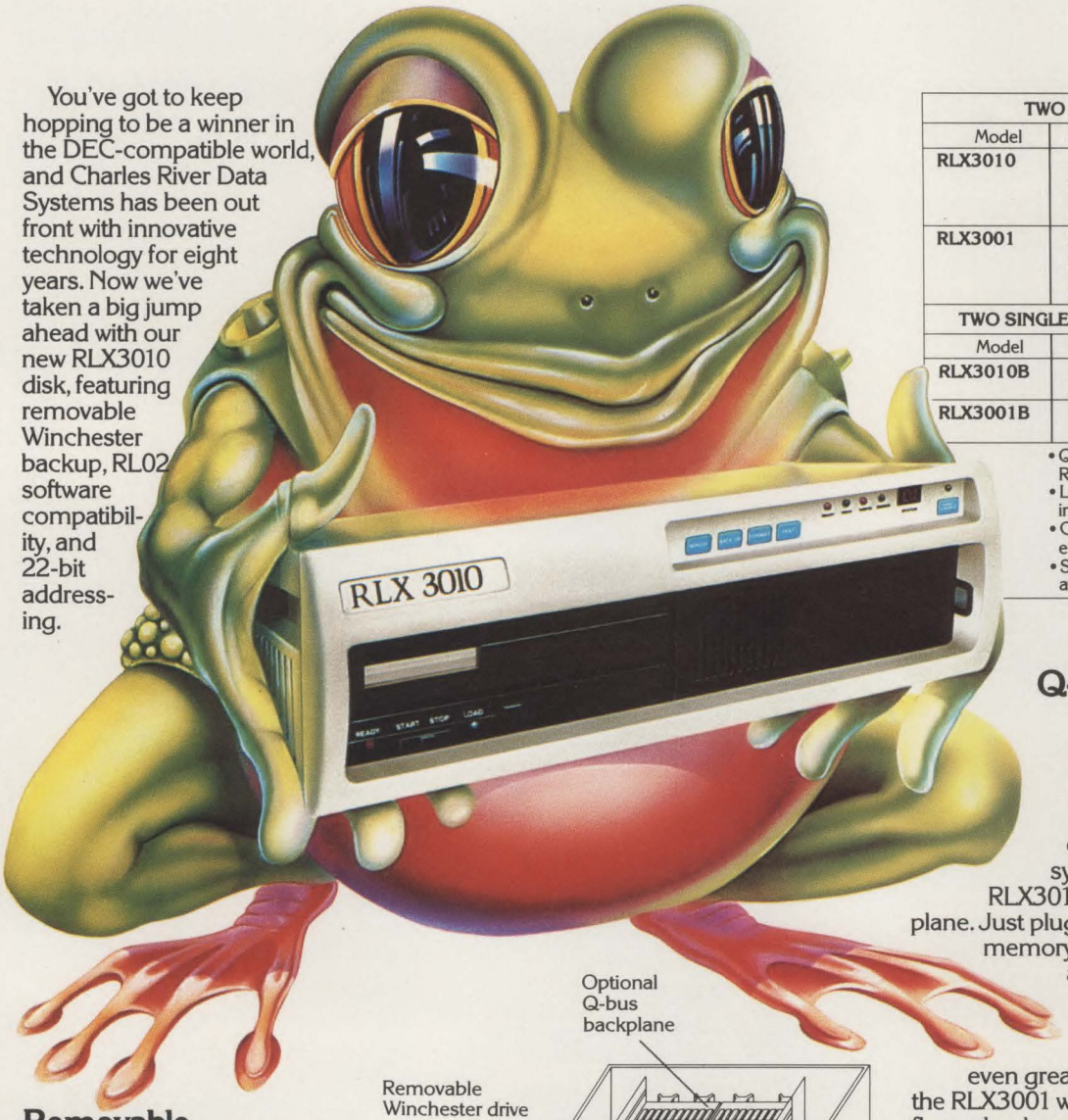

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RLX3010	31.2MB fixed Winchester (=3RL02)	10.4MB removable Winchester (=1RL02)
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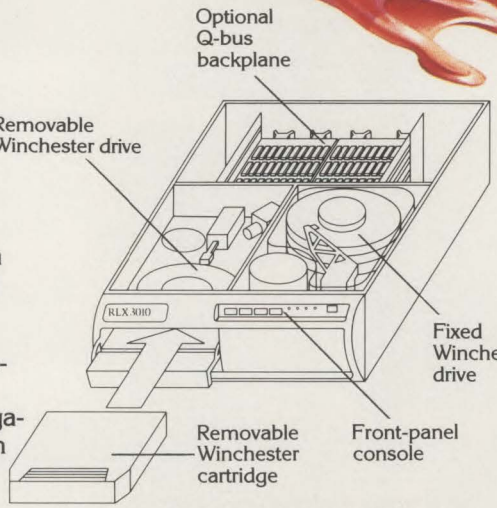

The RLX3010 fits in a 7-inch-high table-top or rack-mount enclosure. Yet it's equivalent to four DEC RL02s (at 40 inches tall and 300 pounds).

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Winchester backup for less than 'six bits' (75¢) per megabyte

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¼-in. streaming cartridge-tape drives provide inexpensive backup for 10M- to 50M-byte Winchester disks

The popularity of Winchester-disk drives for small-business, word-processing, office-automation, computer-graphics and data-entry systems has created a need for equally reliable, but removable, backup media to compensate for the fixed nature of Winchesters.

The most urgent requirement has been for backup systems that match the capacity and transfer rates of Winchester drives in the 10M- to 50M-byte range—a range that is beyond the capabilities of floppy disks but lower than the practical threshold for ½-in. reel-to-reel tape. Streaming ¼-in. cartridge-tape drives fill this gap, with significant cost savings compared to other backup alternatives. Their suitability results from a classical marriage of old magnetic-tape technology, borrowed 6250-bpi coding techniques and the new use of unsaturated recording for digital data.

Why streamers?

Storage costs vary according to drive and media cost (Fig. 1). The media cost for a fully loaded 45M-byte streaming cartridge, for example, is less than 75¢ per megabyte. For lower capacity 20M-byte cartridges, media cost is still only $1.50 per megabyte—compared to $4 for start/stop cartridges and 8-in. floppies, and $18 for removable-disk storage modules.

Backup-hardware costs follow a similar pattern, but relatively low media and device prices are not the only advantages of streaming-tape cartridges. All the other backup devices require multiple exchanges to dump or load medium-sized Winchesters—requiring human operators and making it impractical to treat the backup system as extended on-line storage.

Transfer-rate limitations imposed by backup media can also reduce system throughput and increase processor overhead. It may take hours to unload a 40M-byte disk onto multiple minifloppies, compared to minutes for a single high-capacity streaming-cartridge drive. The only other backup alternatives with comparable transfer rates are expensive storage-module drives.

BACKUP DEVICES COMPARED

Device	Price (Q = 500)	Formatted capacity (M bytes)	Media required to store 20M bytes	Media cost to store 20M bytes	Media cost per M byte	Device plus media cost per M byte (20M bytes)	Time to record 20M bytes (minutes)
¼-in. streaming cartridge-tape drive	$632	20	1	$30	$1.50	$33.10	4
¼-in. start/stop cartridge-tape drive	$1200	8.6	3	$90	$4.50	$64.50	60
8-in., double-density, double-sided, diskette drive	$530	1.3	16	$80	$4	$30.50	34
5¼-in., double-density, double-sided, diskette drive	$325	.409	50	$150	$7.50	$23.75	100+
Fixed/removable cartridge-disk drive	$1900	6.4 fixed 6.4 removable	4	$500	$25	$120	4
Removable-cartridge disk drive	$1500	8.8	3	$375	$18.75	$93.75	4

Fig. 1. Cost of Winchester backup depends on costs of drive, media and operator time. *Streaming-cartridge drives provide the lowest media and operator costs. Cost of device plus media is lowest for 5¼-in. diskettes, but more than 1½ hours is required to load, unload and sequence 50 media. Removable disks match streaming tapes in time and operator involvement, but drive and media costs are twice as high.*

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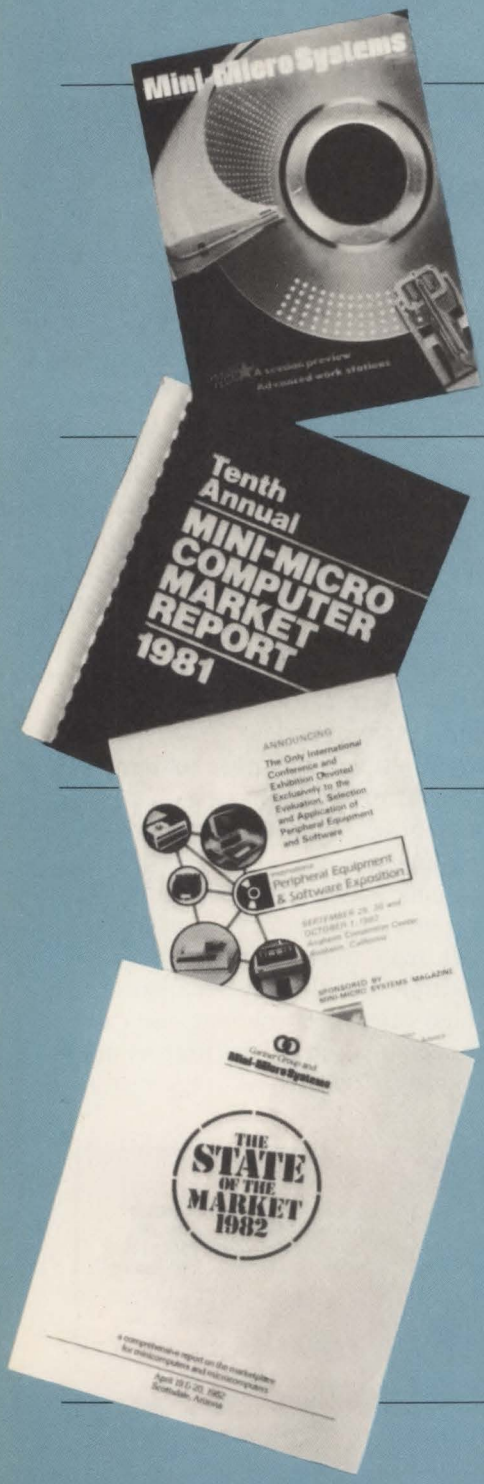

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Transfer-rate limitations imposed by backup media can also reduce system throughput and increase processor overhead.

Something old

Magnetic tape has been used for mass storage since the earliest days of the computer industry. The principal on-line- and backup-storage medium, until the advent of high-capacity disks, was ½-in. tape. The digital-tape cartridge, the vehicle for the new ¼-in. tape streamers, is in its second decade of commercial development, with industry standards established for it (ANSI X3.55-1977), multiple sources of supply and a long history of enhancements and expanded capacities.

There is nothing novel in the technology of the streaming-cartridge drive. Medium and transport have simply come into their own with the development of mid-range rotating memories and a corresponding demand for compact, reliable, low-cost backup.

Fig. 2 illustrates the basic cartridge design used in both streaming and start/stop drives. The compact, 4- × 6-in. unit is completely self-contained, with its own supply and take-up reels, tape guides and tensioning mechanism. Unlike conventional cassette or reel-to-reel transports, there is no direct contact between the tape and the drive capstan, roller or pulley. Instead, both reels within the cartridge are driven by a flat belt that maintains constant tension on the unsupported tape as it streams across the read/write heads at speeds as fast as 90 ips.

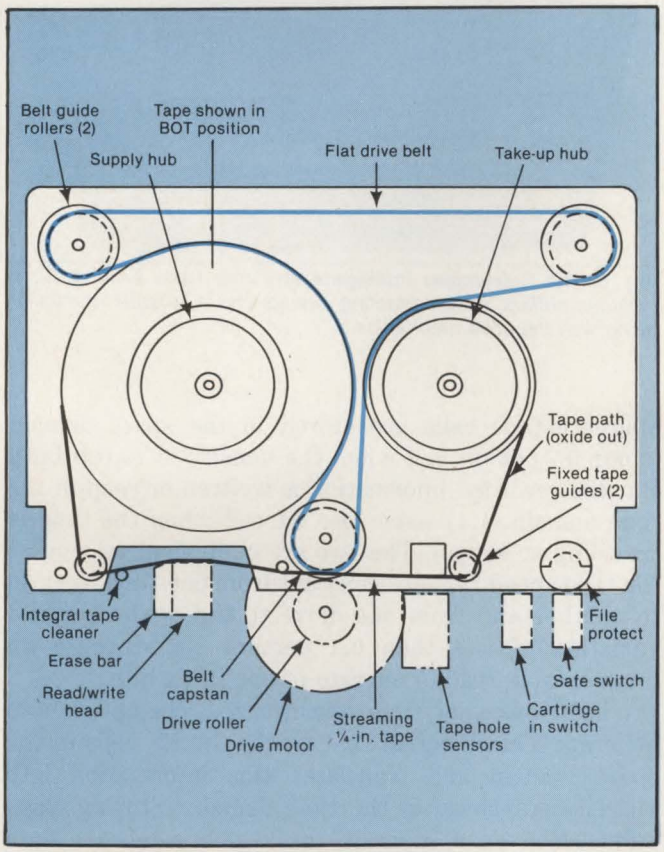

Fig. 2. ¼-in. tape cartridges are driven by an internal flat belt, *eliminating contact between the tape and drive capstans, rollers or pulleys. The belt also maintains constant tension on the tape during streaming and start/stop operations.*

Nearly twice as wide as audio-cassette tape, the ¼-in. recording surface has room for more than a dozen parallel—but serially recorded—data tracks. The number of tracks represents an economic trade-off between data capacity and cartridge-drive manufacturing costs. Standard tapes measure 300, 450 and 600 ft., with beginning of tape (BOT), load point, warning point and end of tape (EOT) marked by optical-sensor holes. A 450-ft., four-track cartridge, recorded in a serpentine pattern (Fig. 3) to minimize rewinds and dual-channel head repositions, has a formatted data capacity of 20M bytes. Nine tracks increase the formatted capacity to 45M bytes.

A typical cartridge drive, engineered for volume production and easy maintenance, features a glass-reinforced polycarbonate mainframe and a minimum number of moving parts (Fig. 4). To simplify integration into existing systems, DC-power voltages and optional mounting dimensions match those of industry-standard 8-in. floppy disks.

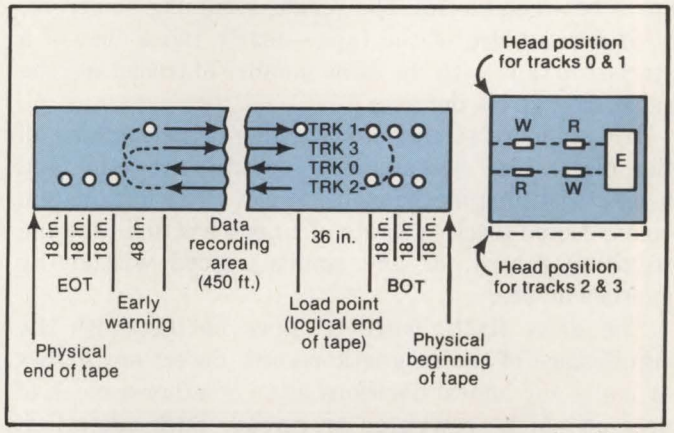

Fig. 3. Serpentine recording of serial data permits 90 ips streaming *and minimizes rewinds and dual-channel head repositions on this 20M-byte, 450-ft., four-track cartridge. Nine-track cartridges hold as much as 45M bytes.*

Making cartridges stream

Cartridge drives are also optimized for streaming rather than start/stop data recording and retrieval. Instead of pausing for further instructions at the end of each data block—a necessity for file management—the recording medium streams continuously between BOT and EOT. The drive's motion is limited only by the data-transfer capabilities of its companion disk drive and host computer.

By eliminating the need for fast, low-inertia starts and stops, streaming-drive components can be designed for rugged, extended-life service and minimum manufacturing expense. The streaming cartridge is the only Winchester-backup device that sells for less than the disk it backs up.

The principal on-line- and backup-storage medium, until the advent of high-capacity disks, was ½-in. tape.

Nonstop streaming also accounts for the low media costs of streaming-cartridge drives. As much as half the length of a start-stop tape can be wasted on inter-block gaps. Longer blocks reduce the number of gaps, but increase the amount of data that must be rewritten or reread when a block-in-error is detected.

An identical trade-off applies to the length of streaming-cartridge data blocks. In this case, however, the gap size can be reduced to the length required to separate the blocks and resynchronize the read/write circuitry at the start of each block. In the case of an intelligent drive, for example, the block length is fixed at 512 storage bytes with only 16½ storage bytes in the space between blocks. The result, assuming no errors, is 97-percent use of the tape—nearly twice that of a start-stop tape with the same number of tracks and the same storage-bit density.

The standard streaming-cartridge drive contains all the electronics necessary to control the tape and head-positioning mechanisms. It can write information on a selected track at a rate of 10,000 frpi and read the resulting record, or any similar record written by another device.

The drive itself, however, does not establish the significance of the magnetic record, detect any errors or make any logical decisions as to whether a block of data should be rewritten or reread. Such controller/formatter functions must be provided by a user or incorporated into an intelligent drive (Fig. 5).

Beyond the simple storage and retrieval of information, there are four primary design objectives for an intelligent streamer:

- An easy-to-implement host-computer/operating-system interface,
- A data-transfer rate that is compatible with the host-computer DMA channel,
- An error-detection-and-correction procedure that reduces the number of soft (correctable) errors to fewer than one in 10^8 bits and the number of hard (uncorrectable) errors to fewer than one in 10^{10} bits,
- A data-coding technique and tape format that take maximum advantage of the drive's flux-reversal density and the short inter-block gaps that continuous streaming allows.

Something borrowed

Most of these objectives have been achieved by a single design innovation that was borrowed from 6250-bpi reel-to-reel tape technology.

A serially recorded data track can be viewed as a series of cells representing binary 0s and 1s, with the boundaries of each cell defined in time and space.

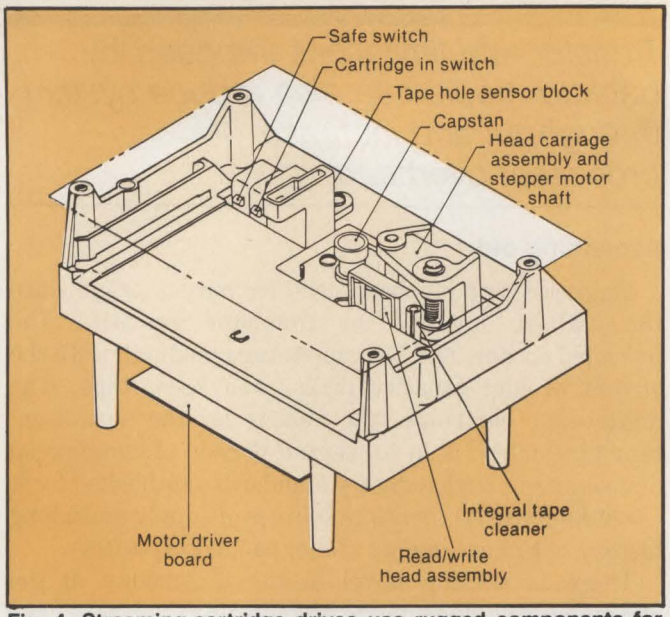

Fig. 4. Streaming-cartridge drives use rugged components for continuous tape motion, *unlike conventional drives that use low-inertia components for start/stop operations. Most tape-handling hardware is in the tape cartridge, keeping the drive's parts count low.*

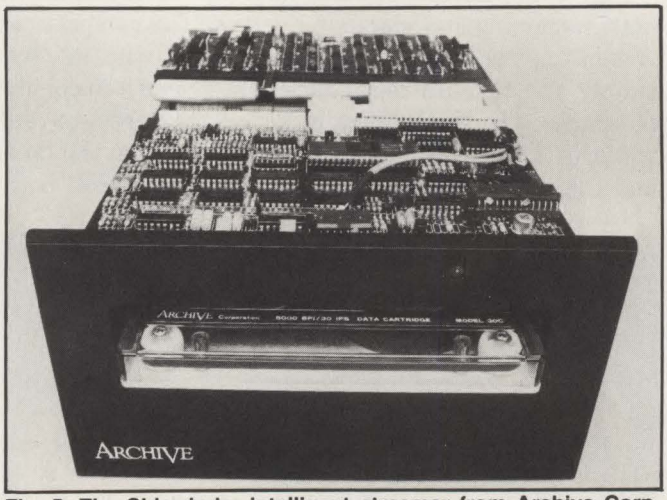

Fig. 5. The Sidewinder intelligent streamer from Archive Corp. *includes buffers, error correcting circuits and a formatter/controller, along with the drive mechanics.*

Magnetic-tape cells are stored in the space domain (0.001 in. per bit cell when the density is 10,000 bpi). But the recorded information is written or read in the time domain (1.11 μsec. per bit cell when the tape is traveling at 90 ips). The two are equivalent as long as the tape speed remains constant from one track section to another and from one drive to the next. A speed variation of less than 0.1 percent would cause an unacceptable read-error rate of one in 1K bits.

To keep space and time synchronized, one option is to generate a clock signal that tracks the bit cells in the space domain and translates this information into bit-cell boundaries in the time domain. Storing clock information on a separate track alongside each data track, however, would halve the drive capacity. A more efficient method would be to directly or indirectly use the recorded data as the synchronizing source.

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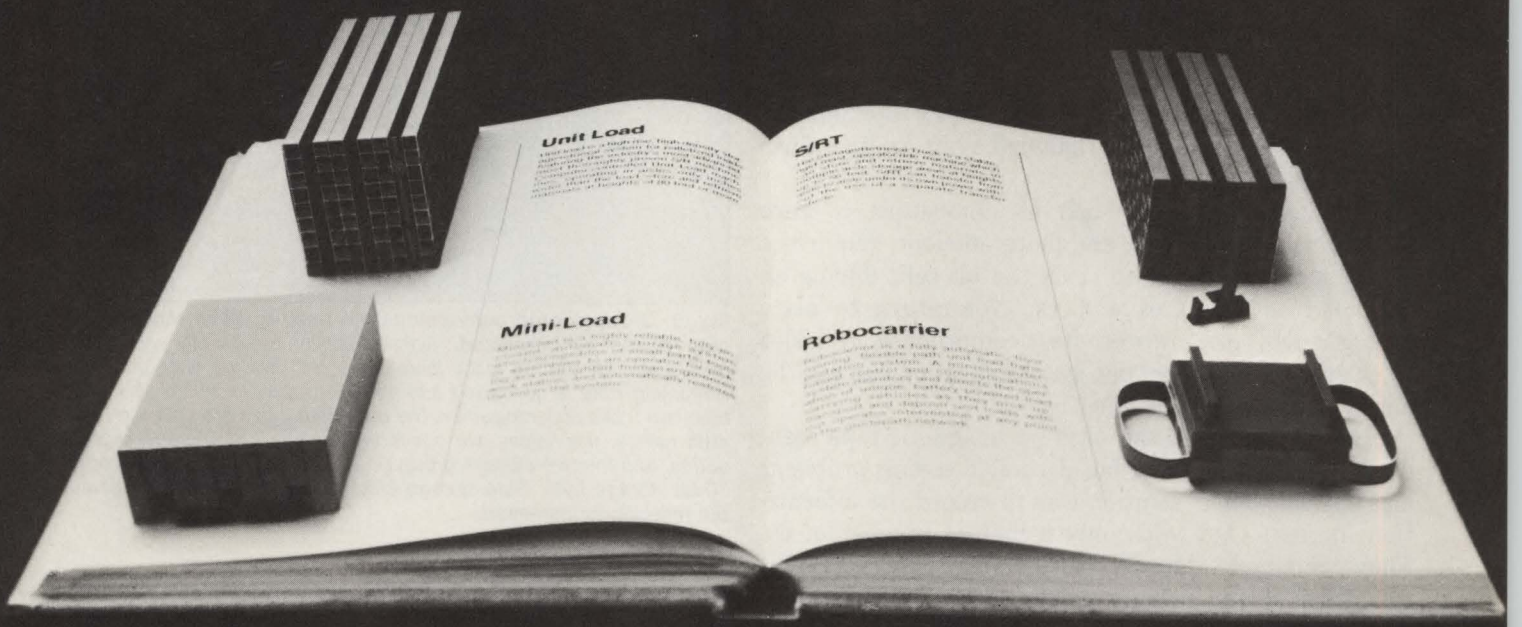

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CIRCLE NO. 50 ON INQUIRY CARD

Streaming-cartridge drives offer impressive backup-media savings by storing the data at high bit-cell densities.

A variety of self-clocking codes have been developed for this purpose, but each has its limitations. Phase encoding, for example, requires two flux reversals to identify a single bit. Modified FM codes discriminate between 0s and 1s by a half-cell shift in the flux-reversal pattern.

A non-clocking code such as non-return to zero (NRZI), although simpler and more efficient, requires a separate timing signal to clock the bit cells during an extended series of 0s and 1s. Non-return to zero, change on 1s (NRZ) represents a compromise. A series of 1s are self-clocking, but synchronization can still be lost with a long series of 0s.

The developers of the 6250-bpi magnetic-tape standard (ANSI X3.54 1976) faced similar coding problems and options. Their solution was to record the information in NRZI—but with only a limited number of 0s. They combined 7 data bits with an error-correction bit to form a group-coded recording (GCR). The 8 data-group bits to be stored along each track were split in half, and each half was converted to a 5-bit storage-group code in which no more than two 0s occur in succession, even when the storage-group codes were combined end-to-end to form a 10-bit byte (Fig. 6).

Intelligent cartridge drives use a 4-bit-to-5-bit code conversion in the same manner. Each 8-bit data byte is converted to a 10-bit storage byte before it is recorded. Data capacity is reduced by 20 percent (10,000 frpi can store only 1K 8-bit data bytes instead of a theoretical 1250 per in.) But the system can still support data-transfer rates as high as 90K bytes per sec., or only 11 sec. per megabyte when a disk is being loaded or dumped. Error rates are also sharply reduced by the unambiguity of the NRZI codes.

A number of other advantages can be noted. The limited-0 bit steam is virtually self-locking, allowing a third-order, wide-band phase-lock loop to track the bit cells with extreme accuracy and speed, despite snaps and vibrations in the tape as it streams from reel to reel. (A μp-controlled capstan servo holds the tape speed to within narrow tolerances.) Moreover, only half the potential number of 5-bit codes are used in the data-to-storage code conversion, leaving as many as 16 illegal codes for formatting fuctions.

4-BIT DATA			5-BIT STORAGE GROUP CODES	
HEX	BINARY		HEX	BINARY
00	0000	=	19	11001
01	0001	=	1B	11011
02	0010	=	12	10010
03	0011	=	13	10011
04	0100	=	1D	11101
05	0101	=	15	10101
06	0110	=	16	10110
07	0111	=	17	10111
08	1000	=	1A	11010
09	1001	=	09	01001
0A	1010	=	0A	01010
0B	1011	=	0B	01011
0C	1100	=	1E	11110
0D	1101	=	0D	01101
0E	1110	=	0E	01110
0F	1111	=	0F	01111

GAP = 1F = 11111
SYNC = 07 = 00111
FILE MARK = 1C = 11100

Fig. 6. Group-coding conversions are used to keep streaming-tape drives synchronized. *Synchronization of serially recorded NRZI data bits can be lost if long series of 0 bits are encountered. Streaming data is converted into a GCR format, in which no more than two 0 bits occur together. The 8-bit data bytes are split into two 4-bit halves, the halves are converted to two 5-bit storage group codes, and the two storage group codes are combined to form one 10-bit storage byte. Data-storage efficiency is reduced 20 percent, but reliability is increased.*

Error detection and correction

Fig. 7 shows the format that intelligent cartridge drives generate. Data are divided into 512-byte blocks for error detection and correction. However, instead of the conventional erased gap—without any synchronizing signal—the drive controller inserts 13 illegal (all 1s) 10-bit storage bytes and a 0.5-byte (5-bit) sync code to signal the start of user data. The final bytes in the block are two coded CRC (cyclic-redundancy-check) characters

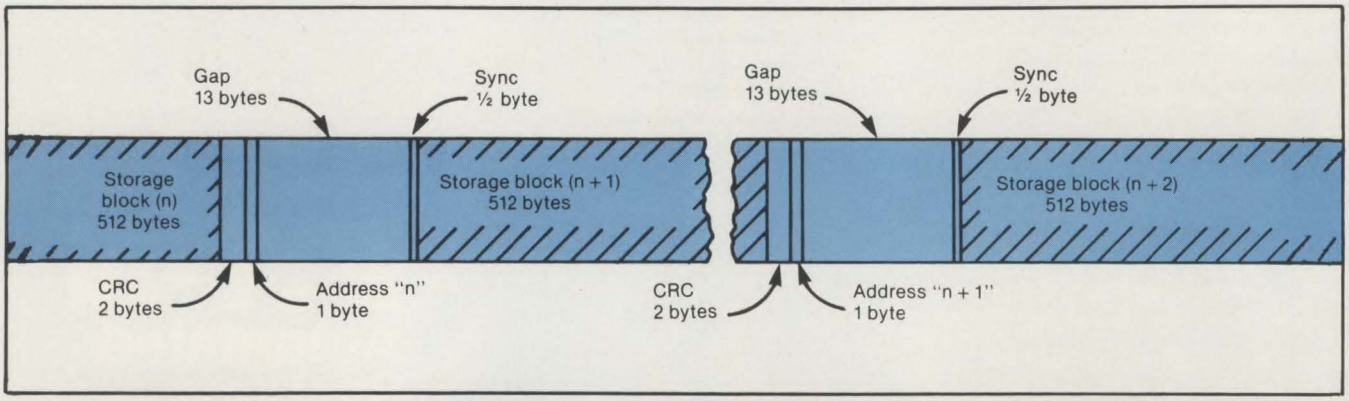

Fig. 7. A streaming-tape format makes efficient use of its media. *Storage blocks contain 512 bytes of data, 2 bytes of cyclic-redundancy-check data and a block-address byte. The long, blank inter-record gaps of conventional drives are replaced by 13 illegal bytes (all 1s) for block separation and ½ bytes of synchronizing data.*

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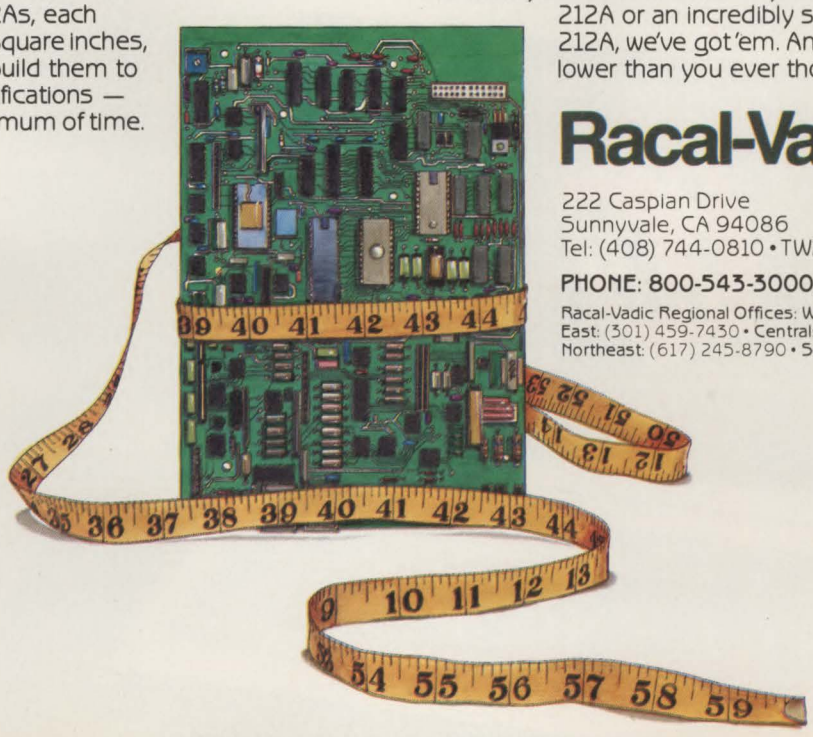

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Finite element model displayed created by PATRAN, a product of PDA Engineering.

Streamers are being shipped in volume and have a secure place among the mass-storage options available to OEM designers and end users.

calculated by the drive controller and an address-storage byte.

Intelligent controllers can also be programmed to generate a 512-byte storage block of illegal codes as a file mark. Any number of file marks can be inserted into the tape record by the host computer to serve as stopping points when data files are to be recorded and retrieved. The host computer can seek a record by counting file marks and the storage blocks that follow a selected file mark. Alternatively, the block, or blocks, immediately following a file mark can be coded with file-identification data or with a block-by-block directory of the information contained in the file.

However, storage blocks must be counted because the streaming-format address byte attached to each block is stripped from the data stream during the read operation and is transparent to the host. There is no direct relationship between the storage blocks and the way the data are organized on the disk or in the computer memory. The main function of the address byte is to identify and correct a block containing a write or read error. The controller also uses the addresses to ensure that data is returned to the computer system in the same sequence as it was received.

The error-correction scheme used by intelligent streamers during a write operation differs from that used by start/stop tape drives. Read-after-write and CRC comparisons detect any recording errors. But instead of backing up and rewriting the block in error with a progressive foward creep that bypasses a faulty section of tape on each rewrite, the streaming-cartridge drive keeps the tape in motion, rewriting the faulty block until an error-free block is detected. Rewrites followed by an accurate record are viewed as soft errors and are identified during subsequent read operations by monitoring the sequence of block addresses. After 16 unsuccessful rewrite attempts, the cartridge tape is stopped, and a hard error is reported to the host computer.

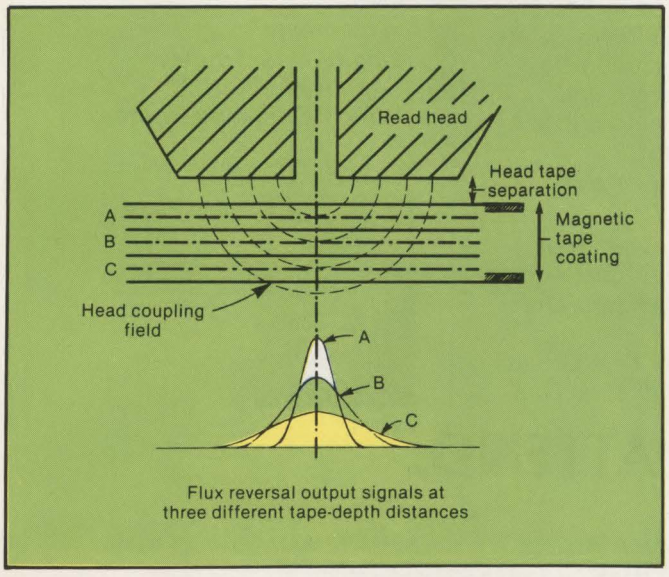

Fig. 8. Unsaturated recording produces sharp output signals (A) compared to normal saturated recording, *which produces strong, deep magnetic fields. Unsaturated signals are easier to filter and erase, and rarely produce write-through errors.*

Read-error detection and correction are more conventional and less frequent. The tape is stopped, reversed and reread as many as 16 times before a block with a hard CRC error is flagged and transferred to the host computer for a more sophisticated error-correction analysis.

Soft-error rewrites and rereads are transparent to the host but are separately logged by the intelligent drive. Totals are maintained in registers and returned to the host each time a status report is requested by the host software or operator. Thus, the quality of the cartridge tape is continuously monitored and a replacement can be made before excessive degradation occurs.

Streaming-cartridge drives are highly efficient when the tape is allowed to stream continuously, but are relatively ineffective as backup devices if the tape must be frequently stopped because the host or disk cannot supply or receive data fast enough to sustain continuous tape motions. A 30-ips unit can outperform a 90-ips drive if the latter is forced to stop and reposition at frequent intervals. I/O-rate matching is important to the productive integration of streaming-cartridge drives into a system of any size.

Something new

Streaming-cartridge drives offer impressive backup-media savings by storing the data at high bit-cell densities. But the savings would be negated, for the most part, if the high density imposed an excessive hardware cost.

The new ¼-in. streaming drives avoid this problem through a sharp departure from the conventional magnetic-recording technique. Instead of saturated bit cells that are separated by strong hysteresis-curve flux reversals, the cartridge-tape record consists of light-write, unsaturated cells that are separated by neutral-state boundaries. The results consist of high recording densities, reduced write currents, a lower risk of write through from one overlapping section of reeled tape to the next and less expensive read/write heads.

With saturated recording, a read head is sensitive to the magnetic state of the tape not only across its gap, but also on its sides (Fig. 8). The strong magnetic fields resulting from saturated, adjacent bit cells can, therefore, influence the head output and cause read errors.

The smaller magnetic fields generated by unsaturated cells reduce this effect. Only the iron-oxide particles near the tape surface are recorded—reducing the distance between the center plane of magnetization and the head surface. Unsaturated bit pulses are more

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By eliminating the need for fast, low-inertia starts and stops, streaming-drive components can be designed for rugged, extended-life service and minimum manufacturing expense.

sharply defined and easily filtered, compared with saturated bit pulses.

The lower magnetic states created by the unsaturated recording make the recorded tape more susceptible to accidental erasure than normal tape cartridges. However, they are still more magnetically stable than floppy disks, for example. There is also, in principle, no difference in the potential shelf life of the two types of recording. At the crystal level, every magnetic domain is fully saturated in one direction or another. A so-called unsaturated state means only that a percentage of the domains still have random orientations and cancel each other in terms of flux patterns.

To ensure this random pattern and to avoid any bit-cell asymmetry or internal demagnetization effects, the streaming tape is AC-erased to a neutral state—in contrast to the saturated DC erase normally used in digital recording. Because no attempt is made to rewrite records on individual tracks, the entire tape is erased with a single broad head as the first track is recorded—further reducing head costs and simplifying streaming-drive operations.

Combined, all of these developments have made the ¼-in. cartridge streamer an effective low-cost backup for the mid-range Winchester. Streamers are being shipped in volume and have earned a secure place among the mass-storage options available to OEM designers and end users.

Yet, the technology of the ¼-in. cartridge drive is still at a threshold state in terms of performance enhancements and cost reductions. Over the next few years, higher bit-cell densities, more tracks, faster tape speeds and longer, more durable tapes will evolve—providing small-system users with added savings. ■

Tom Makmann is vice president, marketing, for Archive Corp., Costa Mesa, Calif.

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Mini digs up answers for mining consultants

A minicomputer replaces time sharing for analysis of drilling and underground storage projects

The analysis of underground rock formations is crucial to mining, drilling and storage applications. Unanticipated instabilities in a formation can quickly turn a multimillion-dollar effort into worthless rock. Serata Geomechanics, a California mining consulting firm, has found a minicomputer to be the most cost-effective way to analyze information for its clients' projects.

From time sharing to in-house mini

Serata provides some 50 clients with information on the stability of underground rock formations. Its clients include mining companies, gas exploration outfits, railways and research institutes.

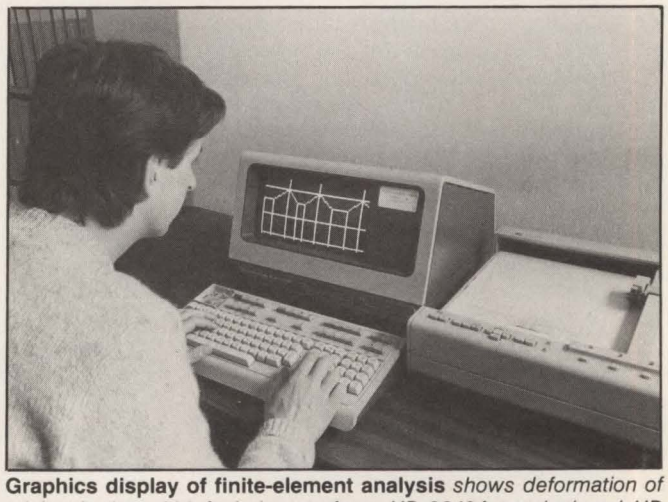
The 16-year-old company provides a complete consulting package. Serata's analysts start by taking rock samples from a proposed drilling or mining site and analyzing those samples for geological properties in their Berkeley, Calif., laboratory. They then design instruments that will provide round-the-clock data on the stress and strain of the underground rock formation at the field site. Data are fed to a Hewlett-Packard Co. 1000 F-series minicomputer, which produces an analysis of the proposed excavation layout. The analysis includes a graphic projection of how the shape of the underground cavity will change over the decades as it is subjected to the tremendous pressures under the earth.

Before installing the minicomputer, the company used an outside time-sharing service, running up a monthly computing bill of $6000. "It was extremely costly," says Serata systems analyst Jim McNamara. "This constricted the development work we could do."

The company decided to get a computer that could handle the huge amount of data and complex calculations to predict the underground forces that cause rocks to move. After considering several machines, the company selected the HP 1000 with 1M byte of main memory. The system is configured with a 120M-byte disk drive, a tape drive, a line printer, a four-color plotter and five terminals including one graphics display.

The company installed the HP 1000 in July, 1980. "The quality of our work has gone up amazingly," says McNamara. He claims that an in-house computer has allowed engineers to develop better ways to analyze and graphically represent their data. This has resulted in more complete and accurate reports for the company's clients. Their monthly computing costs, meanwhile, have dropped to $2500.

Serata analysts now use HP graphics software to manipulate their mine configuration data graphically on a CRT screen. The graphics representations are printed on the system's four-color plotter. In the short time Serata analysts have worked with their new computer, they've developed several new plotting routines. The enhanced graphics mean easier interpretation of complicated data.



Graphics display of finite-element analysis *shows deformation of mining horizon 300 ft. below surface. HP 2648A terminal and HP 1000 minicomputer have helped consultants lower computing costs and increase productivity.*

Before installing the minicomputer, the company used an outside time-sharing service, running up a monthly computing bill of $6000.

To calculate the underground forces that cause rock to change shape, the Serata analysts use a 25-year-old engineering technique—the finite-element method. With this technique, a large volume, such as a salt mine, is divided into small elements. Instead of calculating stress/strain solutions for each point in the underground continuum, the computer calculates average or approximate values for each element. "We're getting the amount of data to a level that's sufficient to indicate what's happening underground without overloading the computer's capabilities," he explains.

The computer uses these approximate values to predict such factors as stability of mine excavation and construction; soil and rock vibration; seepage of fluids through the mine; and displacement, deformation or breakage of the rock as it is subjected to pressure.

The finite-element program used by Serata was developed by company founder Dr. Shosei Serata over a period of five years. This program can be used to analyze any earth material that exhibits elastic, viscoelastic and viscoplastic behaviors (terms that describe a rock's ability to return to its original shape after being deformed by pressure).

A program developed by Dr. Robert Taylor at the University of California at Berkeley is used at Serata to analyze underground heat transfer. This information is especially important in analyzing potential storage sites for radioactive wastes.

Serata Geomechanics used this software to design an oil-storage area to be constructed in an underground salt dome as part of the Louisiana Offshore Oil Port. When put into use this year, LOOP will be the first terminal able to off-load oil directly from supertankers in the U.S. The oil will be pumped from the LOOP terminals through 19 mi. of pipeline to the Louisiana shore, then across 28 mi. of marshland to the storage depot in the Clovelly Salt Dome.

The Clovelly formation is a solid pillar of salt thrust up vertically through the earth like a chimney. While fairly stable in its natural state, a salt-storage cavern may begin to "creep" or flow once drilled. As the underground pressures break the ionic bonds that hold the sodium and chloride of the salt molecules together, the creeping salt can completely seal off access to the surface.

Although the storage facility was designed before Serata Geomechanics acquired its HP 1000, the minicomputer has handled subsequent design and analysis. Plans call for 19 caverns in the salt dome, each measuring 1000 × 190 ft. Each will store a different type of crude oil ready to be shipped by pipeline to refineries in the Midwest.

McNamara points out that large-scale analyses such as the LOOP study are greatly enhanced by the computer system. Data analysis can be easily and quickly accomplished, and engineers can develop plotting routines to enhance the computer graphics of such studies with no time or cost restrictions on the computer. ■

HOW IS ROCK LIKE A GLASS OF WATER?

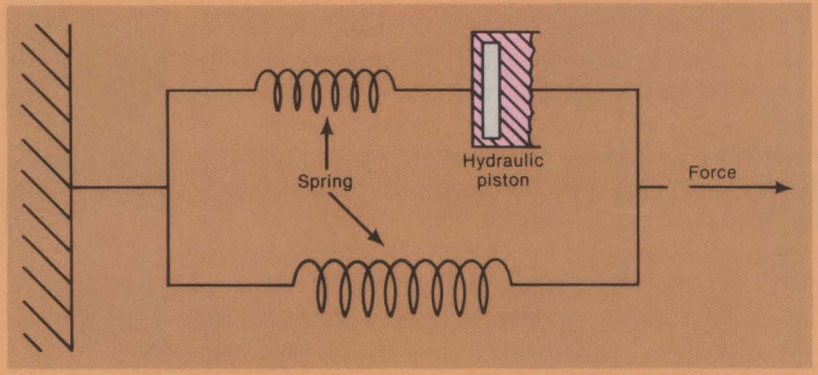
While most people think of rock as rigid, geologists and geoengineers must grapple with its fluid and elastic properties.

Rock doesn't exactly flow like water, but it does "creep." Sustained pressure over a long time can cause significant deformation in a slab of rock. Collectors of antique glass are familiar with the concept: a 100-year-old bottle is slightly thicker at the bottom than the top because the glass has flowed under the pull of gravity (and glass is a form of rock). Ice provides a more dramatic example of the rheological (fluid) properties of a seemingly brittle substance, as evidenced by the glacier-sculpted terrain of much of North America.

Rock usually exhibits a combination of rheological and elastic behavior, depending on the type of rock and the direction and duration of the forces involved. Geologists sometimes use a fluid and spring system to model the behavior of a rock formation (Figure). The analysis of such systems leads to equations that, combined with the great quantities of data involved in geoengineering, require a computer to handle.

Most of us can get by quite nicely thinking of rock as non-deformable. Ice exhibits significant creep in 14 days, and salt does the same in a year, but most minerals must be pulled at for 1000 to 10 billion years to cause anything resembling flow. Still, engineers count on these properties in their design of projects such as mines and dams, and a miscalculation can be disastrous.

—David Freedman



Model used to approximate rock motion *combines rheological (flowing) behavior of piston in fluid with elastic behavior of spring. Such models can be described in terms of first or second order, linear or nonlinear differential equations. With the aid of computers, geoengineers can sometimes use these equations to predict the behavior of complex rock formations subjected to forces in different directions.*

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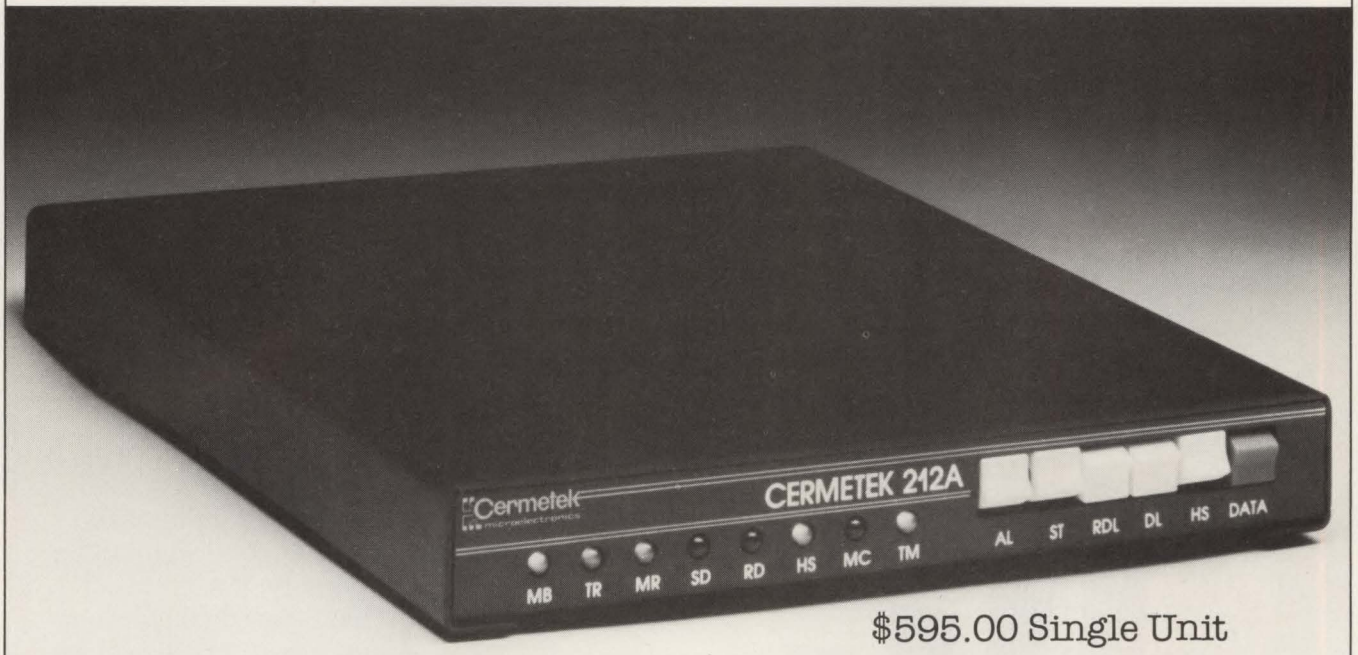

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The Cermetek 212A gives modem users the features they want:

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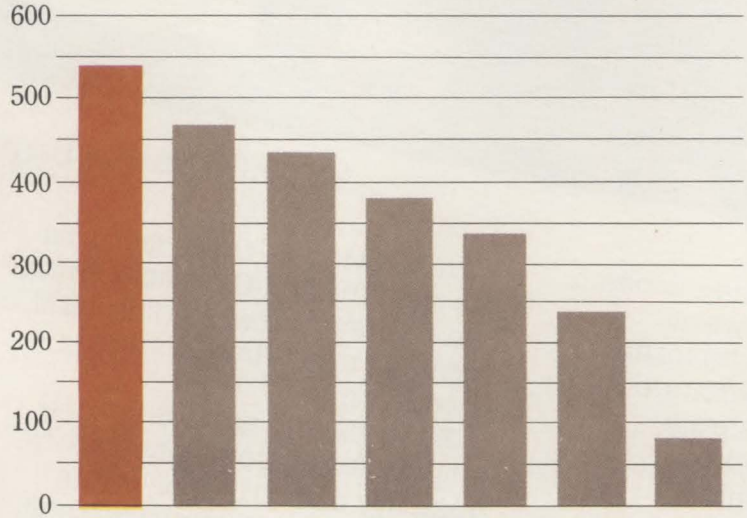

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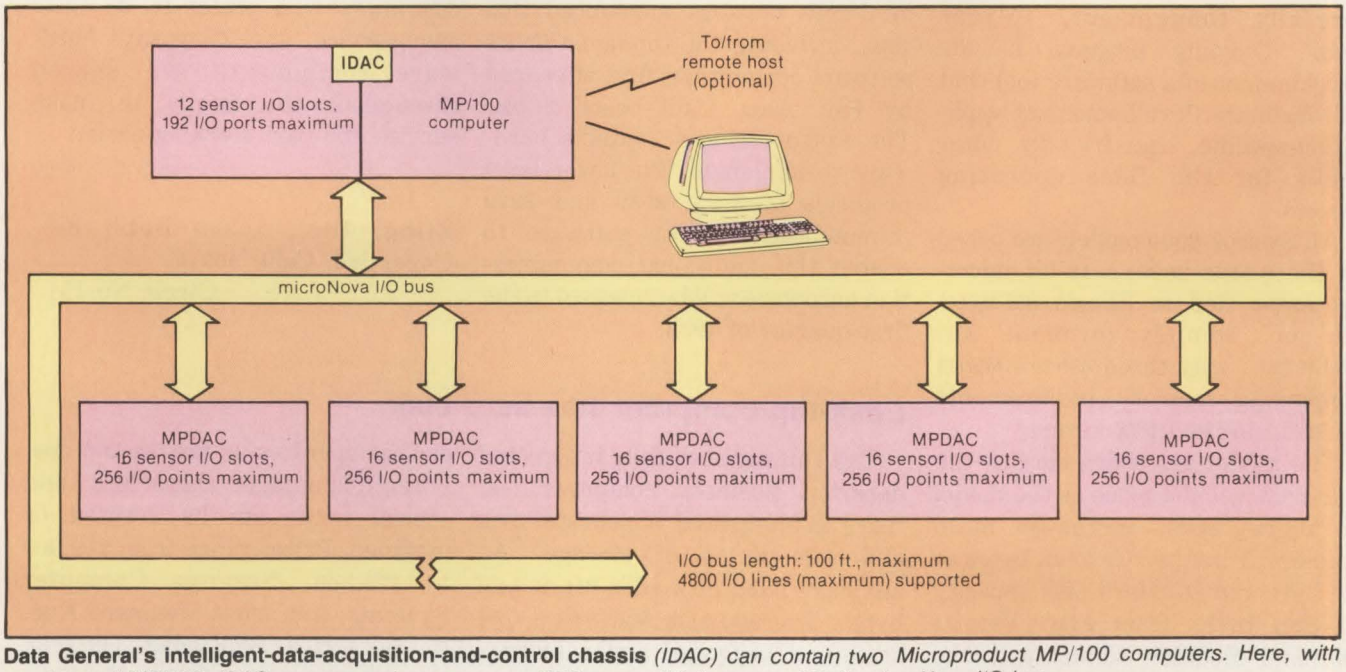
Data General adds intelligent sensor system

Data General Corp. has introduced an intelligent sensor I/O system that can be used in both stand-alone and distributed industrial-automation configurations of as many as 4800 digital and analog I/O lines. The intelligent data-acquisition-and-control (IDAC) chassis has five slots for DG's microproducts cards, including the system processing unit, as much as 64K bytes of combined RAM/EPROM, peripheral controllers and communications cards. A total of 12 additional slots are available for any combination of I/O sensor cards.

IDAC applications include environmental monitoring, numerical machine control and real-time process-control management. IDAC joins the company's data-acquisition-and-control product line, which includes the data-acquisition-and-control subsystem for Nova and Eclipse computers (NEDAC), the data-acquisition-and-control subsystem for microproducts computers (MPDAC), the sensor I/O cards and the associated components. The systems can be mounted in 19-in. racks. Each sensor card measures about 7 × 11 in.

The IDAC's system processing unit consists of the MP/100 computer using the mN602 CPU with an integral real-time clock, an asynchronous interface and a ROM-based soft console that replaces the front-panel control and data switches. The soft console connects to a system terminal over the asynchronous interface or to another system. The soft control panel, implemented in 512 words of ROM, allows a user to inspect the system's condition. Memory is available in three single-board configurations: 32K-byte RAM, 64K-byte RAM and combined 32K-byte RAM and 32K-byte EPROM. The IDAC MP/100 supports software development in Macroassembler, MP/FORTRAN, MP/BASIC or MP/Pascal under the MP/OS operating system. In I/O-intensive applications, dual CPUs can be placed in one IDAC chassis, allowing one processor to handle data acquisition while the other performs calculations or communications with a host CPU or peripheral devices.

The IDAC system, including 32K to 64K bytes of memory, but without terminal boards, is priced from $6850 to $7510. The system with one terminal board is priced at $7300 to $7600. DG is also offering two analog set-point monitors. A −5V to +5V monitor sells for $1450, and a −25-mA to +25-mA monitor sells for $1850. All products are available within 90 days after receipt of order. Set-point monitors track the state of as many as 16 analog input channels and start an interrupt request when any channel exceeds a predefined high or low limit specified by the program. **Data General Corp.**, Westboro, Mass. 01581. **Circle No 150**



Data General's intelligent-data-acquisition-and-control chassis *(IDAC) can contain two Microproduct MP/100 computers. Here, with one integral MP/100, IDAC can support as many as 4800 sensor I/O lines on a 100-ft. microNova I/O bus.*

Zilog expands its System 8000 family

Four siblings have replaced Zilog Inc.'s year-old System 8000 model 20 "supermicro," the company's initial microcomputer system offering from last year. The family of UNIX-based systems encompasses an eight- to 24-user, $13,950 to $39,000 range of hardware through which software can be moved transparently, and Zilog has added communication, expansion chassis and nine-track tape-backup options. On the software side, the Zeus operating system will be upgraded from a UNIX Version 7 to UNIX System 3 base, and a software architecture has been defined in which compilers for FORTRAN, Pascal, C and a soon-to-be-released BASIC will share a back end, calling conventions and a global code optimizer.

	System 8000 family			
	Model 10	Model 11	Model 21	Model 31
CPU slots	6	6	10	10
Maximum slots	6	6	20	20
Memory type	parity (ECC option)	parity (ECC option)	ECC	ECC
Standard memory (bytes)	256K	256K	1M	1M
Maximum memory (bytes)	1M	1M	4M	4M
Standard disk (bytes)	18M	18M	32M	80M (SMD-compatible)
Maximum disk (bytes)	36M	36M	128M	320M
Standard users	8	8	8	8
Maximum users	8	8	24	24
Backup	1M-byte floppy	17M-byte tape cartridge	tape cartridge	tape cartridge
9-track	N/A	N/A	optional	optional
Intelligent communications processor	optional	optional	optional	optional
Price	$13,950	$16,950	$29,950	$36,000 to $39,000
Available	November	September	September	November

Zilog's Series 8000 models 10 and 21 *use different pedestal enclosures and feature different main and auxiliary memory capacities. Both use the 6-MHz Z8001A 16-bit processor.*

"We are taking a computer-science approach to the software," says Rolando Esteverena, vice president of Zilog's General Systems division. "We have an elegant, carefully thought-out, 10-year plan." Ongoing projects include development of a software tool that will facilitate development of application-specific, user-friendly outer shells for the Zeus operating system.

All System 8000 models are based on the 6-MHz Z8001A 16-bit microprocessor tied to Zilog's 8M-byte-per-sec. semi-synchronous ZBI 32-bit bus, with three Z8010A MMUs supporting memory requirements inherent in the UNIX kernel.

The model 21, which carries the same $29,950 list price as the model 20 it replaces, increases main memory from the 20's 256K bytes to 1M byte and standard disk capacity to 32M bytes from 24M. The 21 shares a modular cabinet with the 31, while the 10 and 11 share a smaller 26-in.-high cabinet.

The intelligent-communication-processor option is a single-board, Z8000-based controller that implements all layers of Zilog's ZNET2 local-area network announced this year, including the top-layer UNET software conventions first advanced by Palo Alto, Calif.-based 3COM. The $3950 ICP also contains hardware to implement the lower level protocols of X.25, 2780 and 3270 communications. The software to enable this additional communication hardware will be released in the first quarter of 1983.

Service for the System 8000 family is available from Zilog or on a contract basis with a third-party service organization. Training and spares kits are available for customers who prefer to do their own service, and Zilog says hardware components are shared throughout the family to make service and part stocking easier.

—Kevin Strehlo

Zilog, Inc., 10340 Bubb Rd., Cupertino, Calif. 95014.

Circle No 151

Desk-top computer has hard disk

The Durango 900 fully integrated desk-top business computer features an integrated Winchester disk and 15M bytes of storage. An auxiliary fixed disk adds 7M or 14M bytes. The 900 also features a CRT screen, a keyboard and a bidirectional, dual-mode, dot-matrix printer that operates as fast as 200 cps. Foreign-language characters and special fonts can be created or modified. Prices range from $19,900 to $24,500. **Norango Computer Systems, Inc.,** 2025 Sheppard Ave. E., Suite 2203, Willowdale, Ontario, Canada M2J 1V7. **Circle No 152**

OEM EUROPE MEETS AT THE INVITATIONAL COMPUTER CONFERENCES

Seminars on the newest product technology—and "hands-on" displays of the latest computer and peripheral equipment for the quantity buyer are available to European OEMs at the Invitational Computer Conferences.

In Amsterdam, Milan and Munich this October, decision makers will meet manufacturers for "one-day-only" intensive coverage of mini/micro computers, disk drives, CRTs, tape drives, printers, interfaces, controllers, graphic display systems and other equipment. These international conferences are tailored exclusively to meet the requirements of the European OEM—regional locations are selected so extensive travel is not required; the seminars and displays are focused in purpose so there is no sorting through mountains of useless data; and the conferences are limited in size so in-depth coverage can be made in a single day.

Some of the companies displaying products in last year's series were: AED, Century Data Systems, Cipher Data, Data Electronics, Inc., Dataram, Fujitsu, Genisco Computers, Hewlett-Packard, Kennedy Co., Micromation, Inc., Micropolis, Micro Peripherals, Inc., National Semiconductor, Pertec, Priam, Printronix and Remex.

Plan to attend the conference nearest your area. Invitations are available (without charge) from participating companies or from the ICC sponsor. For further information contact:

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82/83 Schedule	Frankfurt	March 1983
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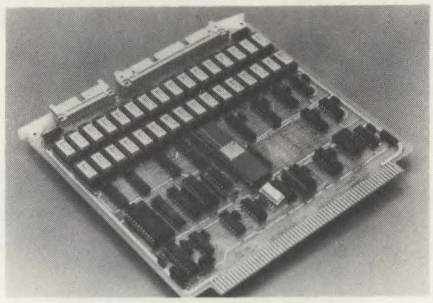
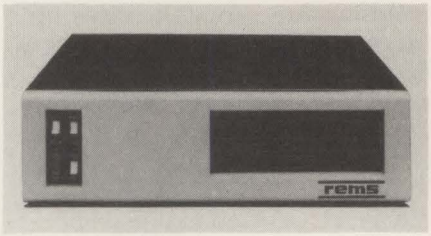
Invitational Computer Conferences

CIRCLE NO. 78 ON INQUIRY CARD

System upgrades Z80-based devices



The Z8000 dual-processor system upgrade provides Zilog's 8-bit Z80-based microcomputer systems with 16-bit power. It includes a Z8000 microprocessor board with a Z8001 CPU running at 6 MHz, 256K bytes of RAM and a set of Z8000-based software development tools comprised of a screen editor, a high-level assembly language, a symbolic debugger, a Z80-to-Z8000 translator and interface software between the Z80 and Z8000. The upgrade is priced at $1495; an upgrade-enhanced PDS 8000 system is $8500. **Zilog, Inc.,** 1315 Dell Ave., Campbell, Calif. 95008. **Circle No 153**

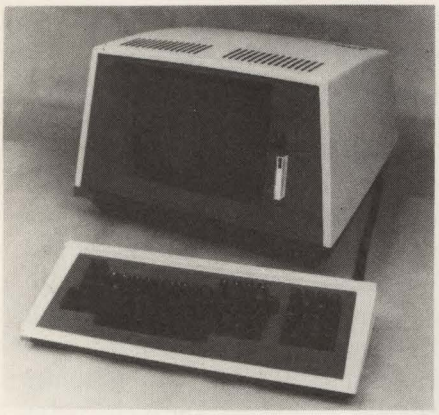


Systems offer DEC compatibility

The Flexibles series of computer systems uses DEC LSI 11/23 and LSI 11/23 Plus processors. The low-end 11/23 offers 256K bytes of RAM and two 1.2M-byte, 8-in. floppies. The high-end 160 offers 1M byte of RAM, 22-bit addressing, 160M-byte disk drives with 160M-byte backup and a 132-column CRT terminal with a separate keyboard. Chassis designs feature eight dual-slot backplanes, four expandable serial ports and top or front access. Operating systems include RT-11, TSX-Plus, RX-11 M and UNIX. Prices range from $10,250 to $48,695. **REMS Systems and Technology,** 2215 29th St., S.E., Building C-1, Grand Rapids, Mich. 49508. **Circle No 154**

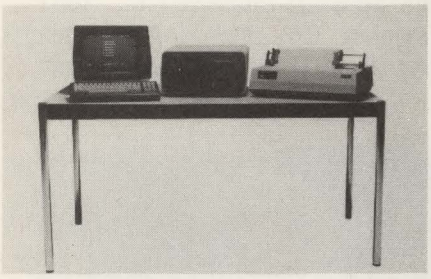
Desk-top microcomputer stores 1M byte

The IST 86 desk-top microcomputer system features 128K bytes of error-correcting memory, expandable to 1M byte. The multi-user system consists of a 16-bit main job processor, a 16-bit I/O processor, a 15-in., high-resolution CRT screen, a detachable keyboard, a 10M-byte hard disk, a tape-cartridge drive and six serial ports. Available



programming languages include COBOL, FORTRAN, BASIC, PL/1 and Pascal. The standard IST 86 is priced at $12,950 in single-unit quantities, with OEM discounts available. **Interactive Systems Technology,** 5259 N. Tacoma Ave., Suite 11, Indianapolis, Ind. 46220.

Circle No 155



16-bit work stations have four or nine slots

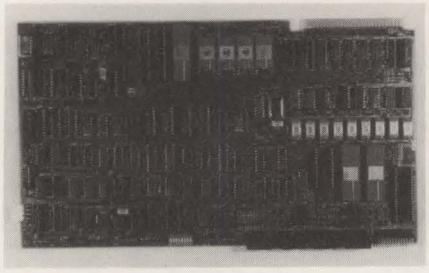
The Workstation I family of modular 16-bit desk-top work stations range from an enclosure, chassis and power-supply configuration to a complete development system. Configuration flexibility is based on four- or nine-slot chassis, to which OEMs can add floppy-/Winchester-disk controllers for as many as four 1M-byte floppies, or two floppies and two 10M-byte Winchesters and multi-channel asynchronous controllers to support terminals or printers. Peripherals can be added through standard interfaces. Single-quantity prices range from $1565 to $13,660. **Computer Automation, Inc., Naked Mini Division,** 18651 Von Karman, Irvine, Calif. 92713.

Circle No 156

Systems

Desk-top systems offer three languages

Models 9826A and 9836A desk-top computers offer a choice of BASIC, HPL and Pascal programming languages. The systems are based on an MC68000 microcomputer chip interfaced to a 100-pin memory and I/O bus, and feature keyboards with 10 user-definable soft keys, IEEE interfaces, real-time clocks, programmable beepers and graphics displays. Standard ASCII-character and foreign sets are available. The 9800 backplane has eight user-accessible slots for interface cards and memory. Model 9826A, with a 5¼-in., 264K-byte floppy-disk drive, sells for $8950 in single-unit quantities. The larger screen, double-capacity model 9836A is $11,950. OEM discounts are available. **Hewlett-Packard Co.,** 3400 E. Harmony Rd., Fort Collins, Colo. 80525. **Circle No 157**



Single-card micro includes Z80A

The DSTD-764 high-performance single-card microcomputer fits in an 8-in. floppy-disk drive envelope. The microcomputer includes a Z80A microprocessor, an RS422 channel, three RS232C channels, two 8-bit parallel I/O ports, a floppy-disk controller with DMA, a hard-disk host adapter, 64K bytes of RAM with parity and a parallel port to interface to a video display controller daughter board. Single-unit price is $950, with discounts on orders of 10 or more. **DY-4 Systems, Inc.,** 888 Lady Ellen Place, Ottawa, Ontario, Canada K1Z 5M1. **Circle No 158**

Hazeltine unveils two terminals

Hazeltine Corp.'s Executive 10 and the Esprit II display terminals address the middle and low ends of the terminal market, respectively.

The Executive 10, for data entry/inquiry and software development, provides eight programmable function keys, a programmable 25th status line, editing features, a 7 × 10 dot-matrix display, a split-screen display and a business graphics character set. The unit also features a detached keyboard and a tilt-and-swivel screen that displays 80 characters × 24 lines in an 8½- × 6-in. viewing area.

Display attributes include high/low intensity, blink, blank and reverse video. A user-selectable cursor is either a box or a blinking underline.

The Esprit II economy terminal has a 12-in. diagonal non-glare CRT screen. Its editing capabilities include character and line insert/delete and local print. A bidirectional auxiliary port for hard-copy or data-recording devices with local-print operation is included.

The Esprit II is compatible with the Hazeltine 1500 and emulates the ADDS Regent 25 and Lear Siegler ADM-3A. End-user price is $645. The Executive 10 smart terminal is priced at $1195. Volume discounts are available.

Hazeltine Corp., Commack, N.Y. 11725. **Circle No 159**

The Executive 10, *aimed at the middle range of the terminal market, is one of two terminals introduced by Hazeltine Corp.*

Qume unveils half-high minifloppy, enhances printer line

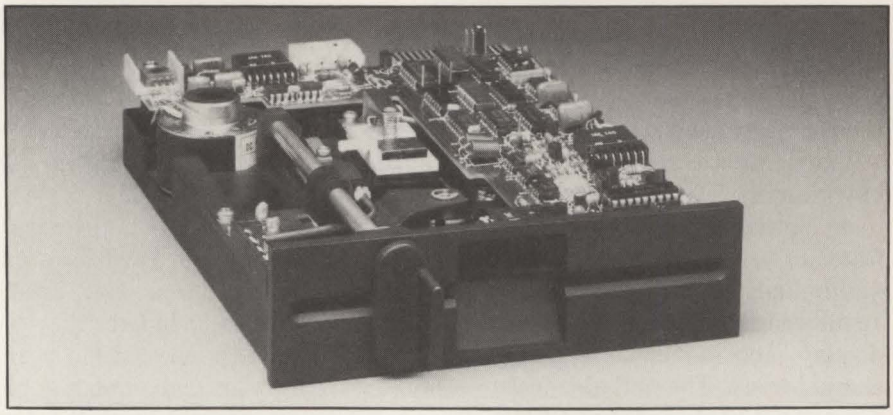
ITT subsidiary, Qume Corp., San Jose, Calif., has unveiled its first in-house-designed disk drive—a half-high, 5¼-in. floppy-disk drive priced 30 percent less than standard-height 5¼-in. products with comparable capacities. At the same time, the company announced additions to its Sprint 8, 10 and 11 daisy-wheel printer families.

Qume's Qumetrak 142 is a double-sided, 48-tpi, half-height, 5¼-in. floppy drive with an access time of 12 msec. that provides as much as 500K bytes of storage. Like other half-high minifloppies from Tandon Corp. or Alps Electric Co., for example, the 142 is designed to provide builders of desk-top computer systems a way to increase storage capacity without retooling the system chassis. Qume is aiming the 142 at the small-business-system and word-processor markets, say company officials.

The 142 will be manufactured at the company's San Jose, Puerto Rico and newly established Taiwan facilities. The company entered the floppy-disk-drive market in 1978 by licensing an 8-in. drive design from Japan's YE Data Corp. Qume executive vice president Stephen Bowling indicates that the two firms will work together on a half-height, 8-in. drive in the near future. In the case of the 5¼-in. drive, however, YE may license the Qume hardware.

Evaluation units of the 142 will be delivered this month, and production quantities are due in the third quarter. Bowling expects large-volume OEM prices for the drive to be less than $150 each.

Besides adding the Qumetrak 142 to its storage product line, the company broadened its line of daisy-wheel printers with 35-, 40- and 50-cps, 96- and 130-character models.



The Qumetrak 142 *offers as much as 500K bytes of storage on double-sided, 5¼-in. floppy-disk drives.*

Qume's new daisy-wheel printers *are available in print speeds from 35 to 50 cps and with 96- or 130-character print wheels.*

To the Sprint 8 and 10 families, Qume added the 8/35 and 10/35, both 35-cps devices. The 8/50 and 10/50 are 50-cps printers aimed at high-volume applications. All models use a standard 96-character print wheel.

For applications calling for special character sets, such as those required for scientific or engineering applications or for foreign-language output, Qume's 8/40-130 and 10/40-130 feature the company's new 130-character daisy wheels. Text is printed at 40 cps. Wide-carriage models are available as well. The new models are being delivered now, the company says. OEM prices start at $1695.

Like the 8 and 10 lines, Sprint 11 devices have been enhanced with 35- and 50-cps, 96-character devices; a 40-cps, 130-character printer; and a wide-carriage model. Prices for a Sprint 11 start at $1776 each. *—Larry Lettieri*

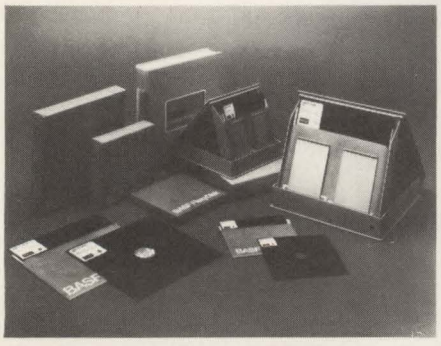
Qume Corp., 2350 Qume Dr., San Jose, Calif. 95131. **Circle No 160**

DEC-compatible Winchester is fixed/removable

The RLX3010 LSI-11-compatible storage system backs up an 8-in., 31.2M-byte fixed Winchester with an 8-in., 10.4M-byte removable-cartridge Winchester. Each disk is mounted on its own spindle and operates independently. Transfer rates for the fixed and removable drives are 540K and 847K bps, respectively. Average access time is 60 msec. An optional built-in Q-bus backplane allows the entire system to be packaged in a 7-in. enclosure. Price is $9800 in 10-unit quantities. **Charles River Data Systems, Inc.,** 4 Tech Circle, Natick, Mass. 01760. **Circle No 161**

Winchester adds 11.3M bytes to Apple II

The Gallium 10 Winchester-disk subsystem gives an Apple II computer 11.3M bytes of formatted storage. The system, which is compatible with DOS 3.3, Pascal and CP/M operating systems, offers an average access time of 3 msec. and a data-transfer rate of 5M bps. The unit's controller drives as many as four disks. A Gallium 10 system with one 11M-byte disk sells for $2495. Each additional disk is priced at $1200. **XitenSystems,** 16815 Hawthorne Blvd., Lawndale, Calif. 90260. **Circle No 162**



Quad-density diskettes certified error-free

The FlexiDisks line of quad-density diskettes, individually certified as error-free for all double-density, 96-tpi applications, are available in all sector designs as well as in single- and double-sided models. They are packaged in soft box, plastic library box or bulk configurations. Price is $2.50 to $4 each, depending on packaging and number of recording sides. **BASF Systems Corp.,** Crosby Dr., Bedford, Mass. 01730. **Circle No 163**

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Computer Systems News Editorial

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Computer Systems News Report

Ron Audet, OEM Division manager at NCR Corp., agreed that the show was worthwhile. "We have had literally hundreds of inquiries...from some very qualified people.

"As far as we're concerned, the show has been very successful. I don't think I've ever seen one that has been quite so productive for us or the people that have been attending."

Computer Systems News Editorial

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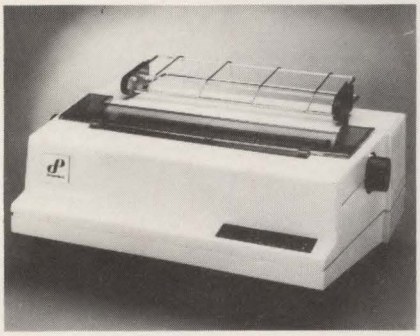
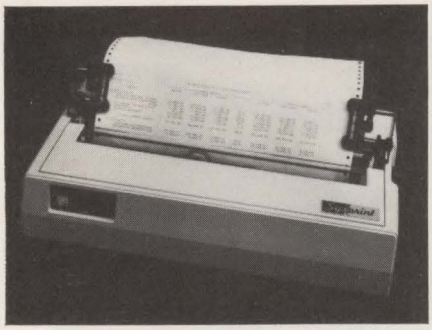


Printer accepts plastic, metal wheels

The 55-cps model DP-55 and the 35-cps model DP-35 letter-quality, daisy-wheel printers accept metal or plastic print wheels and offer digital status displays, 120-dpi horizontal resolution and 10, 12 or 15-cpi proportional character spacing. Vertical resolution is 48 dpi, and line spacing is 6 or 8 lpi. A control panel displays 16 printer conditions, and an operator can select more than 20 printing parameters. RS232C interfaces and interfaces with Qume, Diablo, Centronics and other printer characteristics are available. Memory is expandable to 12K bytes of PROM and 1K to 3K bytes of RAM, enabling users to customize parameters. In OEM quantities, the DP-55 sells for $1400, and the DP-35 sells for $1200. **Dataproducts Corp.,** 6200 Canoga Ave., Woodland Hills, Calif. 91365.

Circle No 164



Printers work with Datapoint computers

The Sysprint serial/parallel dot-matrix printers for Datapoint computers offer 120- or 200-cps speed, (depending on model) and bidirectional short-line-seeking operation. A nine-pin print head produces 9 × 9 dot-matrix characters including the 96-character ASCII set and 64 block shapes for graphics. The units offer double-width and condensed spacing and handle a variety of paper forms. Six models are available: three for RS232C and three for Datapoint parallel data signals. Serial unit prices range from $995 to $1850; parallel unit prices from $1190 to $2050. **DP-TEK, Inc.,** P.O. Box 2411, Wichita, Kan. 67201.

Circle No 165

Evaluation Report
Computer Memories 5¼" Winchester

PERFORMANCE	EXCELLENT
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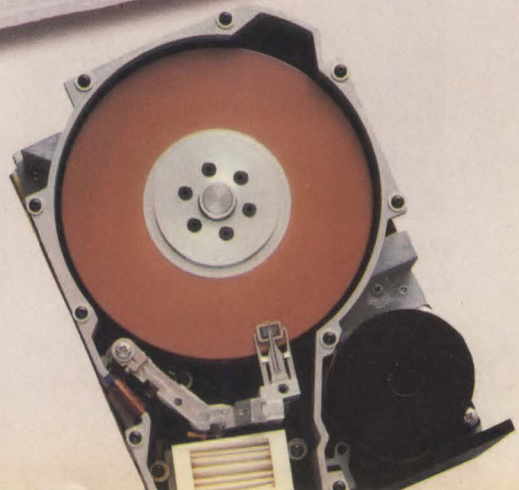

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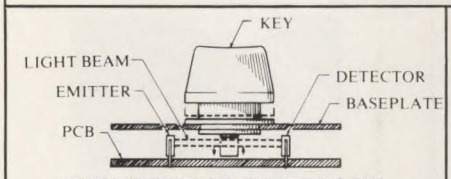

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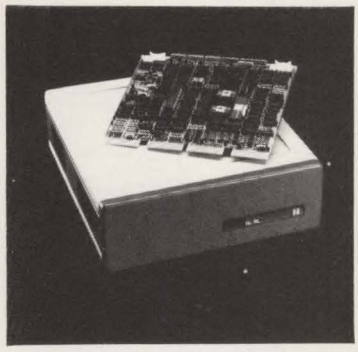

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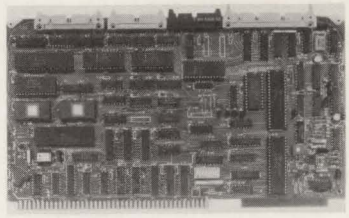

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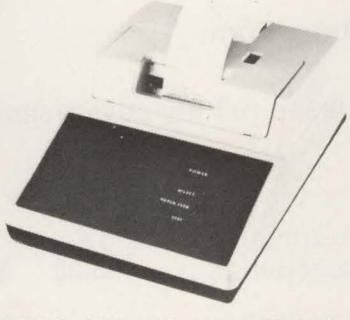

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Featuring an Apple II®-compatible parallel interface, Addmaster Corporation has produced a new dot matrix printer, Model 170. The interface includes a Centronics-type handshake and DB-25 interface connector, Baudot, and day — and time clock. The Model 170 provides 18 or 21 characters per line, 6 lines per inch print density, on standard 2½" adding machine tape. Designed to use with personal computers, Model 170 will produce hard and carbonless copies of programs, data or results. **Write Addmaster Corporation, 416 Junipero Serra Dr., San Gabriel, CA 91776 or call 213/285-1121.**

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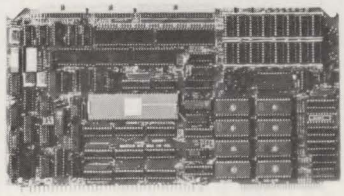

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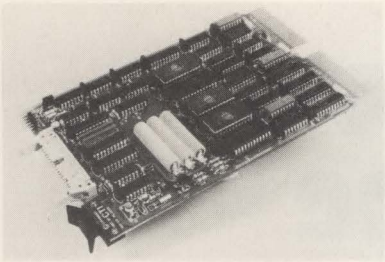

LSI-11 "Q-TIMER" SYSTEM MODULE

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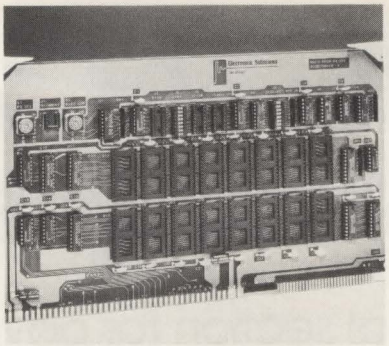

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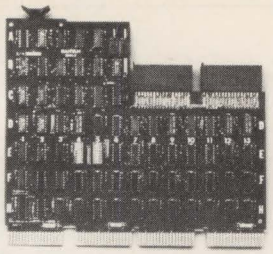

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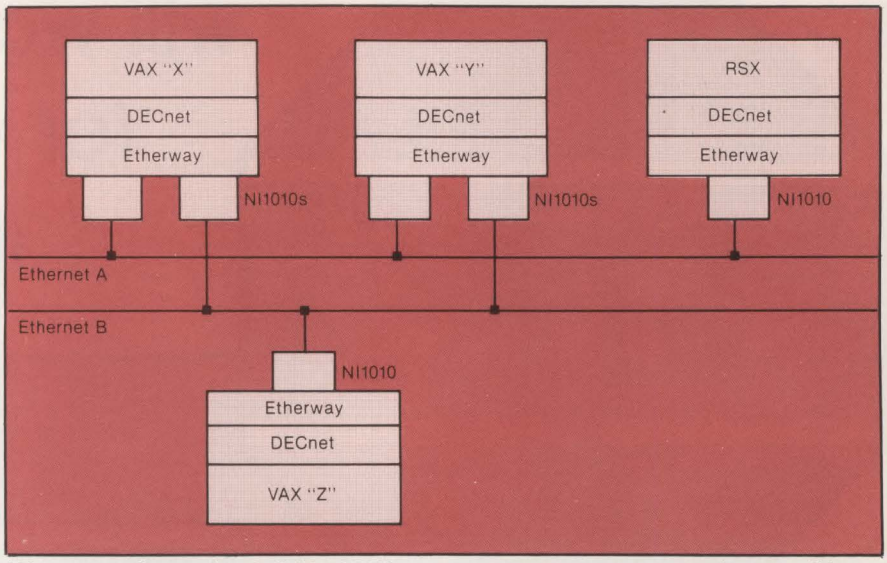
Interlan to add Ethernet to DECnet before DEC

Less than a month after Digital Equipment Corp. announced that its Phase IV DECnet products would include support for the Ethernet local-area network (MMS, July, p. 58), Interlan, Inc., Chelmsford, Mass., unveiled its own product designed to let Ethernet run on DECnet systems. With shipments of Interlan's Etherway software scheduled to begin this month, the year-old manufacturer of Ethernet communications controllers should beat DEC's Ethernet/DECnet products to market by six to 12 months.

Developed for Interlan by Technology Concepts Inc., a communications consulting and engineering firm in Sudbury, Mass., the Etherway software is designed for operation with Interlan's controllers. At the time Etherway was announced, Interlan also introduced its second-generation Ethernet controllers, which follow the first-generation products by only six months.

Coupling the higher level DECnet protocols to the low-level Ethernet protocols, Etherway will enable each DECnet node to support multiple Ethernet controllers and, therefore, multiple Ethernet networks. With multiple Ethernet networks linking the DECnet nodes, heavy traffic loads can be divided among the networks, and backup data routes are available if one Ethernet network fails.

Etherway will also simultaneously support DECnet and non-DECnet application programs, without affecting the standard DECnet operation. Two Etherway products will be available, supporting either VMS or RSX network software. In quantities of one to five, Etherway/VMS will sell for $3500 each, and Etherway/RSX will sell for $2500. A one-year extended warranty will be available for $1000 per year.



Etherway software *lets individual DECnet computers connect to more than one Ethernet local-area network. The NI1010s are Interlan's Unibus-to-Ethernet controllers. Etherway was developed by Technology Concepts Inc. and is distributed exclusively by Interlan, Inc.*

Interlan's second-generation controllers, the A-Series, reportedly offer 30 percent greater throughput, require 30 percent less power and are priced more than 40 percent less than the company's first products. The NI1010A Unibus, NI2010A Q-bus and NI3010A Multibus controllers all incorporate the new NM10A Ethernet protocol module.

Like its predecessor, the NM10, the NM10A contains all the data communications logic to interface computer systems to Ethernet. While the NM10 used two separate data paths for transmitted and received data, the NM10A incorporates one shared path. This structural change, combined with lower priced components, reduces cost while increasing performance.

The NM10A carries 14.5K bytes of receive FIFO buffering and 1.5 bytes of transmit FIFO buffering, features self-test and loop diagnostics and collects various network operating statistics.

Available this month, the NM10A sells for $1290 in single-unit quantities. Also in single quantity, the NI101A sells for $3190, the NI2010A sells for $2290, and the NI3010A sells for $1890. For orders exceeding 500 units, a discount schedule reduces these prices by as much as 48 percent. **Interlan, Inc.,** 160 Turnpike Rd., Chelmsford, Mass. 01824.

Circle No 166

Intelligent controller supports eight channels

The MCS-1062 intelligent Multibus serial controller features eight independent channels with programmable data rates as high as 38.4K bps. Several field-interchangeable modules offer selectable RS232, RS422 (two- or four-wire), optical current-loop or customized electrical interfaces. The unit's Intel 8088 CPU accesses 48K bytes of EPROM and 128K bytes of RAM. Handshake architecture

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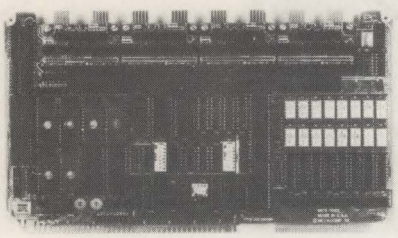
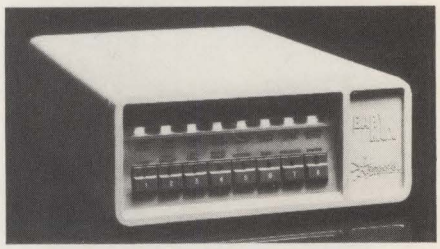


includes a channel-attention register, channel-completion interrupts and 64K bytes of dual-port RAM. The unit supports 20-bit addressing and 8- or 16-bit system operations. The MC-1062, with RS232 modules for eight channels, sells for $1485 in quantities of 50. **Metacomp, Inc.,** 7290 Engineer Rd., #F, San Diego, Calif. 92111. **Circle No 167**



Statistical multiplexer can be user-upgraded

The Babymux statistical multiplexer operates transparently to a computer, a terminal and a user, and can be upgraded by the user from a two-port unit to one with five or eight lines. A DMA interface supports the composite line, enabling the line to operate at 19.2K bps synchronously or 9600 bps asynchronously. Each terminal and its corresponding port can be set to different baud rates. The unit, designed for unattended operation, features automatic startup, configuration-retention during power-off and diagnostics. The two-port unit with options sells for $1350; each three-port expander kit is $475. Quantity pricing is available. **Network Products, Inc.,** Progress Center, Research Triangle Park, N.C. 27709. **Circle No 168**

Random access modems use AC power lines

The RAM-11 and RAM-22 random-access modems transmit digital information over AC power lines in synchronous or asynchronous mode using as many as five 9.6K-bps full-duplex channels. The units include RS232 or 449 interfaces and

support point-to-point and multi-drop capabilities. Three configurations are available, including a stand-alone version, a rack-mounted PC card and an OEM PC board. In single-unit quantities, the RAM-11 asynchronous modem sells for $875, and the RAM-22 synchronous modem sells for $985. **Data-Control Systems,** Commerce Dr., Danbury, Conn. 06810. **Circle No 169**

Bell 212-compatible modem uses 10 ICs

The microprocessor-based, Bell 212-compatible Micro Link 1200 modem features 10 ICs and operates at 1200 bps (120 cps) in full duplex over standard phone lines. The unit connects via an RJ11C jack, and interfaces to a computer or terminal via an RS232C interface. Operation is manual originate/manual answer. Other features include analog loopback self-test, and front-panel LED indicators for power on, carrier detect, self-test, send data and receive data. The modem, including phone-line cable and power supply, sells for $449, in single-unit quantities. **U.S. Robotics, Inc.,** 203 N. Wabash, Suite 1718, Chicago, Ill. 60601. **Circle No 170**

Direct-connect modem connects to Osborne 1

The Microconnection modem connects to the Osborne 1 computer, interfacing it with public telephone networks to access other computers and systems. The Bell 103-compatible modem operates in both the originate and answer modes at 300

bps. Microlink or other standard CP/M software can be used. A voice-grade cassette recorder can be plugged into the modem, which transcribes on-line communications for playback. Single-quantity price is $159. **Microperipheral Corp.,** 2643 151st Place N.E., Redmond, Wash. 98052. **Circle No 171**

Utility converts MICOS data to BITS

This package is said to perform about 80 percent of the work needed to convert files written with DG Nova and Eclipse computers under the MICOS operating system to run under the BITS operating system. The menu-driven software, which reads MICOS disks and translates data into BITS format, is intended for end users who do not have extensive knowledge of operating systems or application software. The package sells for $2500. **Executive Automated Systems, Inc.,** 1919 Veteran's Memorial Blvd., Kenner, La. 70062. **Circle No** 172

Package provides WP for HP-85

Super Scribe provides word processing for the HP-85 computer, with single-key access to editing functions such as cursor positioning, insertion and deletion, block movement, phrase searching and underlining. Formatting commands facilitate changing and justification of margins, tabbing, indentation, centering, spacing and page numbering. Documents can be printed on the built-in printer or any other serial printer as wide as 132 columns at speeds as high as 120 characters per sec. Introductory price is $595. **Applied Microcomputer Systems,** P.O. Box 150, Silver Lake, N.H. 03875. **Circle No** 173

Package processes graphics for Apple II Plus

The Graphics Processing System (GPS) creates, manipulates and edits graphics just as a word processor works with text. Features include a grid for scaling and dimensioning, six primary colors that can be mixed, zoom, 2D rotation, text manipulation, overlays that can be printed in different colors and selective erasure of images. The standard version, at $59.95, works

with Apple-compatible paddles or joysticks; the "professional" versions at $99.95, also works with a digitizing tablet, a light pen and plotters. **Stoneware, Inc.,** 50 Belvedere St., San Rafael, Calif. 94901.

Circle No 174

CP/M utilities handle housekeeping chores

CP/M Power, a set of 45 housekeeping programs runs on microcomputers under the CP/M operating system. Features include selection, deletion and transfer of files and execution of programs by number from a screen menu; restoral of accidentally erased files; and salvaging of disks with bad sectors. Disks can be changed at will and switched between densities. Monitor commands read and write to selected tracks or sectors from anywhere in memory; programs can be loaded at any location. Price is $149. **Computing!,** 2519 Greenwich St., San Francisco, Calif. 94123.

Circle No 175

CP/M simulator creates virtual floppy disks

The Bridge CP/M simulator for DEC computers runs on the VAX-11 series under the VMS and UNIX operating systems. The package builds a 64K CP/M environment on the VAX, and allows user application programs to execute just as they would on a microcomputer, with files stored on VAX disks. Utilities are included for reading and writing CP/M diskettes on RX01 and RX02 floppy-disk drives, and for transferring CP/M files to or from the VMS or UNIX file system. **Virtual Microsystems,** 2409 Telegraph Ave., Berkeley, Calif. 94704.

Circle No 176

COBOL generator runs on four-phase computers

HIBOL, running on Four Phase Series IV and IBM 370 computers, includes a high-level language and a data dictionary. A typical 60-statement HIBOL program is said to produce 1200 lines of COBOL and documentation. On-line programs can include menus, file maintenance and inquiries; batch programs can process multiple files with sort, merge, update and subtotal functions, and produce multiple reports. COBOL statements can be inserted into generated programs. An OS version sells for $13,500; a DOS version sells for $9500. **Delphi Data Systems Inc.,** 9905 Hamilton Rd., Eden Prairie, Minn. 55344.

Circle No 177

Word processing uses English-like commands

Word Right, running on microcomputers under the CP/M operating system, uses English-like commands. The user controls page length, characters per inch, lines per inch, left-margin setting, line length and top and bottom margins, with heading and footing lines. The package prints any page, or from any page to end of text, using proportional spacing, and merges text with mailing lists. Tab functions include left or right flush, decimal-point alignment and center tab. The user can replace accidentally erased words or phrases. **SSG,** 5204 Claremont Ave., Oakland, Calif. 94618.

Circle No 178

Debugging tool is aimed at OEMs

MACDBG-RT, intended to simplify debugging of PROM-based applications, works with programs written in Macro-11 for LSI-11/2, LSI-11/23 and SBC-11/21 Falcon microcomputers. The package, aimed at OEMs and high-volume end users, runs under the RT-11 operating system on a PDP-11 computer used as a development system. Application software is down-loaded to the target system; then MACDBG-RT controls its execution and debugs it. The user-installable package sells for $750. **Digital Equipment Corp.,** 146 Main St., Maynard, Mass. 01754.

Circle No 179

Multi-user system runs on DEC machines

The MicroMAGIC multi-user software-development system for 8- and 16-bit microprocessors runs on dec pdp-11 (under the RSX-11 operating system) and VAX-11 computers. Targets include the DEC LSI-11 and SBC-11/21 Falcon, Intel 8086 and Motorola 6809 and 68000. Written in the high-level RTL/2 language, the package consists of a compiler, cross assemblers, a linker, a down-line loader, debugging facilities and a ROMable real-time multitasking executive for the target microprocessor. The package has been sold in Europe for more than two years. Introductory price is $7500. **Intelligent Industrial Systems, Inc.,** One Harmon Plaza, Secaucus, N.J. 07094.

Circle No 180

Executive for C resides in memory

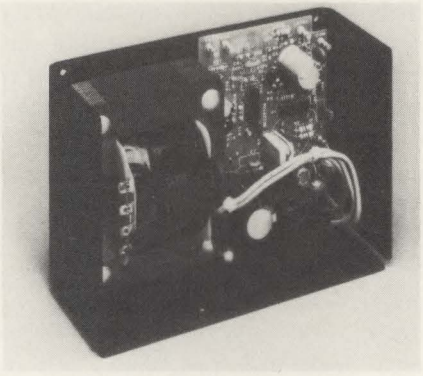
The C Executive resides entirely in main memory, supporting concurrent execution of multiple C-language programs on LSI-11, MC68000, Intel 8080/8085 and Zilog Z80 processors. Features include input/output facilities for terminals, permitting terminal characteristics to be defined dynamically; an intertask communication facility similar to mailboxes and message exchanges in some operating systems; a general-purpose locking/unlocking mechanism to coordinate resources; and procedures for linking application programs and interfacing user programs to the Executive. Prices range from $20 in quantities of 500 or more to $300 in single-unit quantities. **JMI Software Consultants, Inc.,** 1422 Easton Rd., Roslyn, Pa. 19001.

Circle No 181

Rotary UPS support DEC computers

The RUPS rotary, uninterruptible power system for DEC PDP-11/34, 11/44, 11/70, VAX/750, 780, 782 and DECSystems 10 and 20 combines a brushless, synchronous motor generator with an optional off-line square-wave inverter and battery pack. The motor generator features 100-percent load isolation, voltage regulation to 1 percent, frequency regulation to 0 percent, power-factor correction, 80- to 90-percent efficiency at full and partial loads and 30-percent brownout protection. After a failure, commercial power is automatically routed back to the motor generator, and batteries are recharged. Prices start at $35,000. **Computer Power Products,** 2900 E. Olympic Blvd., Los Angeles, Calif. 90023.

Circle No 182



Floppy-disk supply has dual outputs

The FD-323 5¼-in. floppy-disk power supply has dual outputs of +5V at 2A and +12V at 4A. The unit powers four disk drives simultaneously with automatic current-limiting foldback and reverse voltage protection on all outputs. Features include a dual input of 115V/230V AC ±10 percent (47 to 440 Hz) with line and load regulation of ±0.1 percent. Price is $61 in quantities of 250. **Elpac Power Systems,** 3131 S. Standard Ave., Santa Ana, Calif. 92705.

Circle No 183

Power supply includes Molex output connector

The CP-340 minifloppy power supply includes conventional solder output terminals and a Molex output connector. The device supplies 5V DC at 0.5A, 0.7A peak, and 12V DC at 0.9A, 1.8A peak. It sells for $44.95 in orders of one to nine and $35.95 in quantities of 100. **Cougar** DC Power Supply Co., 2111 Barnett St., Oxnard, Calif. 93033.

Circle No 184

UPS offers optional diagnostics

The Series 2000 uninterruptible power system uses a digitally

synthesized waveform and independent LEDs for circuit-breaker status, power-circuit status, rectifier and inverter switching and self-test capability. Microprocessor diagnostics are optional. Models range in one-phase ratings from 10 to 30 kW and in three-phase ratings from 15 to 45 kW. Single-unit prices range from $17,500 to $50,000. **Exide Electronics,** 2 Penn Center Plaza, Philadelphia, Pa. 19102.

Circle No 185

Mobile power system is self-contained

The OmniBus self-contained, rollabout system for computer-room power distribution and power-line noise attenuation can be plussed into the facility power source. The unit provides circuits, circuit breakers and outlets to match individual components that are plugged into it. The mobile power center provides 100 dB of common-mode noise attentuation and a minimum of 60 dB attenuation of transverse-mode noise. Power ratings range from 10 to 30 kVA, and prices range from $5530 to $7125, with quantity discounts available. **Topaz, Inc.,** DPP Division, 3857 Ruffin Rd., San Diego, Calif. 92123. **Circle No 186**

2-kVA system provides uninterruptible power

The 2-kVA ContinuAC single-phase, uninterruptible power system isolates smaller loads from aberrations on an incoming AC power line. The free-standing or rack-mounted 400-lb., 40- × 17- × 15-in. unit includes a switch that ensures "no-break" transfers in the event of output overload or inverter failure. The unit also features a digitally metered performance-monitoring system that can be remotely installed. ContinuAC sells for less than $6000. **LorTec Power Systems, Inc.,** 5214 Mills Industrial Parkway, N. Ridgeville, Ohio 44039.

Circle No 187

Literature

Network cost analysis described in brochure

The cost of implementing and maintaining a private data-communications network is analyzed in a brochure. The brochure pinpoints six cost areas—staffing, corporate allocations, nodes, leaded lines, modems and equipment—and provides users with a formula for figuring their own per-drop and overall network costs. **Cylix Communications Network,** 855 Ridge Lake Blvd., Memphis, Tenn. 38119.
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Brochure features data acquisition, control

The TAURUS-ONE system for integrating computing and sensory data into a manageable system is featured in a brochure. The literature explains how the TAURUS-ONE simplifies real world data acquisition and control for such applications as laboratory automation, environmental monitoring, energy management, pipeline control, product test stands and high availability situations. **Taurus Computer Products Inc.,** 1755 Woodward Dr., Ottawa, Ontario, Canada K2C 0P9. **Circle No** 189

Brochure describes multifunction terminal

The model 6028 multifunction terminal for bar-code and keyboard data collection is featured in a two-page brochure. The brochure outlines the terminal's flexible data-entry methods, 32-digit alphanumeric display and visible and audible data-entry verification. Other features described in the brochure include remote or free-standing operating, editing, scrolling and buffering capabilities, a switch-selectable tone and durable, tamper-proof steel case. The brochure includes a diagram and a photo. **Identicon Corp.,** 1 Kenwood Circle, Franklin, Mass. 02038.
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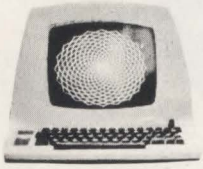
FOR  THE

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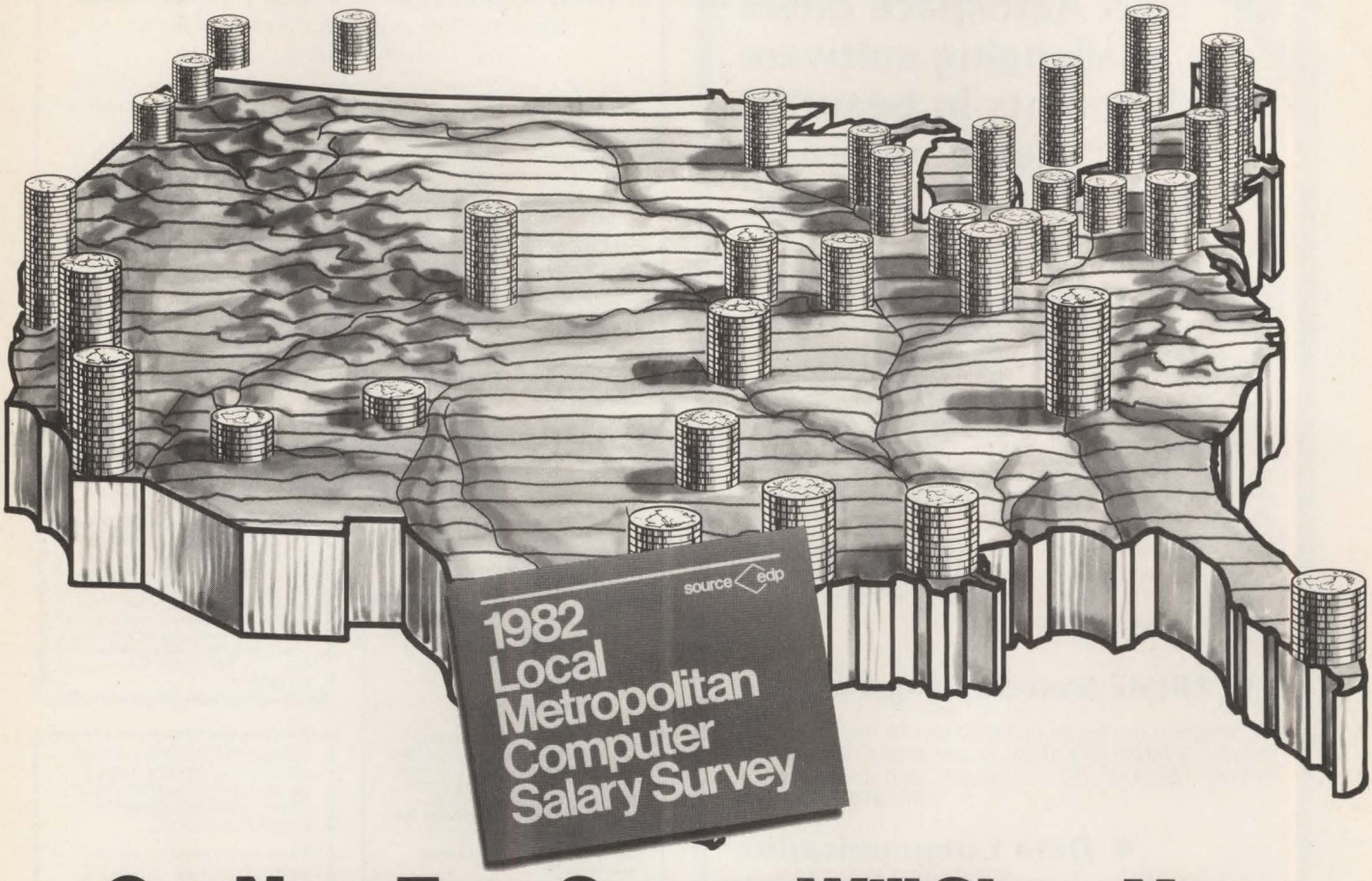

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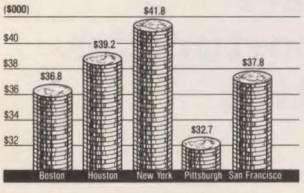

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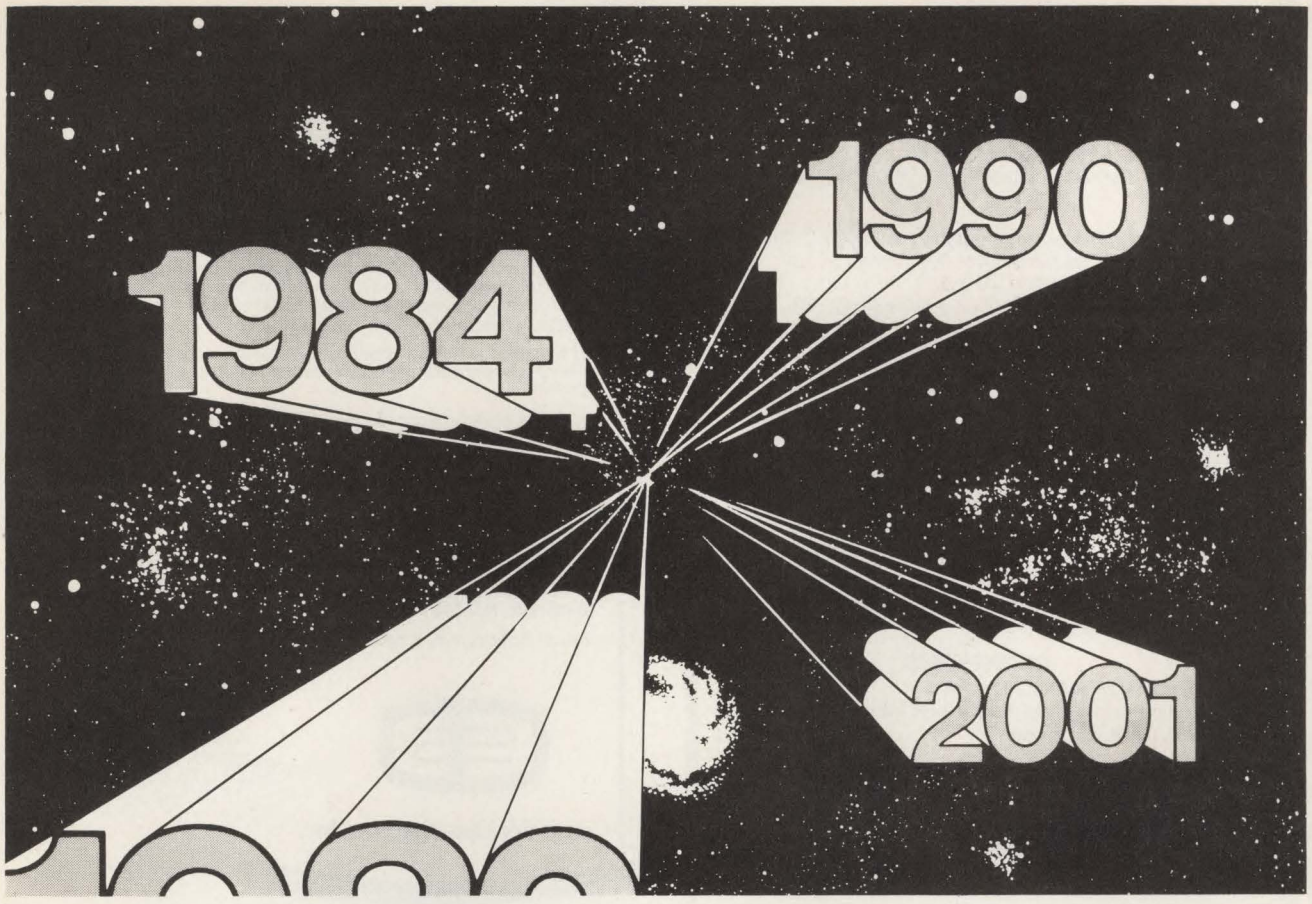

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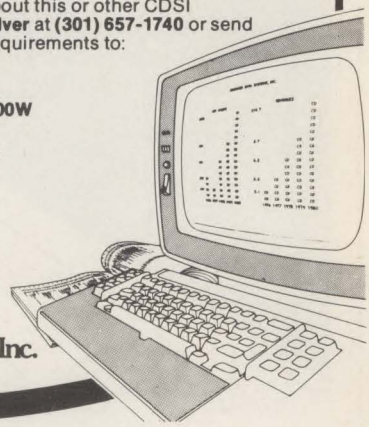

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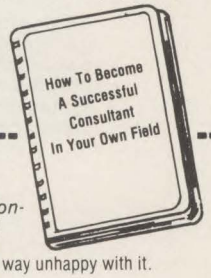

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