JULY 1986

Mini-Micro Systems

THE MAGAZINE FOR COMPUTER SYSTEMS INTEGRATION

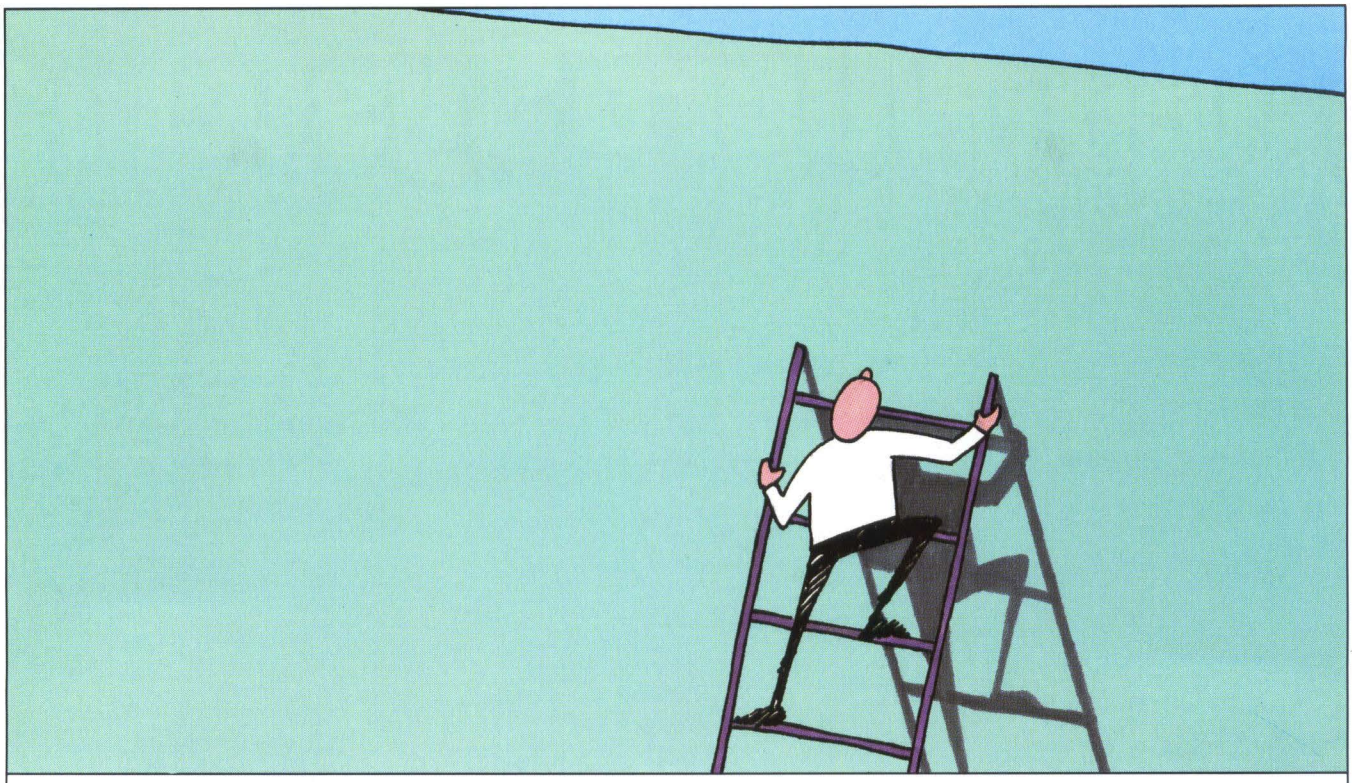
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- **PC board vendors rush to fill EGA demands**
- **Graphics tools broaden PC horizons**
- **Software development fires up workstations**



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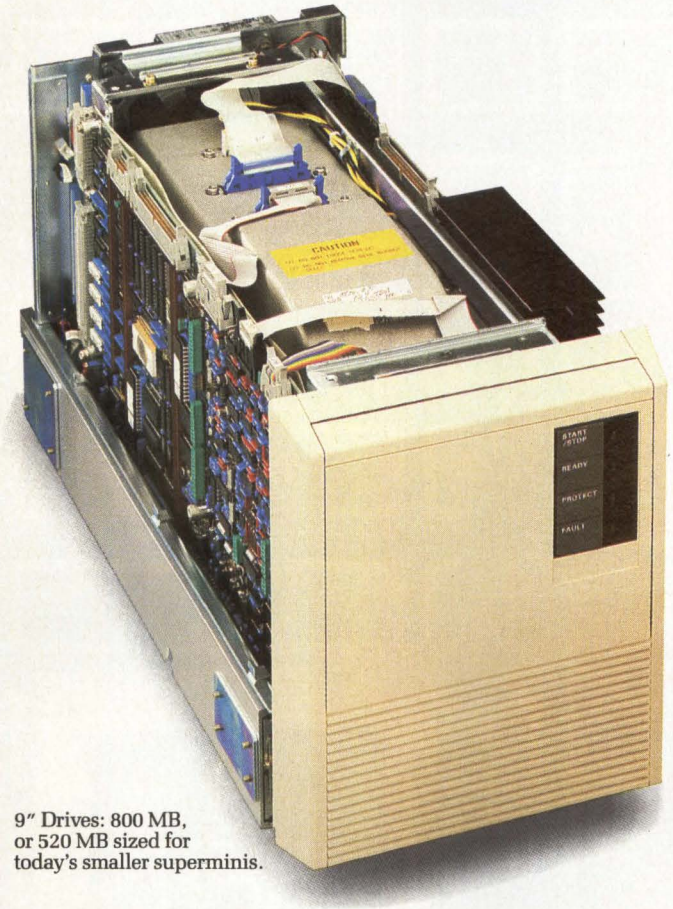
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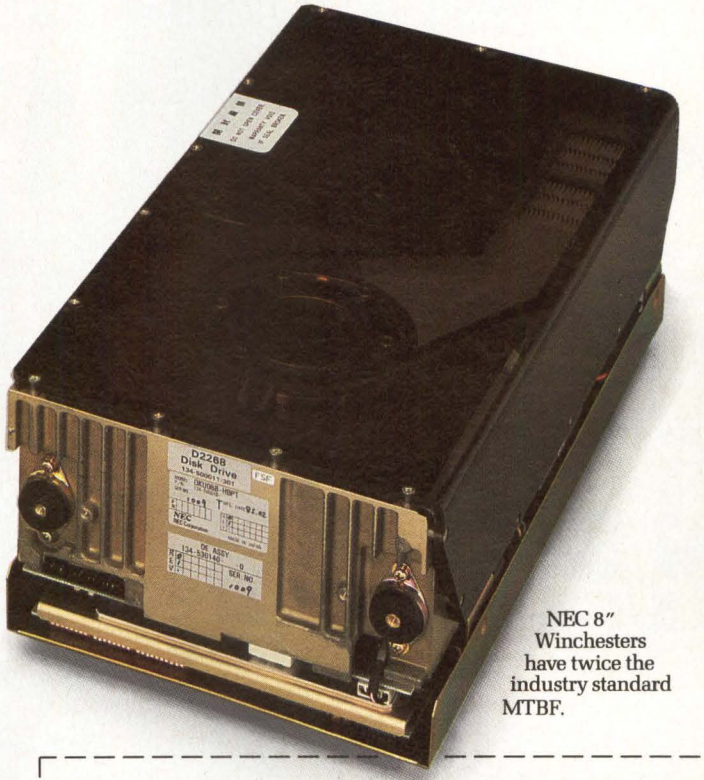
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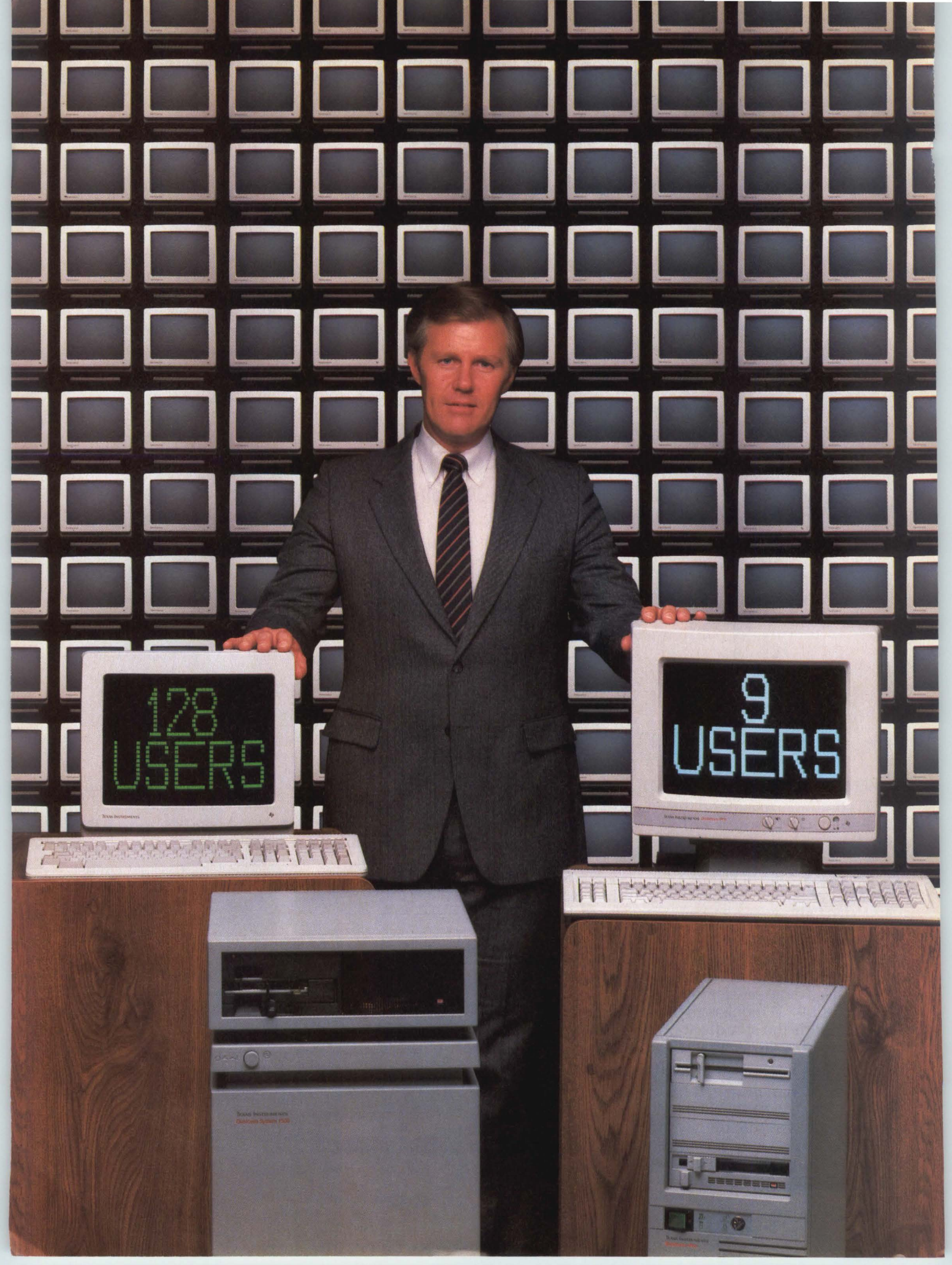
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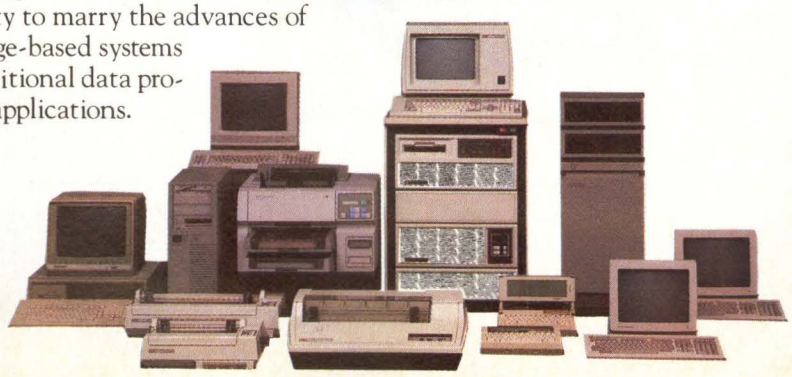
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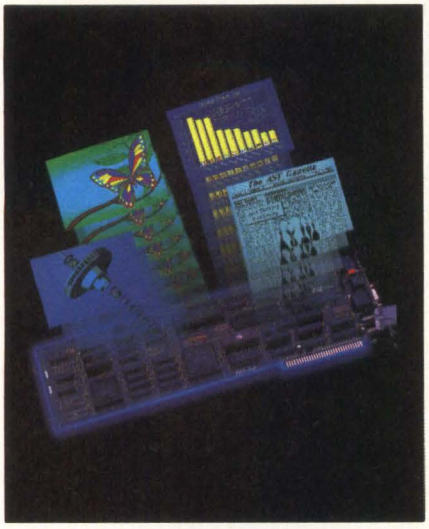
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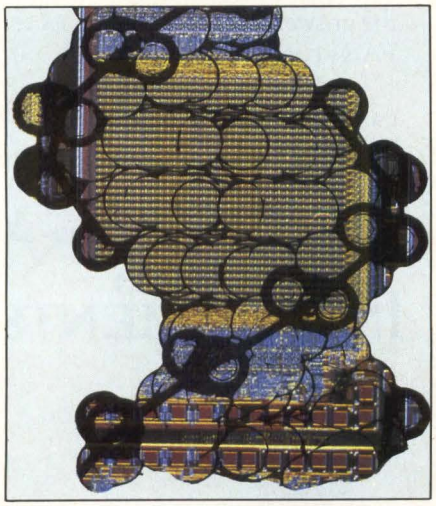
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THE MAGAZINE FOR COMPUTER SYSTEMS



p. 27 . . . . . AST card offers a choice. Art direction and design by Vicki Blake and AST. Courtesy of AST Research Inc.



p. 28 . . . . . A new revolution?

NEWS/INTERPRETER

AST card gives OEMs choice of PC graphics possibilities 27
A new upgrade chip offers greater flexibility in configuring systems

Coming next from Japan: the bionic computer? 28
The Human Frontiers program could spell a new industrial revolution

High-speed modems trudge to market 30
Where are you, V.32?

Heard on the Hill: NSA's waffling on DES worries encryption industry 36
Secrets aren't what they used to be—or so the National Security Agency would have us believe

London link heralds global sales of U.S. computer stocks 39
Satellites bring new meaning to the phrase, "going public"

From Down Under: Software to end program incompatibility 43
An Australian company offers full network-software portability for COBOL applications

*DEC DIRECTIONS

(section begins opposite Page 118)

Mini vendors squeeze into IBM's 'sandwich' D3
Minicomputer vendors claim middle ground with what they tout as a better machine for departmental computing than IBM's System/36

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

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FEATURES

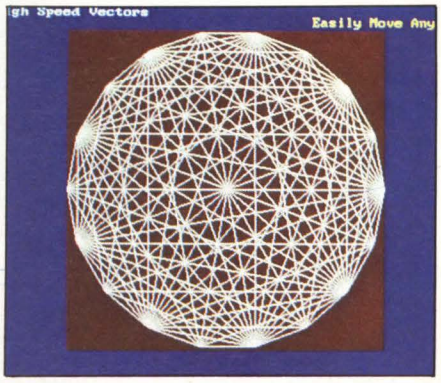
Feature Highlights 49

Upper level OSI protocols near completion 53
As lower level OSI protocols gain acceptance, the protocols of the upper levels—where they are visable to users—are approaching standardization

PC board vendors rush to fill EGA demands 69
Eager to share in the personal computer-based enhanced graphics adapter market, vendors are packaging boards with greater display functions while maintaining IBM compatibility

Graphics tools broaden PC horizons 85
Taking advantage of improved PC display capabilities, graphics software-development tools enable developers to concentrate on more complex applications

Software development fires up workstations 101
System integrators turn workstations into their platforms of choice for computer aided software engineering



p. 85 . . . . . Software tools



p. 69 . . . . . Filling EGA demand

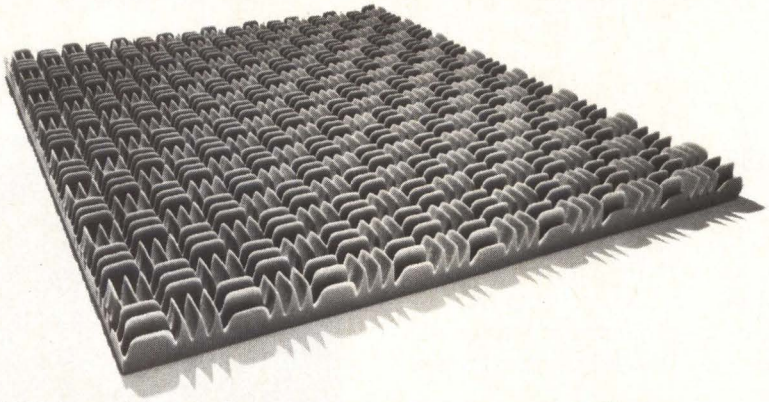
DEPARTMENTS

Editorial Staff 6
Editorial 9
Letters 13
Breakpoints 17
New Products 119
Software Review 135
Index to Advertisers 139
Mini-Micro Marketplace 140
Career Opportunities 142

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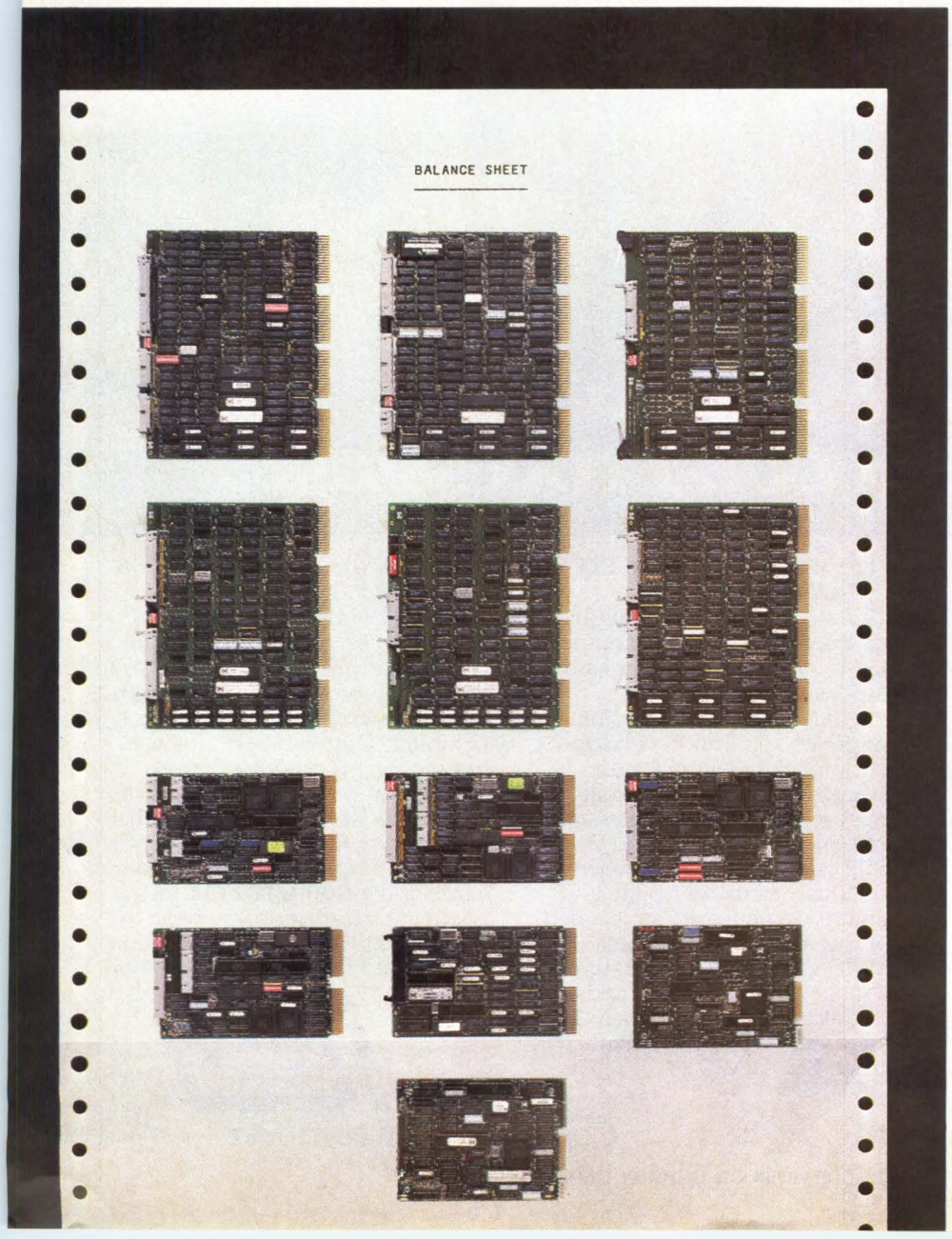
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EDITORIAL



MULTIUSER VENDORS FACE DIM PROSPECTS

Squeezed between departmental minicomputers on one side and PC-based local area networks on the other, small multiuser microcomputer suppliers confront a bleak future. Ironically, just a few years ago, this market was booming. But as usual, when a market segment gains notoriety, competitors jump in and erode individual market share.

At the start, there was room for everyone. But the recent sales slowdown rocked the computer industry in general and its multiuser segment in particular. With overall business fading, leading minicomputer vendors incorporated more powerful processor technologies and lowered prices drastically. These tactics quickly invaded the high end of the multiuser microcomputer market. What's more, departmental minicomputers established order and control in managing the pervasiveness of personal microcomputers and the flood of applications software.

Likewise, at the low end, LANs solved the application control problems in joining different microcomputers and in sharing expensive peripherals.

Meanwhile, between these two pincer forces, small multiuser microcomputer vendors were preoccupied with upgrading their 8-bit systems to 16- and 32-bit systems. In addition, these vendors were spread thin in varied distribution schemes. More important, though, hardware and software standards did not exist. Nearly all multiuser microcomputer companies supplied proprietary equipment.

Not surprisingly, then, the drop in industry business exposed those companies selling nearly identical products. The result? Most small multiuser microcomputer suppliers reported financial losses over the past year.

Yet, market research firms still claim an expanding multiuser market. For example, Input Inc. estimates that the multiuser microcomputer market for two- to 16-user systems will spurt ahead 29 percent annually until 1990, reaching a $10 billion sales level. Similarly, International Data Corp. predicts that shipments will jump from about 231,000 systems in 1985 to more than 974,000 in 1990. This market should grow steadily because many businesses have not yet bought computers for the first time.

Although considered less flexible by industry experts, small multiuser microcomputer systems possess price/performance advantages. These systems generally use inexpensive dumb terminals connected to a central processor. A proprietary, multitasking operating system effectively manages the system's resources and efficiently allocates users their share of CPU, memory and I/O peripherals. Moreover, these small systems increase user productivity and furnish high data integrity.

Unfortunately, though, system throughput drops markedly during heavy duty cycles, and when the central processor fails, the entire system usually goes down. Additionally, system upgrades, enhancements or expansions prove cumbersome, complex and costly.

What's needed, therefore, to move this market forward? One solution to these problems centers on compatibility with de facto hardware and software standards. Another solution calls for concentrated distribution schemes instead of blanket coverage, as exemplified by Altos Computer Systems. Yet another solution involves the porting of popular applications packages that run on widely accepted computers, as typified by North Star Computers Inc. and TeleVideo Systems Inc. Still another solution points to connectivity to common LANs and departmental computers.

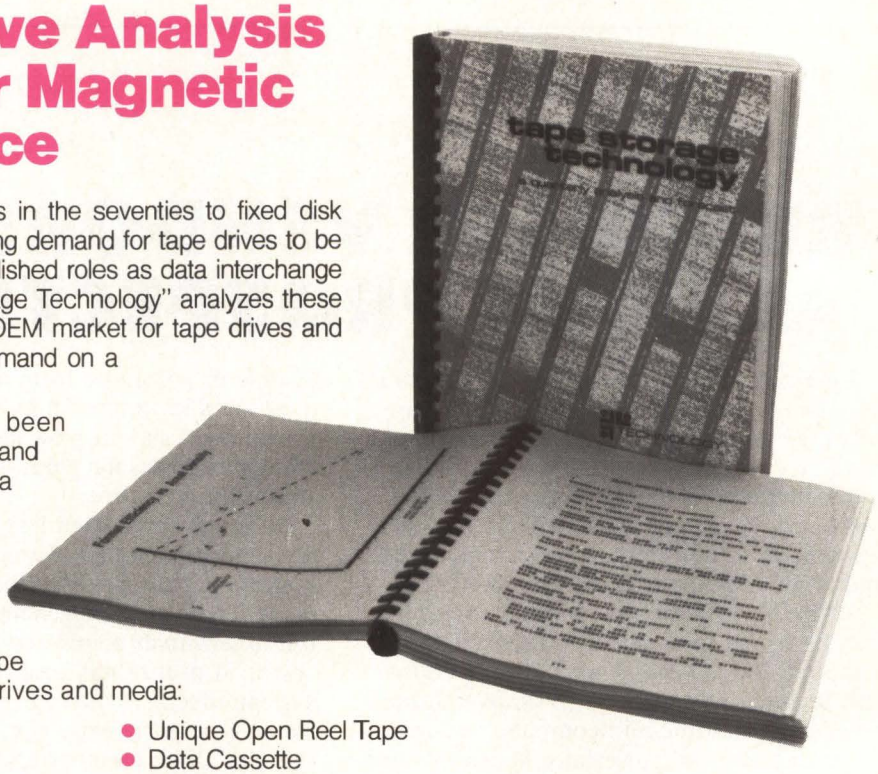
In sum, then, small multiuser microcomputer vendors must provide reliable and standardized products that expand easily to meet new, or unplanned, applications and that accommodate evolving technologies—and at competitive prices. Sounds like basic business practice to me.

George V. Kotelly

George V. Kotelly
Editor-in-Chief

TECHNOLOGY
FORUMS

A Comprehensive Analysis of the Computer Magnetic Tape Marketplace



The shift from removable disk drives in the seventies to fixed disk drives in the eighties has created a growing demand for tape drives to be used for back-up in addition to their established roles as data interchange and archival storage devices. "Tape Storage Technology" analyzes these and other forces which are shaping the OEM market for tape drives and forecasts both technology and market demand on a quarterly basis.

"Tape Storage Technology" has been prepared with the needs of both suppliers and integrators carefully considered. It is a comprehensive yet focused planning tool for product planning, engineering, marketing, and general management personnel.

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"Together with unparalleled SCO hot-line support, documentation, and training, plus the explosive growth of the XENIX applications base, it changed the way we would look at personal computers forever.

"In short, it was the 'SCO XENIX solution' that turned personal computers into *real* computers."

from *"XENIX RISING: The Ascent of Shared Information Computing from 1979 to 1999"*

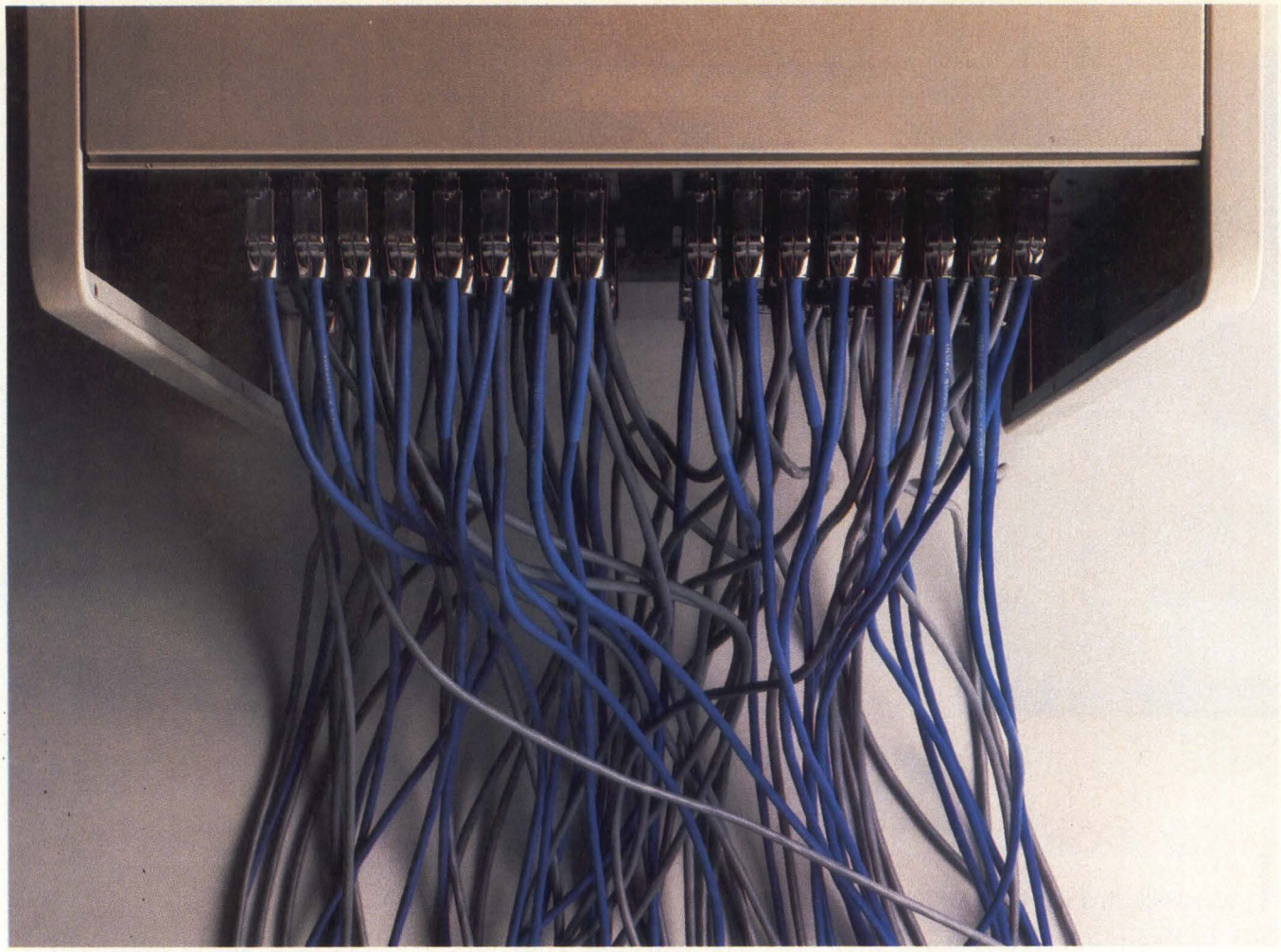
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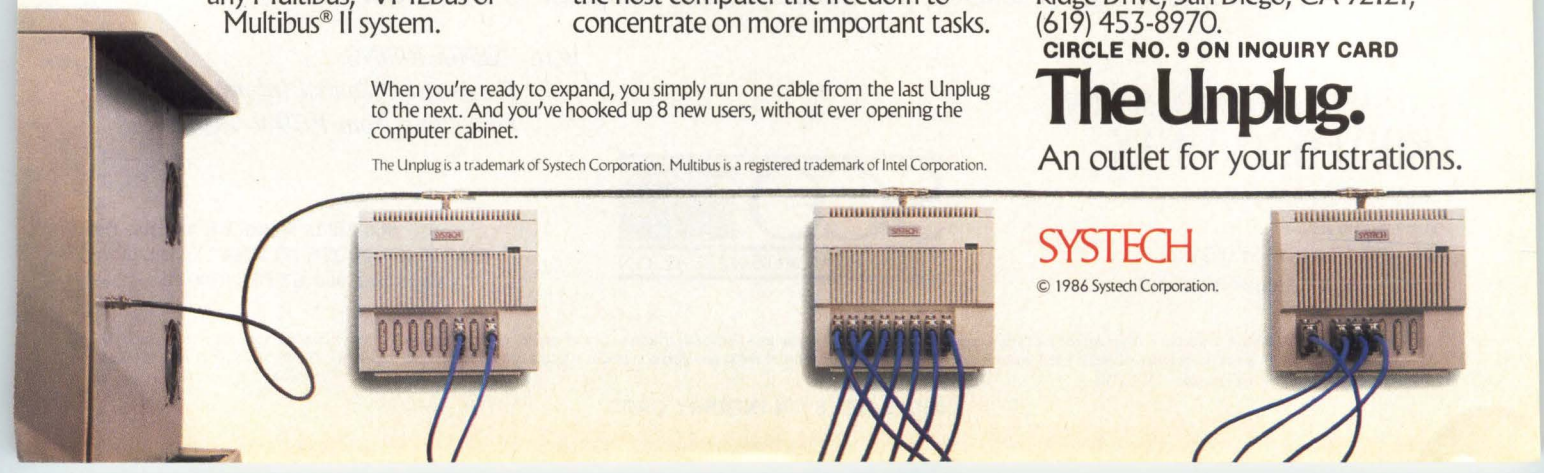
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LETTERS

SONY DISK STABILITY

To the editor:

I read your article, "Optical storage shines on the horizon" (MMS, December 1985, Page 68), with interest. I am writing to correct some inaccurate information reported on the Sony write-once optical disk media.

The article indicates that the Sony media uses a "phase-change technique whereby the physical state of the material is changed from a crystalline to an amorphous state to denote a written bit." The Sony media actually uses a more stable phase-transition technique that changes the media from an amorphous state to an alloy.

In tests carried out so far by Sony engineers, this media has proved to be reliable for over 30 years when stored at 70 degrees Celsius at 90 percent relative humidity.

Bernie Farkas
Manager, Systems Engineering
Systems Products Group
Sony Corp. of America
Sony Drive
Park Ridge, N.J. 07656

MULTIPLE-USER WORM

To the editor:

Regarding your "Optical storage shines on the horizon" (MMS, December 1985, Page 68), let me correct a few incorrect references pertaining to Laserdrive Ltd. and our initial WORM [write once, read many] product.

Laserdrive's optical memory product, denominated the LD33, is *not* particularly well suited for low-level computer applications. The LD33 currently sports the highest single-sided capacity (442M bytes, unformatted) of any announced 5¼-inch optical product, with system performance and universal host adaptor capabilities that make the LD33 much more appropriate in multiple-user environments, such as [Digital Equipment Corp.] VAX [computers] and [IBM Corp.] PC/AT [computers], and similar minicomputer file server and local area network configurations.

One of the fundamental principles underlying the LD33 concept is the combination of the lowest cost per megabyte (our anticipated OEM cost for media is 7 cents per megabyte) together with high system performance and compatibility features that easily will interface the LD33 with all existing minicomputer-based workstations and LANs.

[In addition,] your article listed our fax number as our telephone number, which has caused our fax number to receive untold spurious callups. [Laserdrive's telephone number is (408) 970-3600.]

Paul W. Helgesen
President
Laserdrive Ltd.
Santa Clara, Calif. 95054

WHICH DOS VERSION?

To the editor:

A few errors of commission and omission must be pointed out [in the Systems Integrators' Notebook, April, 1986, Page 154, "How to solve serial interconnect problems"].

First, although turning off the default state of the echo in DOS for the execution of batch files is useful, you neglect to mention which version of DOS this works with. This is important as the COMMAND.COM files in the different versions are of different sizes and, therefore, the particular section of code you are replacing appears in different places.

Second, the environment space in DOS stores only strings, not programs. The example you gave of:

SET PAY=\ACCOUNTING

simply adds the string "\ACCOUNTING" to DOS' environment. If you then say, PAY, nothing happens, as this does not automatically invoke the environment string. The environment can be read by programs that run under DOS and by the DOS BATCH PROCESSOR. In order to invoke the program, ACCOUNTING, which resides in the main directory of the current default drive, the following line must be present in the batch file:

%PAY%

The %'s tell the BATCH PROCESSOR to look for a string in DOS' environment. This does not work interactively, however. A simple example of how this could be used would be to set a variable called "CURRENT" equal to the current path (i.e., SET CURRENT=C:\BATCH). Then, if batch file needed to return to this directory, all it would need at that point would be the following line:

CD %CURRENT%

which would be interpreted as:

CD C:\BATCH

Note that this works only with DOS versions 2.0, 2.1 and 3.1.

Finally, the "COMSPEC" variable is understood by the resident portion of DOS to contain the path to its COMMAND.COM file. When a large program is run under DOS, it allows the application to overwrite the nonresident part of itself. When an application program terminates, it normally returns control to the resident portion of DOS (which is simply a loader), which in turn does a checksum on the memory space where the nonresident portion of DOS resides. If the checksum is not correct, the resident portion of DOS simply reloads the rest of the operating system from the path denoted in the COMSPEC variable in DOS' environment and passes control to it. If the checksum is correct, it passes control to the nonresident portion of DOS (i.e., normally COMMAND.COM). Also, the name of the file containing the nonresident portion of the operating system is normally included in the COMSPEC variable; that is

COMSPEC=\COMMAND.COM

as the nonresident portion of the operating system, can have any name.

William L. Meyer
Computer Coordinator
School of Aerospace Engineering
Georgia Institute of Technology
Atlanta, Ga. 30332-0150

Editor's response:

The DOS is version 2.0 and the example is MS-DOS.

—Carl Warren

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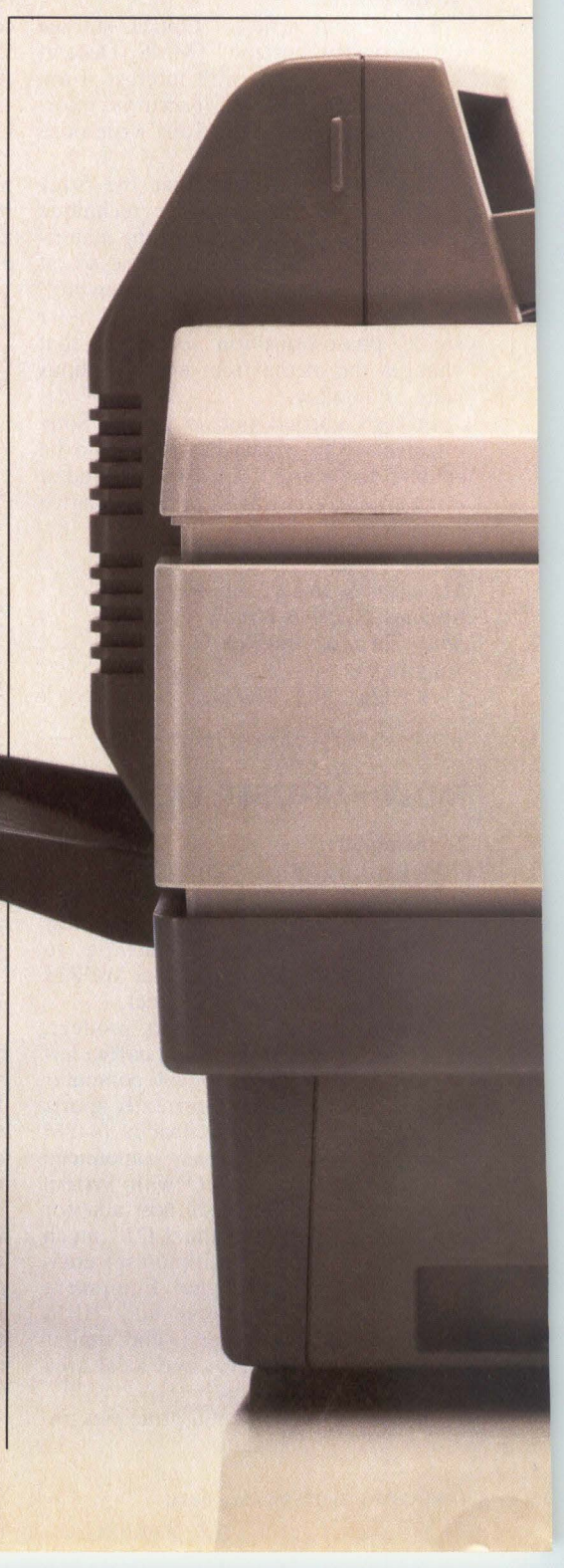
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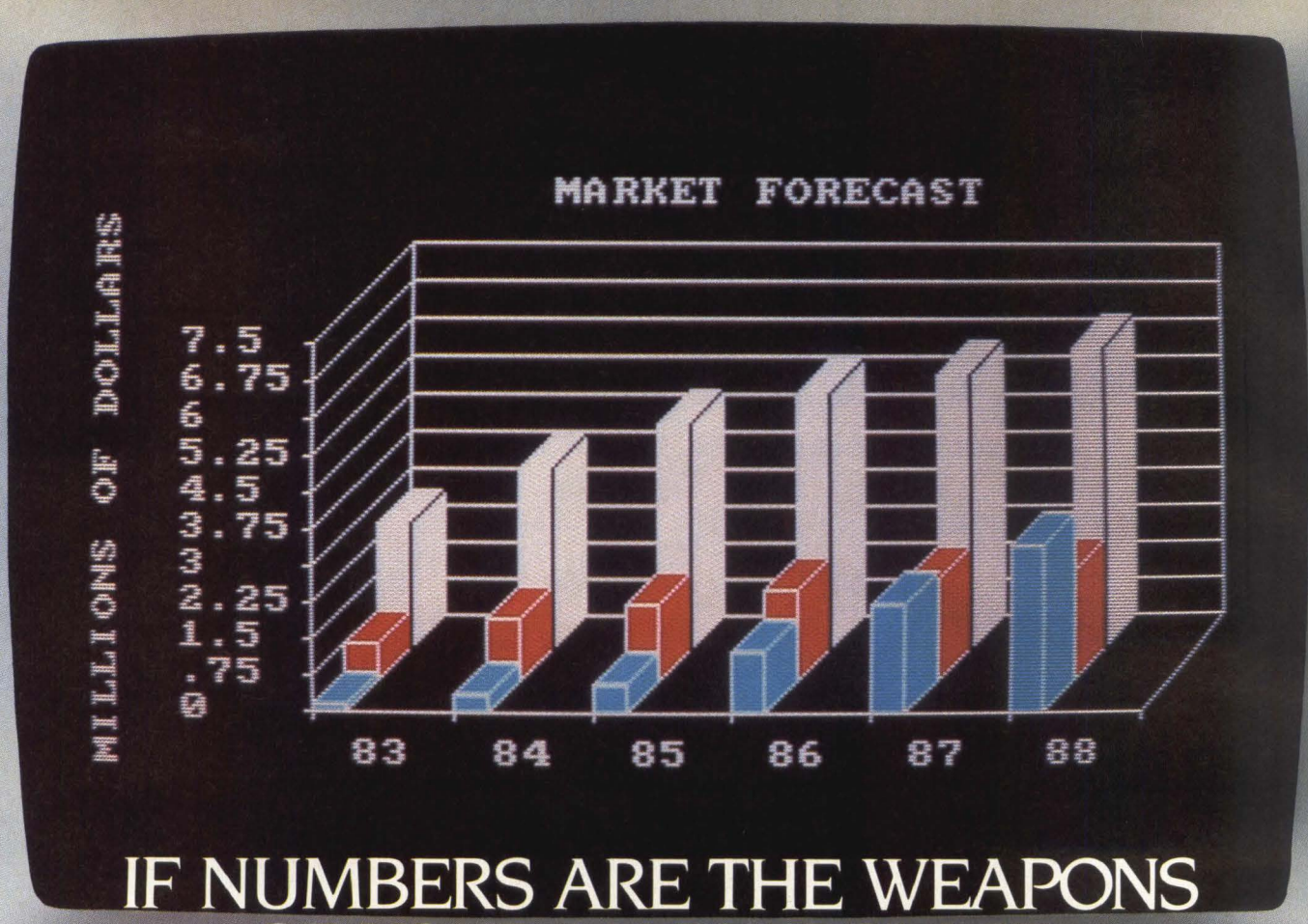
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CIRCLE NO. 10 ON INQUIRY CARD



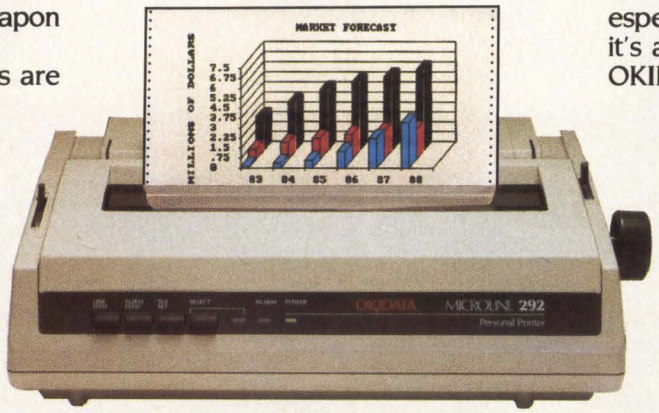
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CIRCLE NO. 11 ON INQUIRY CARD

BREAKPOINTS

NISO, ECMA VIE TO PRESENT CDROM FORMAT AS STANDARD

The National Information Standards Organization (NISO) and the European Computer Manufacturers Association (ECMA) are going head-to-head over who should present the High Sierra compact disk ROM logical file-format standard to the International Standards Organization (ISO). ECMA says it can get the standard approved more quickly. Digital Equipment Corp.'s Howard Kaikow, a member of the ECMA subcommittee working on the standard, says ECMA will have a standard to present to ISO a year from now—much earlier than any standard from ANSI prepared by NISO, he contends. He also believes that ISO will accept ECMA's standard as a Draft International Standard immediately, and that it will be adopted as a full International Standard by the end of 1987 or early 1988. NISO executive director Patricia Harris warns that ANSI can vote against the ECMA standard and predicts that ANSI will have its own standard ready for ISO "18 months from now or even sooner."—*Keith Jones*

FCC BROADCASTS MOTOROLA'S IDEA FOR RADIO LANS

The Federal Communications Commission has issued a Notice of Proposed Rulemaking (NPR—PR Docket 86-174) to solicit comments on a proposal by Motorola Inc. to allocate radio frequencies for the wireless interconnection of computers and associated peripheral equipment. The radio local area network service will employ small transceivers to relay data within an office environment. The FCC has proposed to allocate the 1,700-MHz-to-1,710-MHz frequency band for the radio LAN service.
—*Stephen Shaw*

MOLECULAR FILES FOR CHAPTER 11, PLANS REPOSITIONING

Saddled with debt and an inability to turn a profit since it was founded five years ago, Molecular Computer Corp. is seeking protection under Chapter 11 of the bankruptcy laws. The San Jose, Calif., company, which builds 8- and 16-bit multiuser computers, recently laid off all but a handful of workers. The remaining employees will continue development work on a 100M-bit-per-second local area network, according to Molecular president Frank Zurcher. Although the company plans to market its computers in Europe, Zurcher says Molecular's domestic operations will revolve mainly around selling its planned LAN to OEMs.—*Mike Seither*

CIPHER BUYS MAJORITY SHARE OF OPTICAL-DRIVE MAKER

Cipher Data Products Inc. built its reputation manufacturing tape drives. Now the San Diego, Calif., company wants a piece of the optical disk-drive business. It acquired a stake in June by paying more than $6 million for 90 percent of Optimem Inc., a Xerox Corp. subsidiary based in Sunnyvale, Calif. Optimem, which manufactures a 1G-byte, 12-inch, write-once, read-many optical drive, will remain an independent Cipher business

unit, and is working with 3M on a 5¼-inch, 250M-byte erasable optical drive. Evaluation units are expected later this year.—*Mike Seither*

BOCA PACKS GRAPHICS, EMS MEMORY ON MULTIFUNCTION BOARD

Boca Research Inc., Boca Raton, Fla., has begun shipping its MEMEK multifunction board, which offers up to 2M bytes of expanded memory and conforms to EMS 3.1, (or, the Lotus-Intel-Micrsosoft Expanded Memory Specification). It offers graphics support for a variety of modes, including IBM Corp. monochrome, IBM Color Graphics Adapter (CGA), Hercules Computer Technology monochrome graphics and Plantronics/PC+ Products Inc. ColorPlus. The company claims that it is the only memory/display board that allows full control over the allocation of memory between video, system and expanded memory.—*Dave Simpson*

ATASI EMERGES FROM CHAPTER 11 WITH NEW PRODUCTS

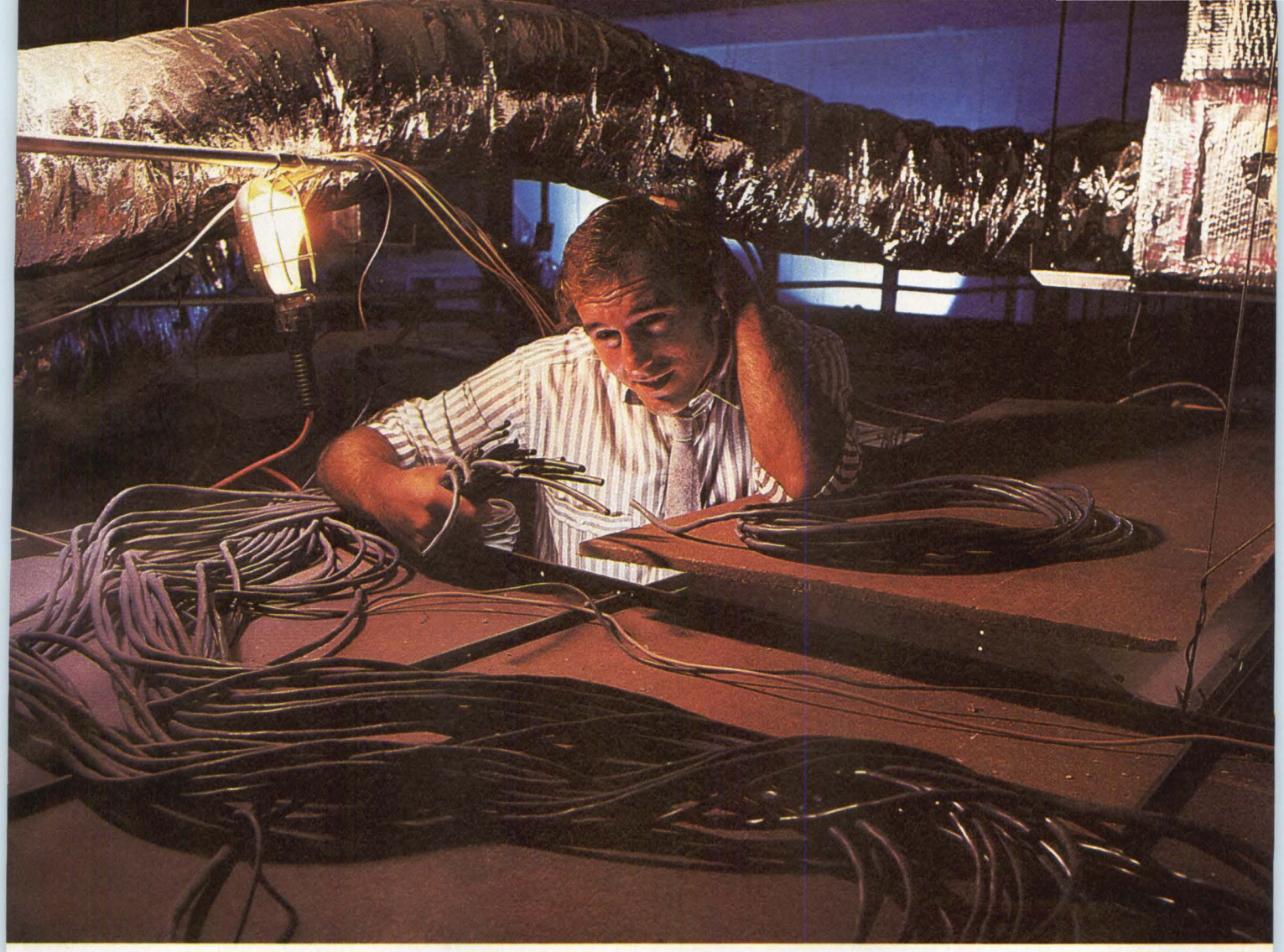
Financially troubled Atasi Corp., San Jose, Calif., a victim of the downturn in U.S. disk-drive manufacturing, may have put its troubles behind it. The company, recently emerged from Chapter 11 reorganization, has continued to ship its 46M-byte and 53M-byte, 5¼-inch, series 3000 Winchester drives and is introducing this month the series 2000. The new models include 85M-byte, 128M-byte and 170M-byte units, which incorporate the small computer systems interface (SCSI) and have a 25-msec average access time. Deliveries are scheduled for the third quarter.
—*Carl Warren*

TOLERANT SUPPORTS 80G-BYTE DATABASE

Tolerant Systems Inc., the San Jose, Calif., manufacturer of fault-tolerant machines, has rolled out a new high-end, on-line transaction-processing machine. The P200, based on National Semiconductor Corp.'s NS32032, processes 45 percent more transactions per second than its 32016-based predecessor, the P100, for a 13 percent increase in price. Tolerant has also reached a sales agreement with Online Computer Library Center Inc., Dublin, Ohio, under which OCLC will use Tolerant's Eternity computers (which include the P100 and P200) to manage its 80G-byte library-information database. That is believed to be the largest database ever supported by a UNIX operating system.—*Dave Simpson*

TREASURY PROGRAMS PROMISE BIG BUSINESS

The U.S. Treasury Department is expected to award more than $1 billion in contracts during the next three years for automated data-processing and telecommunications equipment and services, according to International Data Corp. (IDC), a market-research organization based in Framingham, Mass. The monies will be spent through a dozen multiyear programs ranging in value from $10 million to $700 million. The largest programs, according to IDC, are the Treasury's automated-examination, integrated-collection and automated criminal-investigation programs.—*Stephen Shaw*



Tired of running cables to add terminals?

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Unlike conventional graphics terminals the QG-1280 and QG-640 are directly accessible from the Q-Bus. There are no slow serial communication links. **You "see" results immediately.**

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CIRCLE NO. 13 ON INQUIRY CARD

WYSE BROADENS LINE WITH AT-COMPATIBLE AND DISPLAY PRODUCTS

Wyse Technology, San Jose, Calif., has unveiled a blitz of monitors and a new microcomputer compatible with the IBM Corp. PC/AT. The three new monitors, all with 14-inch screens, are PC-compatible. The WY-530 ($235) is monochrome with non-glare etched glass; the WY-630 ($599) has a 16-color palette but can also work in amber or green; and the WY-640 ($749) offers high resolution for compatibility with IBM's Enhanced Graphics Adapter (EGA). The AT clone, called the WYSEpc 286, is priced from $2,999, with a single 1.2M-byte flexible disk drive, to $4,199, with a 40M-byte rigid disk drive.—*Mike Seither*

APOLLO TO SUPPORT LATEST UNIX ON ITS WORKSTATIONS

Apollo Computer Inc., Chelmsford, Mass., has announced intentions to incorporate AT&T Co.'s UNIX System V Release 3 on its technical workstations. The two companies began working together on the UNIX implementation several months ago. By incorporating the latest version of the operating system into its proprietary DOMAIN/IX system, Apollo hopes to reinforce its commitment to a multivendor computing environment.
— *Lynn Haber*

COBOL GETS A BOOST ON ATTIS' UNIX MACHINES

An agreement between Micro Focus Inc., Palo Alto, Calif., and AT&T Information Systems, Morristown, N.J., will see Micro Focus developing COBOL programming products for all ATTIS computers running under UNIX System V. The two companies are working together to increase the impact of COBOL in the UNIX environment, says Joanne Masingill, a software division manager at ATTIS.—*Keith Jones*

INTEL SUPPORTS MAP WITH INI AGREEMENT

Intel Corp., Folsom, Calif., and Industrial Networking Inc. (INI), Santa Clara, Calif., have signed an agreement to market network products based on the IEEE 802.4 Manufacturing Automation Protocol (MAP). The companies will also jointly develop future products for the token-bus environment. Under the agreement, Intel has exclusive distribution rights for the INI token-bus controller, broadband modem and Multibus I boards.
—*Lynn Haber*

TECH FILES: A QUICK LOOK AT NEW PRODUCTS AND TECHNOLOGY

The latest in dot-matrix printers from **Epson America Inc.**, Torrance, Calif., is the $749 model EX-800, which incorporates a nine-pin printhead providing near-letter-quality printing at 54 characters per second (cps) and draft quality at 250 cps. Available with parallel or serial interfaces, the EX-800 features printing in seven colors: black, red, blue, violet, yellow, orange and green. Deliveries begin this month.—*Carl Warren*

The Modem Combo Cards from the **Persyst Division** of Emulex Corp., Costa Mesa, Calif., are reportedly the first IBM Corp. PC-compatible enhancement boards to combine communications and display capabilities on a single card. Two versions are offered: the Modem Mono Combo provides a fully compatible IBM monochrome display adapter, while the Modem Color Combo offers a fully compatible IBM color display adapter. Both boards also provide a 2,400-baud modem, parallel port and calendar/clock, and are priced at $899. Persyst has also introduced the EG-8 graphic expansion board to provide four types of graphics support: IBM's monochrome, Enhanced Graphics Adapter and Color Graphics Adapter; and Hercules Computer Technology's Graphics Adapter. The $599, PC-compatible card also offers serial and parallel ports, a calendar/clock, print spooling and RAM disk software.—*Bruce MacDonald*

Claiming to have the first color graphics board able to create images 24 planes deep with independent alphanumeric overlay, **Peritek Corp.**, Oakland, Calif., will debut the VCX-Q/U at the SIGGRAPH graphics show, Dallas, August 19 to 22. The VCX-Q/U works with Q-bus and UNIbus computers from Digital Equipment Corp.—*Dave Simpson*

Consider add-in boards from **Clearpoint Inc.**, Hopkinton, Mass., if you want to take full advantage of the IBM Corp. RT PC's 16M-byte address space. Organized as two 40-bit arrays, the $1,895 RTRAM/4 stores 4M bytes using 256K dynamic RAMs, while the $4,395 RTRAM/8 provides 8M-byte capacity via 1M-bit DRAMs. The boards, which have a 150-nsec access time, support the RT PC's error-detection and correction logic.
—*Jesse Victor*

LabVIEW software from **National Instruments**, Austin, Texas, takes a novel, interactive graphical approach to developing and running software for laboratory and scientific instrumentation. Based on the Apple Computer Inc. Macintosh, the $1,995 package allows system integrators to use block diagrams functioning as executable subroutines, graphical front-panel representations and icons to program, configure, debug and control IEEE-488-based instrumentation systems. Statistical-analysis, matrix-manipulation, signal-processing, mathematical and file I/O routines are built in.—*Jesse Victor*

NOTES FROM OVERSEAS: Paris software house **GIE Emeraude** is porting its integrated project-support environment, also called Emeraude, to a wide variety of computer systems, and U.S. companies are among the potential customers. Emeraude is an implementation of the Portable Common Tool Environment (PCTE), now being defined by six leading European computer makers. PCTE runs on top of UNIX System V and adds substantially to the project and programming support facilities that UNIX provides. Additional tools written to run with PCTE can call PCTE functions using a set of C-language instructions being established as a standard in Europe so that a tool can run with PCTE on any machine.—*Keith Jones*



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For fast, accurate data entry, Verbex voice input is the answer. Our voice data entry products are helping companies in material handling, inventory control, inspection, test and other applications save thousands of dollars in labor, time and equipment costs, often with productivity gains of 100% and more. Now you can take advantage of this proven technology in a new, low-cost voice data entry peripheral–the Verbex Series 4000 Voice Recognizer.

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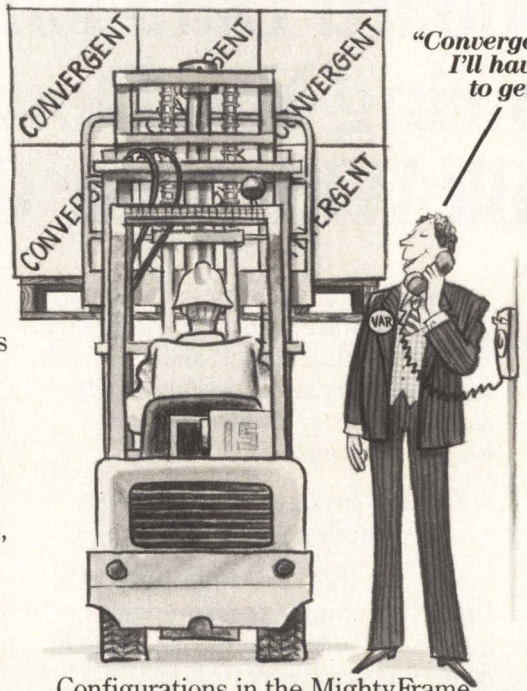
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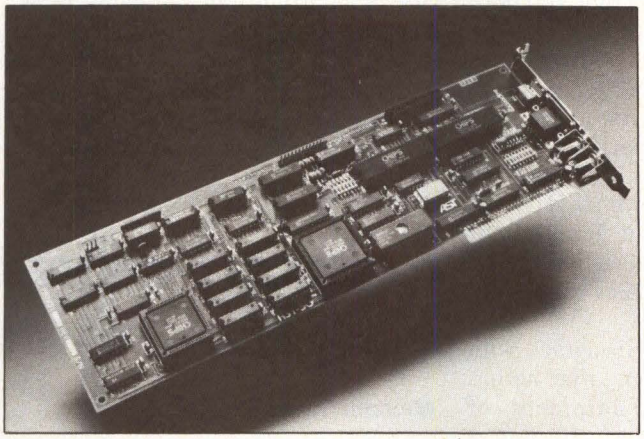
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CIRCLE NO. 17 ON INQUIRY CARD

AST card gives OEMs choice of PC graphics possibilities

Mike Seither
Associate Western Editor



The AST-3G Plus *offers system integrators three graphics standards from which to choose: the IBM EGA and CGA and the Hercules. Options for 256K bytes of memory and a parallel port are also available.*

AST Research Inc. has broadened its foray into the highly charged market for personal computer graphics by introducing an upgrade chip that gives OEMs more flexibility in configuring systems.

The Irvine, Calif., chip manufacturer has added compatability with the IBM Corp. color graphics adapter (CGA) and the Hercules Graphics Card to the AST-3G board. When the company began shipping the AST-3G in late April, the board provided compatibility only with the IBM enhanced graphics adapter (EGA).

Now, system integrators can add CGA and Hercules capability by plugging the $75 upgrade chip into a socket on their AST-3G boards. AST will market a high-end board—the AST-3G Plus—that includes a factory-installed CGA/Hercules chip. The company says shipments of the AST-3G Plus have begun.

The firmware for CGA and Hercules compatibility adds another level of "modularity" to the AST-3G board, says Marty Stein, the company's director of graphics products. The board now supports three popular graphics standards—CGA, EGA and Hercules—and provides either 64K bytes or 256K bytes of onboard RAM to serve various graphics software packages. A parallel port for IBM-compatible printers and plotters is optional. In all, AST Research offers a choice of eight 3G adapter board configurations ranging in price from $425 to $600 (see table).

"System integrators or large corporate end users can standardize on a single board but [need] not buy more than they need for any one PC," says Stein. The choices in AST-3G adapters give system integrators with an installed base easy flexibility in upgrading personal computers as their customers' graphics needs change, he adds. For example, some users who ultimately require graphics may already have personal computers equipped with a parallel printer port, so they wouldn't need to include one as part of the AST board.

AST also says that the flexibility of the 3G line allows buyers to purchase personal computers in volume and configure them with one board for several graphics applications. Later changes in graphics capabilities would only involve adding a chip or changing monitors, according to Stein. No new adapter would be necessary.

For AST, which has manufactured enhancement products for the IBM PC and compatibles since 1980, the 3G cards follow a number of earlier graphics boards. The company also sells Preview!, a $399 card that is compatible with IBM's monochrome display adapter (MDA), and ColorGraphPlus, a $295 adapter that supports only the CGA standard. The company is perhaps best known for its SixPackPlus, which combines on a single board such functions as serial and parallel ports, extra RAM and a clock. Along with Lotus Development Corp., Intel Corp. and others, AST was instrumental last year in creating the Above Board standard, which allows memory extensions beyond the 640K-byte barrier imposed by the IBM PC.

Half a million boards

Despite its considerable experience in the IBM PC market, AST faces plenty of competition, not the least of which comes from IBM itself. According to industry analysts, graphics adapter cards are becoming one of the hottest after-market enhancements for the PC. It's estimated that last year, when it had the market mostly to itself, IBM sold 125,000 of its $930 EGA cards. So says Lewis Brentano, vice president and director of graphics and terminal services at Dataquest Inc., the San Jose, Calif., market-research outfit.

PAYING ONLY FOR WHAT'S NEEDED

AST-3G		AST-3G Plus	
Configuration	**Price($)**	**Configuration**	**Price($)**
EGA/64K	425	EGA/CGA/ Hercules/64K	500
EGA/256K	450	EGA/CGA/ Hercules/256K	575
EGA/64K/ parallel port	450	EGA/CGA/ Hercules/64K/parallel port	525
EGA/256K/ parallel port	500	EGA/CGA/ Hercules/256K/parallel port	600

"I'm not afraid to say that 400,000, even 500,000 [EGA units], will be shipped in 1986," says Brentano. "EGA has come of age."

But Robert Lefkowits, an analyst with InfoCorp of Cupertino, Calif., says those figures are out of line. "I'd be surprised if 1986 shipments passed 100,000. There isn't a demand for EGA yet because there isn't that much software that takes advantage of it."

However, AST's Stein agrees with the higher figures, saying that he has seen information that shipments of EGA monitors exceed 30,000 a month.

Whatever their number, many of those 1986 EGA sales will come from non-IBM sources. Brentano says that, besides AST, two companies, Quadram Corp. of Norcross, Ga., and Video-7 Inc. of Milpitas, Calif., "are shipping in good volumes." Add to that several other companies that are introducing a variety of EGA-compatible cards (see "PC board vendors rush to fill EGA demand," Page 69).

Brentano believes that AST may be well positioned to take advantage of current user needs now that its AST-3G Plus provides compatibility with CGA and Hercules. That's because Brentano, like Lefkowits, believes that much of the software written for those standards has not been rewritten for EGA.

"Fifty percent of the applications that people buy are ready for EGA," Brentano says. "The rest run on CGA or Hercules. Until it's 100 percent, they'll want emulation features."

Meanwhile, Stein says that AST has hired an independent testing firm to run the AST-3G boards against about 80 specific graphics programs to ensure compatibility in all modes: EGA, CGA, Hercules and MDA. "We claim to run with all mainstream software and most compatible PCs," he says. "It's been quite a massive testing effort."

AST plans to bring its substantial marketing and distribution muscle to bear on getting the new boards to market. The company, which totalled $90 million in sales during the first half of its fiscal year, will move the boards through several channels, including dealers, value-added resellers, distributors and large retailers such as Computerland Corp. and Entré Computer Centers Inc.

Stein also foresees significant OEM business. The biggest customer in that category will be manufacturers of IBM PC lookalikes, he says. He further anticipates that 40 percent of AST-3G Plus early sales will be to foreign manufacturers. □

Coming next from Japan: The bionic computer?

Michael Tucker, Associate Editor

In an uncharacteristic move, Japan is proposing a massive, long-term, international R&D project into the field of bionics and related sciences. The program, titled "Human Frontiers," could have a significant impact on world computing technology. The Japanese hope to produce improved artifical-intelligence software, "biochips," intelligent robots and more, in concert with other industrial nations.

Backed by Japan's powerful Ministry of International Trade and Industry (MITI), Human Frontiers would be funded initially with roughly $5 billion at the current rate of exchange. The United States, Canada, Common Market countries and other industrial nations have been invited to participate—at first drawing on Japanese funds but later paying their own way. The program is expected to last 20 years, to 2007.

Observers in the United States seem generally positive about the program, but cautious. Some industry insiders question whether any project backed by the typically insular MITI would actually be open to non-Japanese. On the other hand, officials at the U.S. State Department and the U.S. National Science Foundation say the Japanese wish to begin a genuinely open and international project.

Mother Nature knows best

Bionics is the application of biological principles to the design of machines and electronic systems. AI software, certain kinds of robots, prosthetic limbs, dialysis machines and artificial hearts could all be called bionic applications. One related field is biotechnology, which essentially attempts to do the reverse of bionics and create machines based on the principles of biology (see "Research holds promise of biochips," right).

The Japanese say that applied bionics could lead to a new industrial revolution. Explains Taizo Yokoyama, minister of commercial affairs at the Japanese embassy in Washington, "The basic idea is that the next technological breakthroughs may come from the study of living things. The functions of living beings might be translated into mechanical or electronic functions. For instance, very advanced computers might

come from the study of the human brain."

The Frontiers program has been conceived as a way to effectuate the basic research necessary for this "bionics revolution." "We know," says Yokoyama, "that this is far too ambitious a project for any one nation to carry out."

In the short run, Japan hopes the program will provide improved AI software, better computer-user interfaces, superior industrial robots and so forth. Research programs to make these possible would include work in machine vision, natural languages, artificial associative memory and symbolic processing.

In the long run, the Japanese are quite seriously discussing revolutionary technologies. These include biochips—electronic circuits based on protein molecules, which would, in theory, be far smaller and more powerful than any silicon chip. (Some visionaries have even talked about embedding them in the brain as the ultimate personal computer.)

Frontier or fraud?

The American response to the proposal has been mixed. Government officials who have studied the proposal have been optmistic overall, although they caution that the project is still very much in the planning stages. "At the moment," says Charles Wallace, senior program manager at the National Science Foundation in Washington, "it's just a twinkle in the eye of MITI."

However, Wallace approves of the project's long-term goals. "I'm not cynical about this," he says. "I'm tempered, perhaps, by looking at some of their other research programs, particularly their Fifth Generation project." The Fifth Generation project is the well-known Japanese attempt to leapfrog world computer technology. So far, it has not been a ripping success, partly because of intense competition among the sponsoring Japanese companies.

The U.S. State Department also seems to approve of the Frontier project. An offical there says, "From our point of view, we think it's a nice idea." But Dr. Robert Rabin, the assistant director for life sciences at the White House Office of Science and Technology, has mixed feelings. "We're taking a conservative position at the moment, because we're not sure what their intentions are. One wonders, for instance, how such a project would separate basic from applied research." In other words, the question is how to prevent any one participant from exploiting the others by

Research holds promise of biochips

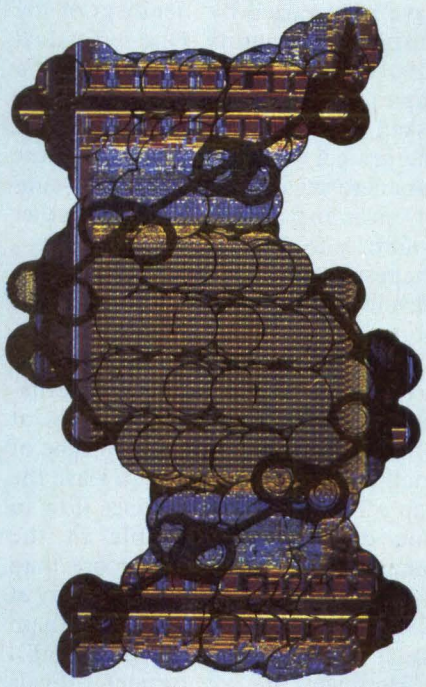
The biochip or, more properly, "molecular computing," is a tantalizing technology even though implementation in computer systems is still many years in the future.

Partisans of molecular computing propose that advances in synthetic chemistry and biotechnology make it possible to manufacture electronic components from individually tailored molecules. For example, some researchers have designed (but not built) diode-like switches that consist of long chains of carbon atoms.

"The idea is to do what semiconductor science does, but with molecular physics," explains G. Allan Schick, a research scientist with the Center for Molecular Electronics at Carnegie-Mellon University, Pittsburgh. But because individual components would be molecule-sized, they could be packed to densities beyond the wildest dreams of silicon designers.

The most effective means of manipulating structures on the atomic level is to use the same techniques employed by biotechnology companies, or even by living things—hence the term "biochip." Schick notes that molecular electronics researchers want molecular components to assist in their own assembly, rather like the DNA molecule. "In biofabrication circles, there's a lot of interest in self-assembly."

Full-scale molecular computers are decades away, even by the most optimistic estimates. But biofabrication is already easing



its way into the commercial world. For example, Gentronix Laboratories Corp., Rockville, Md., is seriously considering biofabricated components.

"The product we envision is an optically addressed memory medium manufactured with biofabrication techniques," says Gentronix president John Wehrung. Existing optical memory systems—laser disks—are limited in the amount of stored information by the size of the area that can be marked by a laser, the so-called "laser spot." But, with biofabrication techniques, says Wehrung, designers might give different optical characteristics to individual molecules. "In the space of a single laser spot, you could store 10,000 bits of information," he explains.

using the research to jump the gun on producing commercial products.

Serious objections to the program have been raised by members of the business community. One individual involved in a joint venture with a Japanese software concern, who asked not to be named, bluntly calls the project a "fraud," saying that the Japanese mean to use Frontiers simply as an inexpensive way to get other countries to do their basic research—the results of which they'd later use to develop still more products for export.

"The [Fifth Generation] project was supposed to be an open, international effort too," he says. "In point of fact, it was open the way a tube of toothpaste is open when you leave the cap off—easy to make things flow in one direction, impossible in the other. The Japanese were more than happy to send their people to study at Cal Tech or MIT, but try and get them to let your people work with them!"

However, the government officals who've actually seen the proposal seem to feel less concern about Japan's current motives. Notes the NSF's Wallace, "I think you have to realize this [Frontiers] is a very sincere effort. There is a very big push in their government for the internationalization of basic research."

State Department officals have similar opinions. One of them comments, "This is a program of basic, as opposed to applied, research. In such a situation, you have to have free exchange of information, or it just doesn't work."

Want Americans in

Whatever the purpose of the Frontiers project, the Japanese are eager for American participation. They are openly inviting American business to become involved. "We have told the U.S. government that the involvement of the private sector is quite essential," said Yokoyama. However, the exact mechanism for that involvement remains undefined—along with much of the rest of the program's proposed operation.

This vagueness could seriously discourage American researchers from participating, particularly given the business community's suspicions about Japan's real motivations. One possible solution to the problem, which has been aired in certain government and business circles, would be the creation of an R&D consortium, like the Microelectronics and Computer Corp. of Austin, Texas, established as a response to the Fifth Generation project.

But, instead of competing with the Japanese, this new consortium would act as a middleman between American researchers and the Frontiers administration in Japan—making Americans aware of the program, conveying information, and, generally, protecting American interests.

But American participation in the program in any form will have to await clarification of Frontier's basic aims and organization. Says the White House's Rabin, "We're enthusiastic about this thing. It looks interesting. But we're not ready to say that we know enough about it to get involved." □

High-speed modems trudge to market

Lynn Haber, Associate Editor

Implementation of the international CCITT V.32 recommendation for synchronous, high-speed data transmission in full-duplex mode over dial-up or leased lines has sent modem vendors down an unexpectedly bumpy road.

After a series of postponed product introductions by a number of manufacturers, only Concord Data Systems Inc. (CDS) and Infinet Inc. are shipping fully compatible V.32 products. British Telecomunications Plc, Codex Corp. and NEC America Inc. have scheduled shipments this summer.

The V.32 modems allow, for the first time, full-duplex, dial-up capability at 9,600 bits per second (bps). Such high-speed performance is the result of a built-in error-correction scheme, known as trellis coded modulation, and an echo-cancellation technique that makes speedy data transmission possible over unshielded telephone lines.

For users, these modems provide four times the data throughput of the slower V.22 modems, which operate at 2,400 bps in full-duplex mode. The ability of the V.32 modems to operate over both private and dial-up lines gives them greater flexibility than the V.22s.

CDS, of Marlborough, Mass., the first company to ship V.32 modems, has approximately 1,500 units in the field, according to CDS products marketing manager Philip Sliney. Priced at $3,495, the CDS V.32 Trellis modem features 9,600 bps and 4,800 bps; full-duplex over two-wire dial, or four-wire and two-wire unconditioned leased lines; and full CCITT V.32 compatibility with trellis coding. It also provides auto-answer and auto-rate determination of the incoming call; full automatic adaptive equalization with echo cancelling; and test and diagnostic capabilities.

According to Sliney, CDS, like some of its competitors, ran into development difficulties. "We expected to have our product out a year ago, but found problems with the far-end echo cancellation in the beta tests, and had to postpone delivery until corrections and new tests were complete," he says.

NEC America, San Jose, Calif., also encountered delays in shipping its V.32 trellis modem after it was announced last fall. According to product line manager Rick Pitz, echo-cancellation problems caused the delay, but they have been corrected.

Pitz, like CDS' Sliney, agrees that the delivery delays of the V.32 modems can be attributed to manufacturers underestimating the prob-



Codex's 2260 *V.32 high-speed modem, priced at $3,495, is scheduled for shipment this summer.*

lems involved in dealing with the units' advanced technology. "Implementing the far-end echo cancellation was difficult and costly," he maintains, adding, "getting products out the door then became largely a development problem."

The price of an echo

Echo cancellation is necessary to maintain data integrity during transmission. Moreover, it must be employed for trellis modems to comply with the CCITT V.32 standard. Unfortunately, says Sliney, the CCITT recommendations do not specify how echo cancellation should be done.

As explained by modem maker Codex, of Mansfield, Mass., there are two possible sources of echo in a dial connection: the local and remote terminations. An echo during data transmission is the same as that experienced during a telephone conversation when, for example, the voice is delayed for a few seconds after speaking. This is merely annoying in a telepone conversation; in data transmission it is unacceptable. Because both the transmitter and receiver share the same bandwidth in a two-wire scheme, the received signal will be masked by the transmitted signal unless the transmitted signal can be eliminated—thus, the need for echo cancellation. This problem is most commonly encountered when satellite phone links are used.

According to Codex director of dial products, Michael Moritz, the company's models 2250 and 2260 high-speed modems are due out this summer and will be priced at $2,995 and $3,495, respectively. The 2250 operates at 4,800 bps. The 2260 is compatible with other V.32 trellis and non-trellis coded modems at 9,600 bps and 4,800 bps.

Also shipping fully V.32-compatible modems is Infinet of Andover, Mass., with its V.32 Trellis that it buys under an OEM agreement from CDS. Lynn Faust-Berger, product marketing manager, expects to see sales of the V.32 units to dial customers who are looking for speed enhancements. She also believes the modems will be attractive to private-line users who want improved leased-line capabilities with an easy-to-use, single-call dial backup, all in one box.

Awaiting mass VLSI production

One reason for V.32 modem delays has been a lack of needed VLSI chips. Product-development time has been long, and costs have been high, because manufacturers have had to custom-design their own chip sets. Although Sliney says that CDS' modem uses off-the-shelf components and adds value by software, he contends that most semiconductor manufacturers are now developing V.32 chip sets. Indeed, a spokeswoman from Rockwell International Inc.'s Semiconductor Division in Newport Beach, Calif., says that the company is working on a board-level product expected to be available in mid-1987. Meanwhile, Codex's V.32 trellis modem uses a VLSI chip set designed by parent company Motorola Corp.

Lynne Davis, a senior research analyst with International Data Corp. (IDC) of Framingham, Mass., contends that, because of the high cost of the technology for the V.32 modems, many vendors have refrained from manufacturing them. She believes that will change when the chip sets are produced in volume.

While companies such as CDS, Codex, Infinet and NEC are busily going ahead with products, other modem makers believe that too many aspects of the CCITT V.32 recommendation remain unclear to risk pursuing the technology. That was the consensus at a recent CCITT V.32 meeting in Europe, says attendee Gregor Ferguson, vice president of marketing at Microcom Inc., Norwood, Mass. A number of proposals to modify or extend the current V.32 recommendation were suggested at the meeting, he says.



Concord Data Systems' *V.32 Trellis modem satisfies the full international CCITT V.32 recommendation for synchronous two-wire, full-duplex data transmission at 9,600 and 4,800 bits per second for dial-up and leased lines.*

Sliney reports that while buyers of CDS' V.32 Trellis have been positive about the units, it will take another three to six months of using them in a network before it becomes clear in which applications the modems function best.

Sliney believes that perhaps the greatest stamp of authority for the new trellis technology has been AT&T Information Systems' entrance in the V.32 arena. ATTIS recently introduced the $2,995 model 2248 modem, which complies with the V.32 standards for operation at 4,800 bps (but not at 9,600 bps).

Drawbacks remain

According to IDC's Davis, one disadvantage of the V.32 modems is that they are not compatible with the large installed base of CCITT-compliant and Bell Laboratories modems operating at 1,200 bps and 2,400 bps. But she expects that vendors will solve this problem and add backward compatibility to their products when CCITT defines the fall-back procedure. Additionally, while adhering to international standards implies that different vendor's equipment will be compatible, no testing between different manufacturers' products has yet taken place. □

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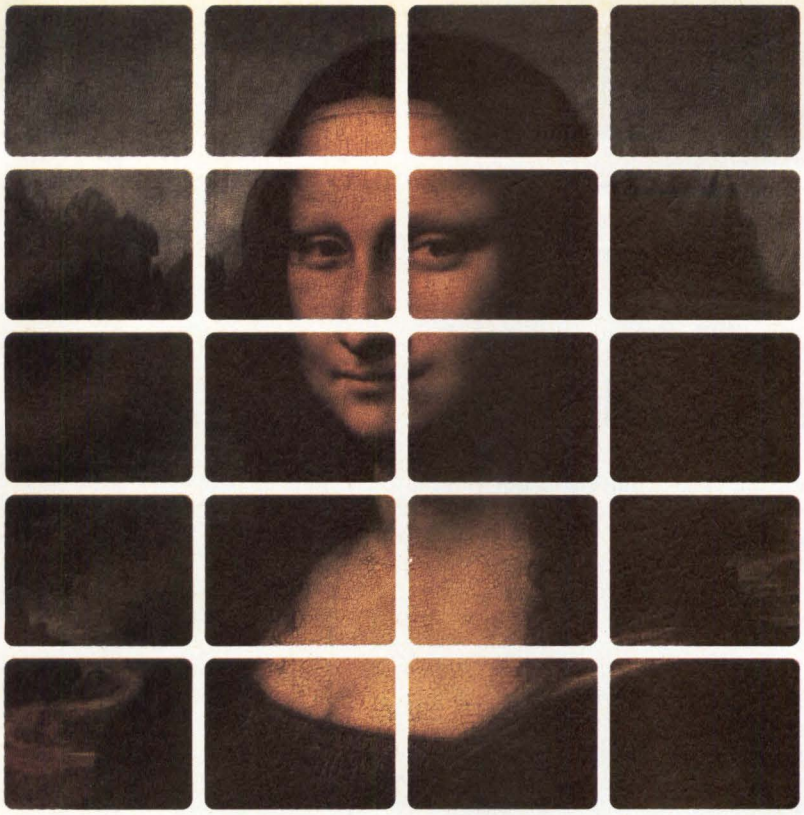
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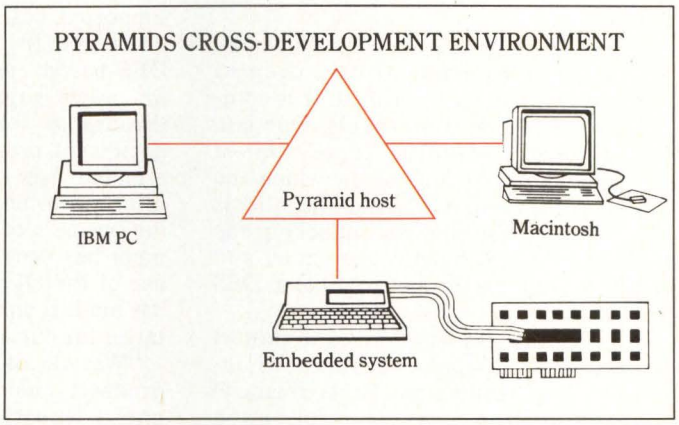
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CIRCLE NO. 20 ON INQUIRY CARD

HEARD ON THE HILL

NSA's waffling on DES worries encryption industry

Stephen J. Shaw
Washington Editor

Shooting oneself in the foot is a grand old Washington tradition. Jim Watt did it when he banned the Beach Boys from playing a concert on the Washington Mall. George Bush did it when he said that the price of gasoline was too low. Now, the National Security Agency (NSA) has joined the august list of those with itchy trigger fingers.

NSA, the not-so-secret government organization charged with maintaining the integrity of U.S. codes and ciphers, while ensuring that everybody else's can be read like an open book, may be waffling in its support of the data encryption standard (DES), an encoding method that the agency helped design in the mid-1970s.

DES is used to encrypt transmissions of government data deemed sensitive, but unclassified. It is composed of two components. One is a publicly available algorithm—a mathematical process on which the data encryption is based. The other is a key: a formula for unlocking the data, known by only the sender and the recipient in any particular DES application.

DES is also widely used to protect commercial data transmissions, including banking and other financial information, and information deemed proprietary by the sender. For classified government information, NSA maintains its own proprietary set of encryption algorithms, or processes.

In the decade since DES was adopted by both governmental and commercial organizations as the standard encryption system, a small industry has grown up around it. DES-based encryption chips are now available from the majority of leading integrated-circuit manufacturers; software vendors tout packages that implement DES; and users have jumped on the DES bandwagon believing that, as one observer puts it, if it's good enough for NSA, it's good enough for American business.

Or, at least, DES used to be good for business—maybe.

DES loses luster

Earlier this year, NSA began to send quiet signals at industry conferences and meetings that DES was no longer good enough to protect U.S. data communications. NSA's feelings surfaced publicly in March when Harold Daniels, the agency's deputy director of information security, responded to questions raised by analysts at Datapro Research Corp. of Delran, N.J., about NSA's current view of DES.

In a letter to Datapro, Daniels said: "The National Security Agency has supported, based on efforts that were initiated in the mid-1970s, the use of DES-based encryption equipment for unclassified U.S. application through a formal equipment-endorsement program and direct government user support. This unique initiative to engage U.S. industry in the business of cryptographic equipment has been very successful...The use of the DES algorithm, however, has made it an increasingly attractive target for our adversaries."

"We will continue to endorse DES products under the existing program until 1 January 1988," he continued, "but do not intend to certify the DES algorithm when it is reviewed in 1988."

In short, DES has become a victim of its own success. Since it has become widely accepted in both government and commercial circles, it has become more of a target for code breakers. Thus, NSA's thinking seems to run, it's time to change.

The reaction from industry sources to Daniel's statement was quick in coming. Most answer NSA's implicit criticism of DES with a challenge to point to any instance where the encryption system has been successfully descrambled without the key, despite some well-publicized commercial attempts to do just that. Others predict that the encryption industry will be seriously injured by the confusion.

"The vendors of DES-based technology are going to lose big with this," comments Michael Schwartz, vice president of Prime Factors Inc., a manufacturer of computer-encryption equipment in Oakland, Calif. "The biggest losers, though, are going to be the end users who now face a two-year or longer period when DES is going to be available, but who now have questions about using it because of what Daniels has said."

"Lots of non-NSA types say that DES is still a secure approach and won't stop being secure despite what NSA says," says Fred Diamond, Datapro's editor of its "Information Security" reports. "But companies will have to start new product and marketing approaches."

Even other government agencies are in a dither over NSA's comments. One official at the National Bureau of Standards (NBS), the official standards-setting arm of the U.S. government, said that NSA's authority in setting encryption standards by decree is not clear-cut. "NSA is not the one that issues government standards," the NBS representative sniffed. "We do." The official asked not to be identified.

There's also evidence that the flap over Daniels' letter is having some effect on NSA itself. Telephone calls to Daniels were referred to NSA public relations officials. There, an NSA official said that Daniels' letter contained some "inaccuracies" and that an official statement explaining NSA's "real" position on DES would be forthcoming.

Until NSA further reveals its plans for DES, the agency may do well to remember that the Beach Boys still play Washington, and the price of a gallon of gas is still around a buck.

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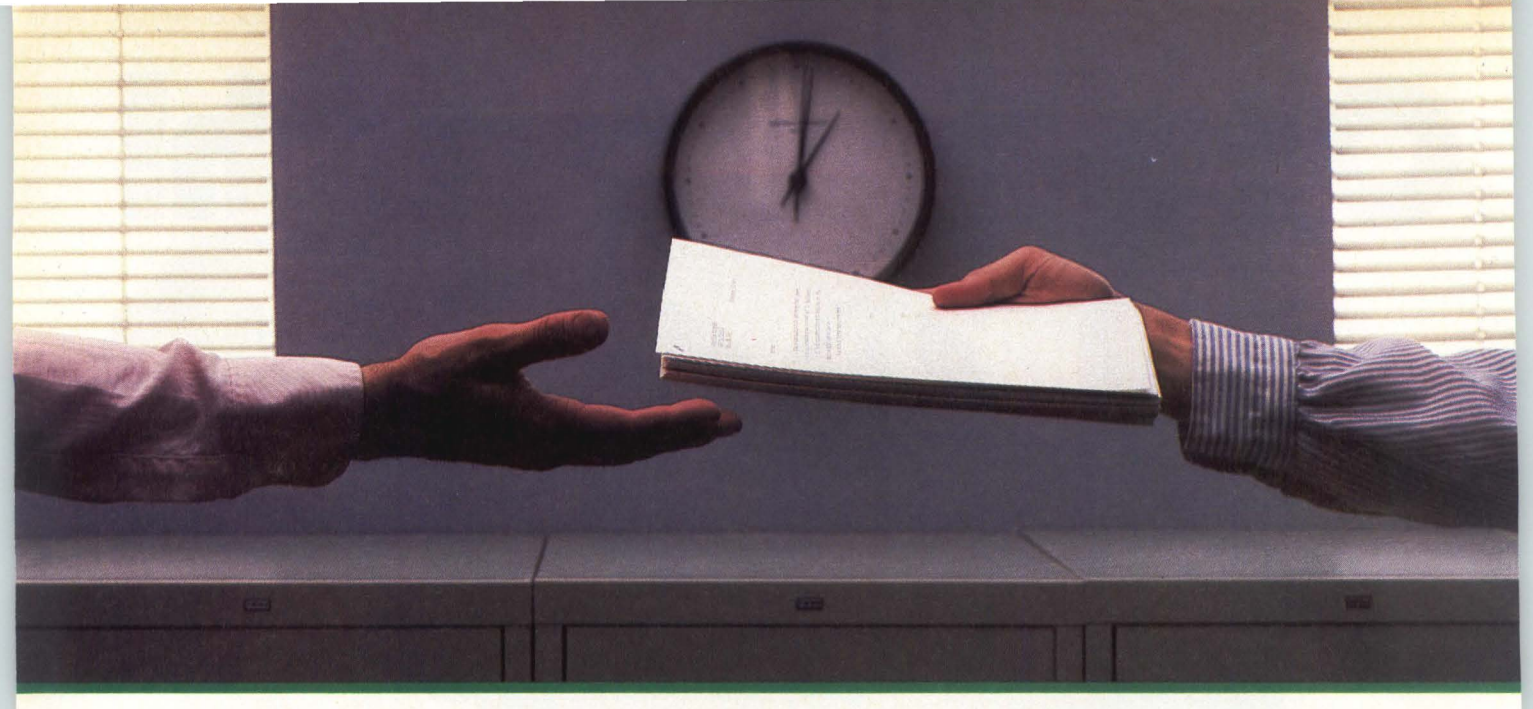
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London link heralds global sales of U.S. computer stocks

Keith Jones, European Editor

U.S. computer stocks are finding new investors on foreign exchanges through satellite links.

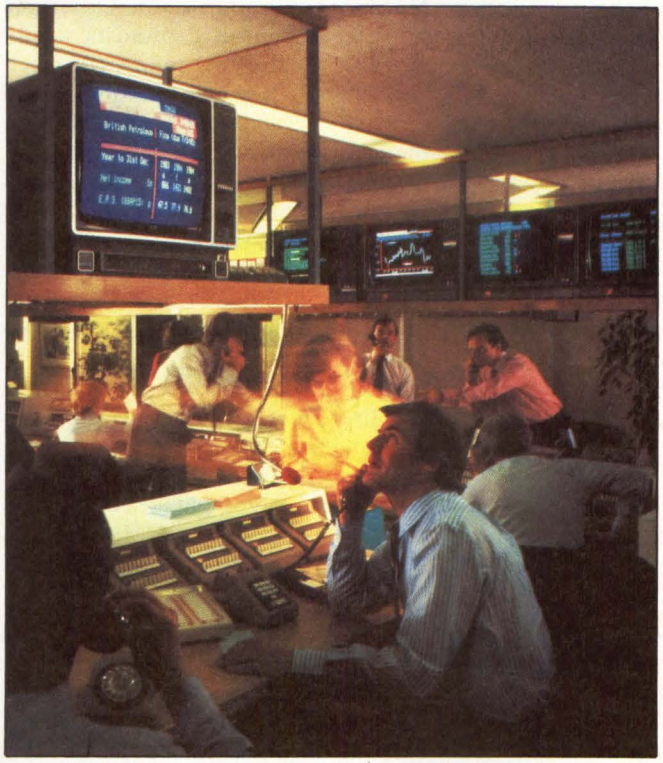
The National Association of Securities Dealers (NASD), Washington, whose trading system handles scores of computer industry shares, has taken a step toward a worldwide stock-trading network by connecting its Automated Quotation system (NASDAQ) by satellite to the Stock Exchange in London. That link, completed in April, enables NASD stock-price information to be continuously displayed and updated on the Stock Exchange's computer network.

Among the benefits that public U.S. computer companies anticipate from such trans-Atlantic trading are higher visibility in European financial markets and financial press; a better balance of investors; and, most important, more investors and more capital. Observers believe that the link will help healthy U.S. start-up companies secure European venture capital and that European stockholders will find it easier to track a U.S. company's progress, once it goes public on NASDAQ.

Key to the new trading network is the integration of the Stock Exchange's TOPIC system—Teletext Output of Price Information by Computer—with a new system called SEAQ, Stock Exchange Automated Quotations. TOPIC provides share information to securities dealers and stock brokers throughout Britain on a network of approximately 3,000 terminals controlled by 14 Classic minicomputers from Modcomp Inc., Fort Lauderdale, Fla.

The SEAQ, which comes into full operation in October, is modelled on NASDAQ. It shows the prices and bids of competing securities dealers who are geographically dispersed.

"Within the next five years, most major exchanges around the world will be linked like NASDAQ and the Stock Exchange in London," predicts NASDAQ president Gordon Macklin. "London is the first to be connected to NASDAQ because it's a prime location and because SEAQ is similar to NASDAQ. But we believe that other exchanges will follow SEAQ and NASDAQ." NASDAQ chairman David Hunter adds, "This is the beginning of the global network for 24-hour equity trading. This is the start of a true world-equity market."



Prices of U.S. computer *company stocks are among the NASDAQ quotations displayed in real time on the London Stock Exchange's TOPIC system. About 3,000 terminals, controlled by Modcomp minicomputers, are installed at brokerages throughout Britain, including this London office of Edinburgh broker Wood Mackenzie and Co. Ltd.*

Start with 300 stocks

Macklin estimates that computer companies account for only about a fifth of the total value of NASDAQ-quoted stocks. Still, the NASDAQ-Stock Exchange link will initially transmit information on approximately 300 NASDAQ stocks to London and about 300 London-traded stocks to NASDAQ. The NASDAQ stocks will include the leading 100 industrials, among them Apple Computer Inc., Cipher Data Products Inc., Convergent Technologies Inc. and Lotus Development Corp.

"The link with the London Stock Exchange will be very beneficial for companies quoted on NASDAQ," contends Robert Saltmarsh, Apple's treasurer. "One of the benefits for Apple will be the public-relations support it will provide for our subsidiaries in Europe. For example, the European financial press is more likely to write about Apple than previously."

That view is shared by Mick Prokopis, Lotus senior vice president of financial operations, who believes that the publicity value of increased European visibility will assist Lotus' rapidly expanding European operations.

Don Muller, chairman of Cipher Data Products, adds that the link should help increase his company's already large number of European investors. "Our big OEM customers in Europe are reassured by Cipher having European investors," he explains.

A Convergent Technologies spokesman says the increased visibility of its stock will make it easier for the company to establish a listing on London's Stock Exchange.

Apple's Saltmarsh believes, however, that the trans-Atlantic link will mean companies won't have to list separately in London. Nonetheless, he believes a better balance of investors will result from NASDAQ listings being displayed on the Stock Exchange. "Having European, as well as American, investors provides a healthier mixture of stockholders," he asserts. "American investors tend to be focused on quarterly earnings. In Europe there is less speculation in stocks. They hold their stocks longer and trade less often."

A boon for start-ups

Saltmarsh is among those who believe the trans-Atlantic link could be beneficial not only for established companies but also for start-ups and young companies, not yet listed on NASDAQ, who are seeking European venture capital. These would be companies that plan to go public on NASDAQ at some point. Observers say that European capitalists would be more willing to underwrite such ventures if they knew that, once a company was launched on NASDAQ, they could easily trace its fortunes.

"The existence of NASDAQ is of key importance for venture capitalists," stresses Peter Dicks, a director of Abingworth Plc, a London venture-capital company with 75 percent of its portfolio invested in U.S. concerns.

"The link is good news because it will provide a better service for British investors when a company goes public on NASDAQ," says Kevin Landry, managing partner in venture capitalists TA Associates, Boston. TA hopes to raise $30 million in Britain for investment in U.S. companies, including in fledgling computer-equipment manufacturers.

A flotation on NASDAQ is not the only way a young U.S. company can go public in Britain. Ronald Cohen, chairman of the British Venture Capital Association (BVCA), London, which represents many British venture-capital funds, notes that six U.S. companies have been first floated on the London Stock Exchange rather than on a U.S. exchange. These include Infrared Associates Inc., New Brunswick, N.J., and a chemicals industry concern, CVD Inc., Boston. No computer company has yet launched in London.

These American companies chose an approach used by many young British companies: they went public on the Unlisted Securities Market (USM). The USM is operated by the Stock Exchange, but differs from it by permitting a company to be floated

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A USM flotation can be easier than going public on NASDAQ, too, says Alistair Alcock, director of finance at London stockbrokers, Phillips and Drew, which has helped two U.S. companies go public on the USM. Alcock explains that the London investment community is more interested in floating small companies than are U.S. investors because British companies in general tend to be smaller. Additionally, the fees charged in London for a USM flotation are much lower than those charged for going public in the United States.

Nonetheless, Alcock expects NASDAQ to remain a much more important market than USM for trading U.S. stocks in London, owing to NASDAQ's reputation and the greater number of shares traded on its market. The growth of USM will be steady, he says, but it will not become a major avenue for capital for U.S. computer companies.

NASDAQ president Macklin says plans are now under way to extend NASDAQ's satellite link with the Stock Exchange to all 2,200 companies traded on NASDAQ. NASDAQ stocks can already be purchased in London from the London offices of the major New York securities dealers such as Merrill Lynch, Pierce, Fenner and Smith Inc. and Morgan Stanley and Co. Inc., which trade on the NASDAQ system. He adds that the automatic deal execution and settlement facilities provided by NASDAQ in the United States will be extended to London as further developments.

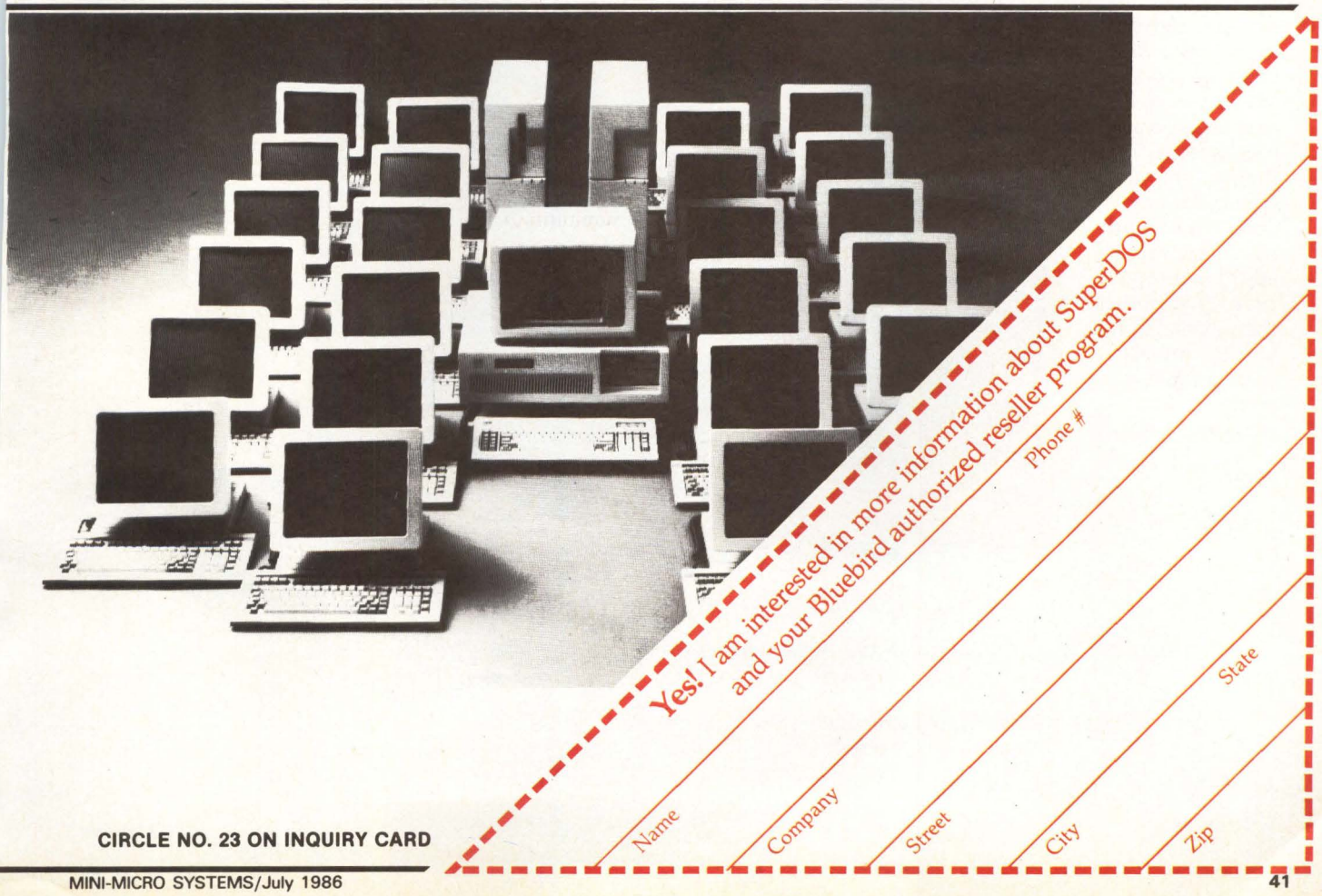
Reluctance remains

In spite of the benefits to U.S. computer companies that the satellite link will provide, it does not necessarily presage a road to riches. Such companies are not always viewed by the British financial community as good investments. □

LOOKING AHEAD IN MMS

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

- The August issue will cover single-board computers and microprocessors.
- Add-in/add-on subsystems will be studied in the October issue.



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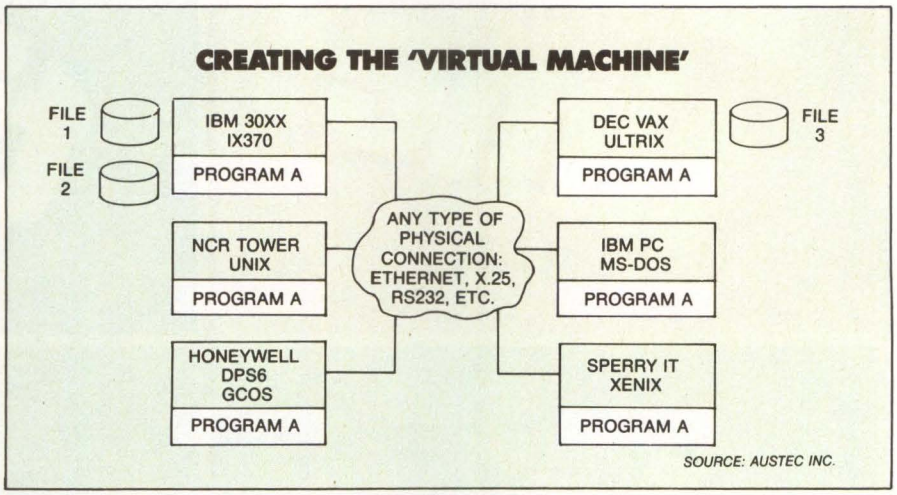
From Down Under: Software to end program incompatibility

Mike Seither
Associate Western Editor

An Australian systems software company has taken networking to new limits by making it possible to run a single version of a program, and to exchange data files, on dissimilar networked machines without having to rewrite the code to match individual computers.

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Distributed Data Access *from Austec allows an application program to be loaded downline on a network and executed on dissimilar computer systems where Austec's ACEBRIDGE software resides.*

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CIRCLE NO. 26 ON INQUIRY CARD

Austec International Ltd., Melbourne, Australia, began its "push" campaign by first convincing more than a dozen computer giants to support its ACE (Austec Conformable Environment) software products. Present licensees include AT&T Information Systems, Digital Equipment Corp., Hewlett-Packard Co., Honeywell Information Systems Inc., IBM Corp. and NCR Corp. Austec expects to sign up a dozen more vendors before long. The manufacturers sign agreements to resell the ACE networking software, which Austec tailors for vendors' specific machines. Most of the computers involved run on versions of either the DOS or UNIX operating systems.

Austec's method is to re-engineer parts of each computer's operating system, file structure and I/O control through a program called ACEBRIDGE. Using about 200K bytes of memory, ACEBRIDGE resides on the networked computers and allows the CPU to read and execute a common machine code generated by Austec's ACECOBOL compiler.

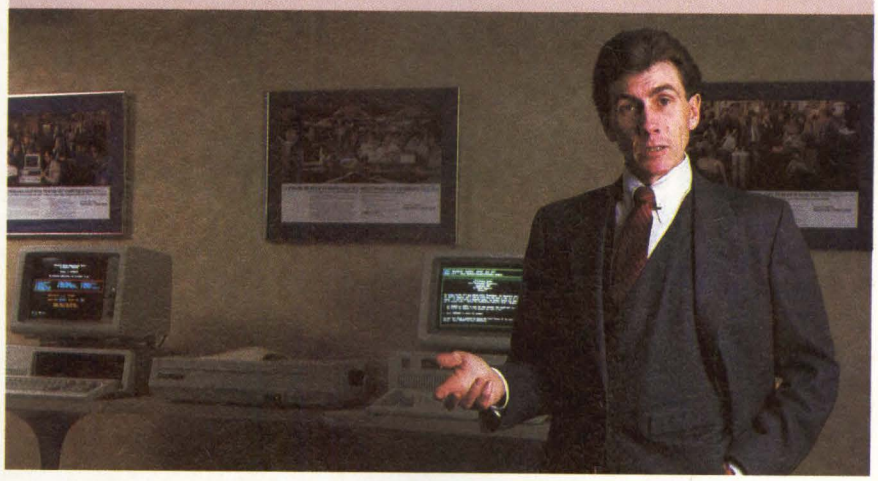
Austec claims that any computer running ACEBRIDGE software, regardless of the operating system, can operate in unison with similarly equipped computers from other vendors. The upshot is what Austec describes as a "virtual computer"—a network of disparate machines that can share processing power, data and, most important, application software.

The conformable pitch

Austec anticipates that its system will help users get more mileage out of their personal computers. "The industry has been selling people hardware that they use only 10 or 20 percent of the time," says Leslie McNeill, Austec's chief executive officer. "There is really a need to make these machines begin to earn their way."

With the backing of manufacturers assured, Austec is now trying to "pull" other customers to its door through a $2.5 million publicity campaign that includes full-page adver-

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tisements in the *Wall Street Journal*. Part of the strategy is to get end users, in-house system integrators and resellers clamoring for Austec's conformable software from their computer suppliers.

For system integrators, the message is that there is an opportunity to sell a wider selection of products. If a computer uses ACE software, a system integrator presumably can concentrate on price and performance characteristics of various manufacturers' computers without having to worry about the availability of application programs. For governments and businesses whose several agencies and departments buy equipment independently, "conformable" systems will allow the separate units to exchange data and programs.

Austec's system allows COBOL software developers to write one version of an application source code and have it work on all ACE-compatible computers. Finally, Austec is telling manufacturers themselves that their diverse product lines need not remain incompatible. Incompatability is a key concern for vendors whose customers insist on protecting their investment in software when moving to larger systems.

The test for portability

To prove its claims, Austec contracted with International Data Corp.'s (IDC) Technology Laboratories, Palo Alto, Calif., to evaluate Austec's Distributed Data Access (DDA). DDA is Austec's latest enhancement to the ACE line, the portion that provides the actual networking capability. It is an add-on module to ACEBRIDGE and implements the top six layers of the Open Systems Interconnection (OSI) reference model. Austec does not deal with the OSI's first layer, which handles physical connection. The company says that any physical connection, from RS232 to Ethernet and X.25, will provide a link among computers.

Austec has offered COBOL program compatibility through ACEBRIDGE since 1984. But, without DDA, users have had to physically load a program compiled under ACECOBOL onto the target computer disk or tape drive. DDA, on the other hand, makes it possible for a user to load object code on another computer downline, access remote data and lock out others when using a file.

In recent demonstrations in New York and California, IDC used Austec software to demonstrate the company's claims of interconnectivity of a single COBOL application. In the IDC lab, the program resided on an ATTIS 3B2/400 running UNIX, and was loaded downline on an NCR Tower XP. The program also was able to access files on an ATTIS PC 6300 Plus running MS-DOS. Several users were put on the job simultaneously to

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show that only one person at a time could access the file in use.

The ACE software is available only from those manufacturers who license it from Austec. The manufacturers are responsible for sales, support and marketing, and prices may vary according to the type of system. For example, an ACEBRIDGE license for the IBM PC costs about $500, while a version for ATTIS' 3B2 costs $1,000. The ACECOBOL compiler is priced at $1,000 for the PC and $2,200 for the 3B2, according to Austec.

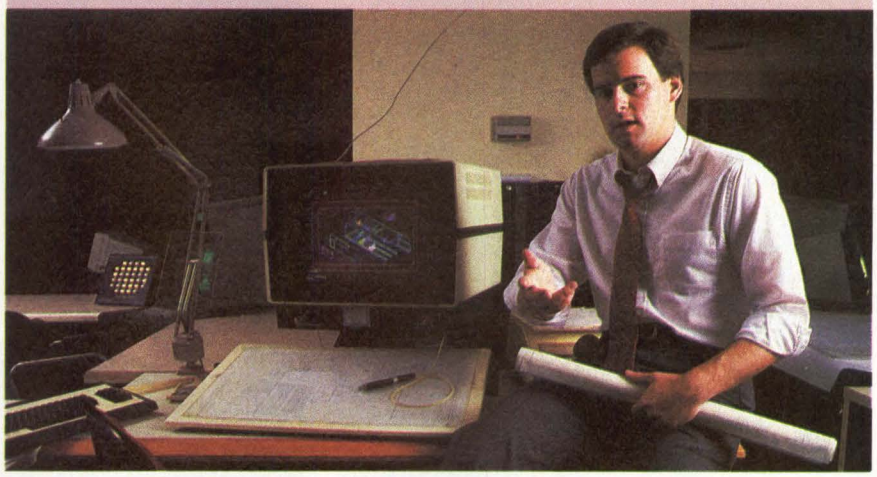
Austec estimates that there are more than 20,000 COBOL applications available worldwide and that most of them can work with its software. The chief reason is that Austec's ACECOBOL works with most of the popular COBOL dialects written for compilers from companies such as Data General Corp., Ryan MacFarland Corp., Olivetti S.p.A. and Micro Focus Inc.

Although Austec will market only a compiler for COBOL, McNeill says that ACEBRIDGE can be used to share applications and distribute data from programs written in other languages, such as C, FORTRAN and Pascal. The only proviso, according to Austec, is that the computers where ACEBRIDGE resides must support a modern C compiler.

Although COBOL is one of today's most popular programming languages, some analysts wonder how long that situation will last, especially as personal computers continue to proliferate. Those personal computers aren't running that many COBOL programs, says Robert Lefkowits, an analyst with InfoCorp, a market-research concern in Cupertino, Calif. "There are about a thousand times as many [Ashton-Tate] dBASE programs running on PCs as on COBOL," says Lefkowits. "COBOL is disappearing as an application language for micros."

But Austec's McNeill says it is not Austec's intention to drive COBOL into the personal computer. "All we're saying is that you can now attach all that computing power, of which PCs are only a part, and make it work within your business." □

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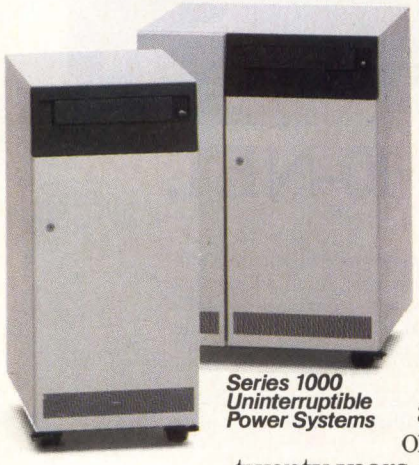
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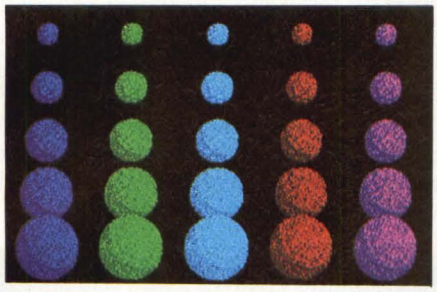
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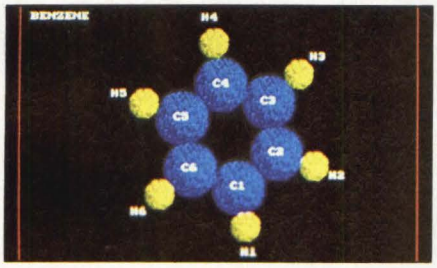
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FEATURE HIGHLIGHTS



p. 69 . . . . . Improving graphics



p. 85 . . . . . Software-development tools



p. 101 . . . . . A new application area

UPPER LEVEL OSI PROTOCOLS NEAR COMPLETION 53

The second article of a three-part series on the International Standards Organization's Open Systems Interconnection (OSI) networking model takes a close look at the technical issues surrounding the upper-level protocols that implement layers 5 through 7 of the seven-layer model. Those are the layers that are visible to the user. They deal with application-oriented tasks such as how to establish a connection, transfer a file, access a database management system, send a message and get a printout.

PC BOARD VENDORS RUSH TO FILL EGA DEMAND 69

One of the key ways to improve the graphics of IBM Corp. PCs and lookalikes is via enhanced graphics adapter (EGA) cards, most of which are compatible with IBM's own EGA standard. However, most of the color graphics boards go beyond IBM's, offering a greater variety of resolutions, more memory, added functions and lower prices. Our survey takes a look at over 20 companies with products that enhance PC-based graphics.

GRAPHICS TOOLS BROADEN PC HORIZONS 85

High-resolution displays and graphics cards are useless without the proper software to take advantage of them. Although there are many off-the-shelf packages available, system integrators and software developers are increasingly turning to graphics software-development tools to customize packages that stand apart from the crowd. Software tools range from programming languages to subroutine libraries and operating environments.

SOFTWARE DEVELOPMENT FIRES UP WORKSTATIONS.101

Most people associate workstations with applications such as computer-aided design and engineering. Recently, however, software-development joined those oldtimers as applications suitable for the powerful 32-bit machines. In fact, a leading market-research company reports that 17 percent of all workstations sold last year were destined for software engineering; that percentage is expected to increase this year. The new application area is called computer-aided software engineering (CASE) and encompasses a range of tasks relating to the development, management and maintenance of code.

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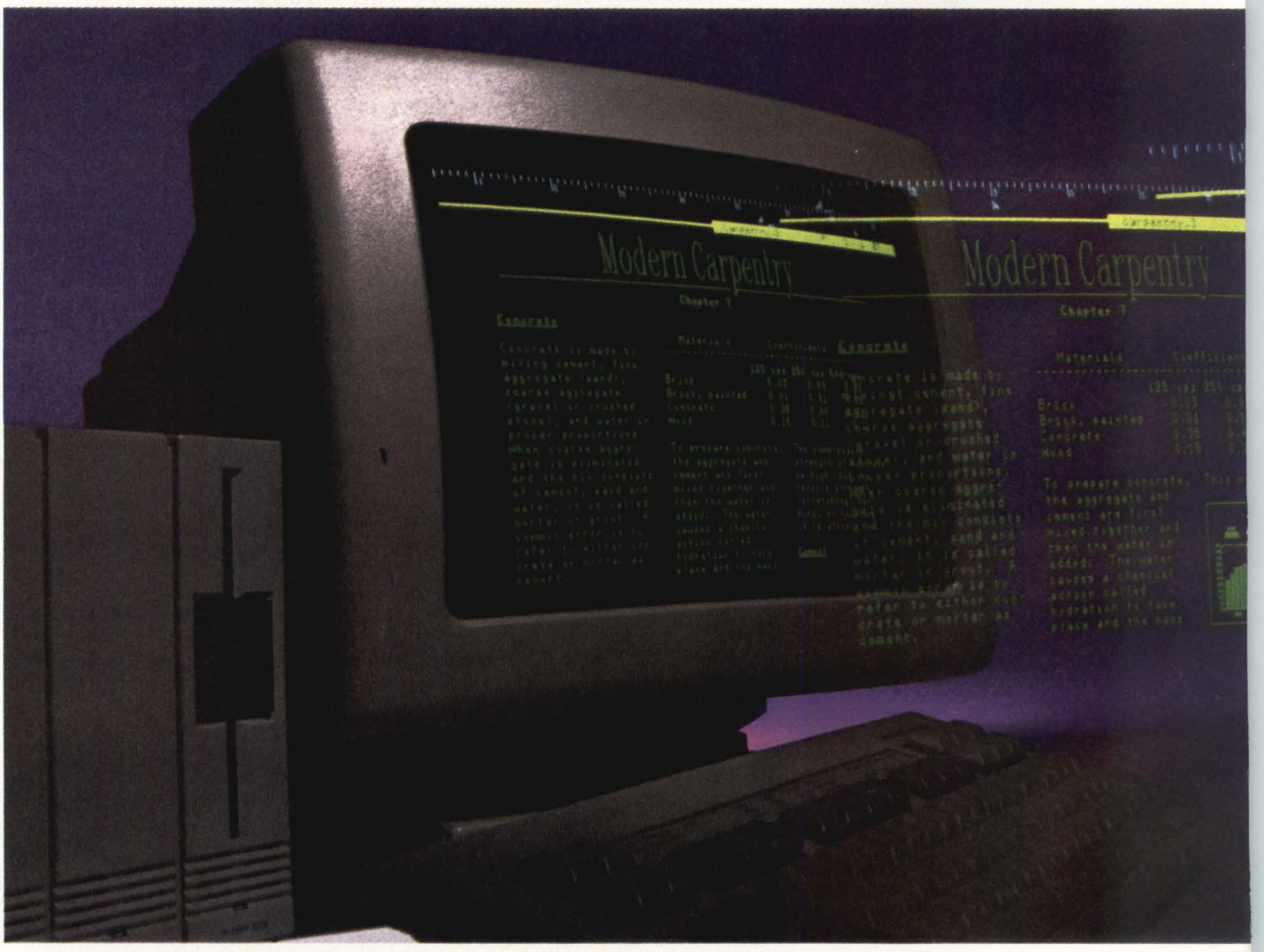
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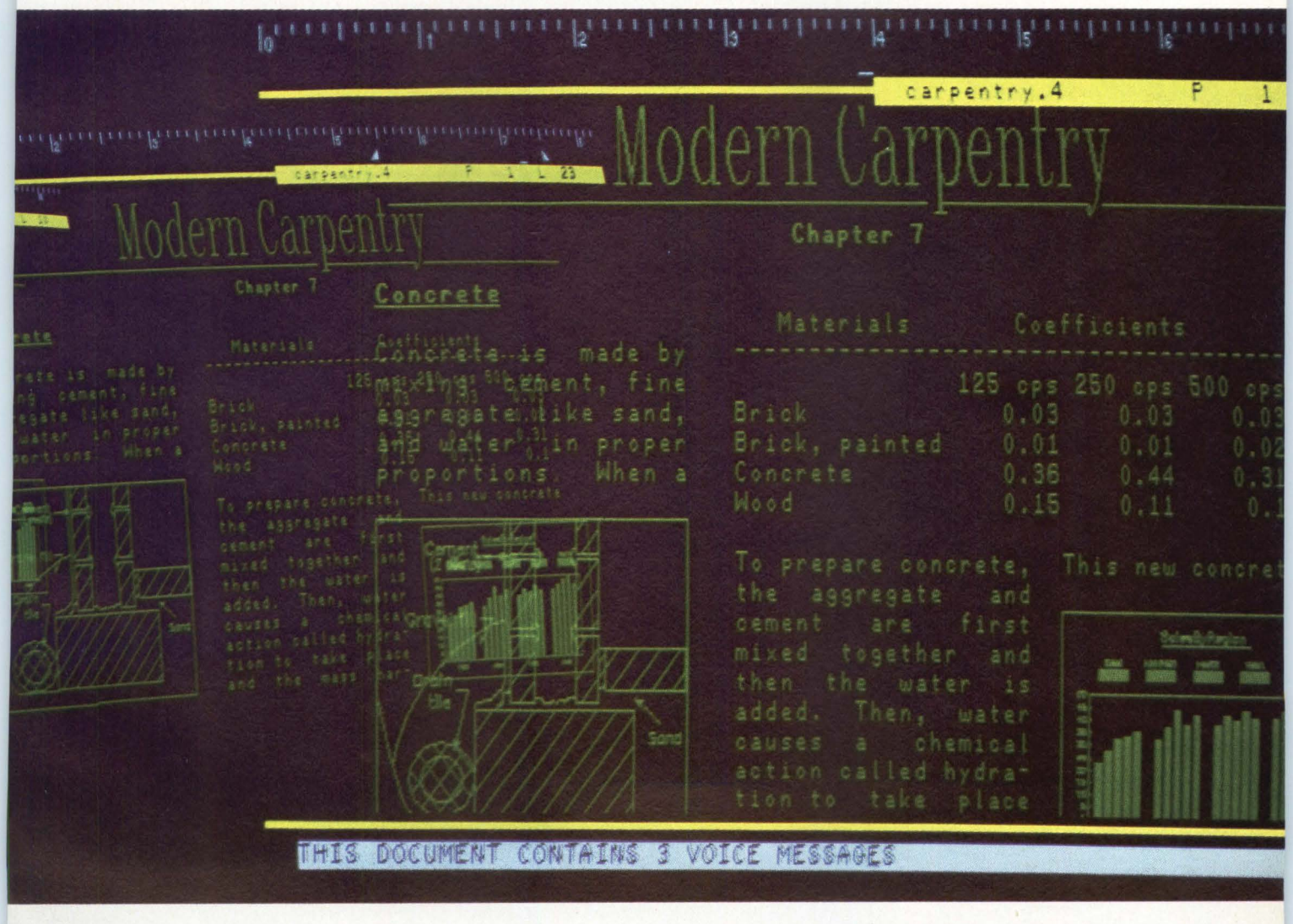
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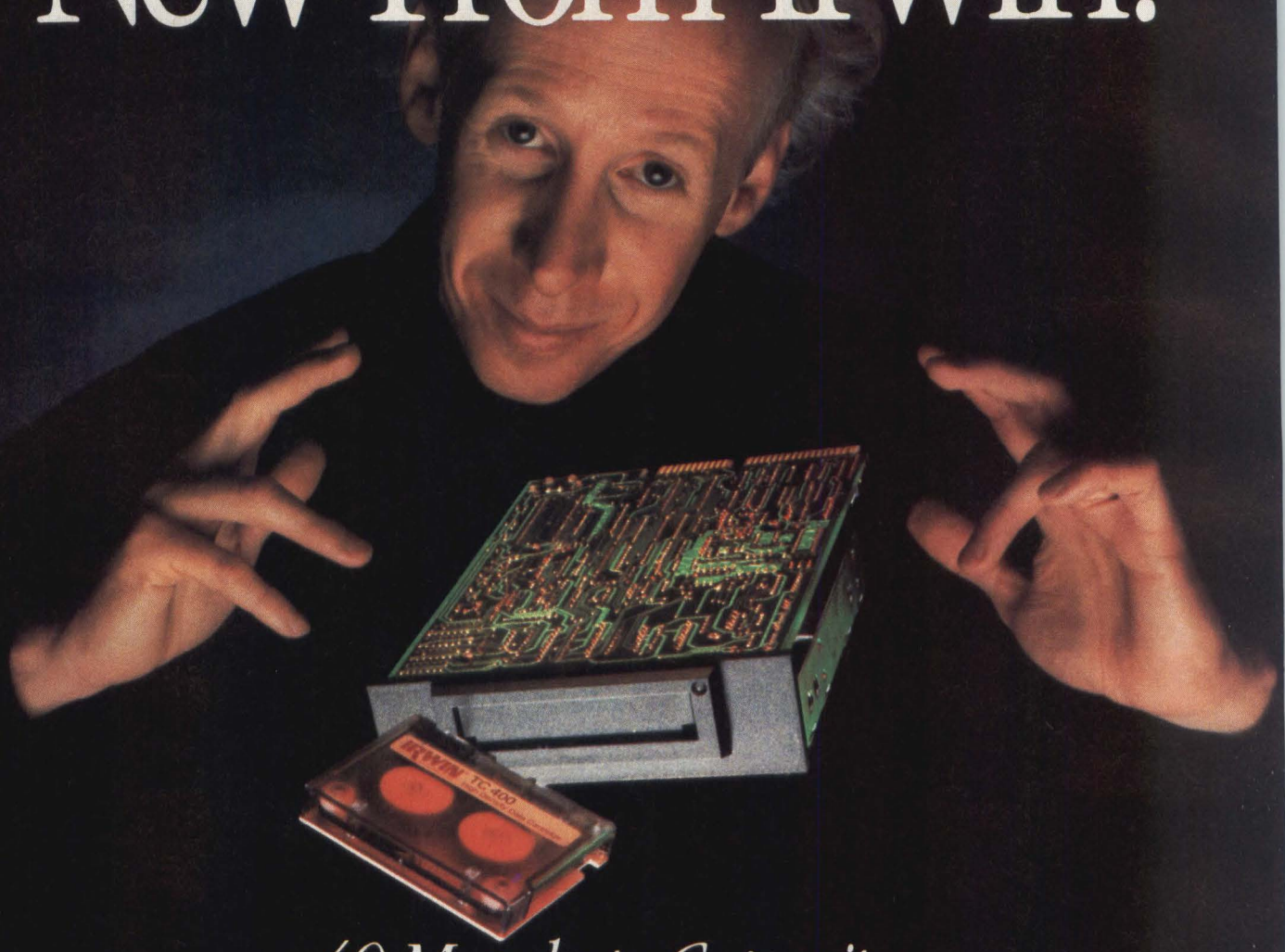
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UPPER LEVEL OSI PROTOCOLS NEAR COMPLETION

As lower level OSI protocols gain acceptance, the protocols of the upper levels—where they are visible to users—are approaching standardization

Wendy Rauch-Hindin
Special Features Editor

When commercial networks first came on the scene, the emphasis was largely on such design considerations as the type of transmission medium, the network topology and the accessing method. But end users are concerned with application-oriented tasks: how to establish a connection, transfer a file, access a database management system, send a message and get a printout.

Such application undertakings are within the province of the upper level protocols that implement layers 5 through 7 of the International Standards Organization's Open Systems Interconnection (OSI) seven-layer network model. With the lower level protocols becoming established, vendors now are betting heavily on these higher layers—the protocols directly visible to the user. As shown in Part 1 of this series (MMS, June, Page 67), many of the lower layer OSI protocols have already reached International Standard status, and within the last year major computer manufacturers have introduced a wealth of products embodying these protocols.

The final standardization stages are now close for several upper level protocols, such as the Presentation Layer protocol; File Transfer, Access and Management (FTAM); Common Application Service Elements (CASE); Basic Class Virtual Terminal; and the X.400 electronic-mail facility. Also nearing standardization are two database languages, a remote-job-entry protocol, several office-automation protocols, a computer graphics communications protocol and two formal description languages for protocols. Many vendors plan to launch upper level OSI protocol products soon.

Lest it be thought that the standards efforts are finite and soon over, one need only look to users' continuously evolving requirements. With the Department of Defense—the last major holdout—adopting OSI, security becomes paramount. Accordingly, a recently defined security addendum, which addresses what security services need to be resolved at different layers, went out from ISO to its members for approval as a draft proposal. At the same time, the ubiquitous use of spreadsheets led to new OSI work to develop a standard spreadsheet format for communications.

The Session Layer, level 5, is the lowest layer that recognizes the existence of users on a network. The Session Layer protocol has been an approved international standard since 1984.

The Session Layer's functions include the establishment and termination of a communi-

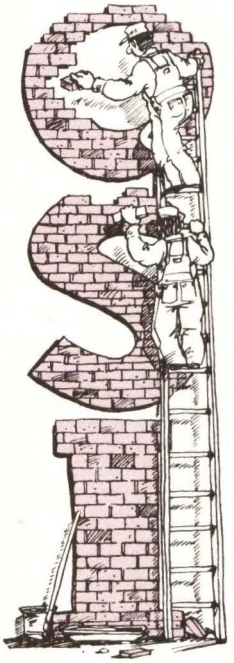


Illustration by Jon McIntosh

This is the second of a three-part series scheduled to appear in Mini-Micro Systems *on OSI standards. The first part ran in the June issue. The third article, which will appear in the September issue, will cover vendors' OSI implementations and strategic directions. It will also discuss user applications and the major interoperability issues and solutions.*

Which subset to implement turns out to be the major Session consideration because different subsets are required for different applications.

cating session, data synchronization and the mapping of addresses to names. It also structures the communicating session that occurs on a Transport Layer (level 4) connection by allowing full-duplex, half-duplex or simplex communications and by determining who speaks when and for how long. In addition, Session manages the breakup of dialogues into different activities that are handled on one connection.

The Session protocol has four subsets: Session Kernel, Basic Combined Subset (BCS), Basic Synchronized Subset (BSS) and Basic Activity Subset (BAS). Which subset to implement turns out to be the major Session consideration because different subsets are required for different applications that users may want to run in one network.

The Session Kernel provides the fundamental Session capability, which is to connect, transfer data and disconnect. BCS adds to the kernel full- or half-duplex operation, optionally expedited data, exception reporting and negotiated release. It does not provide synchronization facilities.

The BSS provides the same services as the BCS in addition to major and minor synchronization, resynchronization, negotiated release and typed data (data sent out of turn). It supports both major and minor synchronization points with different rules about what happens when the communicating partners roll back to one or another of these points.

The most highly structured Session protocol subset is the BAS. BAS provides the BCS capabilities, supports exception reporting and minor synchronization and manages multiple activity subsets. Activity subsets are independent "activities," each of which can be alternately operated, suspended and resumed over the same Session connection.

Manufacturing Automation Protocol (MAP) connectivity requires, at a minimum, the Session Kernel and the "Duplex Functional Unit." The latter, however, is part of the BCS version of Session, which supports other services for factory applications as well. Therefore, a number of MAP products support the BCS.

The BSS subset is intended for applications such as synchronized file transfer and bulk data transfer. But the CCITT X.400 electronic messaging protocol requires the BAS version of the Session protocol.

"I think you will see a merging of these subsets," predicts Ann Jenkins, product marketing manager for communication systems at Prime Computer Inc., Natick, Mass. "That [merge] will be particularly important in environments where users are implementing protocols like Session, FTAM and X.400 on their host because they will want to run Session with multiple [application] protocols. The Session is a large layer, and users will not want to support multiple sessions running concurrently. Therefore, it will be necessary that the Session support FTAM as well as X.400."

FTAM and X.400 are important functions in business and engineering offices. It follows then that a merge of the Session subsets will be a factor in the specification of the Technical and Office Protocols (TOP). But the MAP arena is different. "If industrial users are running MAP only, they are likely to streamline it to the more minimal BCS version, because they will want as little overhead as possible on the CPU," Jenkins says.

How an application works

Residing above the Session level are the Presentation and Application layers, in that order. The Presentation and Application protocols work together to represent and transfer structured information between application processes. They then pass the information to the Session layer for actual transmission. For example, a point-of-sale application process in a store computer might request a credit-card verification from a credit-authorization process in a bank computer. The Presentation and Application protocols encode the store computer's request as an application-protocol data unit containing the credit-card identification number, the sales price and an action code requesting authorization to accept the charge. They then pass this structured data in an agreed-upon bit encoding to the Session service. The Session service transfers the data to the peer protocol in the bank computer (example from R. desJardins and J.S. Foley, "Open Systems Interconnection: A Review and Status Report," *Journal of Telecommunications Networks,* Fall 1984).

For this transaction, the Application Layer structures the information to be transferred into an abstract syntax notation language (not a bit encoding). The Presentation Layer encodes this abstract syntax in a concrete syntax (bit encoding), mutually agreed upon by the communicating Presentation processes.

Because these Presentation and Application protocols work together so closely, the ISO decided to ballot on the Presentation, FTAM and CASE protocols as a package. They were voted upon in April as Draft International Standards.

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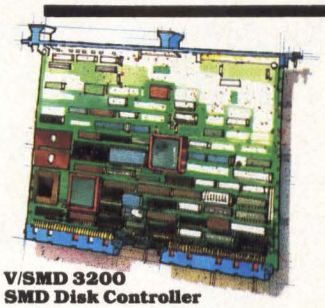
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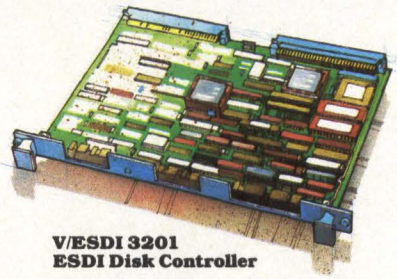
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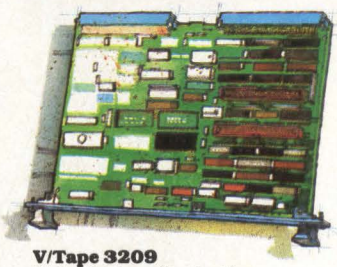
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for information such as character codes, alphanumerics, data types and file formats. The Presentation protocol negotiates a syntax to represent the information that two communicating applications will exchange.

The Presentation Layer needs two types of syntax to represent and transfer the structured data. One is the abstract syntax, known as ASN.1, that the ISO is developing for use by the Application Layer. Abstract syntax describes data in a way that people can understand, but it does not describe how the data will be encoded for transfer or storage. The "integer 17" and the data structure representing the information in the credit-card verification request example illustrate the concept of an abstract syntax.

ASN.1 is based on the CCITT X.409 standard encoding syntax, developed for the CCITT Message Handling Facility and is upwardly compatible with it. Currently a Draft International Standard, ASN.1 differs from X.409 in its general structure, which allows the addition of more data types.

One important data type, the "object identifier," is not supported by X.409 but is proposed for ASN.1 and is needed for Presentation Layer functions. The object identifier is simply a hierarchical notation that is used to identify and select a concrete syntax for transmission. It might be used, for example, in a videotex application to first identify a videotex syntax and then select the syntaxes for a graphic and for text from the document, and so on. The object identifier is an important data type because there are so many concrete syntaxes to identify. Many are complex because they involve compression, encryption, alternative coding or subsets, and, therefore, a sophisticated mechanism is needed to describe them.

The second Presentation Layer syntax, the concrete-transfer syntax, is the bit-level encoding of ASN.1 data. An ASCII or EBCDIC character string or an IEEE floating-point standard 64-bit string are examples of concrete syntax. The standard, "ISO Basic Encoding Rules for ASN.1" (Draft International Standard 8825), is compatible with the standard X.409 representation. Draft International Standard 8825 specifies the rules for encoding ASN.1/X.409 data in an ISO-standard concrete syntax.

The Presentation Layer can use either the ISO encoding rules or any other negotiated bit encoding to encode information. The only requirement is that the Presentation layers in both communicating applications agree on the encoding so they can both interpret the data transferred.

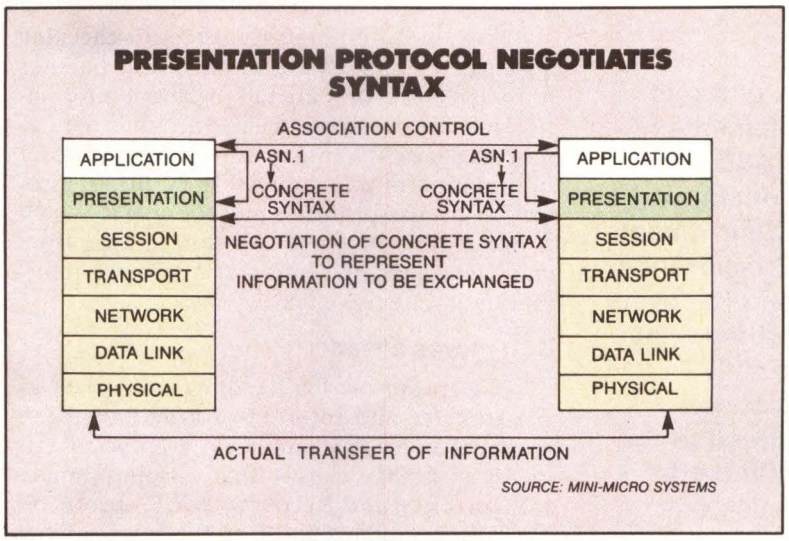


Fig. 1. Peer Application Layers *agree on the semantics, or meaning, of the information to be exchanged, which they represent in an abstract transfer syntax (ASN.1). This information is encoded in concrete syntax for actual transfer.*

To negotiate the syntax to be used in the data transfer, Presentation protocol software selects a presentation context—a category of syntax or data to be transferred, such as ASCII or NAPLPS. Applications using the selected contexts pass information to the Presentation protocol in ASN.1 form. The software then uses Presentation protocol negotiation procedures for proposing, sending, accepting and rejecting concrete transfer syntaxes. When negotiations are completed, the protocol software translates the abstract syntax into the agreed-on concrete syntax and passes it to the Session Layer for transfer (Fig. 1).

The CASE of the Application Layer

Users are most aware of the Application Layer protocols during a communication. There are two basic types of Application protocols. One is CASE, which contains a kit of service elements for common use by specific application protocols. A number of more specific protocols deal with application-oriented tasks such as file transfer, electronic mail, graphics, database and virtual-terminal functions.

The most common elements in CASE perform "association control." Intended principally for use in distributed enterprises, where computers and applications can communicate autonomously, association-control protocols specify the procedures that ensure that applications communicate with appropriate applications in a relevant context. Using these procedures, one application sets up an association with a named peer application and negotiates the semantics, or meaning—without concern for syntax—of the information to be exchanged.

A group of elements in CASE, constituting a Commitment, Concurrency and Recovery protocol, has quietly plodded ahead to the standards finish line.

For example, a point-of-sale credit-checking application and its communicating partner must agree that they are talking about information relevant to credit checking, rather than to mortgages or inventory, and must interpret information in that context. In addition, association-control protocols must be able to switch between different contexts—for example, from credit checking to loans—and transfer information in either context.

CCR moves ahead

While protocols for handling tasks such as file transfer and internetworking have been receiving much OSI publicity, a group of elements in CASE, constituting a Commitment, Concurrency and Recovery (CCR) protocol, has quietly plodded ahead to the International Standards finish line. The CCR protocol provides for the reliable completion of distributed activity in the event of system failure. Toward this end, CCR specifies distributed synchronization; coordination of logging and backup; and recovery and restart of work when a crash is detected. It is intended for use with distributed databases; Job Transfer and Manipulation (JTM), a generalized remote-job-entry Application level protocol; and transaction-processing protocols.

JTM specifies job distribution

The JTM protocol is used primarily in job shops and universities, where jobs are likely to be distributed on different systems. Currently a Draft International Standard, it defines how users should specify the way a job should be distributed as well as how the distributed-processing pieces and results should be processed and controlled in execution processors and reassembled in a single destination processor. The JTM service and protocol are geared to unattended operation and remote management by exception.

A number of MAP products introduced this year are touted as implementing OSI FTAM, but they don't. In fact, they can't because until recently only the File Transfer subset of the OSI FTAM protocol was defined. Because MAP developers needed to provide file-transfer capabilities, they adopted the "FT" part of FTAM for MAP 2.1. But the MAP Task Force formed by General Motors Corp. to develop protocols admits that MAP 2.1 is only an interim standard because it provides only bulk file transfer.

The full FTAM, now up for Draft International Standard balloting, also provides file-access and -management capabilities as well as heterogeneous transfer using the presentation services. The current FTAM products can't provide heterogeneous transfer because the Presentation protocol was only recently defined.

FTAM's file-access capabilities support the selective access and arbitrary picking apart of a file. Remote users can retrieve one or more records from the middle of a file, add or insert a record into the file and delete files.

The file-management part of FTAM contains service elements that allow users to create new files and file attributes, to inspect and change the properties of a file and to handle the naming of files. In addition, the protocol manages file-ownership functions such as who has access rights to read, write or modify a file.

The heterogeneous transfer capabilities that FTAM supports use the Presentation Layer services. With the Presentation services, users can change codings during a transfer. They can, for example, transfer an EBCDIC file so that ASCII pops up at the other end.

Messaging protocols gain popularity

Besides FTAM, the most widely implemented application protocol this year is the CCITT's X.400 recommendation for store-and-forward electronic messaging. Once approved, it achieved instant popularity and is being implemented by common carriers, value-added networks, computer manufacturers and local network vendors. Among others, AT&T Co., Burroughs Corp., Data General Corp., Digital Equipment Corp., Excelan Inc., Hewlett-Packard Co., GTE Corp., ITT Inc., MCI Communications Corp., NCR Corp., Northern Telecom Inc., Sperry Corp., 3Com Corp., Wang Laboratories Inc., Western Union Corp. and Xerox Corp. have or will shortly have X.400 implementations.

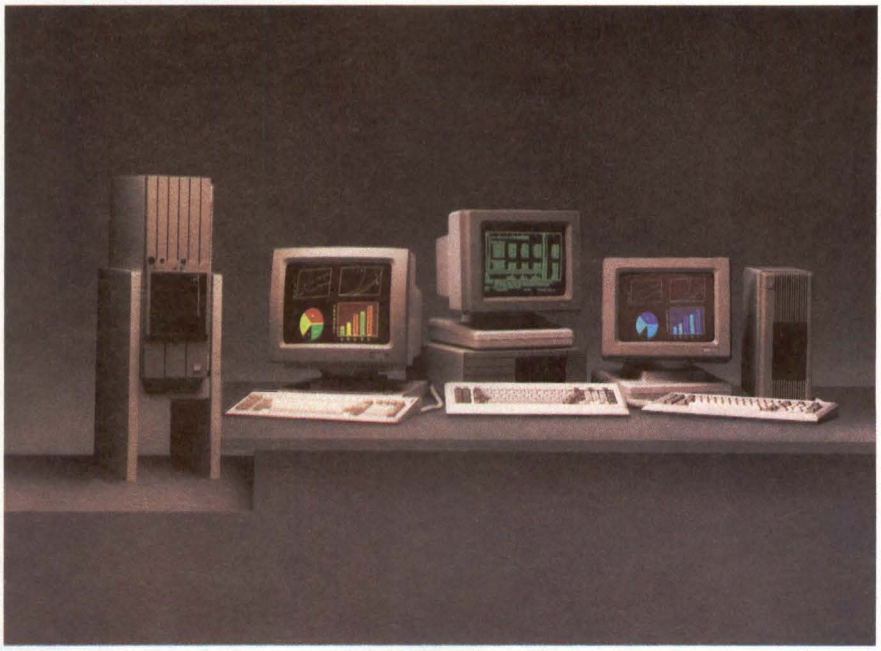
A series of protocols, the X.400 specifies message-transfer syntax, fields and format and the services and protocols for handling, transferring and forwarding messages. In addition, the approved electronic-mail protocols span the functionality of the Xerox Network System Courier protocol. Like Courier, X.409 defines standard data types, such as integers and strings. Only the details of the data-type encoding scheme have been changed.

X.410 is derived from the Courier protocol's remote-procedure-call capability. The remote-procedure-call mechanism allows an application to make a procedure call on one machine and have it transparently answered or executed by another. This capability is particularly important for directory services and network-

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management protocols. Unfortunately, X.410 still lacks several features that prevent its general-purpose use in distributed processing.

Although the CCITT X.400 series is not an OSI standard, the messaging facility is being widely implemented with OSI networks. Furthermore, the X.409 encoding scheme forms the basis for a good deal of OSI and related protocols. For example, X.409 underlies the Presentation Layer's abstract and concrete syntax, the office-document protocols and the newly emerging MAP/RS-511 real-time messaging protocol.

Protocol defines generic terminals

Anyone who has tried to transfer files and documents between dissimilar terminals knows the frustration that can occur when what is sent from one end bears little resemblance to what is produced at the other. Different terminals can have not only dissimilar character sets, but also different screen characteristics, such as number of characters per line; different control functions, such as end-of-line, tab, underline, form feeds and up arrows; and different control characters to handle these functions.

The Basic Class Virtual Terminal protocol resolves differences between terminals by defining a generic, or virtual, type of terminal that the communicating end terminals implement (Fig. 2). The standard specifies the characteristics of a character-oriented display terminal and the operations it can perform. It specifies these in a way that allows end terminals to understand the same displays and allows each terminal's control functions to cause the same operations to occur in the remote terminal. Characteristics and operations include characters per line, lines per screen, colors and possible methods of emphasis such as underlining and boldface. Not restricted to specific ASCII-encoded terminal operations, the standard also specifies manipulations such as line- and page-oriented operations, protect fields, blinking capabilities and accommodation of input devices such as light pens and mice.

The characteristics that communicating terminals will use are negotiated at the start of a Virtual Terminal session. To ensure the same interpretation of control functions, the Virtual Terminal protocol uses "object-oriented techniques." This means that the terminal's characteristics and data structures are defined as abstract objects and the actions a terminal can perform are defined as operations to manipulate the abstract objects. This setup simplifies the mapping of operations to different terminals because protocol implementers need know only what the objects and operations are. No code is associated with either of these.

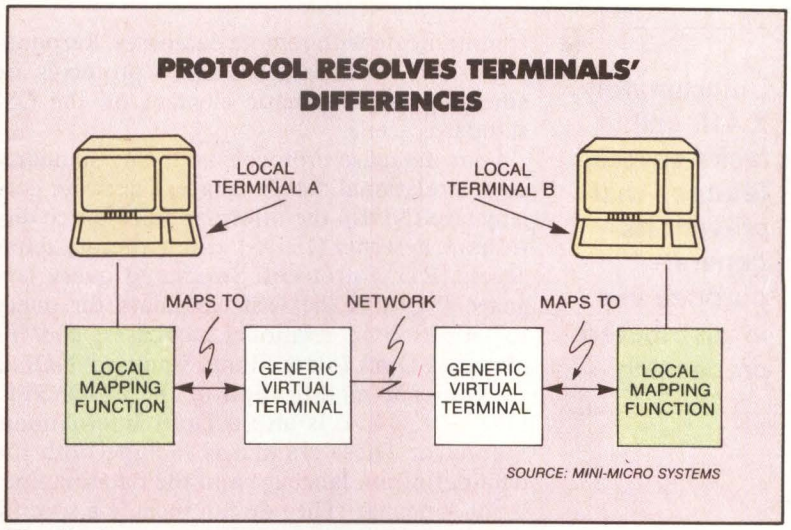


Fig. 2. Communicating terminals map *operations and control functions to a generic terminal (defined by the Basic Class Virtual Terminal protocol), to ensure that they both interpret the operations and functions in the same way.*

To perform a control operation remotely, the originating terminal sends the name of a control operation, such as blinking, to its own control object. The control object is the data structure that contains the list of operations that define the current screen. The control object sends the operation name, "blinking," to the corresponding control object in the remote terminal. The remote terminal's control object then uses its own methods to execute blinking. Its method may be different from that used by the originating terminal, but it produces the same results.

The Basic Class Virtual Terminal was scheduled for approval as a Draft International Standard in July. As approval dates neared, the MAP Task Force was working on incorporating the Virtual Terminal protocol into MAP, and similar support was expected for TOP. OSI members are now looking toward the development of more sophisticated versions of the protocol. These include a forms-oriented Virtual Terminal protocol, which supports fields, displays forms and transmits only filled-in information; graphics Virtual Terminal protocols; and mixed-mode Virtual Terminal protocols, including speech.

The increasing decentralization of control in the industrial, financial and a variety of other business communities requires the ability to

Unfortunately, X.410 still lacks several features that prevent its general-purpose use in distributed processing.

communicate with remote databases. Responding to this need, database-access protocols are emerging as a dramatic element on the OSI standards scene.

Four database protocols are being standardized: a relational data language, a network data language (NDL), the information resource dictionary systems (IRDS) and a remote data-access (RDA) protocol. Structured query language (SQL) is the OSI candidate for query specification in relational databases, and it's already a Draft International Standard. NDL is a significant modification of the CODASYL. Like SQL, NDL is also a Draft International Standard. These standards include both the data-definition language and the data-manipulation language. They do not include a specific binding to programming languages. Specific programming or user-interface languages will likely be the subject of additional standardization.

The third protocol, IRDS, is still a working document. It is intended to provide a data-dictionary standard.

The fourth database protocol, RDA, is a relatively new work item, still in the working document stage. Its aim is to allow remote access and updating, via OSI, of relational databases or of database systems that support relational interfaces. RDA uses the standardized SQL as the relational data-manipulation language for remote database interactions. The SQL statements are transferred across the network in an encoded form, using the ASN.1 encoding rules. The query is then analyzed at the remote site and translated into an appropriate query understood by the remote database, and the data is then shipped to the user.

The National Bureau of Standards does not believe that a similar remote-access standard will be defined for network or hierarchical databases using NDL. "The advantage of SQL is that it allows you to express a large volume of data very concisely," says David Jefferson, manager of the database architecture group, Information Systems Engineering, at NBS. You can't easily do that for a network or hierarchical database, Jefferson explains. Both network and hierarchical databases tend to require a lengthier procedural and navigational query, as for example, where you get a record, process it, get the next record or series of records and so on.

Jefferson recommends using SQL wherever possible to specify a query for a relational, network or hierarchical database and then using a translation facility to map the SQL to a form understood by the queried database. This technique, however, is subject to a few limitations. One limitation is SQL's inability to specify records in a certain order unless the data sets are tagged.

Database access takes time, so performance can be a problem. Relational databases have sometimes been accused of being slower than network or hierarchical databases. Network and hierarchical databases allow programmers to increase performance by setting up an efficient path to the data.

The situation is different for remote databases. There, communications is often the more important issue. "A concise way of specifying a remote database query leads to more efficient communications and cuts down on the communications cost," says Jefferson. "In terms of trade-offs, for remote database interaction, this may weigh more than efficiently getting to the data at the remote site."

OA protocols handle documents

Office computer users need to be able to create and transmit formatted documents across a network so that they can be exactly reproduced, worked on and revised at their destination. Today's communications techniques don't allow this. The integrity of the control functions, which control the formatting of a document, is lost during transmission. Consequently, if a document is transmitted in final form, then centered headings, tabbed characters, margin settings, font selections, partial lines up and down, superscripts and subscripts either do not show up at the receiving end or cannot be worked with and still maintain the same format. For example, if a few characters are added to a centered heading, the heading will no longer be centered.

The OSI Text and Office Systems protocols support the transmission of revisable-form documents by standardizing control codes so that their meaning can be reproduced at the communicating end system. Wherever possible, these standards draw upon existing protocols such as FTAM and X.400 messaging, rather than requiring the design of new data-exchange methods for office-document protocols.

The Text and Office Systems standards have six parts, all of which went out in April for approval as Draft International Standards. Based on perceived voters' attitudes, Shirley Watkins, manager of the office systems engineering group at the NBS, expects the standard to meet final approval as a Draft International Standard by the end of this year, even should changes be required.


THE
SECRET
BEHIND
THE PLOT.

The first part of the Text and Office Systems protocols, "User Requirements," addresses management-support functions. For Part 2, a task group is developing the protocols for Office Document Architecture/Office Document Interchange Format (ODA/ODIF). The Text Interchange Group is working on Part 3, message handling. Part 4 specifies content architectures so that complicated documents containing mixtures of text, graphics and spreadsheet information, for example, can be transmitted. Part 5 is concerned with text description and processing languages and is aimed at the publishing industry. And Part 6, "User System Interfaces/Symbols," deals with user-interface matters such as those concerning keyboards and displays.

Of all the office-document protocols, ODA/ODIF and the content-architecture protocols are garnering the greatest attention from the largest number of users, vendors and other standards organizations such as the TOP user group. The ODA protocol specifies an architecture, which describes a document in terms of a logical description and a physical-layout description. These descriptions, which determine, for example, how text, figures and tables fit together, are abstract; they cannot be implemented directly.

The document architectures are closely tied to the content architectures, which more specifically provide the means of merging different information types. The ODIF, which specifies the format of the data stream used for transfer, is the most specific.

Content architectures currently under development include character, color, graphics, image, voice and spreadsheet. The entire set of content architectures will use ASN.1 for encoding.

The character-content architecture is the first content architecture going to Draft International Standard. The image-content architecture, which refers to facsimile, has already reached the advanced stages, because facsimile is a relatively mature technology. The specification of a graphics-content architecture is also fairly far along. Watkins predicts that spreadsheet will be the next content architecture to be completed.

Spreadsheet-content standardization has drawn a good deal of support, not the least of which comes from federal agencies. The spreadsheet-content architecture standardizes the format for the exchange of spreadsheet data; it is not concerned with the application.

The office-automation protocols are now speeding along after a slow start. The ODA/ODIF and document-content architecture protocols are functionally similar to, but not compatible with, IBM Corp.'s Document Interchange Architecture/Document Content Architecture (DIA/DCA). IBM's DCA was originally intended only for character content, although the company is also adding other information types, thus increasing the similarities.

Database-access protocols are emerging as a dramatic element on the OSI standards scene.

Graphics standards mature

Another area in which standards have recently matured is graphics. It's a good thing, too, because the office-document protocols, advanced Virtual Terminal protocols, MAP and TOP standards want to include the graphics specifications developed.

The Graphical Kernel System (GKS) reached International Standard status in 1985. GKS is a 2-D graphics standard for simple images in document drawings and simple graphics on terminals.

Once they create an image, users often want to transmit it to a device and display it on a screen or send it to a remote terminal. Two standards are concerned with these tasks: Computer Graphics Metafile (CGM) and Computer Graphics Interface (CGI). CGM is a Draft International Standard. CGI is still a working document.

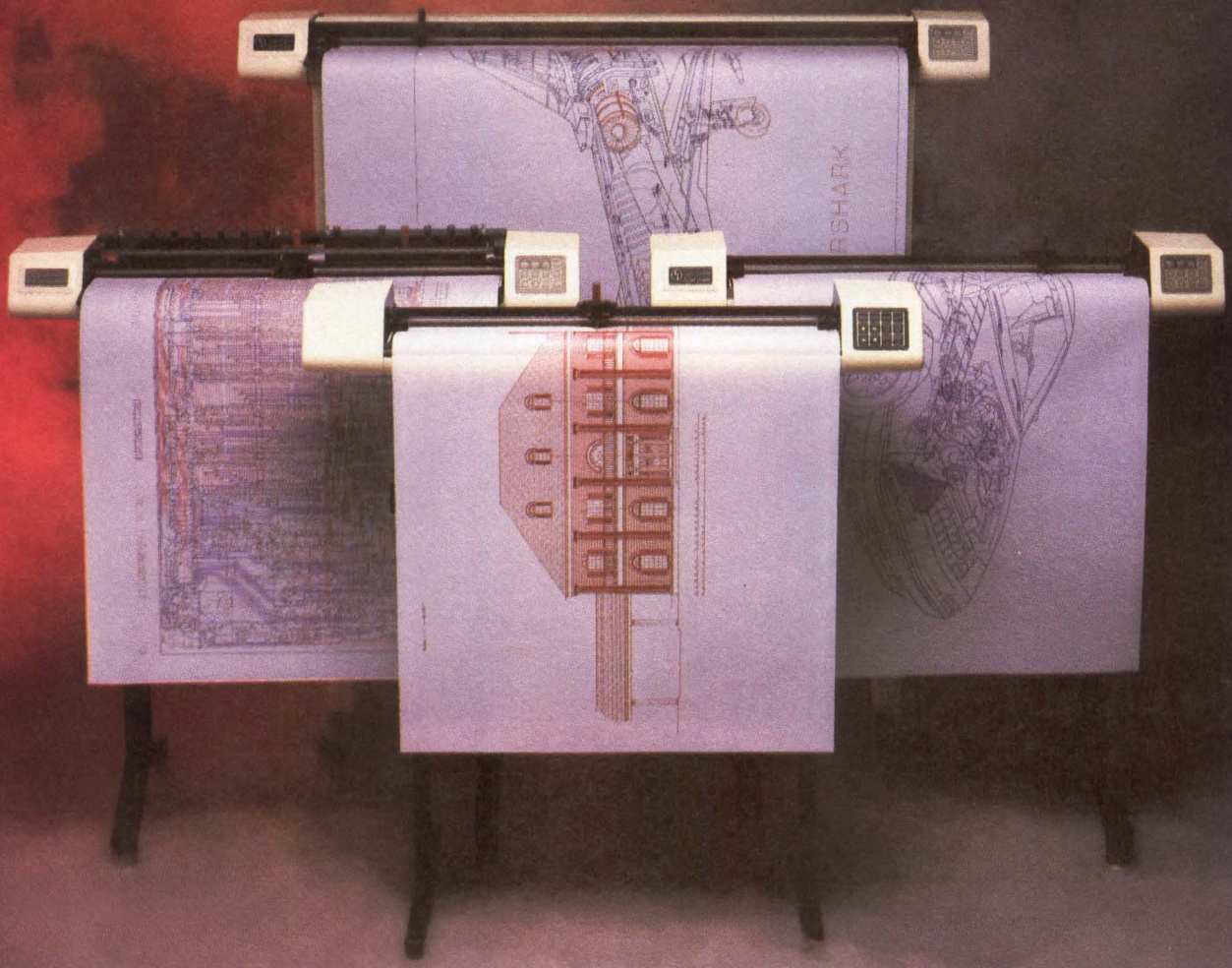
Metafile is a standard needed when sending a drawing, or graphical image. It specifies the format for storing a graphics file in terms of the information content of the image rather than in bits and bytes. With the image in file form, the FTAM protocol is used to actually transfer it to a remote location.

When the image arrives at its destination, the receiving user may want to display it on a terminal or other device. The CGI protocol specifies how to present graphics information to a device at the logical level (not the coding level). This is equivalent to presenting the information at a virtual-device level; hence, the protocol is also called Virtual Device Interface and Virtual Graphics Interface.

Unless the drive toward communications compatibility takes an unpredictable turn, ISO's OSI efforts seem secure. And, considering the large number of OSI products introduced in the past year by major vendors and the even larger number of OSI products announced for shipping over the next two years, OSI networks no longer seem futuristic. □

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PC BOARD VENDORS RUSH TO FILL EGA DEMANDS

Eager to share in the personal computer-based enhanced graphics adapter market, vendors are packing boards with greater display functions while maintaining IBM compatibility

Edward Teja
Contributing Editor

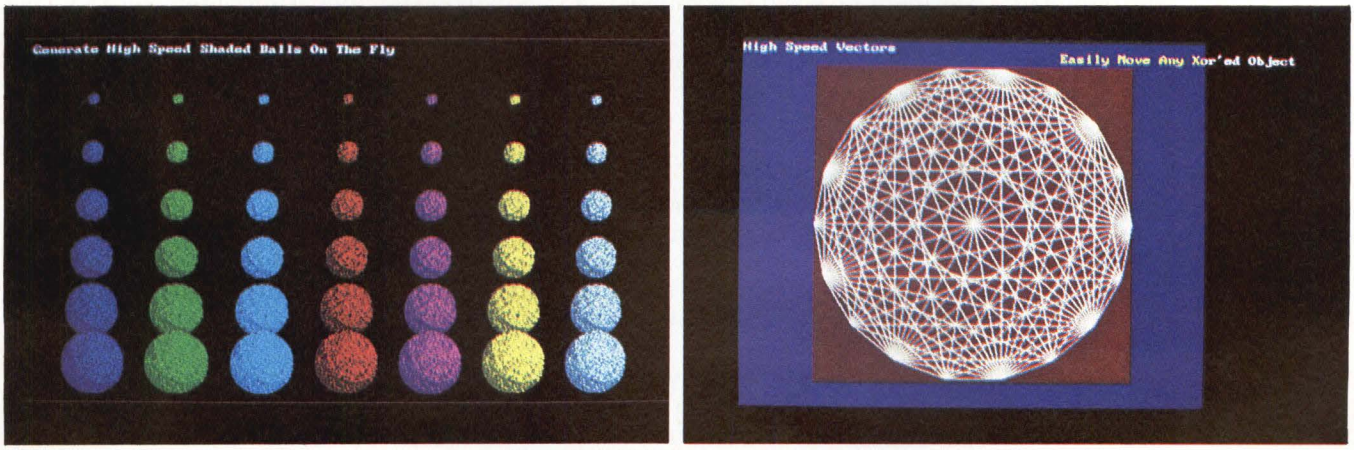
Personal computer manufacturers are rushing to handle increasingly demanding system applications, such as computer aided design/computer aided engineering and scientific analysis. In particular, this demand has generated a need to improve the typical desktop computer's graphics performance. That is, microcomputer-based systems graphics capabilities must be upgraded in order to compete with dedicated workstations.

The most direct means of working toward that end is through the use of enhanced graphics adapter (EGA) boards—plug-in cards that offer a range of graphics improvements. Most are based on, and are compatible with, IBM Corp.'s own Enhanced Graphics Adapter.

Better at displaying both text and graphics than is IBM's Color-Graphic Adapter (CGA) board—the original color graphics standard—the new EGA boards suit system integrators and end users who need higher performance and an IBM-compatible format that is inexpensive to implement. The EGA de facto standard offers that combination.

Among other enhancements, EGA boards provide a choice of display resolutions. Typical EGA-board pixel resolutions are 320 by 200, 640 by 200 or 640 by 350, in color, and 720 by 348 in monochrome. Users can choose not only color or monochrome but also display orientation and aspect ratio.

Of course, monochrome mode provides high resolution and produces sharp, clear images



Shaded spheres and complex shapes *like these are only two examples of what can be generated with an enhanced graphics adapter (EGA) board and sophisticated graphics software, such as the Enhanced Graphics Toolkit from Connell Scientific Graphics.*



An IBM EGA-compatible monitor—*the Quadchrome Enhanced Display—and the QUADEGA+ card, both from Quadram and running on an IBM PC, combine to create this Microsoft Windows screen.*

using varying degrees of gray scale. But, more importantly for desktop systems, EGA boards are relatively inexpensive vehicles for rediscovering how color adds value to sales.

However, adding color can be viewed either as an enhancement or a limitation, depending on the application. For example, in 640-by-200-dot resolution mode, up to 16 colors can be displayed simultaneously from a palette of 64. Although this is lower resolution than that offered by monochrome, the additional perceived information can be enhanced. For example, an edge delineated by a color change can be much sharper than the equivalent in monochrome.

EGA boards eliminate severe user-acceptance problems introduced by IBM's CGA board, which drove users and system integrators toward monochrome display. "CGA was worse than useless for text," says Gary Gonnella, president of Wayne Technology, a systems house in Crestline, Calif. "If you were scrolling through text, the monitor would actually blink off, and then on again, as it scrolled past each line."

More memory enhances display

To enhance display quality, without trading off system performance and throughput, EGAs need on-board memory. This memory, ranging from 64K bytes to 256K bytes, allows the graphics adapter to offload graphics-processing tasks from the CPU.

IBM's EGA board has 64K bytes, yet much of the graphics software being written for IBM PCs, and especially for PC/ATs, requires 256K bytes. Most other EGA boards are available with 256K bytes, whereas adding memory to IBM's EGA requires a piggyback card. And some boards can take advantage of as much as 4M bytes of directly accessible memory.

According to Nandu Marketkar, president of NSI Logic Inc., the question isn't strictly how much memory you have. Although he agrees that 256K bytes of display RAM are necessary to effectively handle most graphics software, he points out that it needn't be expensive video RAM. NSI Logic uses true dual-ported memory on its $595 (retail) Epic board. "Other boards only give the host processor access to the display RAM about 20 percent of the time," which isn't enough update time for applications such as solids modeling and CAD, where images must be frequently modified. In contrast, using dual-ported memory gives the host access to display RAM 100 percent of the time.

Thus, it isn't simply having a lot of memory but, rather, how the memory is used. Generally, on-board graphics memory is effective because it is private to the controller chip and is dedicated to graphics tasks. The other solution to the need for graphics memory is the addition of so-called enhanced memory.

Enhanced memory is system memory that goes beyond the PC's 640K-byte boundary and theoretically allows the addition of up to 16M bytes into a PC/AT-type computer. But, according to Jim Anderson, president of Digitalk Inc., a Los Angeles vendor of software-development packages, "About all you gain is faster memory-access times by using the extended memory as a RAM disk," which doesn't speed graphics processing.

EGA boards not only provide compatibility with IBM's EGA, and backward compatibility to IBM's CGA, but most also work with software written for non-IBM boards, such as the popular Hercules Computer Technology's Graphics Card. It isn't the hardware, but the firmware in the graphics system's basic input/output system, that determines compatibility. The boards can thus take advantage of the capabilities of controller chips that exceed the boundaries of standard EGA performance.

What's available?

Video-7 Inc.'s Vega uses proprietary logic to incorporate CGA, EGA and Hercules Graphic Card compatibility on a short-slot board. Priced at $599 (retail), the board comes with 256K bytes of display memory. Quadram Corp.'s QUADEGA+ is another multicompatible offering, priced at $595. In addition to the standard range of display resolutions, QUADEGA+ features flicker-free scrolling and panning, can display up to 512



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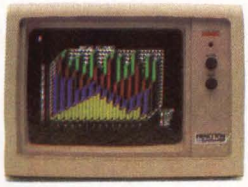
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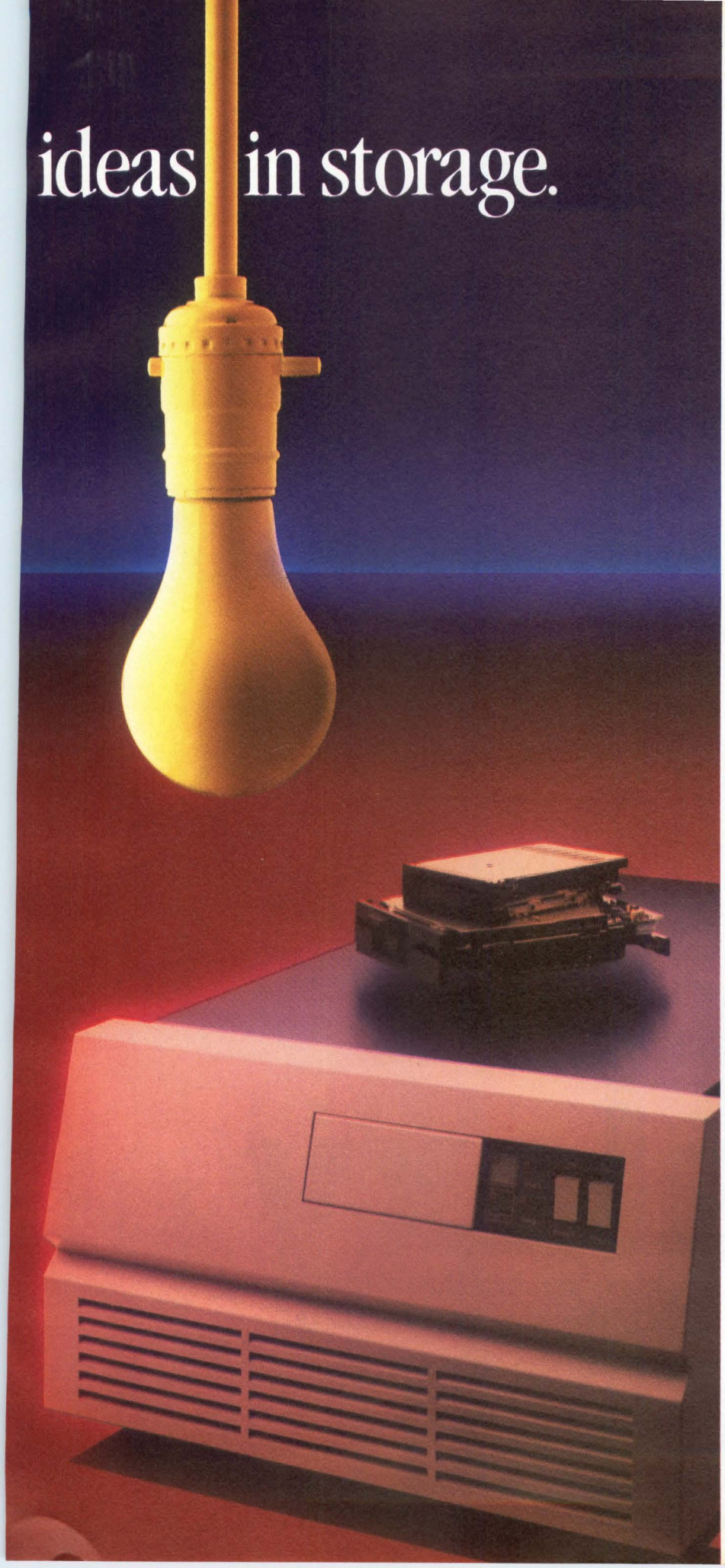
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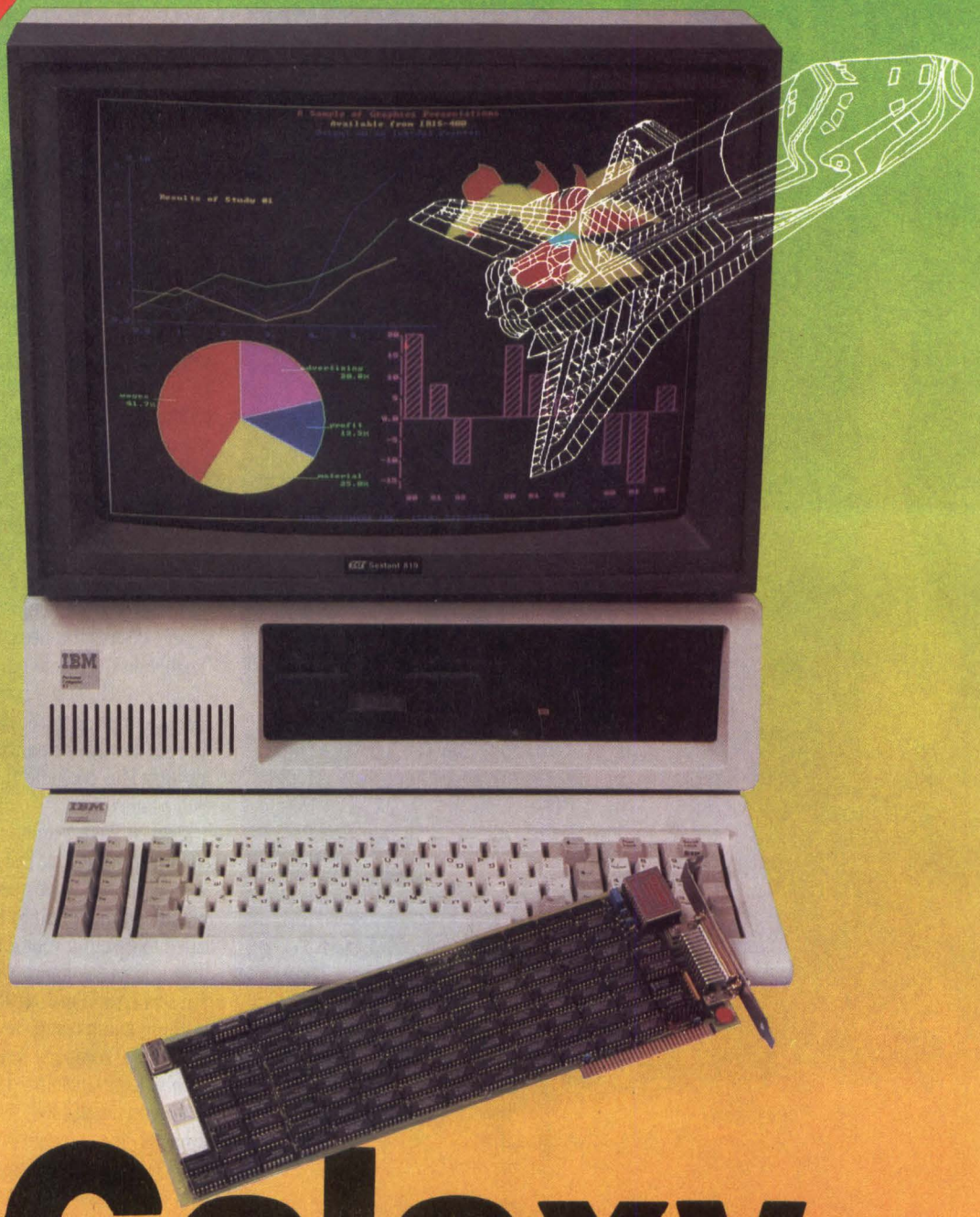
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character codes and supports as many as eight pages of graphics memory.

Genoa Systems Corp. offers the Super-EGA, a half-size board, as well as the full-size Super-EGA+. Both boards are based on a proprietary two-chip gate array and are compatible with IBM's EGA and CGA and the Hercules Graphics Card. Genoa's boards boast 640-by-400-pixel and 720-by-348-pixel resolutions. The Super-EGA+ adds a clock/calendar and serial and parallel ports to the basic functions of the Super-EGA.

American Mitac Corp. takes the extra-features game a step further by incorporating a light-pen interface and a printer interface into its M.E.G.A. board. This packaging approach eliminates the need for extra circuitry on a separate board, thus saving valuable expansion slots. The M.E.G.A. board costs $245 in OEM volumes.

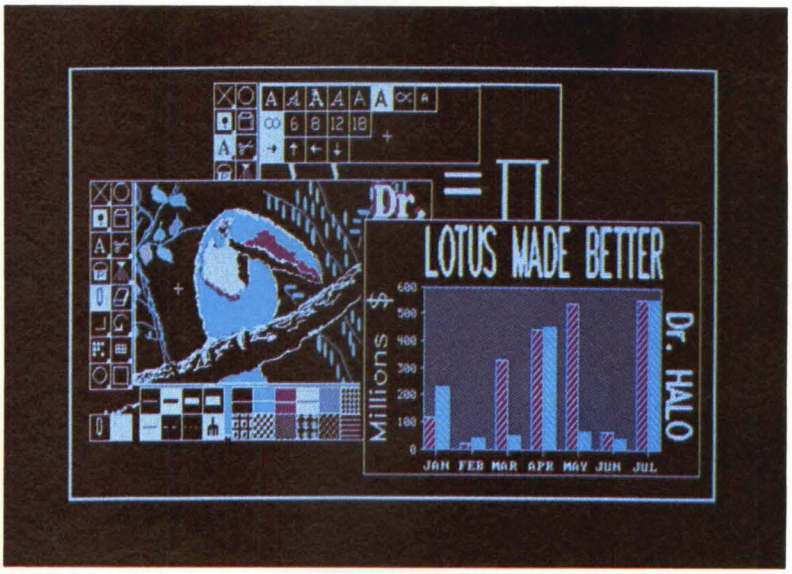
Price-conscious buyers will appreciate AST Research Inc.'s AST-3G, a basic EGA board offering a range of price/performance levels. Offering only EGA compatibility, it comes with 64K bytes of RAM and costs $425, retail; $450 with a parallel port. It costs $450 with 256K bytes but without the parallel port and $500 with 256K bytes and the port. Of course, most users will want the full 256K bytes of display RAM in order to take advantage of EGA features such as hardware pan and scroll. Selling underpopulated boards allows dealers to upgrade the RAM themselves.

Attempt to educate users

Another vendor that offers only IBM EGA compatibility is Tecmar Inc. The company recently introduced the EGA Master, which supports those CGA functions that IBM's EGA board supports but is still intended only as an EGA-emulator board. The full-slot card costs $395, retail. An optional serial port is $50.

For those who need compatibility with IBM CGA and Hercules cards, AST offers a choice. Its AST-3G Plus is basically the same board as its AST-3G, but with firmware that provides additional compatibility. Users can upgrade a 3G to a 3G Plus for $75; buying the Plus outright costs $75 to $125 more, retail, than an equivalently equipped 3G.

The important aspect of AST's strategy is that users don't have to buy anything that they don't need. For some applications, especially those dedicated to a specific task, such as CAD, there is often no reason for the customer to buy the extra compatibility. "It's a matter of educating users about what they really need," says Brent Berg, AST's graphics specialist.



Coupled with an enhanced graphics adapter (EGA) board, *Media Cybernetics' Dr. Halo graphics enhancement kit allows users to produce this kind of creative business graphics.*

A variety of approaches exist to minimize the awkwardness involved in allowing a customer to upgrade while maintaining compatibility with older products. Consider, for example, Everex's Enhanced Evergraphics board. This is a high-resolution, monochrome-only graphics board, priced at $249. Everex subsequently introduced a piggyback board that provides EGA monitor output and 256K bytes of display RAM for $350. The Enhanced Evergraphics board with the piggyback board—a package called the EV-650—costs $599.

Most manufacturers are adding features while maintaining competitive prices. For example, American Micronics Inc.'s AMI-EGA retails for $495—a price that is competitive with most standard boards—but comes with a light-pen interface, parallel port and 256K bytes of RAM, features that often cost more on other manufacturers' boards.

PC's Limited established a new low-price level with its $269 EGAds, which includes a light-pen interface and 256K bytes of memory. The company also introduced a $479, 64-color monitor with 720-by-350-pixel resolution.

For configuration flexibility, consider STB Systems Inc.'s EGA Plus, which comes with a light-pen interface, parallel printer port, disk emulator, a print spooler utility program and accelerator software for PCs and compatibles. Plugging in the optional, battery-operated clock/calendar provides a system clock. Packaging all these functions on one board saves two PC slots.

Not all vendors are comfortable with providing a light-pen interface—at least not to end users. "The light pen is not a standalone de-

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3164	IBM 3101 Model 881

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Double-sized characters	No	Yes	Yes
Line drawing characters	24	24	24
Vertical scroll	Jump	Jump/ Smooth	Jump/ Smooth
Definable function keys	24	24	24
Windowing	No	Yes	Yes
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The difficulty in increasing display performance via a plug-in CRT controller card is that the maximum performance is limited by the display itself.

vice," points out Mike Zachan, director of marketing at Persyst. "The pen has to work with a specific monitor. Without knowing what monitor the end user will select, you can't guarantee that the light-pen interface will work."

Persyst's solution is to provide a light-pen interface as an OEM function and not mention it to end users at all. Thus the new EGA board from Persyst claims only a serial port (not a light-pen port), a parallel port and a clock at a list price of $595.

Overcomes display limitations

The difficulty in increasing display performance via a plug-in CRT controller card is that the maximum performance is limited by the display itself. For example, users can't get 4 million pixels on a 1 million-pixel display. The solution arrived at by Monoterm Corp. is to package a controller along with one of its 19-inch, high-resolution monochrome monitors. Termed Viking, this controller/display package gives a PC a 1,280-by-960-pixel resolution and compatibility with software written for EGA boards.

A 66-kHz refresh rate on the Viking monitor cuts down on flicker and, therefore, on eye fatigue. A 2K-byte-by-2K-byte display memory on the controller ensures that the system can take advantage of the full display quality. The complete Viking package costs $2,195 in OEM quantities.

Similarly, Wyse Technology offers the SY-700, a 1,280-by-800-pixel resolution monitor and graphics board subsystem that runs all PC-compatible software. Priced at $1,595, the SY-700's bit-mapped graphics board plugs into a PC or PC-compatible slot and runs CGA applications by mapping colors into four shades of gray.

The model 460 video interface from Vidco Inc. provides a link between an EGA and a specialized data projector or large-screen monitor. It takes TTL (transistor to transistor logic) signals from the computer and converts them into analog RS170-like video signals capable of driving several hundred feet of standard RG59 cable into a 75-ohm load without picture degradation. The interface costs $450 and adds a new level of versatility to PCs.

Possibly even more important than high resolution is faster imaging. Orchid Technology combines its Turbo286 board, which provides

Companies mentioned in this article

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an Intel Corp. 80286 processor—that runs in parallel with the PC's Intel 8088—with an EGA card to produce the Turbo EGA. The company claims that the Turbo EGA is the fastest EGA card on the market. The main advantage of faster imaging is to minimize the system's response time.

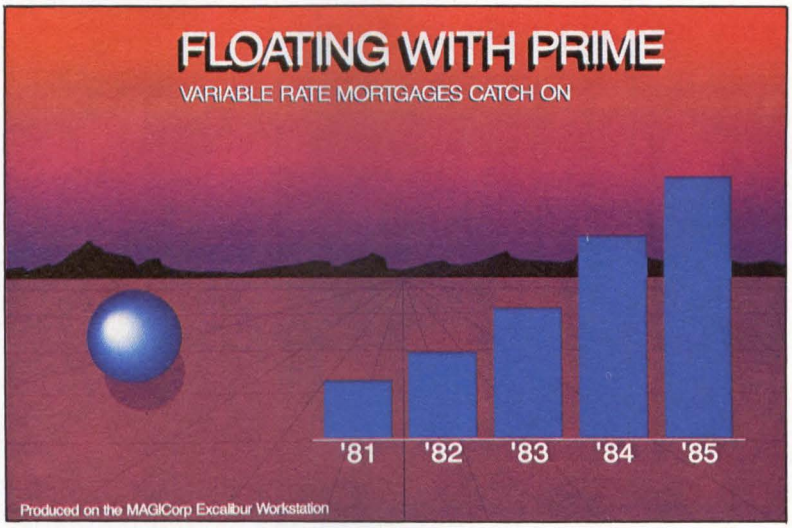
PGA outstrokes EGA

EGA isn't the only road to better graphics. Most of the newer graphics-controller chips also support the professional graphics adapter (PGA) standard. IBM's PGA board can display 256 colors from a palette of 4,096 and has a resolution of 640 by 480 pixels. And board vendors are reacting by providing products with the performance of PGA graphics at reasonable prices.

For example, Vermont Microsystems Inc. has introduced its 8820 board that supports CGA, EGA and PGA compatibility. It offers CGA compatibility with 640-by-480-pixel resolution and a fast draw speed of 1,500 vectors per inch. In PGA mode, it displays 256 colors from a palette of 262,000. Additional colors support shading that is unobtainable from EGA boards. Several vendors of mechanical CAD packages are introducing new products that require PGA boards so that the software can use shading. Shading makes a significant difference in image quality, but it costs. For example, the OEM price of Vermont Microsystems' 8820 board is $2,400.

Whether with EGA or PGA boards, high quality carries a high price. However, Rene Vishney, president of Award Software, Los Gatos, Calif., points out that EGA monitors are competitively priced. "You can get virtually any manufacturer's EGA board and a good quality monitor, and the whole display system will cost under $1,000," he says. PGA displays won't compete directly with EGA displays until the price of PGA controller cards and monitors come down. Currently, PGA controllers cost more than twice the price of an entire EGA display system. However, prices of some PGA-compatible monitors, such as those from Princeton Graphic Systems, are now available under $1,000.

But with the availability of new, more powerful graphics chips, prices of chips, boards and monitors are decreasing. For example, Orchid Technology introduced at the Spring Comdex show a PGA board priced "well below the price [about $3,000] that IBM gets for theirs," according to a company spokesman. Final pricing for the board, however, hadn't been established.



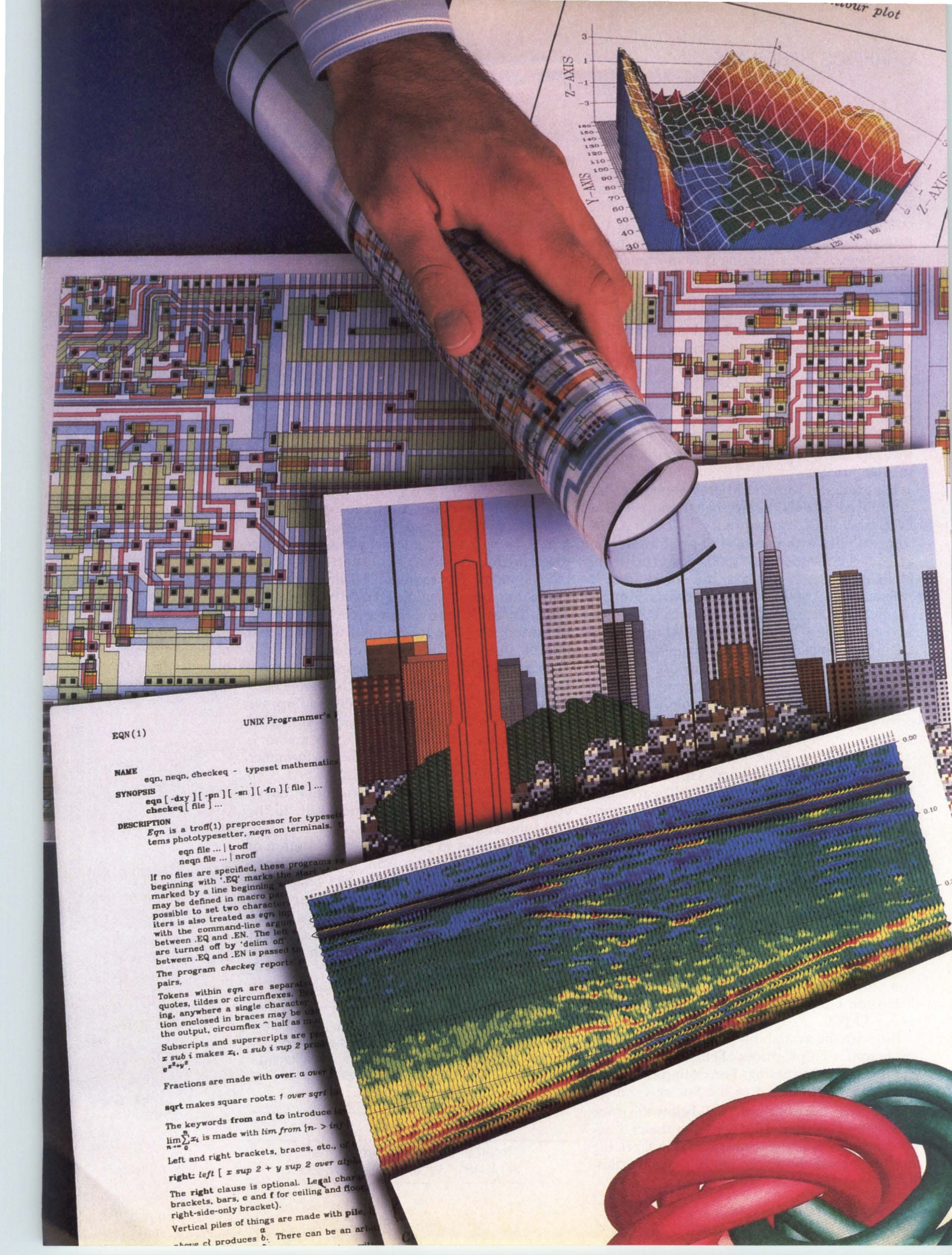
The Professional Graphics Adapter (PGA) *standard provides the shading and color selection needed to support sophisticated graphics software packages. (courtesy: Vermont Microsystems Inc.)*

There is no doubt that the onslaught of cost-effective EGA and PGA boards has just begun. In fact, some microcomputer manufacturers are incorporating EGA functionality into their systems. For example, North Star Computers has begun building EGA compatibility into its multiuser Dimension computers. Mounted on the individual workstation's boards, the controller gives each user EGA output. And this integration reaped an important benefit. According to North Star's chairman, Chuck Grant, "We were able to improve performance by reducing the wait states required for the CPU to access display memory. It [the EGA] has about twice the performance of an EGA plugged into an IBM PC/AT." To gain that performance level, North Star developed its own BIOS, which it now sells to the OEM market.

The best news in the escalating evolution of graphics boards, at least from the system integrator's point of view, is that the boards are much better than IBM's CGA, that prices will continue to fall, that new products will offer more and better features, and that the next generation of hardware will work with software written for the current generation. □

Edward Teja, a contributing editor at *Mini-Micro Systems,* is a vice president of Freehold Corp., Studio City, Calif., which specializes in marketing and writing services for high-technology companies.

Interest Quotient (Circle One)
High 481 Medium 482 Low 483



EQN(1) UNIX Programmer's

NAME

eqn, neqn, checkeq - typeset mathematics

SYNOPSIS

eqn [-dxy] [-pn] [-sn] [-fn] [file] ...
checkeq [file] ...

DESCRIPTION

Eqn is a troff(1) preprocessor for typeset
tems phototypesetter, *neqn* on terminals.

eqn file ... | troff
neqn file ... | nroff

If no files are specified, these programs re
beginning with '.EQ' marks the start
marked by a line beginning
may be defined in macro pa
possible to set two character
iters is also treated as *eqn* inp
with the command-line argu
between .EQ and .EN. The left
are turned off by 'delim off'
between .EQ and .EN is passed t

The program *checkeq* reports
pairs,

Tokens within *eqn* are separat
quotes, tildes or circumflexes. Th
ing, anywhere a single character
tion enclosed in braces may be u
the output, circumflex ^ half as m

Subscripts and superscripts are pr
x sub i makes x_i, *a sub i sup 2* pro
$e^{x^2+y^2}$.

Fractions are made with **over**: *a over*

sqrt makes square roots: *1 over sqrt* 1

The keywords **from** and **to** introduce l
$\lim_{n \to \infty} \sum_{0}^{n} x_i$ is made with *lim from* {*n* -> *inf*

Left and right brackets, braces, etc., of

right: *left* [*x sup 2 + y sup 2 over a*

The **right** clause is optional. Legal char
brackets, bars, c and f for ceiling and floo
right-side-only bracket).

Vertical piles of things are made with **pile**,

$\begin{matrix} a \\ b \end{matrix}$ produces b. There can be an arbi

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CIRCLE NO. 48 ON INQUIRY CARD



GRAPHICS TOOLS BROADEN PC HORIZONS

Taking advantage of improved PC display capabilities, graphics software-development tools enable developers to concentrate on more complex applications

Carl Warren, Western Editor

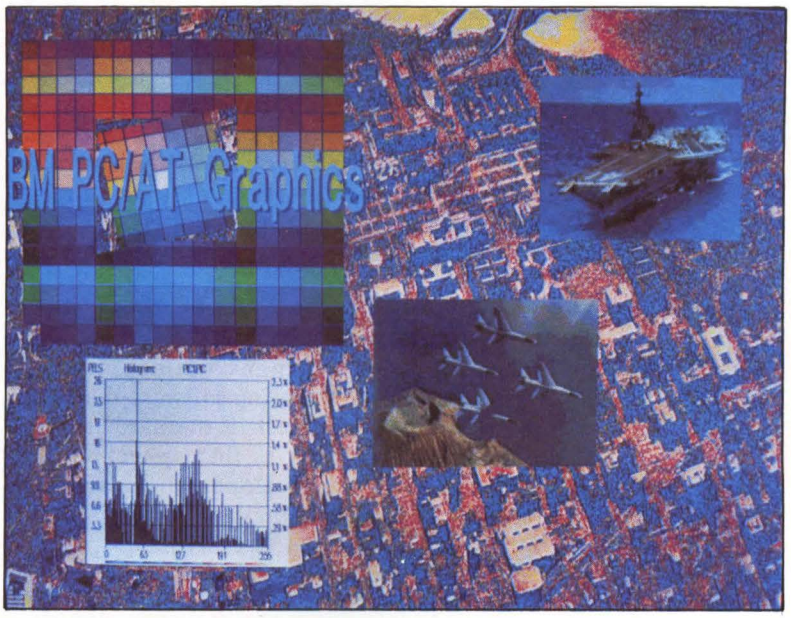
The IBM Corp. PC and compatibles have evolved from desktop units for entering databases and doing word processing to powerful graphics workstations fit for a variety of complex applications. Combined with specialized hardware, such as enhanced graphics adapter (EGA) boards that boost display resolution and add color capability, PCs are now tackling such demands as scientific and engineering tasks and desktop publishing.

Monochrome displays, which come in many varieties of black and white, green or amber, well serve the needs of word processing and database entry. However, computer aided engineering (CAE), process control and desktop publishing call for high-resolution color displays. And managing color displays requires taking full advantage of a system's hardware and software capabilities. Therefore, software developers demand versatility in software tools. Specifically, they want tools that help them exploit enhanced hardware functions, particularly functions made possible by the newest graphics hardware available for PCs, such as EGA boards and high-resolution monitors.

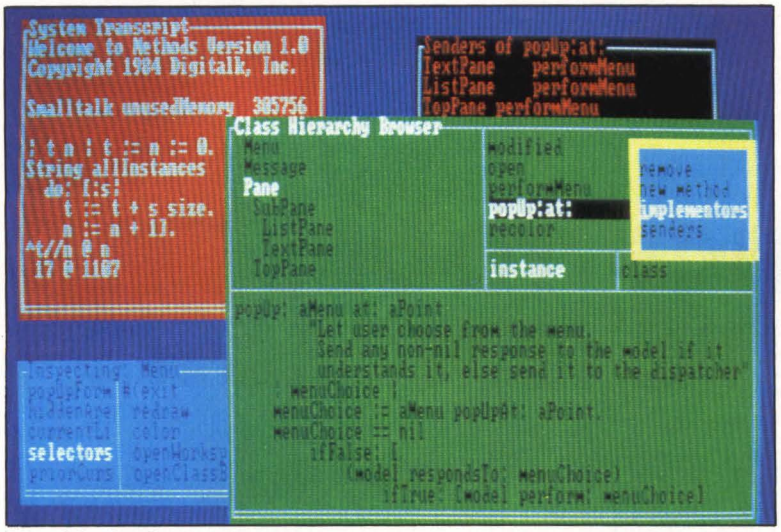
One of the most versatile software-development tools is the C language, which offers programmers several useful development functions. But its most important features are portability across a wide range of systems, and a rich set of subroutine libraries that often eliminate the need for writing code from scratch.

A pervasive version of C is that developed by Lattice Inc. Lattice C doesn't support graphics or IBM's EGA standard directly. "We are the application glue," explains Steve Hersee, cofounder and vice president of marketing, "What we sell is the mortar and bricks, and other tool makers sell the tilt-up walls."

Hersee cites the Dr. HALO II package from Media Cybernetics Inc. as being a good graphics link between C and the hardware. The $139



Using Halo graphics tools *from Media Cybernetics Inc. allows software developers to combine a variety of graphics images—including those captured via digital scanners or digitized video images—and enhance them with color, or depths of gray scale.*



The Methods program-development package, *from Digitalk, permits software developers to define and control the presentation of windows on a display.*

package provides a library of 125 device drivers and 15 language bindings. Multiple language bindings enable developers to generate machine-independent code and, thus, to create programs for a broad range of hardware. For applications that require combining digital scanners and extended memory boards, the company recently introduced HALOScan ($495). Based on icons, the package supports scanners, color printers and plotters.

Interface stability seen key

Media Cybernetics' president Bill Strum insists that excessive richness in a tool set can be a trap. Having too many options can lure programmers into creating software that is incompatible with the rest of the hardware and software. Strum believes that system integrators and software developers are essentially interested in three things: compatibility, performance and product stability.

Digital Research Inc.'s director of product marketing for GEM software, William Higgs, agrees with Strum. He says that one of the keys to creating a strong graphics-development tool is the stability of the interface layer—the module that defines the interaction of hardware and software. "We can keep adding functionality and enhancements, but we have to maintain a standard interface."

Digital Research's GEM Programmer's Toolkit, priced at $500, supplies a device-independent environment with a common graphics interface that is compatible with most operating systems. GEM intercepts graphics requests coming from the system and, using the appropriate device driver, takes advantage of the unique characteristics of the device. The application program working with GEM doesn't have to know anything about the specific system hardware.

One company developing a desktop publishing product under the GEM environment is Ventura Software Inc., Morgan Hill, Calif. The company is betting on the stability of the interface layer to permit long-term enhancements to their product as hardware capability increases. "We don't want to rewrite the underpinning software every time new hardware arrives on the scene," says president John Meyer.

Virtually all system-development tool vendors and application developers agree that by using the undocumented instructions of the Intel Corp. 8086 and MS-DOS you can create a tool kit or application program that will run as much as five times faster than those not using these instructions.

Standards ease software development

Software tool vendors use agreed-upon standards—or, at least, generally accepted methodologies. A strong contender for a standard among language bindings and device drivers is what is termed the Graphics Development Toolkit (GDT) by IBM and called the Computer Graphics Interface (CGI) by Graphic Software Systems Inc. (GSS). GDT and CGI don't force software developers to use a predetermined user interface. Rather, they allow them to define how the application should interact with the user. "The desktop metaphor doesn't always make sense," says GSS chairman Tom Clarkson. "If the developer feels that the desktop metaphor is appropriate, then Microsoft Corp.'s Windows is something to consider. If the application demands something other than a desktop metaphor, then CGI is the best bet."

Another software development tool developed by GSS is the direct graphics interface specification (DGIS), which defines firmware commands that provide an extended command set for an EGA board. Although DGIS is a tool that hardware vendors use to create display boards, software developers benefit by the synergy of CGI and DGIS. "An application written for one doesn't have to be rewritten for the other," says Clarkson.

Visible support tools create metaphors

Besides the array of tools that users never see are those that they consciously interact with every time they use the software. For example, the Desktop GEM module provides a recognizable user metaphor. It paints a desktop on the screen and then allows the user to move around it via a mouse pointer. For software developers, this eliminates the task of creating a user inter-

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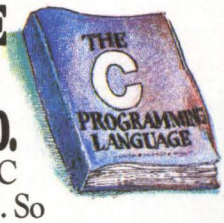
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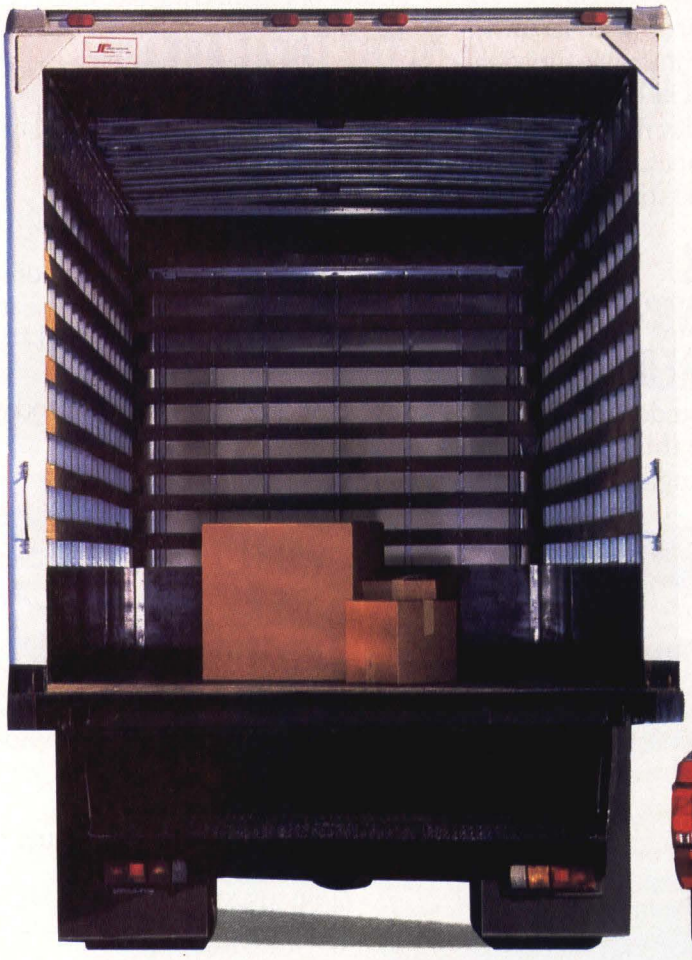
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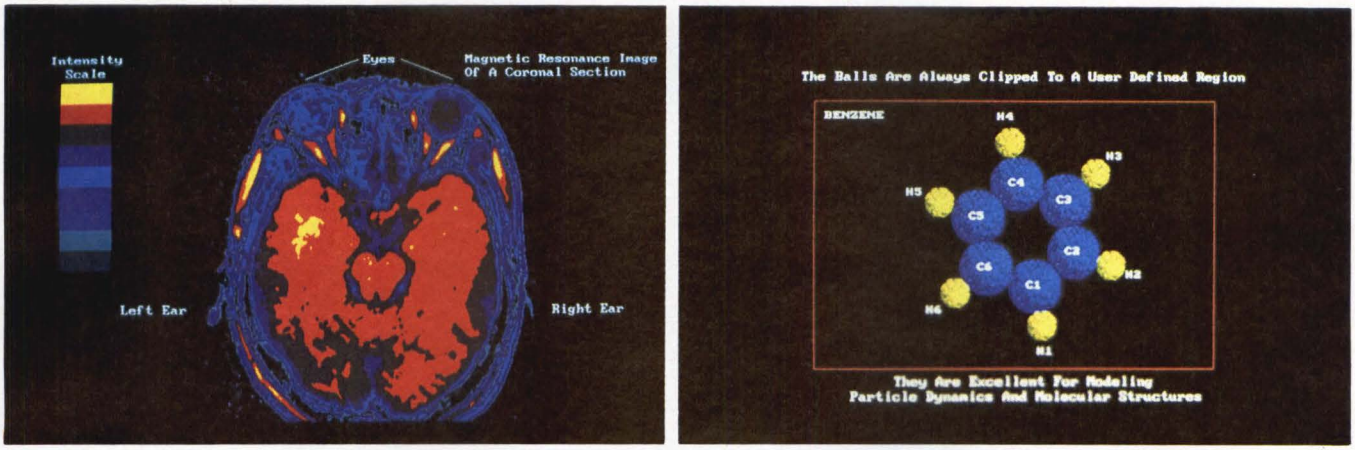
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CIRCLE NO. 50 ON INQUIRY CARD



Enhancing a brain scan, *or creating a textured display of molecular structures, the Enhanced Graphics Toolkit, developed by Connell Scientific Graphics, serves as a powerful tool for software developers who need to add depth to graphics generated on a PC using an enhanced graphics adapter board.*

face and provides a familiar environment to work in.

Microsoft's Windows and IBM's TopView both take a similar tack, establishing window-management environments with a familiar metaphor. Like GEM, Windows and TopView also furnish a common software interface between the application and the hardware.

Programming languages also can be considered visible software-development tools. Virtually all vendors include graphics primitives—such as circle, line, draw and fill—with their versions of BASIC. Microsoft has added graphics and color verbs not only to all versions of BASIC, but also to other languages—such as C, FORTRAN and Pascal—that they supply for the PC. These verbs reduce the complex code previously required to issue graphics commands. For example, the simple statement:

SET POINT (20,20); BOX
(20,40,40,40); FILL (14)

defines a point on the screen, draws a box and fills it with a color. But this approach has its drawbacks: these verbs aren't particularly well-suited for object-oriented graphics. To eliminate this drawback, vendors are moving beyond simply customizing languages to handle the graphics tasks.

One of the steps beyond involves enhancing the operating system. Wendin Inc., for example, has developed an approach for creating powerful customized operating systems and environments for high-performance applications that use graphics. The Operating System ToolBox which, when used in conjunction with the programmer's editor, lets software developers create their own version of any operating system and make decisions such as whether to maintain compatibility with MS-DOS. In addition to the basic ToolBox, the company provides other software development tools, including PCUNIX and PCVMS. PCUNIX, an operating system/environment, uses the Bourne shell and provides all the multitasking and user functionality of UNIX; PCVMS is a look-alike of Digital Equipment Corp.'s VMS operating system but is tailored for the PC. PCUNIX and PCVMS were built using Wendin's ToolBox. Each package costs $99.

The ToolBox, unlike most other tools, lets software developers decide what physical or logical devices in a system they want to exploit and the best way to do so. Moreover, Stephen Jones, director of Wendin's computer service division, points out that you can decide to embed the operating system inside of an application. "We handle all the service routines, and let you do the rest," says Jones.

AI makes graphics smarter

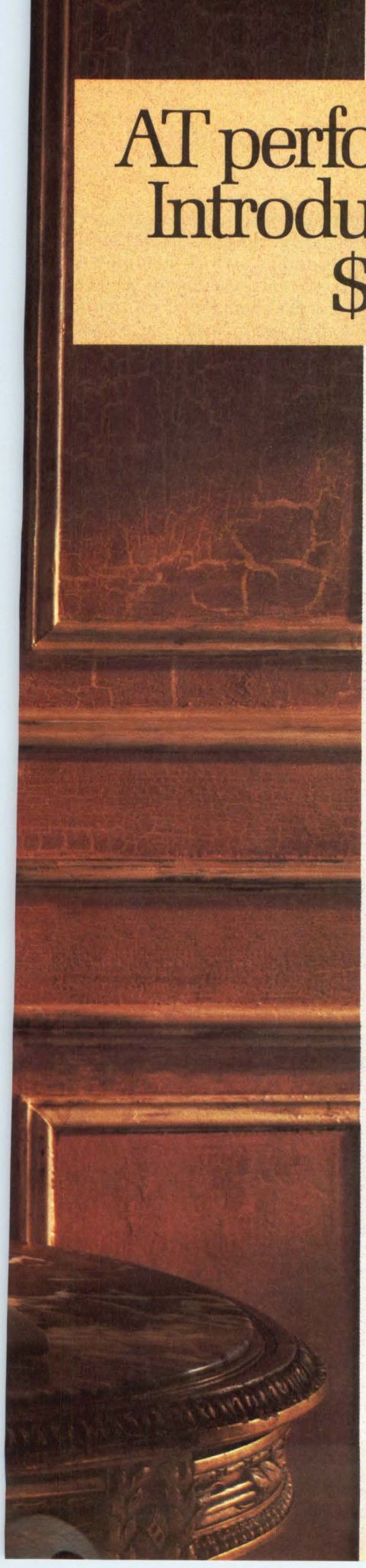
Artificial intelligence is starting to enter the software-development-tool world. Supporting the CGA, EGA and AT&T Co.'s 640-by-400-pixel display is Digitalk Inc.'s Methods program. Priced at $695 for the graphics version and $250 for the text version, Methods is a development tool based on AI concepts and the Palo Alto (Calif.) Research Laboratory Smalltalk language.

"We bring the power of an AI workstation to the developer using a PC," claims Jim Anderson, president of Digitalk. The rule-based inference engine takes its cue from expert-system designs to create an environment in which users can run simulations graphically. This provides the power, via software, to do the kind of things normally restricted to an expensive LISP machine.

Using Methods' window technology, users and software developers can define and control the presentation of windows on the display. The service routines operating behind the visible windows are called classes. The application class synchronizes the pane classes, which ap-


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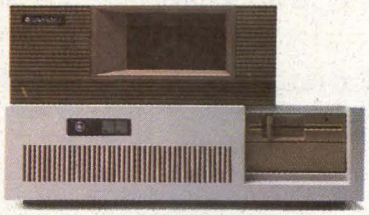
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CIRCLE NO. 51 ON INQUIRY CARD



A paint package and picture editor, *Media Cybernetics' Dr. HALO II lets users create high-resolution graphics on PCs equipped with enhanced graphics adapter boards.*

pear on the screen. Dispatcher classes process keyboard and mouse input.

Another company that uses AI techniques in its graphics tool kit—called Object-Oriented Graphical Modeling System (OOGMS)—is Sherrill-Lubinski. This package, which runs on a host of systems ranging from DEC's VAX to IBM's PC/AT, specifically gives users the ability to handle graphics objects. Company partner, Tom Lubinski, explains that, in this context, graphics primitives are objects in themselves, or are sub-objects when they are part of complex composites. "Although an object can be made up of many sub-objects, it's a single entity and can be manipulated, rotated, sized, or have its color changed." Unlike pixel-oriented paint programs, which manipulate each dot on the screen individually, object-oriented programs have an underlying structure that defines the displayed objects. The $3,400 package for the IBM PC/AT includes a drawing module, graphics language and C function library.

The drawing module, says Lubinski, lets you define the objects displayed on the screen by drawing them. "Process control lends itself to graphic representation of the actual process taking place," he says. Lubinski explains that you can use the drawing module to create a mimic diagram, such as liquid flowing through a pipe and a valve, or a symbolic diagram, such as a representation of a button or meter. Once the drawing module is defined, the graphics language describes the objects to the system for testing and simulation. Finally, the C library provides precreated routines that you link to the final application program.

For low-cost, object-oriented graphics, consider Connell Scientific Graphics' Enhanced Graphics Toolkit. This $195 package includes the source code for Microsoft C, FORTRAN and Pascal. Essentially, the Connell tool kit is a collection of software tools that access the features of an EGA, says Ed Connell, company president. The package is relatively small, taking up only 10K bytes of memory, and is therefore relatively limited. "We don't do windows," quips Connell.

However, the Enhanced Graphics Toolkit does enable object manipulation. For example,

Companies mentioned in this article

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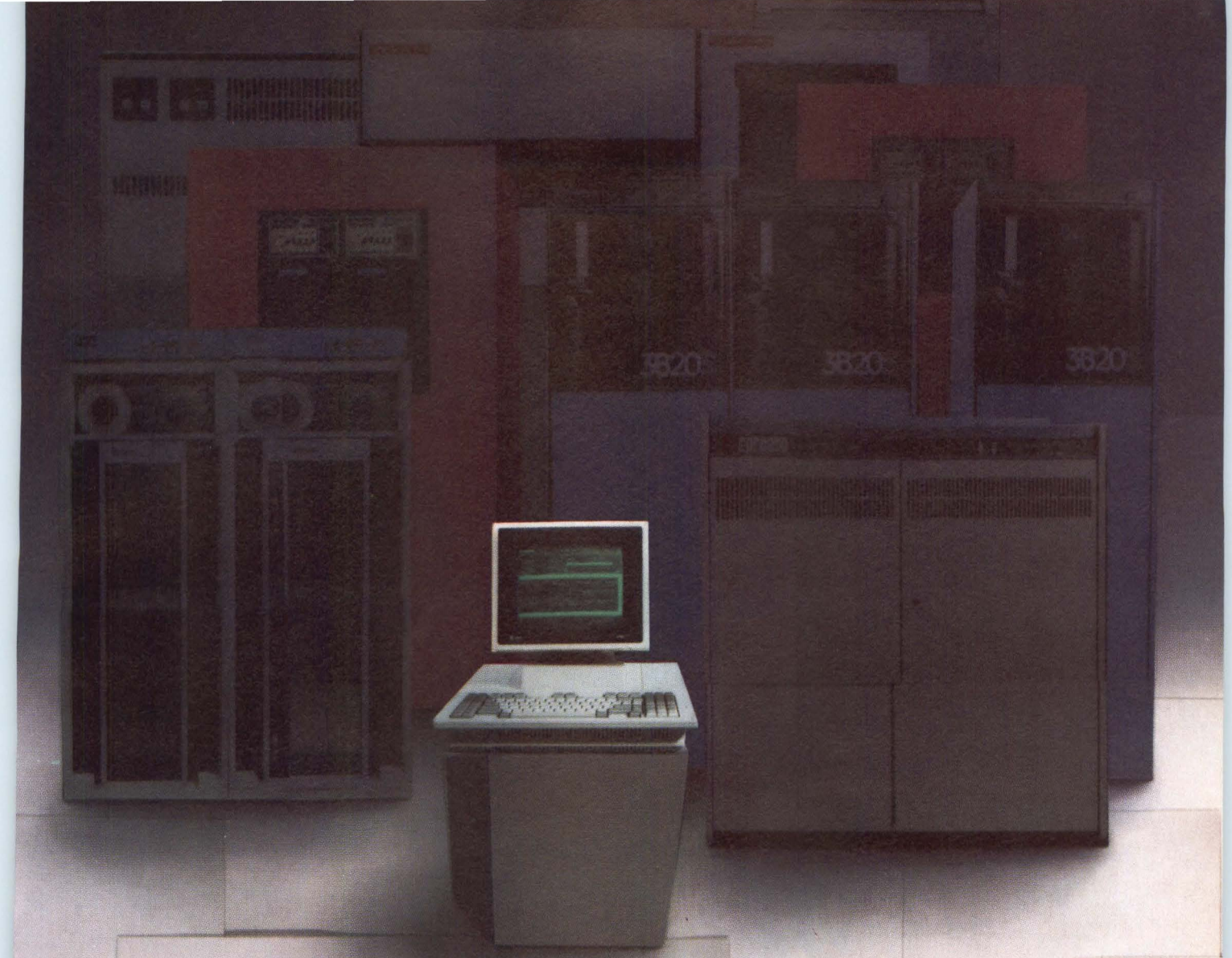
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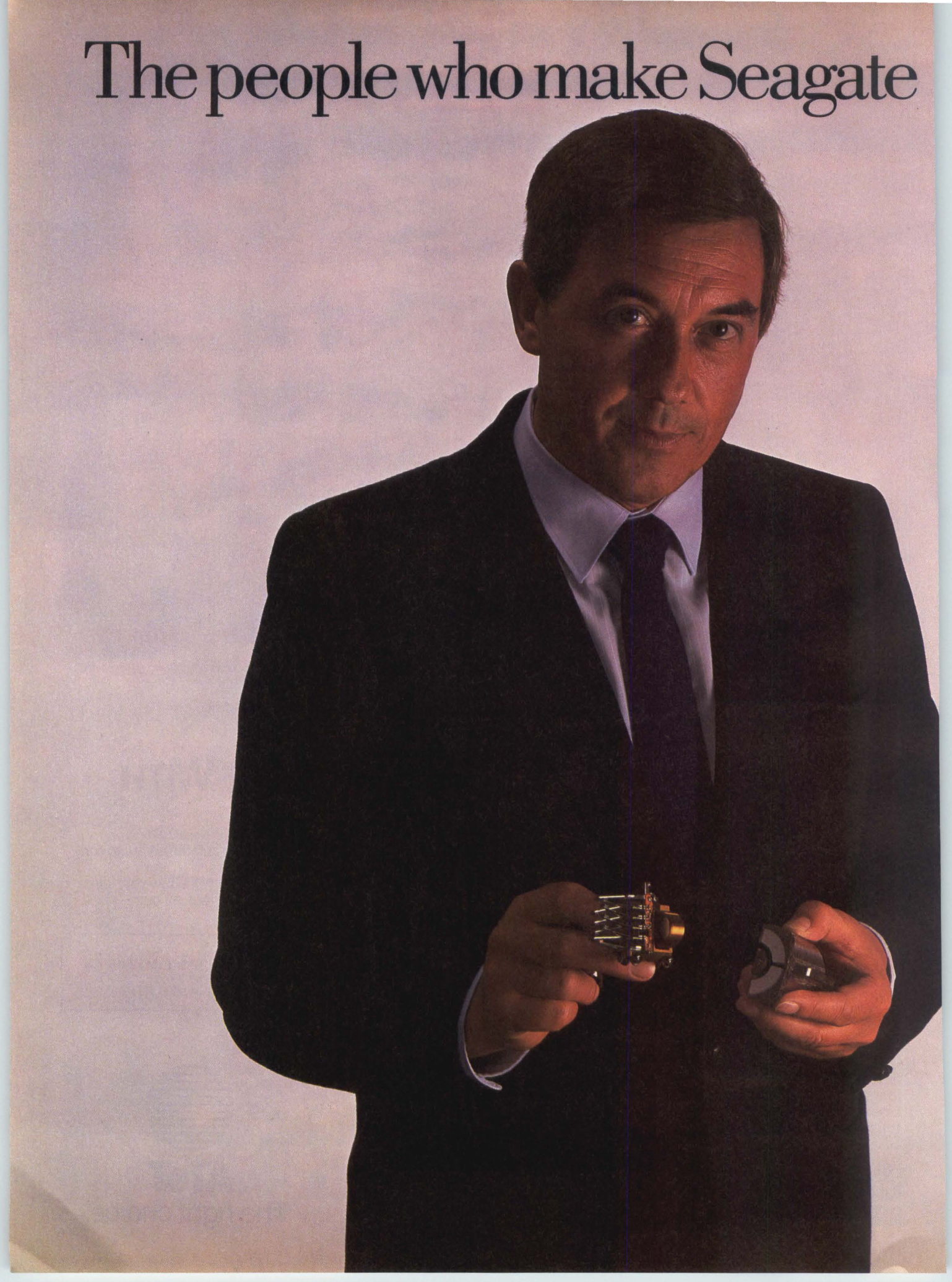
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CIRCLE NO. 52 ON INQUIRY CARD

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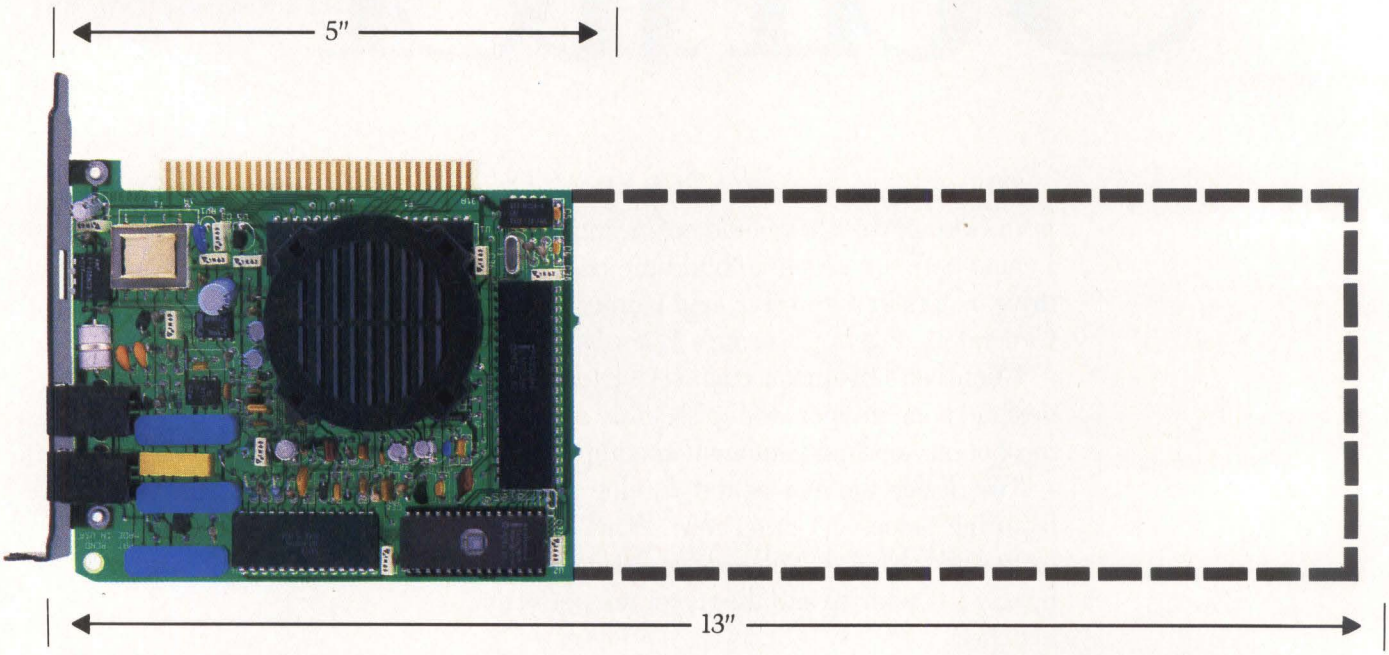
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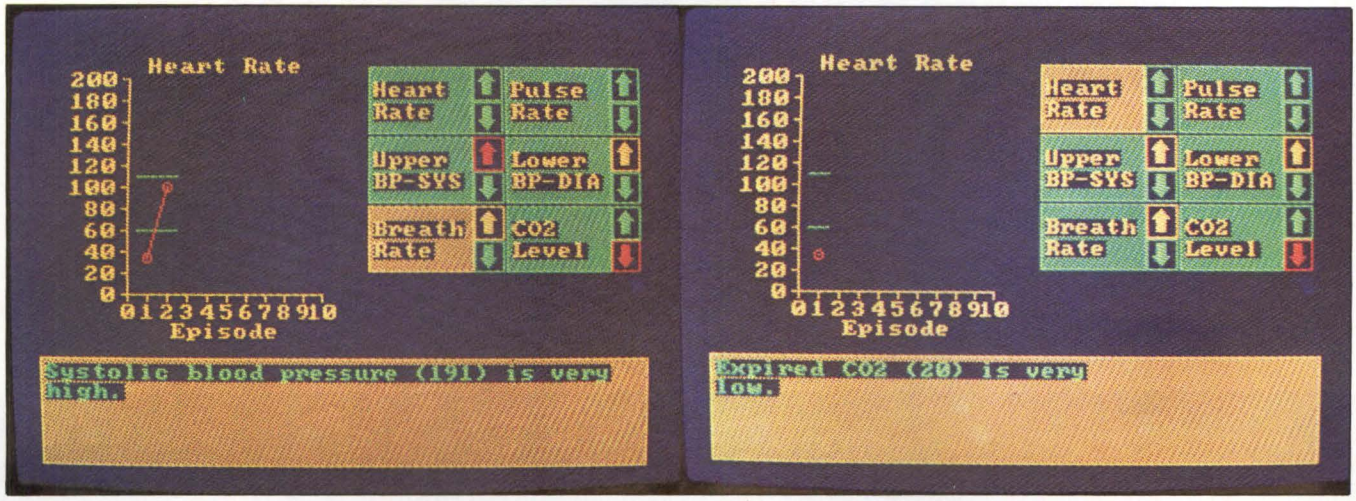
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Built around Teknowledge's *M.1 tool kit and inference engine, the Ventilation Manager expert system uses graphics and artificial intelligence to assist doctors in monitoring post-operation patients.*

users can tell the application where objects should be, whether or not they are animated, and how they should be shaded or textured. Additionally, users can use the tool kit to enhance complex images such as brain-scan data sets. The package also lets users set clipping regions and add labels, using prestored fonts in ROM or their own fonts from RAM.

Uses the right medicine

The purpose of combining powerful graphics software and hardware, of course, is to provide a solution. An example is Stanford University medical researcher Dr. Larry Fagan's Ventilation Manager program, an expert system created with Teknowledge Inc.'s M.1 tool kit. The M.1 tool kit isn't cheap, priced at $5,000, plus $2,500 for a week-long course. But it serves as a base to create expert systems. Company spokeswoman Judy Harris says Teknowledge provides the inference engine: "It's up to the system integrator to provide the user interface."

Ventilation Manager uses the metaphor of a medical oscilloscope to give doctors, who might not be computer literate, access to an expert system that monitors a post-operation patient. The system monitors the patient's breathing, heart rate and blood pressure, and develops a diagnosis based on inferences from this data.

Getting the most from EGAs

Some software-development packages are designed specifically to take advantage of EGAs. For example, Metagraphics Software Corp.'s MetaWindows features bit-mapped graphics and window environments that exploit EGA capabilities. Using MetaWindows, software developers can write procedures that define the user's environment, the metaphor, the viewport and other characteristics, such as icons and pop-down windows.

For example, to define the viewport, the C-language code for the procedure would be:

```
VIEWPORT(XMIN,YMIN,XMAX,YMAX);
        int XMIN,YMIN,XMAX,YMAX;
```

This procedure establishes the X and Y coordinates of the viewing area.

MetaWindows-Plus, the OEM version of the product, adds user-invisible tools—language bindings, system calls and graphics-primitive libraries—needed to develop a finished product. And, for software developers who plan to enter the desktop publishing market, the company offers MetaFonts-Plus ($185), which provides a full font editor and icon editor for bit-mapped and filled characters. The package also lets programmers edit the Postscript document-control language from Adobe Systems Inc. of Palo Alto (MMS, *Spring Peripherals Handbook,* April 15, Page 9).

Jack Davis, president of Metagraphics, explains: "We translate the logical functions into hardware-specific commands so that the developer doesn't have to." The proper role of this kind of development tool, after all, is to maximize the flexibility available to software developers, without complicating their lives. □

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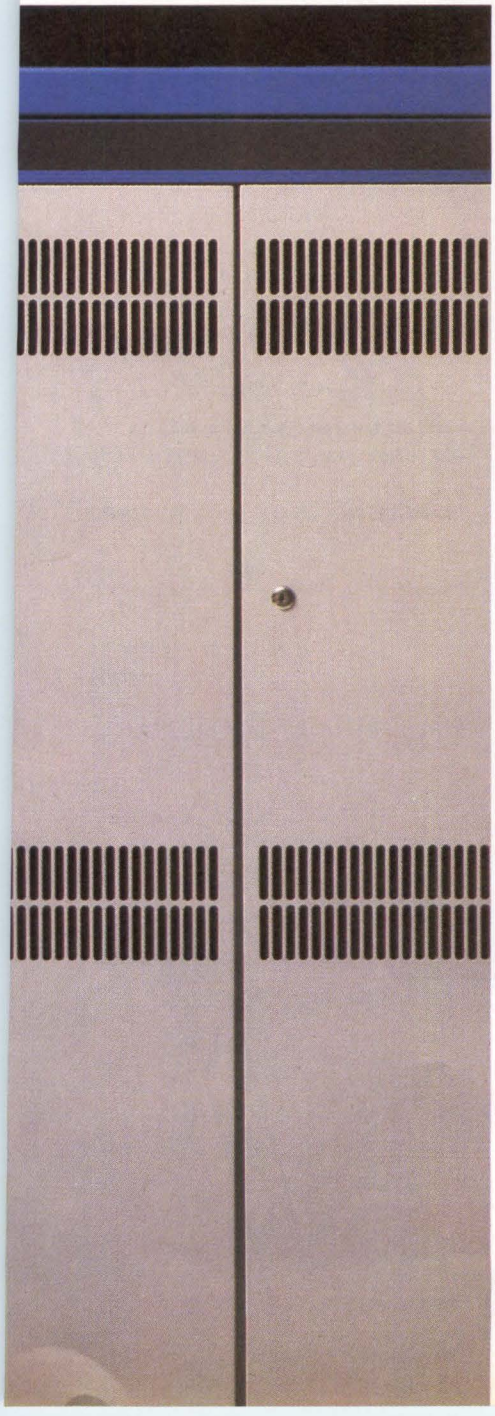
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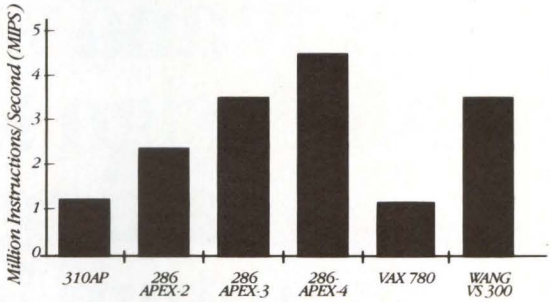
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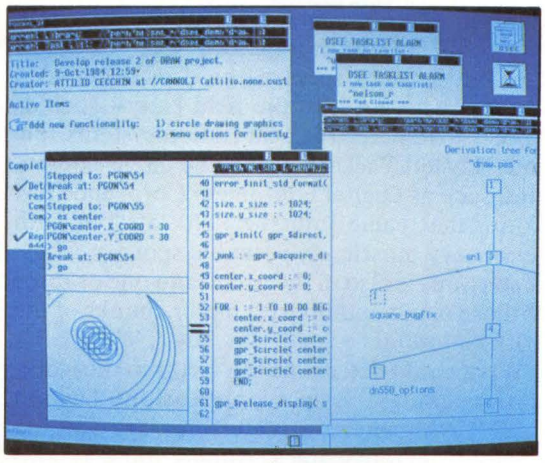
Michael Tucker, Associate Editor

Workstations traditionally have been used for computer aided design, manufacturing and engineering. In fact, the powerful 32-bit systems have been so successful in becoming the engineer's personal computer that some observers saw CAD/CAM/CAE as the machines' only important mission. However, almost unnoticed, an increasingly large segment of workstation sales is destined for software development applications.

According to market research company Dataquest Inc., San Jose, Calif., 12 percent of all workstations sold in 1984 went for general software engineering, and 5 percent were used in developing artificial-intelligence software. During 1985, Dataquest reports, fully 17 percent of all workstations sold were meant for software engineering, accounting for 23 percent of total workstation revenues.

In effect, workstations are becoming the platform of choice for computer aided software engineering (CASE)—a whole series of applications having to do with the development, management and maintenance of code. For example, they are being used increasingly for remote software development, where code is developed for larger or highly specialized target systems by smaller, less expensive machines.

As a result of this new and, in some ways, unexpected CASE market, workstation vendors are reconsidering their concepts of what workstations are and do. Several vendors are modifying their sales strategy, while some are actually modifying their machines. Some companies have begun marketing workstation hardware configured not only for software development, but also for development in specific applications and even in specific languages.



The Domain Software Engineering Environment (DSEE) *supports software ment on Apollo workstations. It isolates code problems, suggests modifications and permits "what-if" modelling of enhancements.*

Workstations claim a new market

Workstations as a technology and as a commodity are so new that even the definition of "workstation" is subject to some debate. In general, though, the term is used to describe any single-user microcomputer based on one of the new 32-bit microprocessors—such as the Intel Corp. 80386, any of the National Semiconductor Corp. NS32000 series and the Zilog Inc. Z8000—and dedicated to technical applications.

The workstation business is one of the most hotly contested in the computer industry. Indeed, the really important thing to find out



A diskless workstation, *the Sun Microsystems 3/50M is well-suited for software engineering. At $7,900, it provides extremely low cost-per-programmer.*

about the workstation market is not who's in it, but who'll survive in it (MMS, April, Page 21). The battle lines seem to be drawn between vendors who got into the field early—such as Apollo Computer Inc., Sun Microsystems Inc. and Hewlett-Packard Co.—and large companies, such as Digital Equipment Corp. and IBM Corp., that came into the field late but with very heavy muscle. As potential spoilers, a host of start-ups is also in the game, and one or more of those could end up with major chunks of the workstation niche.

What could determine the victor in the workstation contest is new applications beyond CAD/CAM where workstations are finding new and lucrative roles. Among these is software engineering, which includes both the management of code and its actual production. Software management—the business of coordinating the work of programmers and keeping track of changes in code—is already an established workstation market. For many developers, software production has become so complex—involving teams of programmers and thousands of modules of code—that powerful 32-bit systems provide the only method of making sense of it all.

Meanwhile, software production is becoming a workstation market. "There are two kinds of development done on workstations," says Ken Pomper, market segment manager for CASE at Apollo. "The first is the development of software for workstations themselves. The second is the development of software for embedded systems. That is, software for computers that are incorporated into non-computer products —like missiles and toasters. That second market will be just immense."

Sun's CASE Marketing Manager, John DeVries, sees a third major market as well: "The newest thing is remote development. That is, suppose you have a Cray [Research Inc.] supercomputer. It just isn't cost-effective to have a bunch of programmers tying up that machine while they develop its software. So, instead, you do your development on a relatively inexpensive, user-friendly workstation."

Attracted to engineering

As one of the premier names in the workstation business, Apollo was successfully marketing its first-generation workstations—DN300, DN330, DN460, DN560 and DN660A—in 1981, while much of the rest of the industry didn't know there was a workstation market to get into. According to market research company International Data Corp., Framingham, Mass., Apollo currently claims 40 percent of the installed base of such machines.

Apollo is also the company most responsible for giving workstations their CAD/CAM/CAE image. The company happily admits that over half of its sales are for engineering applications. Some observers have characterized the early Apollo workstations as virtually dedicated engineering machines, wholly inappropriate for software development. Yet, as early as 1983, one Apollo value-added reseller, Cadre Technologies Inc., was selling Apollo workstations for software management.

Software management is itself an emerging technology—at least for microcomputers. Essentially, it is the art of keeping an exact record of the exact purpose of every part of code, and keeping track of every change made to that code, often over periods of years.

Most large-scale software projects require at least three levels of management. In the first, or "design-specification," phase, system analysts decide exactly what tasks are to be performed by the software and then design a general outline of how the program code will be written. In the second phase, the project manager keeps a detailed record of how the coding is being written, and what sections of code do what, to facilitate later debugging. In the third, "maintenance," phase, which can take place over the entire life of the software, code management consists of keeping track of enhancements, debuggings and any other modifications.

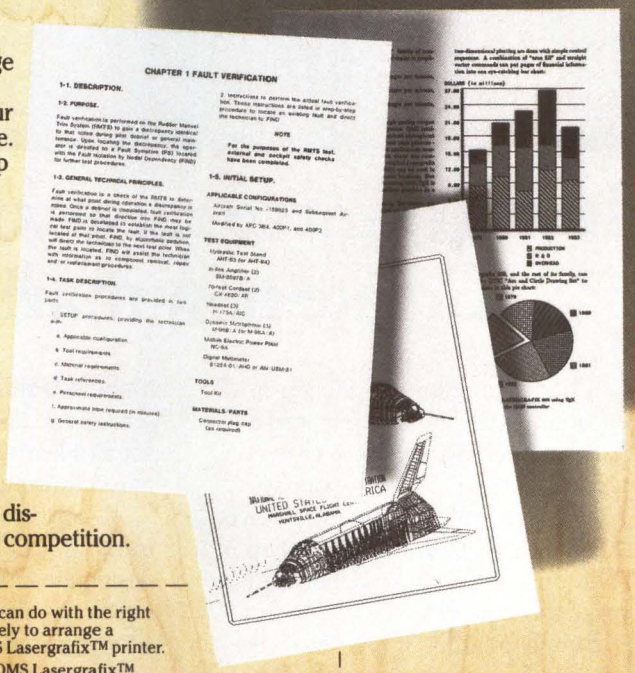
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named after software development expert Edward Yourdon. In the early 1970s, Yourdon's consulting company, Yourdon Inc., New Haven, Conn., pioneered a management technique in which individual coding tasks are represented on hand-drawn charts by special symbols—rather like the symbols electrical engineers use to represent hardware components in schematic diagrams. The Yourdon rules proved popular, if complex, and were widely adopted for large projects.

Cadre took the next logical step and automated the Yourdon rules. With Cadre's Teamwork/SA, running on Apollo workstations linked via Apollo's Domain network, developers can coordinate groups of programmers at all three stages of software management. Teamwork/SA allows project managers to do the initial blueprinting of their projects, keep account of the activity of large groups of programmers during development and record changes or enhancements of the software during its life.

However, programmers soon decided that if software management could be done on a workstation, then so could software production. Apollo discovered it had a new market. "There are several reasons why workstations are good for software engineers," explains Apollo's Pomper, "and most of those coincide with the reasons they're good for CAD/CAE: having a dedicated CPU, networking and graphics." The dedicated CPU means that programmers don't have to compete for time on a shared system; the networking allows users to share resources; and the graphics can give the developer an intuitive feel for what's happening in the code.

Consequently, Apollo introduced this year the Domain Software Engineering Environment, software to support large development projects. DSEE provides a number of functions to make large-group programming easier. Like Cadre's Teamwork/SA, it keeps extensive records on the development and modifications of each piece of code. Moreover, once a module is modified, DSEE will automatically notify other programming team members of the change, and point out where that change will affect their own code. It can also help isolate problems in the code, suggest modifications, permit "what-if" modeling of proposed enhancements and so forth.

At about the same time it announced DSEE, Apollo introduced Dialog—software to produce software for user interfaces. "In the last few years, developers have discovered a host of increasingly sophisticated user interfaces they attach to their products—everything from touch screens to mouse-driven interfaces," says Pomper. "The trouble is, the software for those interfaces can be very difficult to write. With Dialog, however, developers simply specify what kind of interface they'd like, and Dialog writes the necessary code."

'What you're looking at is cost-per-seat. That's the issue.'

New generation comes on

But the real sign of Apollo's commitment to CASE—and a hint of workstations' long-term future—is in hardware rather than in software. Apollo's initial workstations have begun to show their age. However, this year Apollo introduced a new generation of workstations—among them the Series 3000. It boasts a 19-

IBM puts workstations at RISC

There is one vendor that could completely remake the workstation business.

This year, IBM Corp. suddenly entered the technical market with the RT PC. An extremely innovative machine, the RT is based on a proprietary microprocessor that mixes conventional architecture with reduced instruction set computer (RISC) features. It also offers a paged UNIX-variant, AIX, as its operating system. Representing a first foray into the technical field—not a traditional IBM arena—it was a very impressive machine, and some analysts wondered if it wouldn't dominate the workstation marketplace.

Gradually, however, those fears have been calmed. Industry observers decided that the RT, at least in its present form, isn't aimed at the existing workstation market. "At the moment, it's not a workstation. It's a superpersonal computer," says Brad Smith, director of research in Technical Computer System Services at the market research company, Dataquest, San Jose, Calif. "It's missing floating point, communications and so forth. Right now, IBM knows, if it went head to head with the workstation vendors, if would get its head kicked in."

But, notes Smith, that situation may not last forever. With quite minor changes—such as improved networking—Big Blue could loom large over the workstation market. John DeVries, CASE Marketing Manager for Sun Microsystems Inc., says simply, "IBM-watching is dangerous...you never want to discount them, because they'll turn around and bite you. On the other hand, you don't want to get paranoid about them either."

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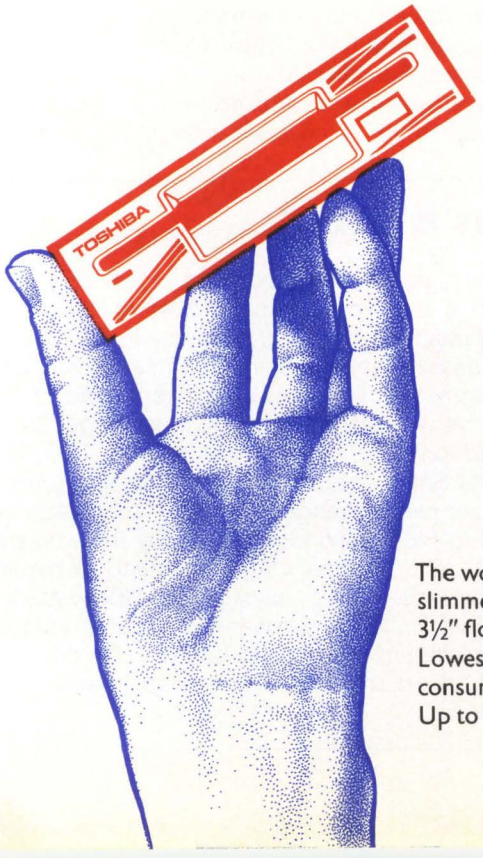
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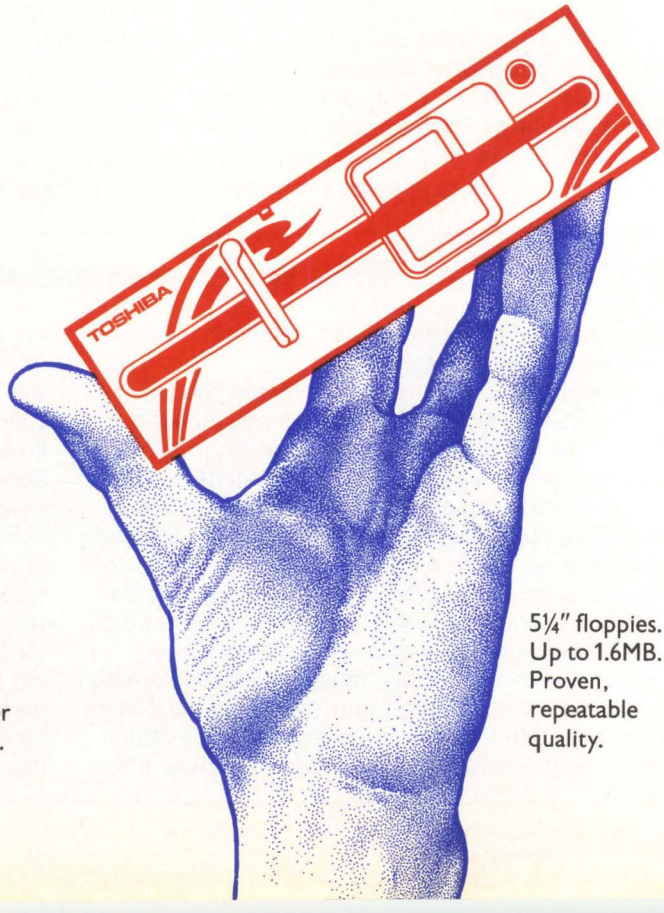
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Remote development shows real signs of being the wave of the future.

inch, monochromatic display with superb resolution and 2M bytes of memory. Both AT&T Information Systems' UNIX System V and Berkeley UNIX Version 4.2 support the Domain networking. It is, in short, a workstation meant expressly for applications outside of CAD/CAM, such as software development.

Meanwhile, workstation vendor Sun Microsystems has become almost as closely linked to software development as Apollo has to software management. Sun was founded in the early 1980s by a group of entrepreneurs that included William Joy, the computer scientist whose work at the University of California at Berkeley gave him the nickname "the father of UNIX 4.2." The company has maintained a reputation for technical innovation, engineering excellence and a certain daring—qualities well suited to win a large share of the workstation market.

Sun's success came as a surprise to some industry observers. While they sometimes are used for CAD/CAM, the Sun machines are not designed to fit neatly into that traditional workstation market—many don't offer color graphics, for instance. The idea that workstations might be sold for anything else seemed to violate both marketing wisdom and common sense. (As late as 1984, the president of one multiuser computer company was heard to say, "I thought Sun would go belly up as soon as it got finished selling boxes to Bill Joy's classmates at Berkeley. Clearly, I was wrong.")

They were sold for things other than CAD/CAM, and quite briskly. Early this summer, Sun estimated that over a third of its machines were going to the CASE market. The company's newest generation of workstations, the Sun-3 line, seems tailor-made for CASEwork. Says CASE marketing manager, John DeVries, "For CASE, color graphics isn't an issue, at least not yet, and ultra-high performance isn't an issue. What you're looking at is cost-per-seat. That's the issue." And consequently, the Sun-3/50M, a diskless workstation with a price tag of $7,900, meets the requirement as a very inexpensive programmer's seat.

Sun is particularly interested in remote development. "The general model we have is the host-target situation," says DeVries, where software is written on one machine and then exported to another. In Sun's view of the world, its customers are developing software for large and expensive systems—so large and so expensive that the customer cannot afford to waste the machines' CPU time on software development. With remote development, the programmers may leisurely produce and perfect source code on their individual workstations, and then drop that code via Sun's networking to the target machine for compilation—and ultimately execution. "You avoid the bugaboo of cross-compilers," says DeVries.

Veterans and start-ups move in

Remote development shows real signs of being the wave of the future. Workstations are so much more supportive of programmers than are terminals on a multiuser system that software developers are finding it increasingly hard to get along without them. Notes DeVries, "We're very near the point where it will just not be cost effective to do development on native systems."

Sun offers a set of software developer's tools that reflect this model of coding. Last September, Sun announced SunPro—short for Sun Programming Environment—a collection of utilities meant for the control, debugging, editing and testing of source code. With SunPro, the programmer can rapidly prototype an application on the workstation before taking it to the larger machine.

At the same time, Sun also introduced SunView, a library of interface software similar to Apollo's Dialog. With it, developers can rapidly produce user interfaces based on windows, scrolling bars, pull-down windows, mice and so forth.

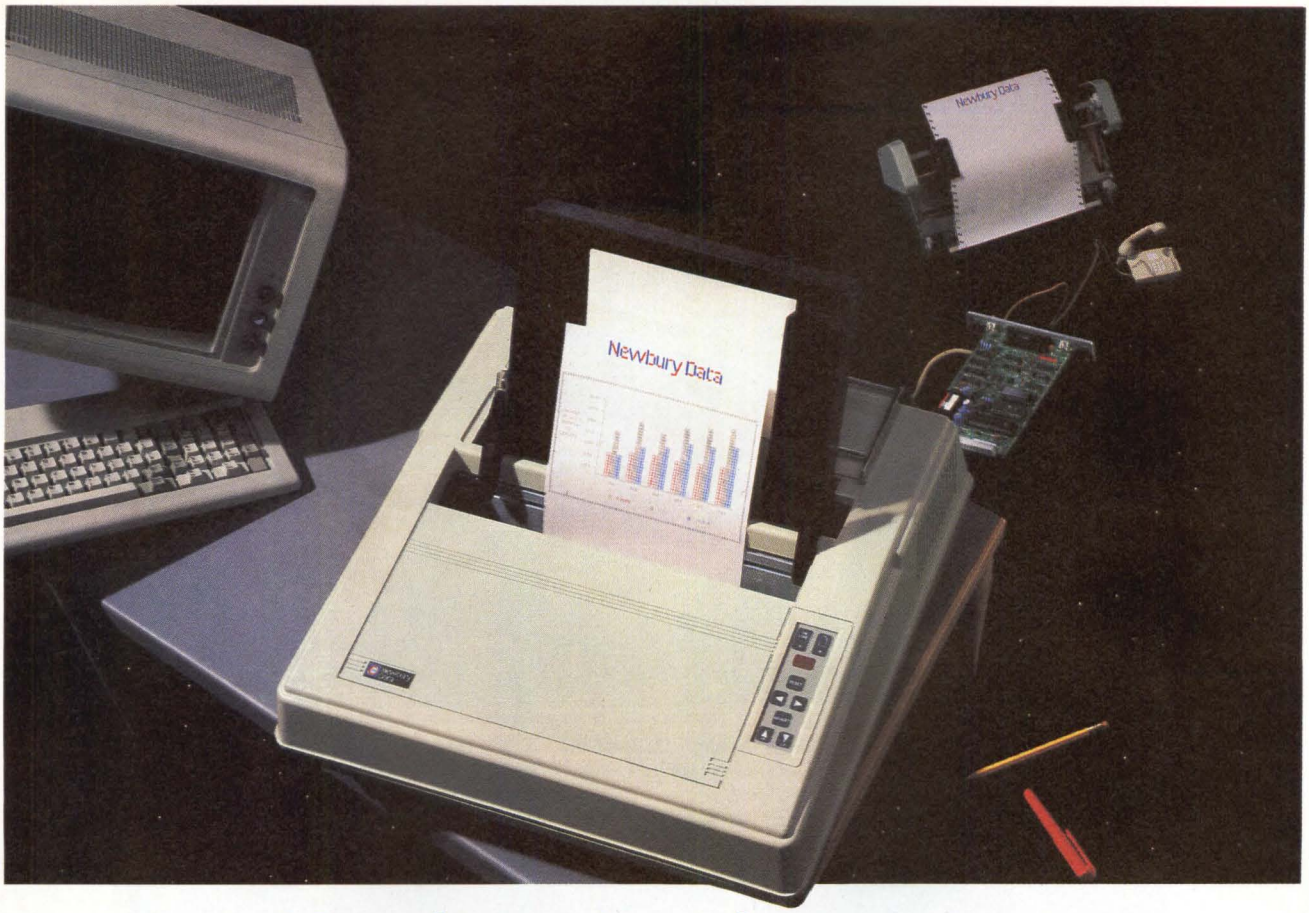
Meanwhile, the workstation market continues to resemble a war zone. Leaders like Sun and Apollo are virtually under siege from a

Workbenches take on workstations

One alternative to the programmer's workstation is a dedicated programmer's workbench, a multiuser system dedicated to remote software development.

One such workbench is available from Dialogic Systems Corp., San Jose, Calif. Their Dialogic Development Center is a hardware and software product for the production of code for IBM Corp. mainframes. It consists of the Workbench Machine, a 32-bit microcomputer based on the Motorola Corp. MC68000 processor, and a package of programming aids known collectively as the Workbench Toolkit.

Like a workstation, the Dialogic Development Center allows programmers to develop code remotely, and then to drop it to an IBM mainframe. Unlike a workstation, however, it can support up to 32 users at a cost of about $3,000 apiece. It can be expanded to up to 96 users.



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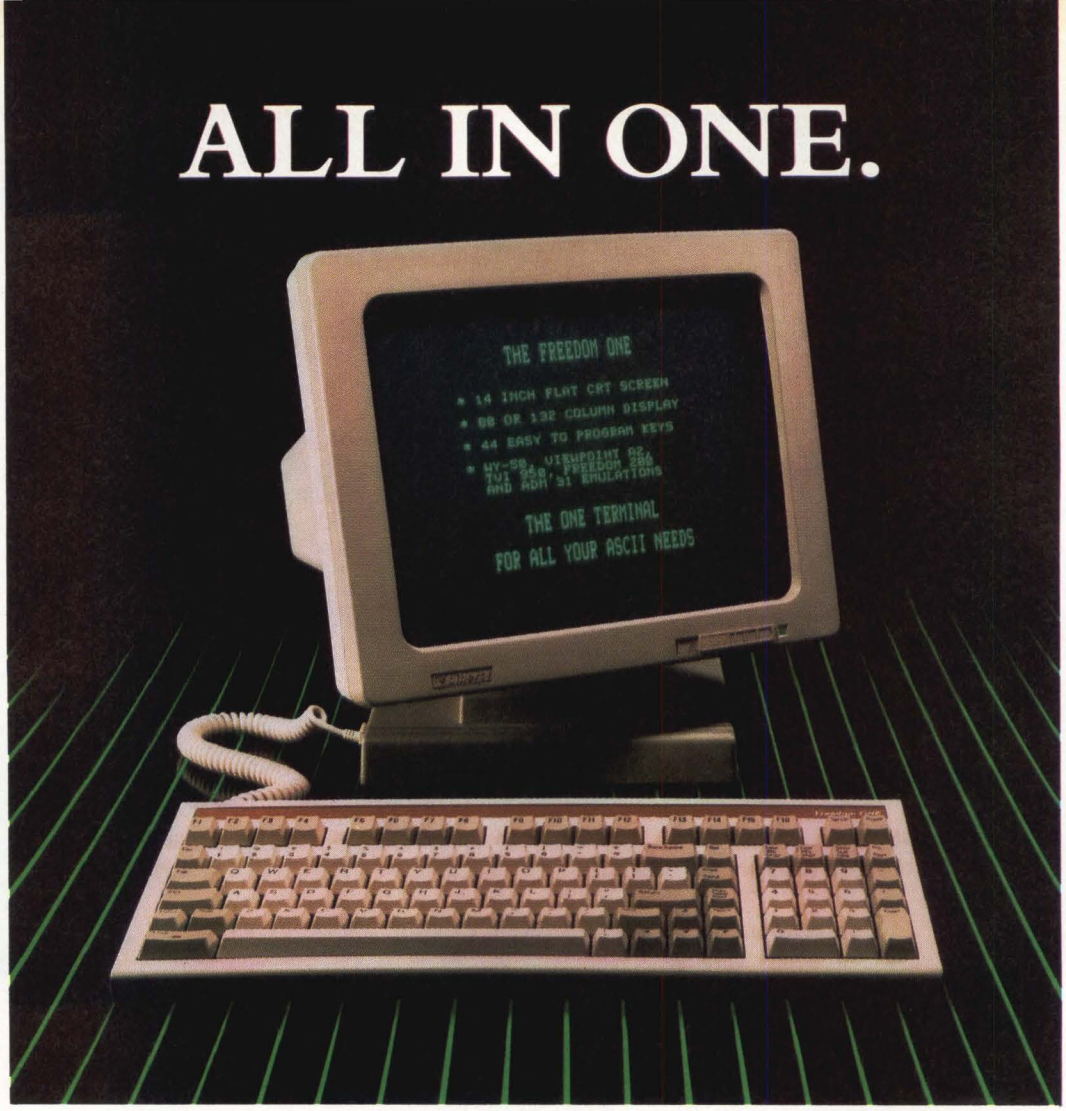
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host of aggressive competitors—ranging from long established powerhouses, such as Harris Corp., to innovative start-ups, such as Celerity Computing. It is, in fact, among these new players that the most dramatic response to software engineering seems to be happening.

For example, last October, Masscomp introduced five very powerful workstations known collectively as the "5000 series." Based on a triple bus that allows extremely fast data transfer, the machines can actually approach mainframe performance in some I/O intensive applications. Priced relatively inexpensively at $15,000 to $250,000, the 5000 workstations might be particularly useful in very demanding, scientific and engineering CASE efforts.

Meanwhile, DEC recently entered the workstation business with the VAXstation, a technical workstation based on the company's proprietary MicroVAX II 32-bit microprocessor. Since its introduction, the machine has been further specialized and upgraded to fit assorted vertical markets.

Less well known, however, is that the VAXstations are also finding a place in CASE. Last year, DEC announced a very unusual machine —the Ada Programmer's VAXstation.

Physically, the machine differs from the standard VAXstation only marginally. But there is a tremendous difference in its marketing and intended purpose. As the name would suggest, the Ada VAXstation is meant for development of applications within a single language, Ada.

The Ada programming language, developed to the specifications of the Department of Defense in the late 1970s and early 1980s, is an extremely powerful, but extremely complex, language. It was meant for extremely demanding applications. It is so large and so difficult that, until recently, Ada compilers were simply unavailable on microcomputers.

So, Ada has traditionally been a language for minicomputers or mainframes and Ada programmers have usually worked on terminals attached to time-sharing systems. DEC, however, was one of the first companies to realize that workstations, with their greater horsepower, could provide individual programmers with desktop Ada. The result was the Ada VAXstation, with up to 9M bytes of memory, strong networking, high-resolution graphics, multiprocessing and windowing. It also has an extremely strong, DEC-proprietary ADA compiler.

The Ada VAXstation is meant for a single language.

DEC does not regard its Ada workstation as a dedicated, turnkey machine. "The Ada workstation could be used for any other application, of course. In fact, I could build an Ada station out of off-the-shelf DEC products," says Kendall. "But I might also make a mistake. I might not include enough memory. Or I might not know about some DEC component that would be particularly useful. This way, we basically take care of the configuration for you."

Strong defense applications

But the Ada VAXstations are pioneers all the same. Not only are they among the first workstations to be specialized in hardware for software engineering in a single language, but also

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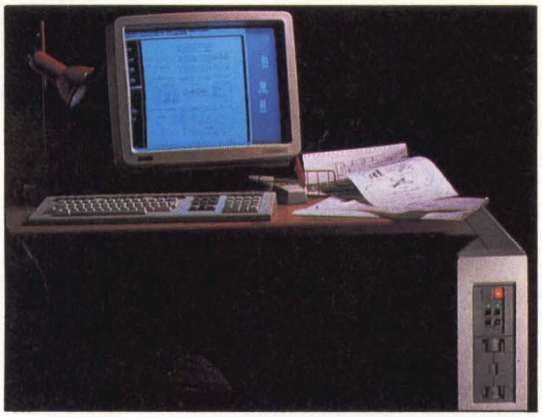
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The VAXstation, *from DEC, is already widely used in CAD/CAM applications. The VAXstation is also finding a role in computer aided software engineering.*



they are among the first workstations meant to address the emerging embedded-systems market.

Embedded systems are computers or programmable controllers contained within non-computing equipment. At the moment, embedded systems are mostly used by the military in missiles, fighter aircraft, weapons systems and so on. This means that most Ada development projects tend to be for embedded systems. Which means, in turn, that the Ada VAXstation has a strong orientation toward such systems. Developers can use the machine to drop code to embedded computers produced by Norden Systems, Norwalk, Conn., which are ruggedized VAXes produced under license from DEC for the military.

This makes the Ada VAXstation a sign of things to come because more and more manufacturers are discovering the advantages of intelligent products. Already, computers are showing up as part of industrial robots, in avionics applications, pacemakers, intelligent appliances and, even, credit cards. For instance, SmartCard International Inc., New York, has recently announced Ultracard. This is a credit card with a 64K combined microprocessor and memory chip, a tiny keyboard and a liquid-crystal display.

As the embedded-systems market grows in importance, workstations used to program those systems will become increasingly important. Developing software for machines that are not themselves computers could easily become the single largest CASE-application of workstations.

The future of workstations in CASE seems assured. They've proved so useful for programming that now the question isn't whether they'll be used for software engineering, but, rather, what percentage of their sales will go to CASE instead of to CAD/CAM. Brad Smith, a researcher at Dataquest, believes that, by 1999, fully 40 percent of all workstations will be employed for the production of code.

However, Sun's DeVries argues, "I expect both CAD/CAM and CASE will lose percentage points as people start finding other applications for workstations—desktop publishing, for instance."

Smith goes further, saying that workstations are appearing for CASE-applications not because of any unique natural affinity between the machines and the task but because of a kind of 32-bit imperialism. "Just as one would expect, the workstation is moving out of its traditional niche and into the rest of computing," he says.

Explains DEC's Kendall, "The workstations are showing up in software engineering at least partly because the software people looked across the hall, noticed the CAD/CAM machines, and said, 'Hey, those guys got good stuff, and we don't.'" □

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A simple keystroke interrupts your business application and allows you to enter any other A-to-Z application. For example, you can create a graph of your existing data and insert the graph into a word processing document, anywhere you want. With A-to-Z, it's easy to add clear, professional-looking graphics to any document. Or you can pass the data to the report writing functions for use in a report, then return to your previous application. A-to-Z makes it all happen with a few simple keystrokes.

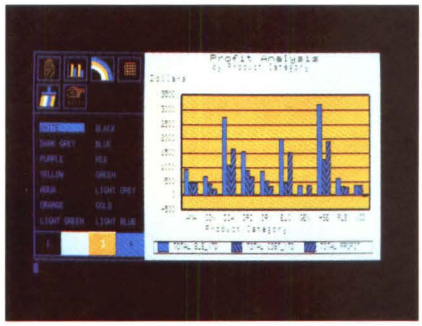
A-to-Z Business Graphics: Dress Up Your Data.
With A-to-Z Business Graphics, you can easily create a variety of graphs that allow you to analyze your business data and simplify the presentation of information.

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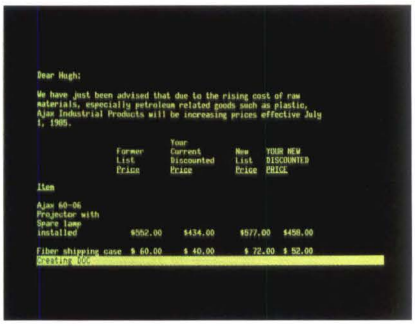




And There Are More Applications.
These are only a few of the A-to-Z applications available from Digital. Investment in application development is on-going, as Digital continues to provide you with the kinds of productivity tools that every office needs.







A-to-Z Word Processing: As Simple As A-B-C.
Every business generates correspondence, bills, memos, reports, and other written material. The A-to-Z Word Processing module makes the job easier with complete editing, document preparation and list processing functions.

You can create new letters, memos, or other documents on your A-to-Z system. Or you can edit and modify existing documents. It's easy to learn and use, and allows you to prepare professional-looking documents in no time at all.

A-to-Z Word Processing uses Digital standard "GOLD KEY" word processing, which is available on all of Digital's PDP, VAX and personal computer families. That means true professional word processing at your fingertips. And, there's no need for retraining users already familiar with Digital computers.

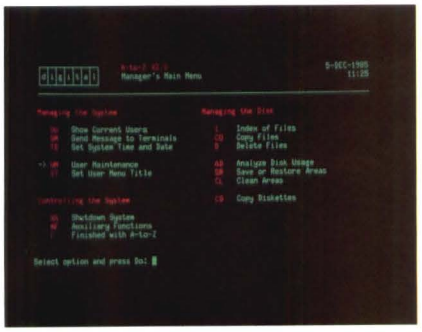
List Processing features are also available with the A-to-Z Word Processing module. It allows you to create customized form letters and reports from lists of information, such as personnel or customer files.

A-to-Z Database Management: Report Writing Made Easy.
The A-to-Z database management function lets you use your data any way you want to create reports quickly and easily.

Instant reports from data files. This function automatically searches files for specified information and then produces a report using the requested information. Reports can be printed out, displayed on-screen, presented in graphic form, or used with A-to-Z's list processing capabilities.

The A-to-Z database management function provides a simplified data dictionary build and data entry facility for creating new databases, and adding, modifying, or deleting records within existing databases.

Sophisticated list processing. A-to-Z database management offers list processing capabilities that enable you to create and update customer rosters, reports and mailing lists from information in existing files. You can then switch over to A-to-Z Word Processing to create personalized direct mail letters to your customers. That's a real plus for businesses looking for inexpensive ways of generating additional revenue from a known customer base.



A-to-Z Works For You.

We make A-to-Z modular to give it the versatility you need for the jobs you do. A-to-Z can process several applications at once.

For example, an order entry clerk can enter purchase orders into the system, while a secretary is typing letters at another terminal, and a sales manager is preparing a monthly sales report at a third terminal. While all this is going on, A-to-Z can accept and respond to a request for inventory status from a shipping clerk in the warehouse.

While A-to-Z is modular, it also makes it easy to bring together information from various sources. Let's say you are preparing a report to a bank manager for a new loan. The A-to-Z system lets you pull together a spreadsheet on projected expenses, a graphic illustration of income growth, a report on your sales history for the two previous years — with a few simple keystrokes. And the result is a professional-looking report that lets your organization shine.

A-to-Z Runs the Show...

The system performs the basic, but critical, tasks that make A-to-Z work so well: providing clear, straightforward menus, controlling system security, displaying appropriate error messages for each user, and executing the tasks of the special function keys.

...But A-to-Z Doesn't Run You.

A-to-Z is designed so you can manage it easily. This system contains lots of features built in to help everyone in your organization work well together. Here are just a few:

- *User accounts for everyone in your company.* With A-to-Z, you don't have account limitations. If you have an eight-user system, but employ 20 people who perform various tasks (i.e., word processing, finance, order entry, and other tasks required in your business), each person can have an account with only eight using the system at one time. Not everyone may need terminals at their desks, but A-to-Z allows them to have an account when they need to use the system.
- *Function keys that do what they say.* No matter what A-to-Z application you're using, function keys make the job easier. Keys marked INTERRUPT, EXIT, CANCEL, RESUME, DO, and HELP do just what they say. These handy keys allow you to quickly and simply interrupt one task, select another application, exit from the second one and resume the first.
- *Individual security feature.* You can lock or unlock your A-to-Z files — just as you can lock or unlock your desk or file cabinet — so that other users can copy information. You can change the security status of your area at will to prevent others from unauthorized access to confidential data. In addition, the system manager can lock unauthorized users out of certain applications, such as restricting access to payroll records to the employees in your payroll department. With authorization, however, you can easily make a copy of another user's file to save retyping time and effort.
- *Special system management account.* A-to-Z makes system management easy. You don't need to be a technical expert; if you can type (even two-finger typing!), you can run A-to-Z. The system manager can call up a special menu of functions to keep the system running smoothly in three critical areas: data storage, system control, and routine functions like backup or making copies of data files.

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NEW PRODUCTS

SYSTEMS

Megan Nields, Assistant Editor

System supplies IBM compatibility

Running 33 percent faster than the IBM PC/AT, the MAI 1500 computer system utilizes an 80286 microprocessor. The IBM-compatible unit includes 640K bytes of internal memory, a 20M-byte rigid disk drive and an RS232C port. A 14-inch monitor displays 720 by 350 pixels. $4,750. **MAI Basic Four Inc.,** 14101 Myford Road, Tustin, Calif. 92680, (714) 731-5100.

Circle 301

Computer supports up to 32 users

A 16-bit microcomputer, Ultraframe handles up to 32 users. The system supports rigid drives and tape backup systems of up to 1,160M bytes and 67M bytes, respectively. It incorporates standard S-100 bus architecture. The data-transfer rate is 2M bytes per second. $34,020. **Independent Business Systems Inc.,** 5915 Graham Court, Livermore, Calif. 94550, (415) 443-3131.

Circle 302

Microcomputer uses 68020 processor

A 32-bit, 68020-based microcomputer, the HK68/V20 is geared toward real-time and UNIX applications. The unit provides up to 1M byte of on-board, dual-access DRAM with parity, and up to 128K bytes of EPROM and nonvolatile static RAM. An RS232C port is standard. $3,595. **Heurikon Corp.,** 3201 Latham Drive, Madison, Wis. 53713, (608) 271-8700.

Circle 303

Computer aims at system integrators

The 0SI 712 supermicrocomputer is aimed at system integrators and VARs. Real-time processing is provided through RTIX, a UNIX- and XENIX-compatible operating system. The unit uses a 68010 processor to accommodate three to 12 users. Standard RAM is 2M bytes, expandable to 4M bytes. A 5¼-inch rigid disk drive with 20M to 200M bytes of internal storage is supplied. $9,990. **Isotron Inc.,** 140 Sherman St., Fairfield, Conn. 06430, (203) 255-7443.

Circle 304

Hand-held computer suits IBM PC

A hand-held, IBM PC-compatible microcomputer, the Datacomputer offers an alphanumeric keyboard, a battery power supply and plug-in RAM boards for up to 256K bytes of memory. Data is transmitted via a Hayes-compatible modem or an RS232C port. The unit weighs 39 ounces. $2,995. **National Datacomputer,** 34 Linnell Circle, Billerica, Mass. 01821, (617) 663-7677.

Circle 305

Workstation offers IBM compatibility

Providing IBM 5080 compatibility, the 2033 Model 2 is a 3-D color raster-graphics workstation. The unit executes CAD/CAM applications such as mechanical design and numerical control. Pixel write time is 45 nsec. Features include a programmable function keyboard and a 1,024-by-1,024 pixel display resolution. $21,700. **CGX Corp.,** 42 Nagog Park, Acton, Mass. 01720, (617) 263-3222.

Circle 306

System handles 128 terminals

The Business System 1500 is a UNIX-based computer system that supports up to 128 terminals and four billion bytes of memory address space. It utilizes multiple 32-bit 68020 microprocessors running at 16.67 MHz. Cache memory is 16K bytes. The unit stores up to 2.5G bytes of data. $70,000 and higher. **Texas Instruments Inc.,** Data Systems Group, P.O. Box 809063, H-850, Dallas, Texas, 75380-9063, (800) 527-3500.

Circle 307

Laptop computer features enhancements

An enhanced laptop computer, the Portable Plus has 256K-byte and 512K-byte RAM versions. Memory is expandable to 1.28M bytes. Available plug-in software includes MultiMate and a proprietary information management package. The LCD display has an improved contrast of 200 percent over the previous model. The unit exchanges information with HP and DEC computers. $2,695, 256K RAM; $3,395, 512K RAM. **Hewlett Packard Co.,** 3000 Hanover St., Palo Alto, Calif. 94303-0890. Phone locally.

Circle 308

PC supplies IBM compatibility

An IBM PC-compatible personal computer, ANSWER provides an 8088 microprocessor, 640K bytes of RAM and two 5¼-inch flexible disk drives. The unit operates under MS-DOS, PC-DOS and CP/M-86. A parallel printer port, a monochrome graphics card and eight expansion slots come standard. The computer includes a monitor and a keyboard with 10 programmable function keys. $999. **Comark Inc.,** 135 N. Brandon Drive, P.O. Box 2608, Glendale Heights, Ill. 60138-2608, (312) 351-9700.

Circle 309

Disk card supports ANSI

The SCSI Hard Disk Card supports the ANSI X3T9.2 SCSI specification. Geared toward the IBM PC family, the unit supplies 21M bytes of rigid disk storage. It plugs into one-and-a-half add-on slots in the PC and connects as many as six SCSI peripherals to the PC. $675. **Micro Design International,** 6566 University Blvd., Winter Park, Fla. 32792, (305) 677-8333.

Circle 310

Tape backs up IBM PC, /XT, /AT

A free-standing, 60M-byte, quarter-inch streaming tape system, Excel-Stream 60-8 backs up the IBM PC, PC/XT, PC/AT and compatibles. The device incorporates configurable DMA channels, port addresses and interrupt lines. Features include automatic tape formatting and automatic read-after-write error checking. The unit backs up 10M bytes in 2 minutes. $995. **Everex Systems Inc.,** 47777 Warm Springs Blvd., Fremont, Calif. 94539, (415) 498-1111.

Circle 311

Tape system services IBM PCs

A 40M-byte, portable tape system, the MT40P is geared toward the IBM PC, PC/XT and PC/AT. The unit weighs less than 5 pounds and supports Image or File-by-File-Backup and Restore commands. It plugs into the PC's external flexible port. $695. **Micro Design International Inc.,** 6566 University Blvd., Winter Park, Fla. 32792, (305) 677-8333.

Circle 312

Disk system offers IBM PC compatibility

Easi-Disk is a portable, IBM PC-compatible, flexible disk system. Data transfers between the PC and incompatibly formatted devices using RS232C, RS422 or parallel interfaces. Features include a 19.2K baud rate, a 4K-byte addressable RAM buffer and dual I/O ports. The unit is controlled by a Z80 microprocessor. $1,095. **Analog and Digital Peripherals Inc.,** 815 Diana Drive, Troy, Ohio 45373, (513) 339-2241.

Circle 313

Tape system runs with IBM

A half-inch magnetic tape system for IBM Systems 34, 36, 5362 and 5364, the TDX-45/5360 transfers data at 28.8K to 56K bps. The system includes a 45-ips start-stop drive with dual density and automatic loading of magnetic tape reels. Features include a bisynchronous interface and a tape-utility software package. $8,950. **Telebyte Technology Inc.,** 270 E. Pulaski Road, Greenlawn, N.Y. 11740, (516) 423-3232.

Circle 314

Tape drive offers IBM compatibility

Suiting OEMs, the I480 cartridge tape drive is the first plug-compatible alternative to the IBM 3480. The data transfer rate is 3M bytes per second. Cartridge capacity is 218M bytes, formatted, and 246M bytes, unformatted. The half-inch unit supplies an 18-track parallel format with 18 read/write channels. It contains 15 percent fewer parts than the 3480. $26,000, OEM discount. **Aspen Peripherals Corp.,** 1860 Lefthand Circle, Aspen, Colo. 80501, (303) 678-0808.

Circle 315

Disk subsystem packs 60M bytes

A 60M-byte, 5¼-inch disk subsystem, the Perfect 60 is configured for either the IBM PC/AT or the Compaq 286, with disk controller. The 5¼-inch unit provides a 30-msec average access time and a 5M-byte-per-second transfer rate. Proprietary software is included. $3,695, IBM version; $3,995, Compaq version. **CMS,** 401-B West Dyer Road, Santa Ana, Calif. 92707, (714) 549-9111.

Circle 316

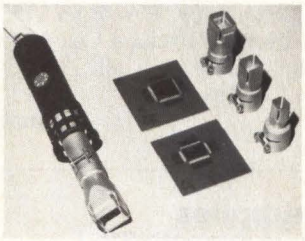
Quarter-inch drive stores 125M bytes

- 72-ips tape speed
- 90K-bps transfer rate
- QIC-120 data format

A quarter-inch streaming cartridge tape drive, the Super Scorpion 5125L-1 stores 125M bytes of formatted data. Information is transferred at 90K bps with a tape speed of 72 ips. A QIC-120 data format allows for a 15-track serpentine pattern. The device conforms to ANSI standards and reads any tape cartridge that conforms to the QIC-24 data format standard. $733, OEM quantities. **Archive Corp.,** 1650 Sunflower Ave., Costa Mesa, Calif. 92626, (714) 641-0279.

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CIRCLE NO. 72 ON INQUIRY CARD

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CIRCLE NO. 73 ON INQUIRY CARD

PRINTERS

Printers work at 30, 45 ppm

- Ion deposition
- 300 by 300 dpi
- 100,000 pages per month

The 3000 series ion deposition printers come in 30- and 45-ppm models with either 240 by 240 or 300 by 300 dpi, respectively. The units produce more than 100,000 pages monthly, and have a standard 500-sheet feeder with an optional 2,000-sheet elevator. The series is compatible with all industry-standard line-printer controllers and software. Features include automatic self-test and an optional job separator and sorter. $11,995. **C. Itoh Electronics Inc.,** 5301 Beethoven St., Los Angeles, Calif. 90066, (213) 306-6700.

Circle 318

Laser printer produces 8 ppm

Producing 8 ppm, the LaserPrinter is compatible with most personal computers. The desktop unit offers 300-by-300-dpi resolution. Noise level is less than 55 dB(a). Seven fonts and a font cartridge are included. $3,995. **Philips Information Systems,** Suite 300, 15301 Dallas Parkway, LB 35, Dallas, Texas. 75248, (214) 980-2000.

Circle 319

Dot-matrix printer suits IBM PC

Generating 120 cps, draft quality, and 30 cps, letter quality, the NL-10 is a dot-matrix, desktop printer. The unit is geared toward the IBM PC and compatibles, the Commodore 64 and 128 and Apple computers. Features include plug-in interface cartridges, an adjustable rear tractor feed and an automatic paper feed. Under $400. **Star Micronics Inc.,** Suite 3510, 200 Park Ave., New York, N.Y. 10166, (212) 986-6770.

Circle 320

Multi-mode printer furnishes color

A multi-mode, dot-matrix printer, the Tempest 220 provides IBM and IDS color printer compatibility. Resolution is 144 by 144 dpi. Speeds range from 215 cps, draft quality, to 45 cps, letter quality. A 12.7K-byte RAM buffer downloads fonts from the host computer. Centronics and RS232C interfaces are standard. $3,890. **North Atlantic Qantex,** 60 Plant Ave., Hauppauge, N.Y. 11788, (516) 582-6060.

Circle 321

Daisywheel printer runs at 60 cps

The 6500 daisywheel printer produces 60 cps. It offers 10-, 12-, and 15-pitch and proportional spacing. The noise level is 58 dB(a). A 3K-byte buffer memory frees the computer for other tasks while the printer is printing. Centronics and RS232C interfaces are standard. $1,395. **Juki Office Machine Corp.,** Printer Division, 299 Market St., Saddle Brook, N.J. 07662, (800) 932-0590.

Circle 322

Dot-matrix printer achieves 1,200 lpm

The HP 2567B dot-matrix printer runs at 1,200 lpm. The unit supplies a resolution of 140 by 144 dpi. Up to 66 double-size and 132 normal-size characters can be generated per line. Supports IEEE-488, RS232C and Centronics interfaces. $28,050. **Hewlett-Packard Co.,** P.O. Box 10301, Palo Alto, Calif. 94303-0890, (415)857-1501.

Circle 323

Daisywheel printer features two colors

The HR-35 daisywheel printer provides two-color output. Generating 35 cps, the unit is supplied with a Centronics or an RS232C interface. A 7K-byte buffer allows device printing while entering information into the computer. A proprietary copy function holds up to five pages of text. $1,049. **Brother International Corp.,** 8 Corporate Place, Piscataway, N.J. 08854, (201) 981-0300.

Circle 324

Thermal printer contains 42 columns

A panel-mount thermal printer, the SP-400G provides dot-addressable graphics. The unit has switch selectable baud rates ranging from 50 to 9,600. Features include an internal 42-character buffer, and RS232C and current loop interfaces. Double-width print is standard. Printing speed is 0.6 lines per second. $365. **Syntest,** 40 Locke Drive, Marlboro, Mass. 01752, (617) 481-7827.

Circle 325

Printer/plotter has high resolution

The Visigraph is a monochrome printer/plotter. Resolution is up to 1,280 by 1,024 pixels, non-interlaced. The device can be programed for 100-, 150-, 200- or 300-dpi input. Maximum print width is 11.7 inches. The unit operates in either print or plot mode. $7,950; OEM discounts available. **Honeywell Inc.,** Test Instruments Division, P.O. Box 16688, Denver, Colo. 80216, (303) 773-4581.

Circle 326

Thermal printer targets OEMs

A 240-dpi thermal-transfer printer, the G-500 suits OEM applications. The unit uses a 2-by-2 or 1-by-1 display format. It prints a full-page color screen bit map in 1 minute on fanfolded paper or transparencies. A Centronics interface is included. $4,000 and lower. **Mitsubishi Electronics America,** 991 Knox St., Torrance, Calif. 90502, (213) 515-3993.

Circle 327

Dot-matrix printer achieves 120 cps

- Desktop unit
- Plug-in interfaces
- 30 cps NLQ

A dot-matrix desktop printer, the NL-100 runs at 120 cps, draft, and 30 cps, near letter quality. The unit furnishes plug-in interface cartridges for the IBM PC and compatibles. Features include three pitch selections and a bi-directional tractor feed. $319. **Star Micronics,** Suite 3510, 200 Park Ave., New York, N.Y. 10166, (212) 986-6770.

Circle 357

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CIRCLE NO. 82 ON INQUIRY CARD

Monitor displays 960 by 1,280 pixels

The Viking 1 CRT and controller suits the IBM PC/XT, /AT and compatibles. It displays 960 by 1,280 pixels at a 66-Hz refresh rate on a 19-inch screen. Graphics-control functions include circle, ellipse and zoom and pan. The controller uses one slot in the personal computer and incorporates a 2 megabit memory for bit-mapped graphics. $2,195. **Moniterm Corp.,** 5740 Green Circle Drive, Minnetonka, Minn. 55343, (612) 935-4151.

Circle 328

Video monitor employs color

A 100-MHz, color display monitor, the 7400 achieves a 1,280-by-1,024 noninterlaced format. The 19-inch unit includes a high-contrast panel and 0.31-mm pitch. Three BNC connectors are included for RGB inputs. Internal or external synchronization is provided. $3,665. **Conrac Division,** 600 N. Rimsdale Ave., Covina, Calif. 91722, (818) 966-3511.

Circle 329

Graphics terminal supports CAD/CAM

A color graphics terminal, the PGT 4111 supports CAD/CAM applications. The unit consists of a 19-inch screen with a 1,024-by-768 pixel resolution. Up to 16 colors can be displayed simultaneously. Refresh rate is 60 Hz, noninterlaced. $12,950. **Prime Computer Inc.,** Prime Park, Natick, Mass. 01760, (617) 655-8000.

Circle 330

Terminal sports 44 programmable keys

An ASCII terminal, the Freedom One displays 24 lines by 80 or 132 columns on a 14-inch CRT. The unit offers 44 programmable keys, a programmable bidirectional printer port and a split screen. It emulates the WY-50, TeleVideo 950, Viewpoint A2 and ADM 31. Features include nonvolatile setup modes, jump or smooth scrolling, eight foreign-character sets and a screen-saver function. $499. **Liberty Electronics,** 332 Harbor Way, South San Francisco, Calif. 94080, (415) 742-9960.

Circle 331

Graphics terminal targets IBM 3270

The CX4111 color graphics terminal is geared toward IBM 3270 environments. It offers a 19-inch, 1,024-by-768 pixel display. Sixteen colors are displayed simultaneously from a palette of 4,096 colors. The unit provides coaxial attachment to IBM 3274 controllers. It supports local segments for zoom and pan capabilities. Up to 256K bytes of memory. Features include DEC VT100 compatibility. $13,950. **Tektronix Inc.,** P.O. Box 500, Beaverton, Ore. 97077, (503) 644-0161.

Circle 332

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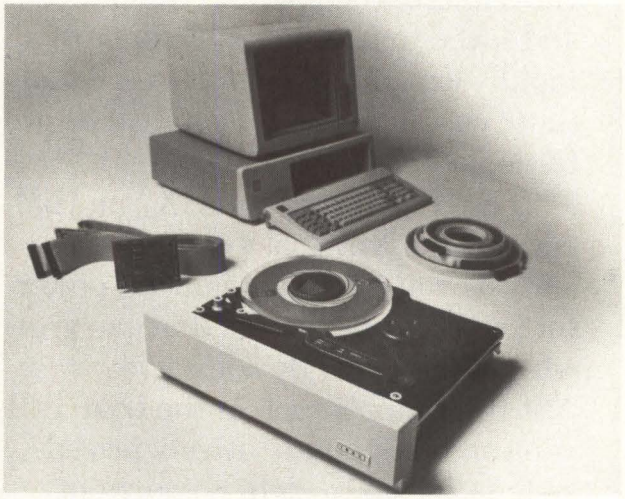
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CIRCLE NO. 75 ON INQUIRY CARD

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CIRCLE NO. 76 ON INQUIRY CARD

Multiplexer runs at 32K bps

A time-division multiplexer with built-in DSU/CSU, the ATDM multiplexes data from up to six synchronous devices onto a 56K-bps transmission link. Data rates, which range from 2.4K to 32K bps, are selected from eight settings. Features include full diagnostics, self-test, LED indicators and EIA signal propagation. $1,890. **Astrocom,** 120 W. Plato Blvd., St. Paul, Minn. 55107-2092, (612) 227-8651.

Circle 333

Package contains hardware options

An X.25 protocol hardware/software package, the SBE/X.25 contains multiple hardware options for Multibus systems. The package supports CCITT procedures for duplex point-to-point links. It is offered on three 68000-based boards, each with X.25 in EPROM to implement layers 1, 2 and 3 of the ISO model. $1,200. **SBE Inc.,** 2400 Bisso Lane, Concord, Calif. 94520, (800) 221-7722.

Circle 334

Multiplexers integrate voice, data, video

The ITM family of T-1 networking multiplexers integrates voice, data, facsimile and video conferencing channels. The series—ITM 1501, ITM 1502 and ITM 1508—supports 12 to 500 channels of voice and data. $7,100 and higher. **Infinet Inc.,** 40 High St., North Andover, Mass. 01845, (617) 681-0600.

Circle 335

Modem accommodates speed variations

The Quattro International V.22 bis modem is compatible with Bell and CCITT standards. The full-duplex device runs at 75, 110, 300, 600, 1,200 and 2,400 bps. A speed-detection feature recognizes the rate of incoming data and accommodates it. Non-volatile memory stores eight telephone numbers. Features include a 2,000-character data buffer. $495. **Dowty RFL Industries Inc.,** Powerville Road, Boonton, N.J. 07005, (201) 334-3100.

Circle 336

Gateway performs in IBM environment

The ACT SNA Gateway performs under the CICS/VS operating system in an IBM MVS environment. It allows IBM 3270 and higher SNA terminals to access applications and databases running on remote host computers and networks. The device supports multiple communications links and logical unit sessions. $35,000. **Advanced Computer Techniques Corp.,** 16 E. 32nd St., New York, N.Y. 10016, (212) 696-3600.

Circle 337

Package integrates software, hardware

A hardware/software package, the NetWare/SNA Gateway facilitates communication between LAN systems and mainframe computers. The device allows one modem to serve up to 32 users. Features include multiple-host sessions, multiple gateways and emulation capabilities. $5,530 to $7,495. **Novell Inc.,** 748 N. 1340 W., Orem, Utah 84057, (801) 226-8202.

Circle 338

Communications device combines functions

A multifunction communications device, the Accelerator combines data compression with an integral V.22 bis modem to provide up to 9,600 bps of full-duplex error-free throughput. The device, compatible with most asynchronous protocols, includes callback security and a 100-number telephone directory. $795 and higher. **Telebyte Corp.,** 215 Oak St., Natick, Mass. 01760, (617) 653-3995.

Circle 339

LAN connects 255 personal computers

- NETBIOS compatible
- PC-DOS 3.1
- 1M-bps transfer rate

AN IBM NETBIOS-compatible LAN, K-Net implements VLSI technology to transfer data at 1M bps. Up to 255 personal computers can be connected within the network running under PC-DOS 3.1. Peripherals such as rigid disks, printers and modems attached to one personal computer can be shared by all other network users. $395. **Kimtron Corp.,** Bldg. 160, 1705 Junction Court, San Jose, Calif. 95112, (408) 436-6550.

Circle 340

Modem suits IBM PC, compatibles

For use with the IBM PC and compatibles, the Signalman LIGHTNINGi is a half-card, add-in-board modem. The auto-dial/auto-answer unit operates asynchronously at 2,400 bps. Fallback speeds of 300 and 1,200 bps are supplied. The modem conforms to all industry standards and uses the Hayes-compatible command structure. The software requires 64K bytes of memory. $499. **Anchor Automation Inc.,** 6913 Valjean Ave., Van Nuys, Calif. 91406, (818) 997-7758.

Circle 341

System links telephones, PCs

The Information Exchange is an office-communications system that links telephones and personal computers via existing telephone wiring to provide integrated voice/data networking. The unit includes the Central Server for file and message storage, a voice/data terminal for file display and shared printer, modem and personal computer ports. It accommodates up to 120 users. $40,000 to $70,000. **Zymacom Inc.,** 2 Lyberty Way, Westford, Mass. 01886, (617) 692-4500.

Circle 342

Board connects six IBM PCs

- Up to 56K baud
- RS232C ports
- Half-card unit

A communications board, the Com Board-6 connects up to six IBM PCs, PC/XTs and PC/ATs using the EasyLAN network. The unit comes as a half-card with an attached daughter board. It utilizes the PC's RS232C ports to transmit data at speeds up to 56K baud. The device supplies switch-selectable addresses and interrupts. $490. **Server Technology Inc.,** Suite 107, 1095 E. Duane, Sunnyvale, Calif. 94086, (408) 738-8377.

Circle 343

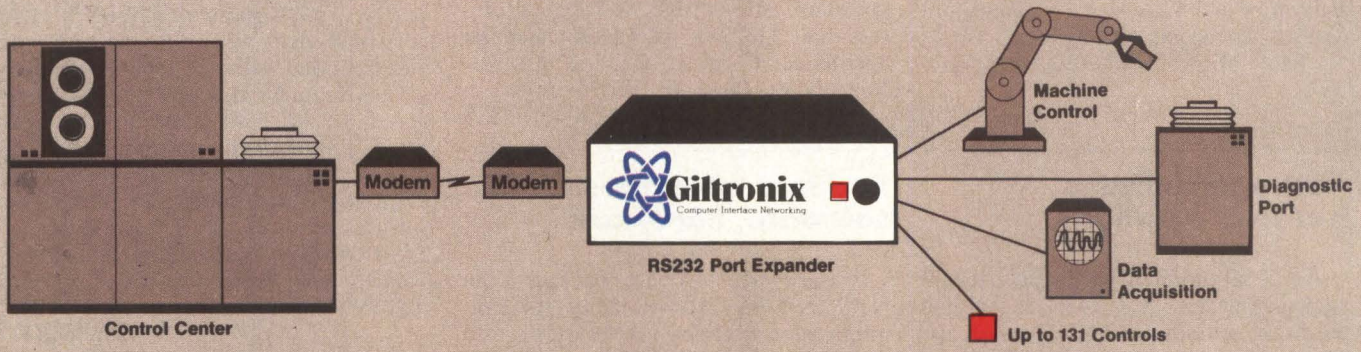
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15 Port-RS232 Port Expander

The Giltronix RS232 Port Expander enables cost-effective automated local and remote testing, data acquisition, remote diagnostic execution and remote peripheral control.

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- RS232, RS422, or RS423 Interface Capabilities



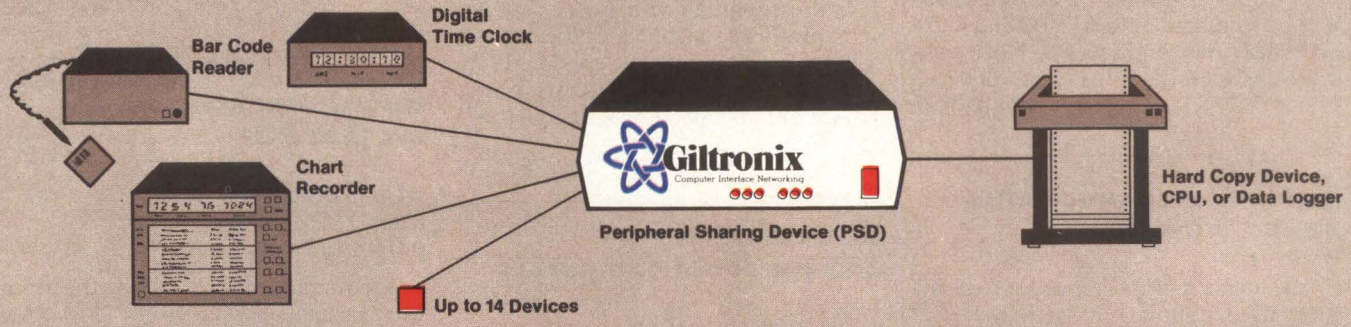
Giltronix for multi-port contention...



Peripheral Sharing Device (PSD)

The Giltronix (PSD) is the low-cost solution for numerous port-contention/device sharing applications such as printer sharing, industrial plant monitoring and data logging for multiple systems under test.

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Integrated program aims at IBM PC

- 16 fonts
- Page composition
- Word processing

Spellbinder Desktop Publisher incorporates word processing, typesetting and page composition into one 16-font package. For use with the IBM PC and compatibles, the software displays layouts on-screen as they will appear on the printed page. The program executes proportional spacing on a right-justified line and supplies varying degrees of vertical and horizontal spacing. Features include hanging indents, runarounds, multiple columns and graphics. $650. **Lexisoft Inc.,** P.O. Box 1950, Davis, Calif. 95617, (916) 758-3630.

Circle 344

Graphics software runs under MS-DOS

- Multitasking
- Screen-oriented editor
- Demonstrater

Operating under MS-DOS 2.0 or higher, pF8086/MSD software provides multiuser, multitasking capabilities. The package consists of an integrated graphics package that runs with IBM color monitors, a screen-oriented editor and a proprietary FORTH compiler and assembler. Applications are created as bootable COM files while programs issue standard DOS calls. Users can interactively execute DOS commands, exit from the software, run other DOS programs and return. The product supports the 8087 math coprocessor. $3,200. **FORTH Inc.,** 111 N. Sepulveda Blvd., Manhattan Beach, Calif. 90266, (213) 372-8493.

Circle 345

Software backs up rigid disk drive

Backtrack software automatically backs up files from a rigid disk drive to a tape drive, to another rigid disk drive or to a flexible disk drive. The menu-driven program works with most software packages. It is compatible with the IBM PC, /XT and /AT. The software requires 256K bytes of RAM. $179. **Tallgrass Technologies Corp.,** 11100 W. 82nd St., Overland Park, Kan. 66214, (913) 492-6002.

Circle 346

Package accesses ten 640K-byte programs

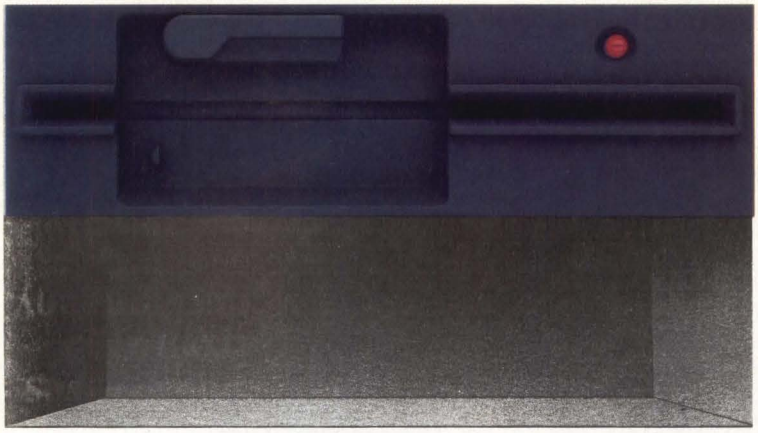
A virtual memory manager, Software Carousel enables ten 640K-byte application programs such as Lotus 1-2-3, Symphony and dBASE III to be loaded concurrently. The package uses 32K bytes of RAM and runs on the IBM PC and compatibles. Resident program compatibility is offered. $49.95. **SoftLogic Solutions Inc.,** 530 Chestnut St., Manchester, N.H. 03101, (603) 627-9900.

Circle 347



CIRCLE NO. 78 ON INQUIRY CARD

Half-Full.



When you've been in the right places as long as we have, you learn that the best solutions don't always take up a lot of room. And that when it's done right, there's some space left over.

Take our family of "half-full half-empty" floppy disk drives. Three industry-standard formats that keep the solutions short and simple.

There's our 8-inch model for the mature supermicro and mainframe market. And a mini-series of 5.25-inch drives. One that performs as a full-height double-sided double-density 8-inch drive, and a dual-speed model that combines the standard 5.25- and 8-inch formats into one small package.

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Group Manager

Image processor accommodates IBM PC/AT

Geared towards OEMs, system integrators and VARs, the Series 151 Image Processor is a VME-based subsystem that connects to the IBM PC/AT via a proprietary interface. Three or four processing modules are available. A proprietary software package is included. $11,495. **Imaging Technology Inc.,** 600 W. Cummings Park, Woburn, Mass. 01801, (617) 938-8444.

Circle 348

Graphics board suits IBM PC

A graphics board for the IBM PC, /XT and /AT, SigmaEGA! supplies 256K bytes of on-board memory. The short-slot card allows all EGA graphics modes to be run without supplementary memory expansion modules. It interfaces with IBM Monochrome and Color Display Monitors. The device is software-compatible with IBM, Microsoft, Lotus and Ashton-Tate packages. $595. **Sigma Designs,** 2023 O'Toole Ave., San Jose, Calif. 95131, (408) 943-9480.

Circle 349

Accelerator card drives IBM PC

- 80286 microprocessor
- 8K-byte cache
- PC-DOS compatible

Powered by an 80286 7.2-MHz microprocessor, the 286 Express is an accelerator card for the IBM PC or PC/XT. An 8K-byte cache memory provides zero-wait access to the most recently used data while allowing a stock personal computer to accelerate as much as 600 percent. The half-slot device is PC-DOS compatible. It operates with LAN and mainframe communications products and conforms to the Lotus-Intel-Microsoft Expanded Memory Specification (EMS). An 80287 8-MHz math floating-point coprocessor is optional. $795. **PC Technologies Inc.,** 704 Airport Blvd., P.O. Box 2090, Ann Arbor, Mich. 48106, (313) 996-9690.

Circle 350

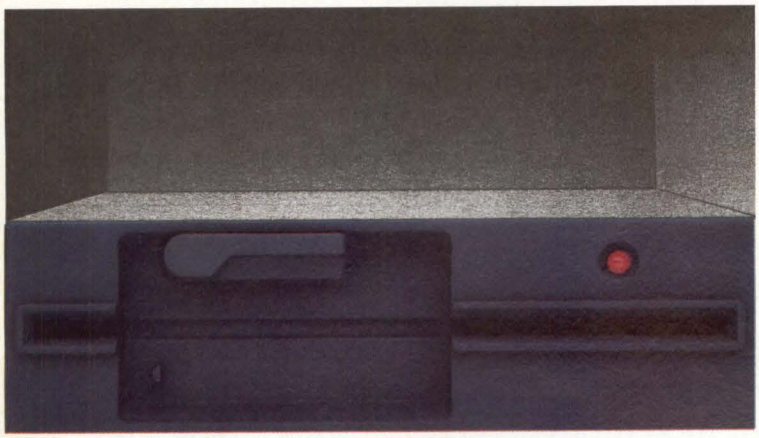
Dual-height board uses 68000 processor

- 512K-byte RAM
- Supplies DMA
- 64K-byte EPROM

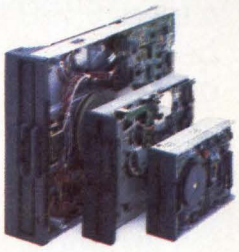
The VUSC is a dual-height VMEbus module based on the 68000 microprocessor. It controls rigid and flexible disks, optical memories, backup devices and printers employing SCSI, ST506 or SA450 interface protocols. The board supplies DMA and employs 512K bytes of dual-ported RAM and 64K bytes of EPROM to achieve zero-wait states. The unit can simultaneously control two ST506 drives, two SA450 flexible drives and up to eight SCSI devices. $2,190. **Dual Systems Corp.,** 2530 San Pablo Ave., Berkeley, Calif. 94702, (415) 549-3854.

Circle 351

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YD-480B-1450B	5.25"	1.0MB
YD-380B-1710B	5.25"	1.6MB
YD-380B-1711B *(Dual-Transfer Rate)*	5.25"	1.0/1.6MB
YD-380B-1714B *(Dual-Speed)*	5.25"	1.0/1.6MB
YD-645B	3.5"	1.0MB
YD-665B	3.5"	1.0/1.6MB

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FEATURES	TELEVIDEO 905	WYSE WY-30
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Tilt and swivel standard	Yes	No
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WordStar® mode	Yes	No
Full-size keyboard	Yes	No



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SUBASSEMBLIES

Video processor generates 64 colors

The VP 210 processes graphics in 64 colors from a computer screen. It transfers the display to almost any color printer or plotter. The video processor accepts RGB input directly from the terminal or personal computer. Data is stored in a 1M- or 2M-byte buffer. Resolution is 1,280 by 1,024 pixels. The unit acquires the graphics page from a screen in two to eight seconds. $2,995, 1M byte; 3,495, 2M bytes. **Graftel Inc.,** 400 Executive Blvd., Executive Park, Elmsford, N.Y. 10523, (914) 592-3700.

Circle 352

Multifunction board stores 4M bytes of RAM

A multifunction board for the IBM PC/AT, Supermax/EMS has 4M bytes of memory, supporting expanded and extended memory. A parallel port and two serial ports are standard. The unit is compatible with Intel, Lotus and Microsoft software. $2,595. **IDEAssociates,** 35 Dunham Road, Billerica, Mass. 01821, (617) 663-6878.

Circle 353

Board achieves 16-bit resolution

A data-acquisition board for the IBM PC/AT, the DT2827 achieves 16-bit resolution and 100-kHz throughput. The unit provides four channels of differential analog output, two 12-bit D/As and 16 lines of digital I/O. It supports interrupts and DMA transfers. Features include a channel RAM list and a programmable clock. $2,495. **Data Translation Inc.,** 100 Locke Drive, Marlboro, Mass. 01752, (617) 481-3700.

Circle 354

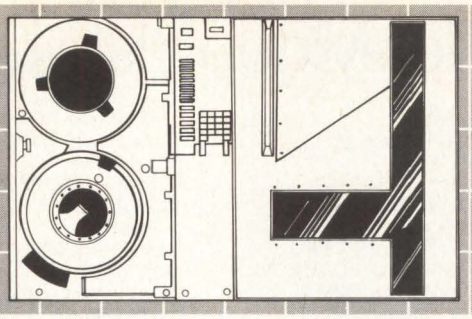
Board supplies 2M bytes of RAM

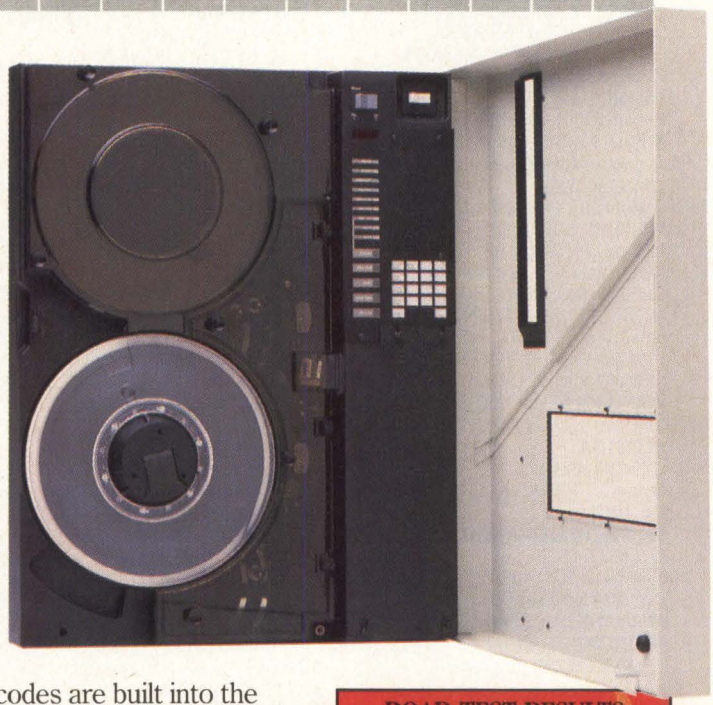
The LBX 512K-2M dual-port memory board supplies up to 2M bytes of dynamic RAM. It runs zero-wait-states in asynchronous mode. Parity checking is standard. The device has a read-data access time of 145 nsec. $890. **Central Data Corp.,** 1602 Newton Drive, Champaign, Ill. 61821-1098, (217) 359-8010

Circle 355

Storage Technology's New 2925 Tape Accelerator.

It goes with unsurpassed speed.
It comes with unsurpassed features.





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StorageTek's Model 2925 gives you the speed you need, and the features your customers demand. The 2925's Accelerator (Cache) feature dynamically adapts to system requirements and the host's capability ...at transfer rates ranging from 100 kilobytes per second up to 1.25 megabytes per second. The 2925 goes with speed indeed; but what it *comes with* is even more remarkable.

AT A GLANCE

Series Standard Features

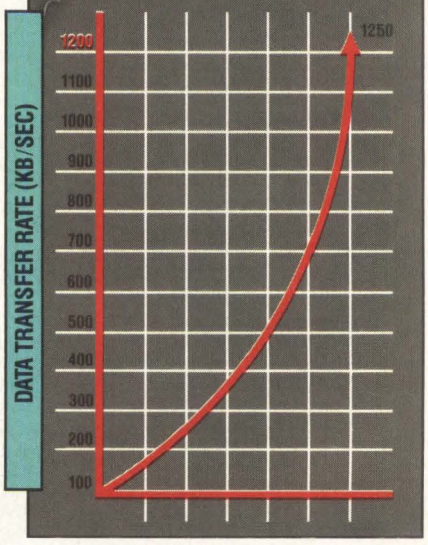
- *Dual-speed 50 ips Start/Stop and 100 ips Streaming with Buffered or Synchronous mode*
- *ANSI Standard 1600 bpi/6250 bpi formats*
- *Convenient Auto-Threading*
- *Integrated Formatter/Controller*
- *Service Panel with Alpha/Numeric Display*
- *Resident Diagnostics*
- *Host-optimized Data Transfer Rates*

Error correction codes are built into the cache's 256k of multi-record memory; so your data is checked both as it enters cache and as it is written onto tape. Data can be retrieved directly from cache–should defective media be encountered. The 2925 allows OEM systems integrators to attach ANSI-compatible 1600/6250 bpi capability to systems ranging from micros to minis...without software modification. For ease of integration, the 2925 is available with either StorageTek- or Pertec-compatible interfaces.

That's still only the beginning–be sure to read the accompanying list of features. You'll understand at a glance that 2925 performance is not only *speed...but reliability, flexibility and ease of operation.* StorageTek's experience with GCR 6250 bpi technology includes a full 11 years of pioneering, proving and perfecting. Our 2920 Series includes the 2921 (50 ips start/stop), the 2922 (50 ips start/stop with 100 ips streaming)in addition to the 2925 subsystem.

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CIRCLE NO. 74 ON INQUIRY CARD

SQL*CALC: CUSTOMER PLEASER FOR SYSTEM INTEGRATORS

Edward Teja
Contributing Editor

System integrators usually run into problems when they specify powerful software tools for end users. The more powerful and flexible the tools, the more hand holding is required before the user is satisfied. Regardless of who makes the software tools, it's the system integrator who must make the complete package work the way the end user wants it to.

SQL*CALC, a software package from Oracle Corp., simplifies procedures for application packages that perform analysis, forecasting or data manipulation. And, if that sounds nice, consider that most users already know how to use the bulk of the package's features.

This user-interface sleight of hand is slower than the eye. There are no tricks. Relying on there being a large number of users who have invested time in learning spreadsheets, Oracle has teamed Lotus Development Corp.'s 1-2-3 compatible spreadsheet with its own relational database management system, ORACLE. The communication language, as you've probably guessed, is the structured query language (SQL) used by IBM Corp. in its mainframe products.

The strategy, therefore, provides a familiar base for users who come from microcomputers (and know Lotus 1-2-3) as well as for users who migrate from the mainframe world where SQL is a standard. These are two large groups of fairly typical users. Certainly, the overlapping group—users who know both—is growing. And, just in case this isn't enough, SQL*CALC comes with a disk-based four-lesson tutorial so basic as to bore most sophisticated users.

Maintains database power

Of course Oracle is not the first company to attempt the integration of database and spreadsheet. But few have achieved it. SQL*CALC provides automatic data sharing between the two. It is not the forced sharing that comes from being able to access the database through the spreadsheet. The shortcoming in this access method, besides the fact that it requires extra steps, is that the user must understand both spreadsheets and database managers.

In SQL*CALC, the database data is the spreadsheet data. And the user won't have to think in database terms.

Despite this spreadsheet interface, Oracle's ORACLE is by itself a powerful relational database. It has stood as a commercial product in its own right and any application that relies on ORACLE alone can continue to do so. SQL*CALC doesn't interfere. This is important if the product is going to measure up to real-world needs. The easiest way to simplify the use of a database, after all, is to simplify the database manager—and therefore the usefulness of the product. The database that SQL*CALC uses is exactly the same product that Oracle sells separately. If you already own the database product, you don't have to buy that portion of the package. That produces warm feelings in this reviewer.

The importance of this lies in the fact that you might want to create an accounting system, or a materials requirements planning (MRP) system, or a diagnostic system—or something that hasn't been done before—and still give your customer a way to selectively review, modify and project the data that the application program collects. By using ORACLE as the database, you install SQL*CALC as the user's window into the data with no modification to the application program.

And if you are concerned with multiple-user systems, or multiple systems sharing data, have no fear. With a networking package to be available from the manufacturer later this year, a single cell on a spreadsheet can effectively operate as a database query on a system located anywhere in the world. But, given the simple operation of SQL*CALC, you don't even have to depend on Oracle to provide the network.

This package demonstrates that it pays (the vendor) to know when to be different and when to be bland.

SQL*CALC currently runs on the IBM PC/XT or /AT and requires 512K bytes of RAM and 2M bytes of rigid disk memory. Development continues aimed at producing a package for UNIX systems. A package providing both SQL*CALC and the ORACLE database costs $995. If you already have ORACLE, the package costs $395.

Oracle Corp., 10 Davis Drive, Belmont, Calif., 94025, (415) 598-8000 or (800) 345-DBMS.

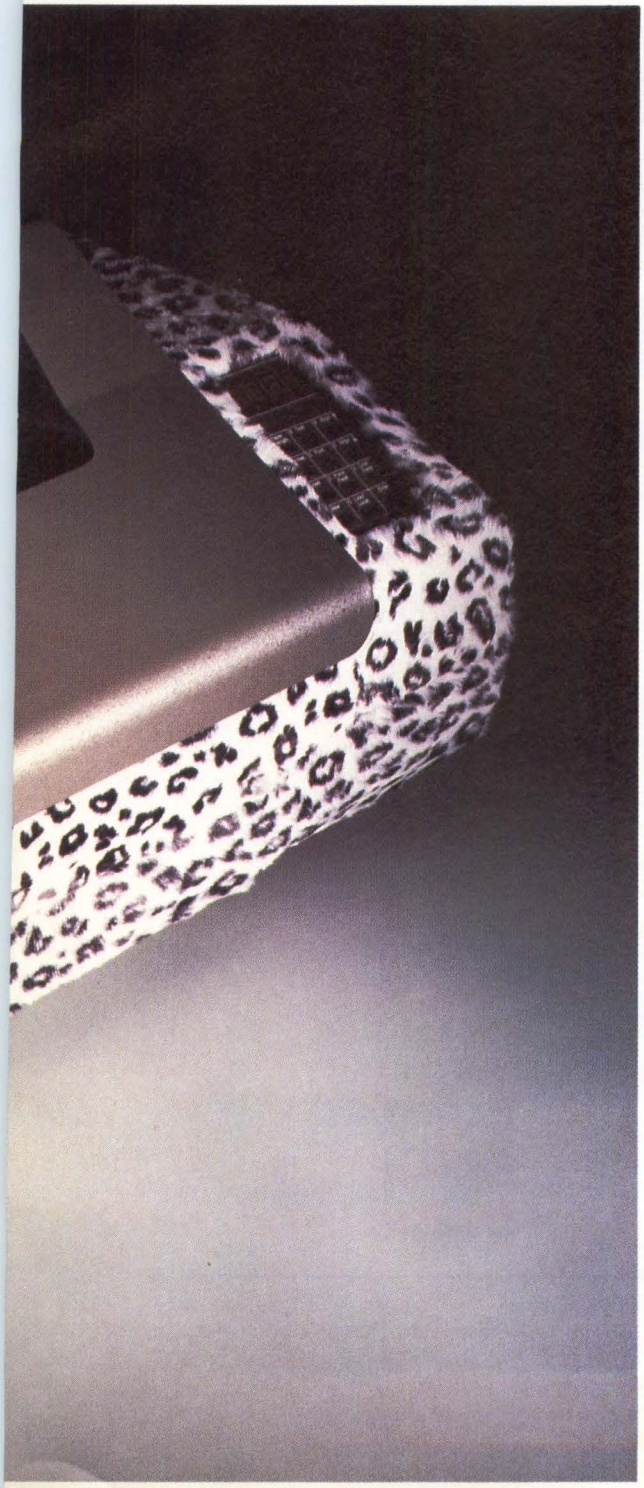
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CIRCLE NO. 84 ON INQUIRY CARD

ADVERTISERS' INDEX

COMPANY	PAGE NO.	INQUIRY NO.
Allen Bradley	112	60
AMF Logic Sciences	68	40
Analog & Digital Peripherals	142	213
AT&T Information Systems	93	52
Bluebird Systems	40-41	23
Boston Business Computing Ltd.	D14	67
Caere Corp.	126	75
Charles River Data Systems	37	21
C. Itoh Electronics	130, 131	80
Colorgraphic Communications	142	207
Communications Research Group	141	206
Concurrent Computer	8	6
Control Data Corp./OEM	60-61	36
Convergent Technologies	50-51	31
Decisionware	142	210
Digital Equipment Corp.	55, 113-118	—
Ducommun	24	15
Emulex Corp.	7	5
Equinox Systems	19	12
Exide Electronics	48	30
ExpoConsul International	D16	71
Facit	136-137	252
Falco Data Products	87	49
Fortune Systems	33	19
Fox Research	45, 47	27, 28
Fujitsu America Inc. Storage Division	72-73	42
Galaxy Graphics	74	251
Genstar REI Sales	142	211
Giltronix	128	77
Grafpoint	32	18
Hayes Microcomputer Products	96	54
Heurikon Corp.	43	25
Hewlett-Packard Co./ISG	42, 121	24, 72
Houston Instrument Div. of Bausch & Lomb	65, 67	38, 39
Ibex Computers Corp.	126	76
IBM/Information Systems	76-77	44
IBM/NDD	125	82
ICC	138	84
ID Systems	D13	66
Illbruck/USA	6	3
Intecolor Corp., an Intelligent Systems Co.	79	45
Intel Corp.	98-99	55
Interface Group	80	46
Interphase Corp.	56	34
Irwin Magnetics	52	32
ITT Information Systems	59	35
Karl Leister	120	253
KMW Systems Corp.	88	50
Liberty Electronics USA	110	59
Logicraft	D6	64
Mannesmann Tally	14-15	10
Matrox Electronic Systems Ltd.	20	13
Maxtor Corp.	62	37
Mercury Computer Systems	D5	63
Microbar Systems	100	56
Microware, Inc.	142	214
Microware Systems Corp.	25	16
Multi-Tech	38	22
NEC Peripherals	26, 100	17, 56
Newbury Data	109	58
Northwest Digital Systems	D1	61
Okidata Corp.	16	11
Omega	141	202-205
Peripheral Technologies	142	208
Princeton Graphic Systems	71	41
Pyramid Technology	34-35	20
Quality Micro Systems	103	83
RDS-Relational Database Systems	Cov. 2	1
Ryan McFarland	46	29
Santa Cruz Operations	11	8
Seagate Technology	94-95	53
Sequent Computer Systems	D8-9	65
Shape Magnetronics Inc.	129	78
Softronics	142	212
Software Link	Cov. 3	85
Source EDP	140	—
Storage Technology	134	74
Strategic Information	D2	62
Systech	12	9
Technology Forums	10	7
Televideo/Computer Div.	90-91	51
TeleVideo/Terminals	132-133	81
Texas Instruments	2-3	—
Texas Instruments Inc./Speech Div.	104	—
Toshiba	106-107	57
TRW Inc./Customer Service Div.	44	26
Universal Data Systems Inc.	Cov. 4	86
Verbex	23	14
Versatec Inc. (a Xerox Co.)	82-83	47
Viking Acoustical	6	4
Wave Mate	142	209
White Pine Software	D15	70
Wyse Technology	122-123	73

See P. 140 for Career Opportunity Advertisers

See P. 141-142 for Mini-Micro Marketplace

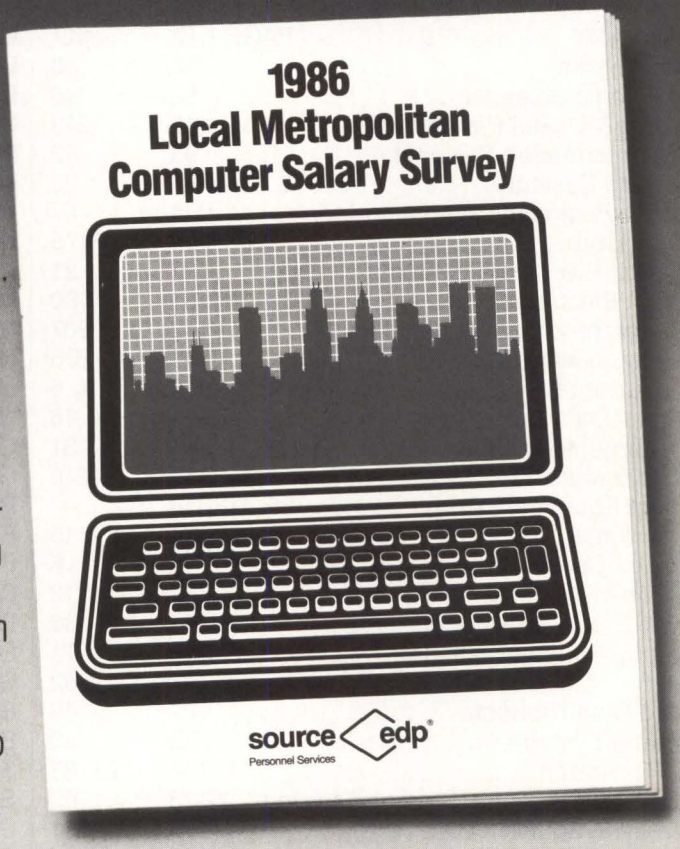
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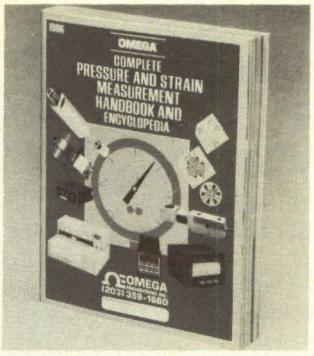
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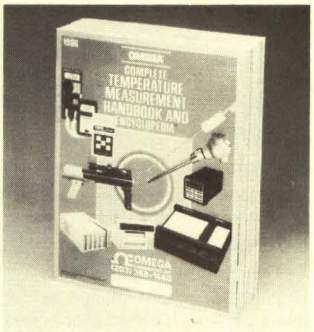
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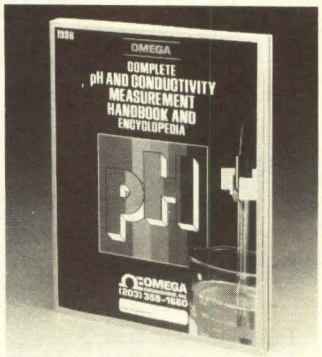
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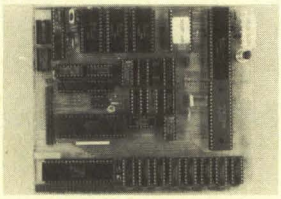
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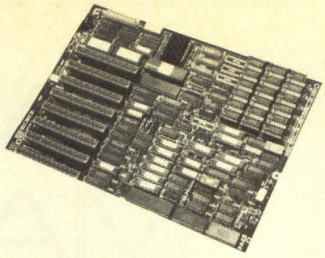


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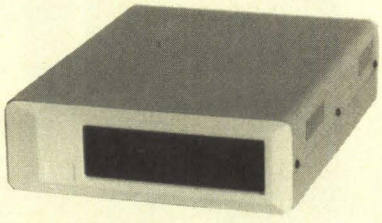
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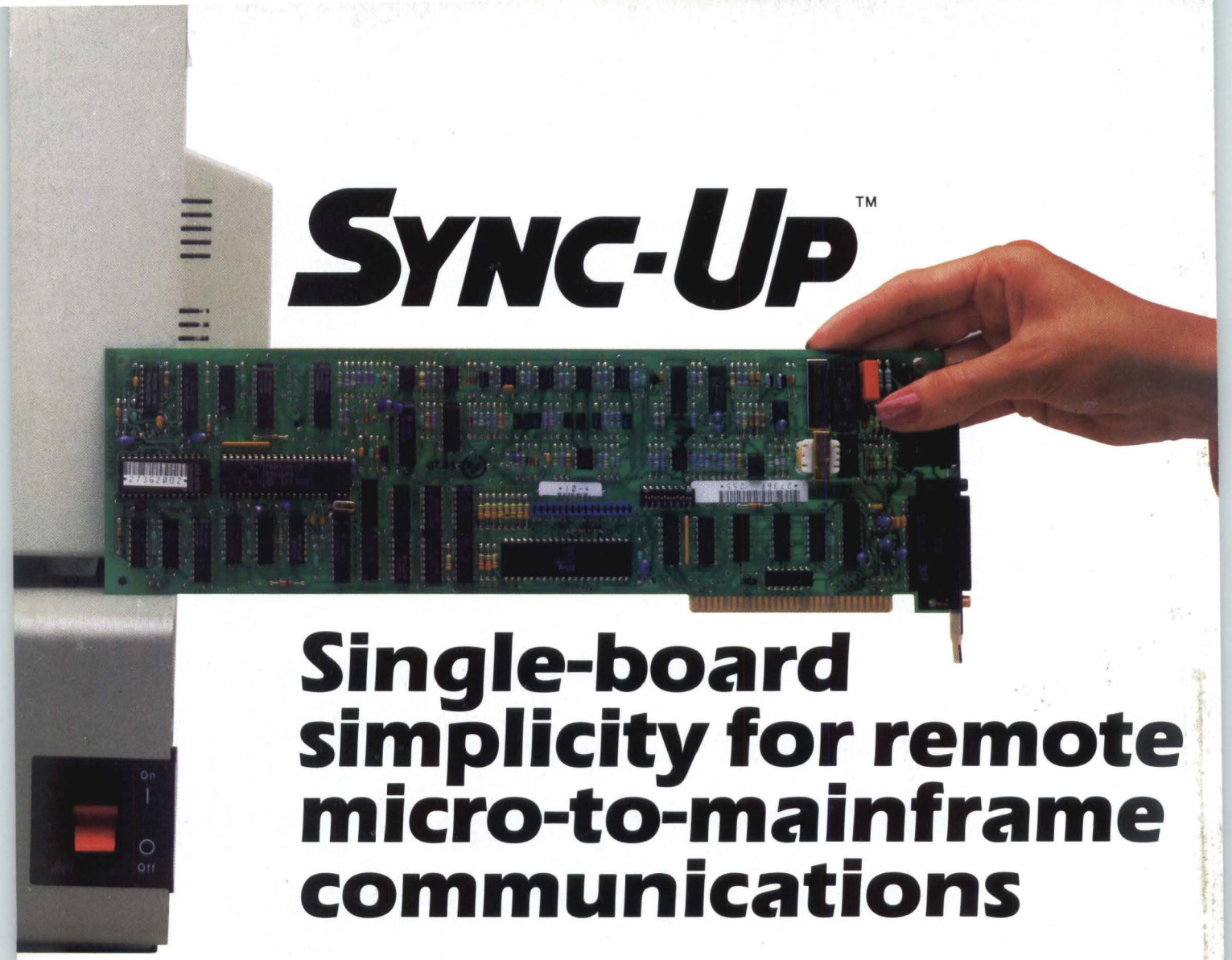
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