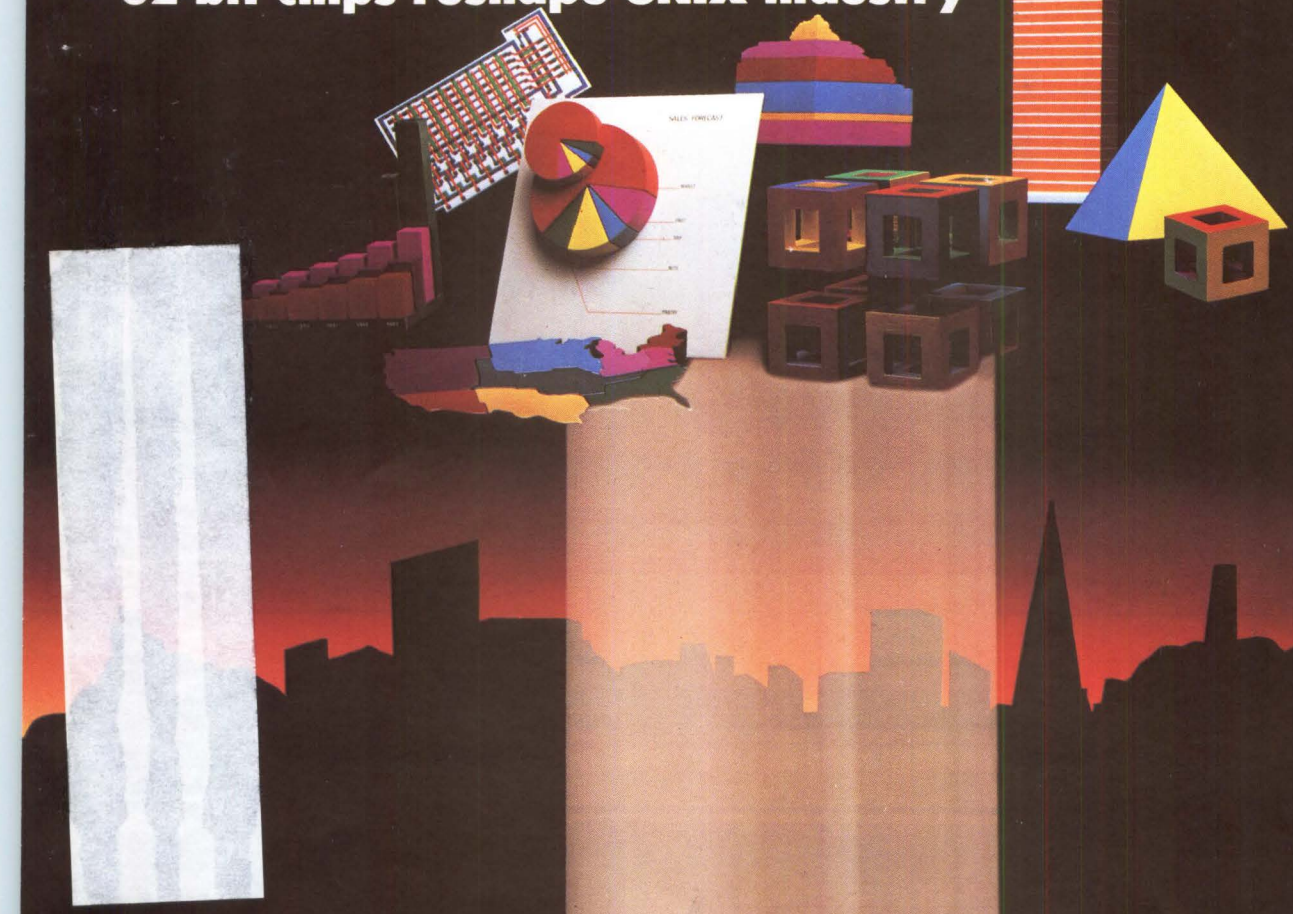
Mini-Micro Systems

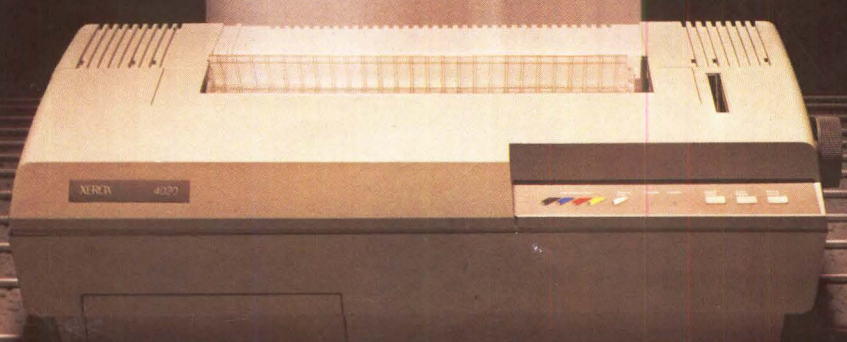
A CAHNERS PUBLICATION

JANUARY 1986

SPECIAL REPORTS:

- **Thermal printing heats up color markets**
- **Micros gain sight with image boards**
- **32-bit chips reshape UNIX industry**





Xerox refines color ink-jet printing

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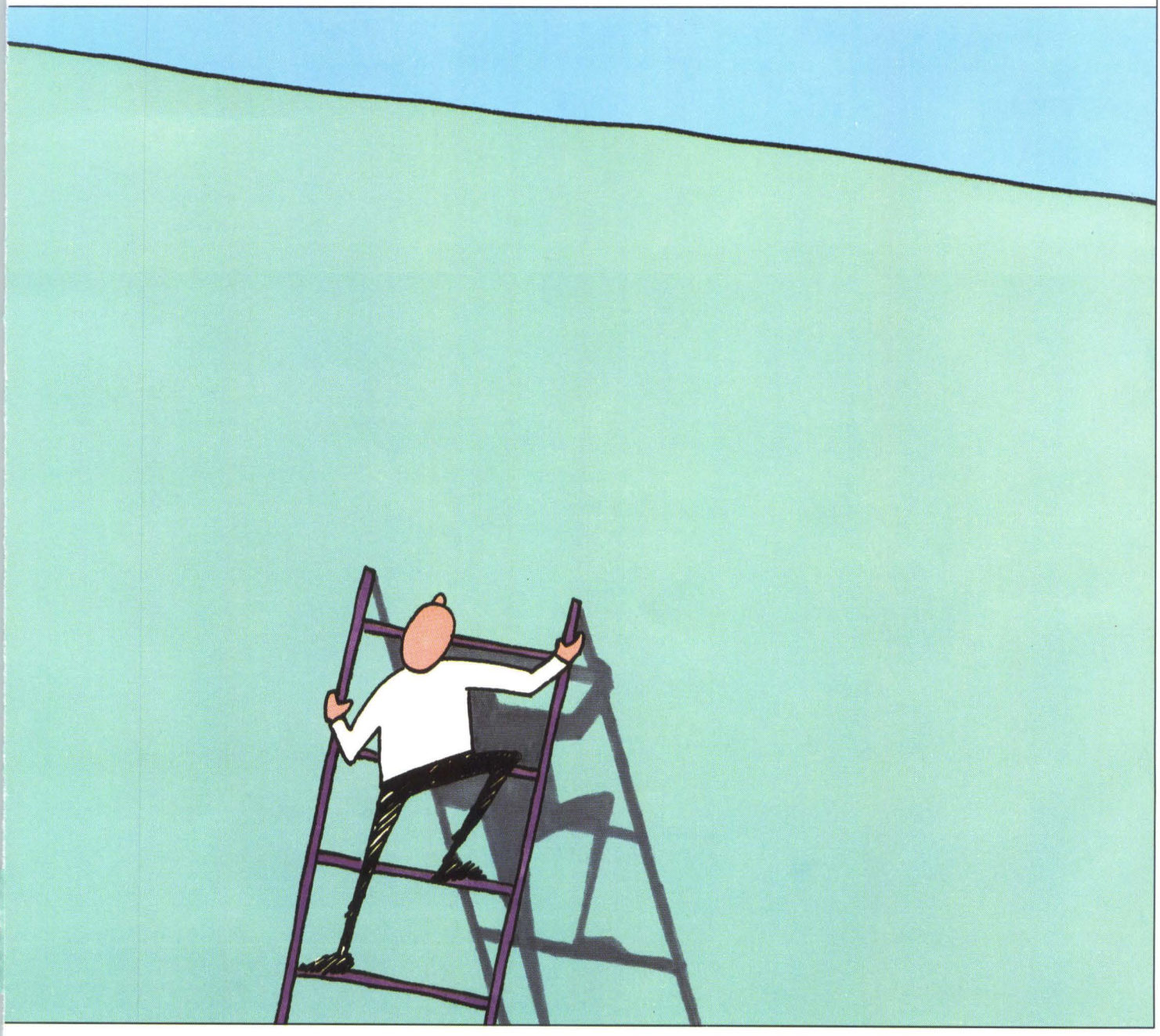

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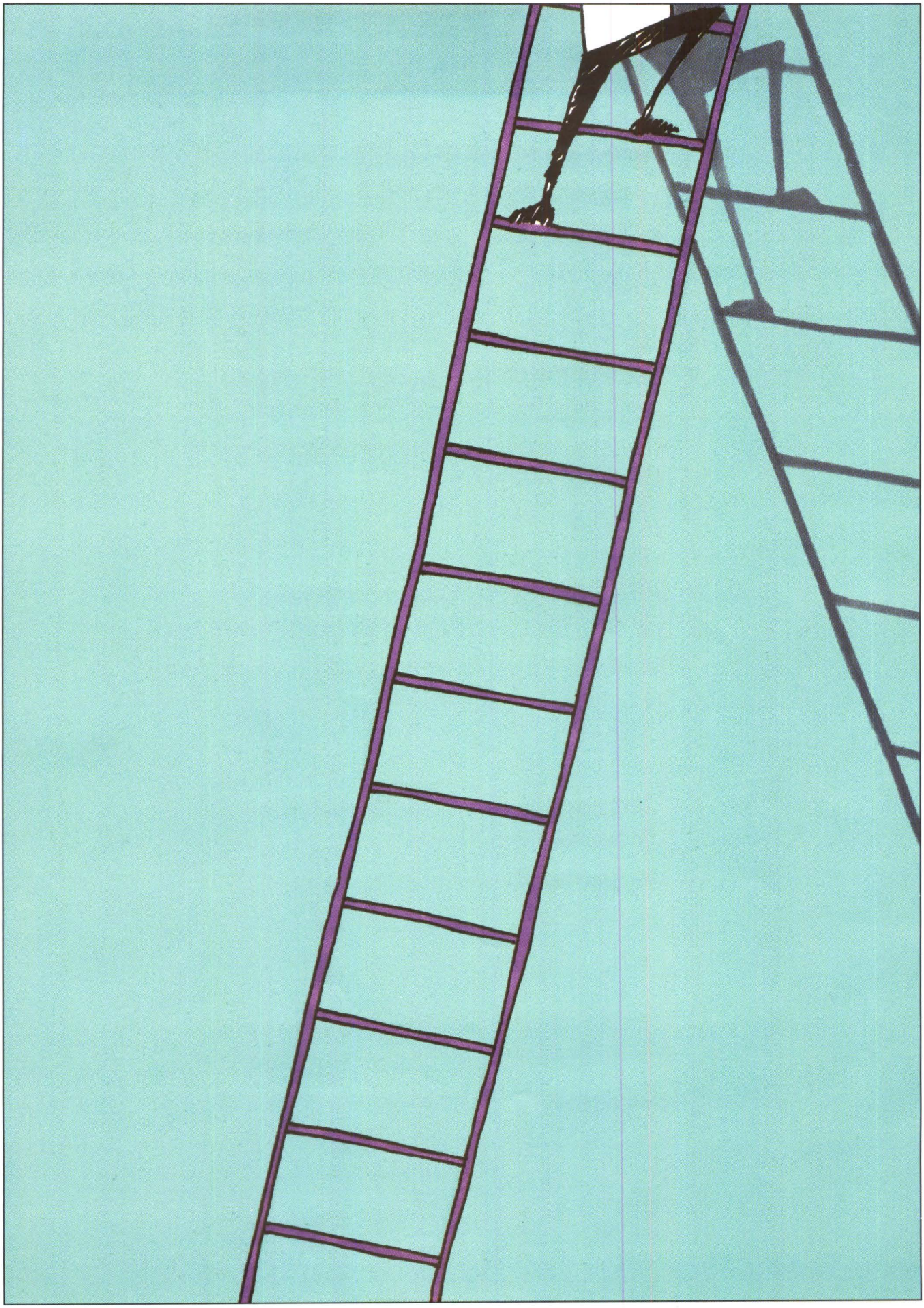

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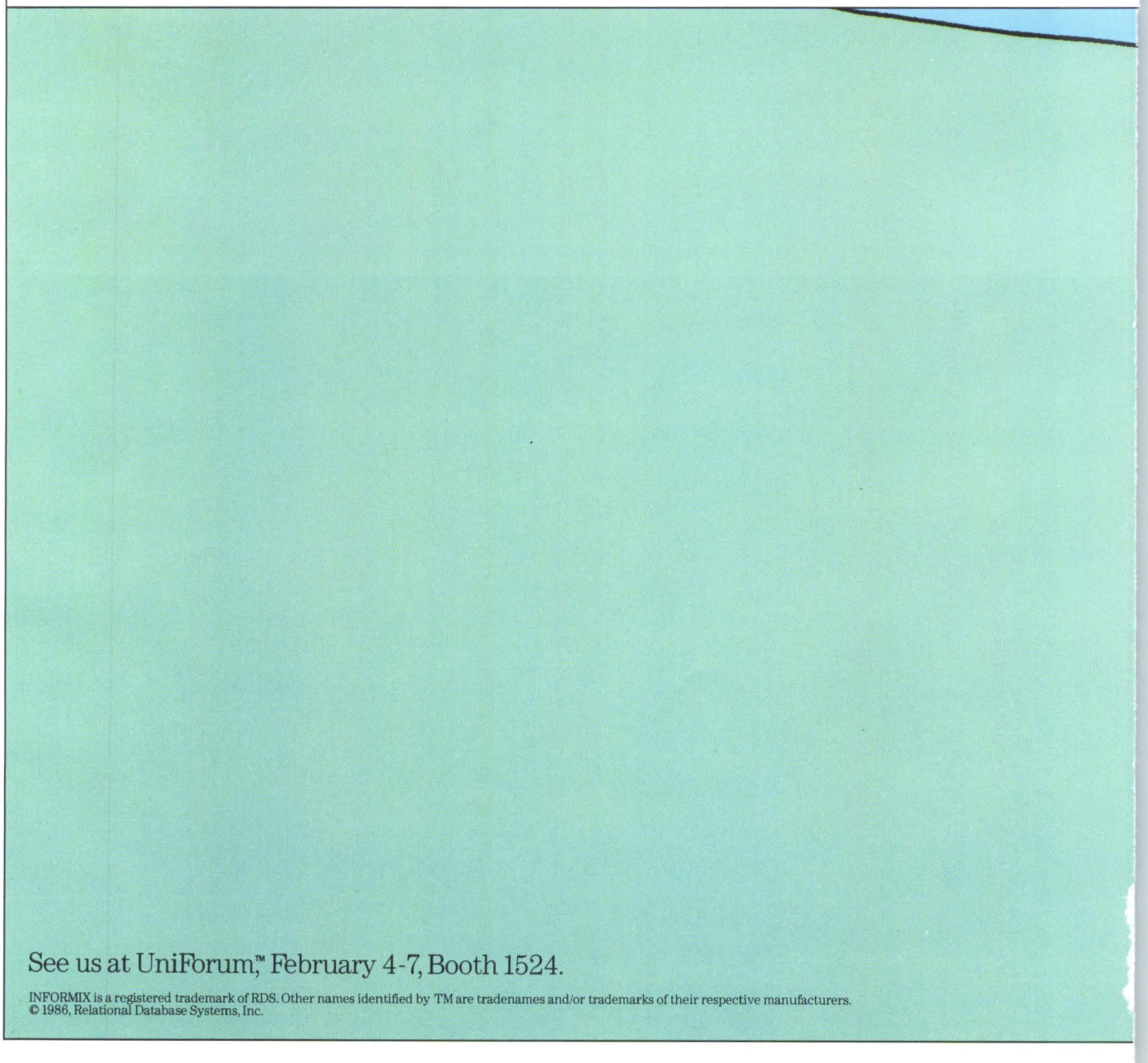

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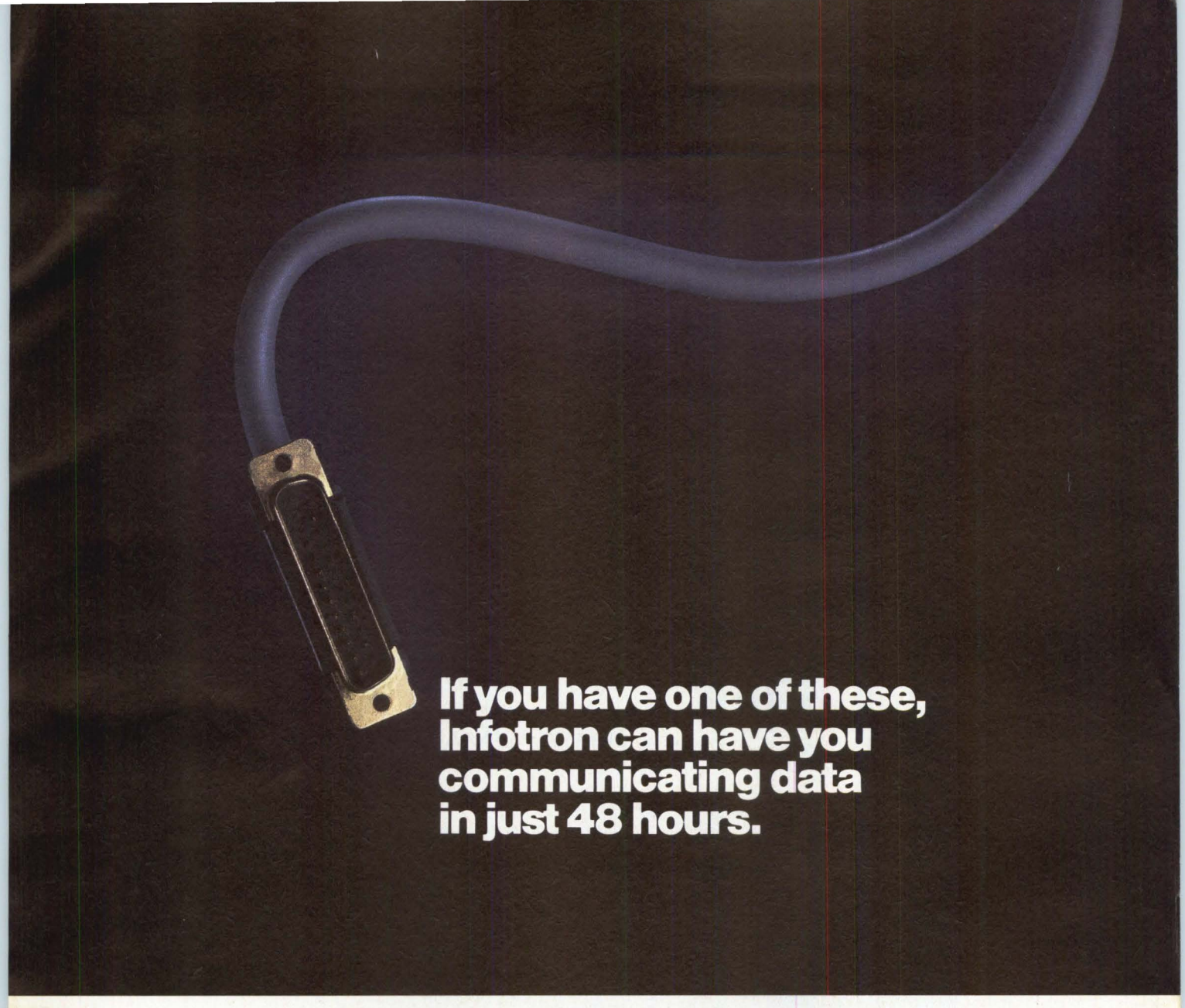

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CIRCLE NO. 2 ON INQUIRY CARD

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Mini-Micro

p. 29 . . Xerox's speedier color ink-jet printer. Art direction and design by Illuminations, photography by Michael Toohey. Courtesy of Xerox Corp.

p. 51 . . . . . Cutting in-house costs

NEWS/INTERPRETER

Xerox boosts reliability, speed of ink-jet printer 29

Add Intel and Motorola to GM's MAP 30

UNIX opens doors to IBM systems 34

IBM's Token-Ring Network signals start for LAN vendors 37

International group prepares worldwide CAD/CAM standard 41

VERTICAL MARKET INTEGRATOR

Software maker creates manuals in-house 51

*DIGITAL DIRECTIONS

(begins opposite Page 98)

Multiuser TSK-Plus beats UNIX in real time D1
The TSK-Plus multiuser operating system has advantages over UNIX for DEC PDP-11 and Professional computers in real-time applications

DEC-compatible controller sales to jump 28 percent D10

Products D11

*Appearing in the DEC demographic edition only

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Systems

VOL. XIX NO. 1 JANUARY 1986

FEATURES

Feature Highlights 67

32-bit chips reshape UNIX industry 69
Powerful 32-bit processing chips propel UNIX into unexpected applications, but the process might change the system beyond recognition

PC-UNIX links penetrate office 83
Software that links UNIX with the IBM PC help system integrators and VARs break into markets saturated with PC-DOS machines

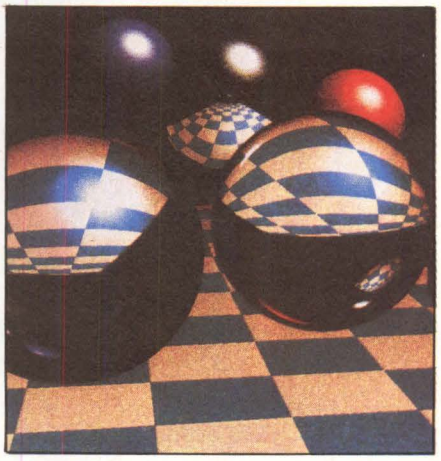
Micros gain sight with image boards 92
Medical imaging, industrial parts inspection, pattern-recognition and teleconferencing applications highlight the diverse uses of microcomputer-based image systems

Thermal printing heats up color hard-copy market 102
Thermal printing forges ahead of ink-jet and electrostatic technologies in producing low-cost, color hard copy

Copier/printer market to explode by 1990 111
With numerous less expensive units in the works, intelligent copier/printers will become more feasible for low-volume operating environments

Uniforum '86: the UNIX connection 117
New products demonstrate UNIX's ability to interconnect diverse applications

p. 69 . . . . . New UNIX applications



p. 102 . . . . Thermal printing surges

DEPARTMENTS

Editorial Staff 4
Editorial 11
Breakpoints 17
New Products 121
Career Opportunities 136
Classified Advertising 137
Artful Intelligence 139
Index to Advertisers 140
Mini-Micro Marketplace 141

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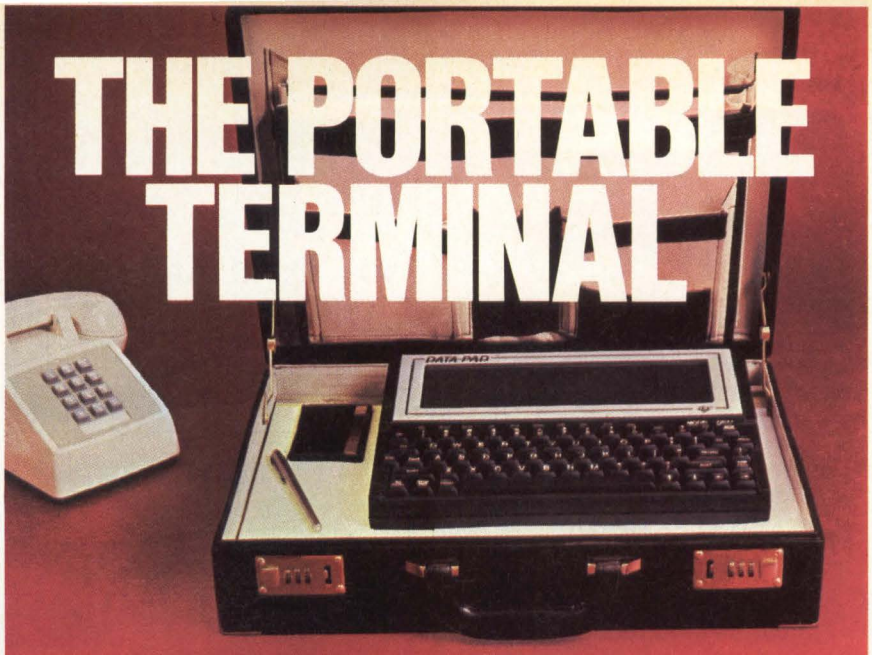

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CIRCLE NO. 3 ON INQUIRY CARD

LOOKING AHEAD IN MMS

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

- PC storage devices and controllers will be profiled in the February issue
- The Communications Handbook with an editorial emphasis on local area networks will appear February 14.

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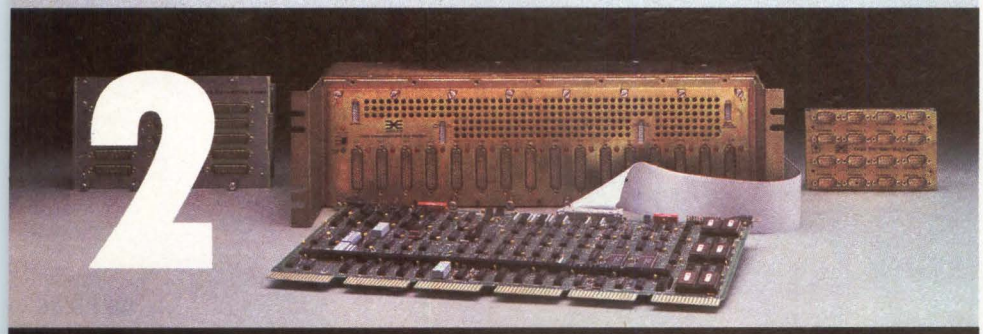

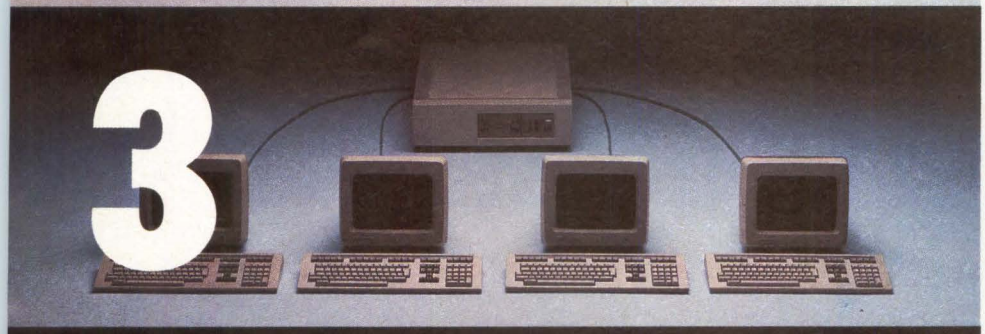

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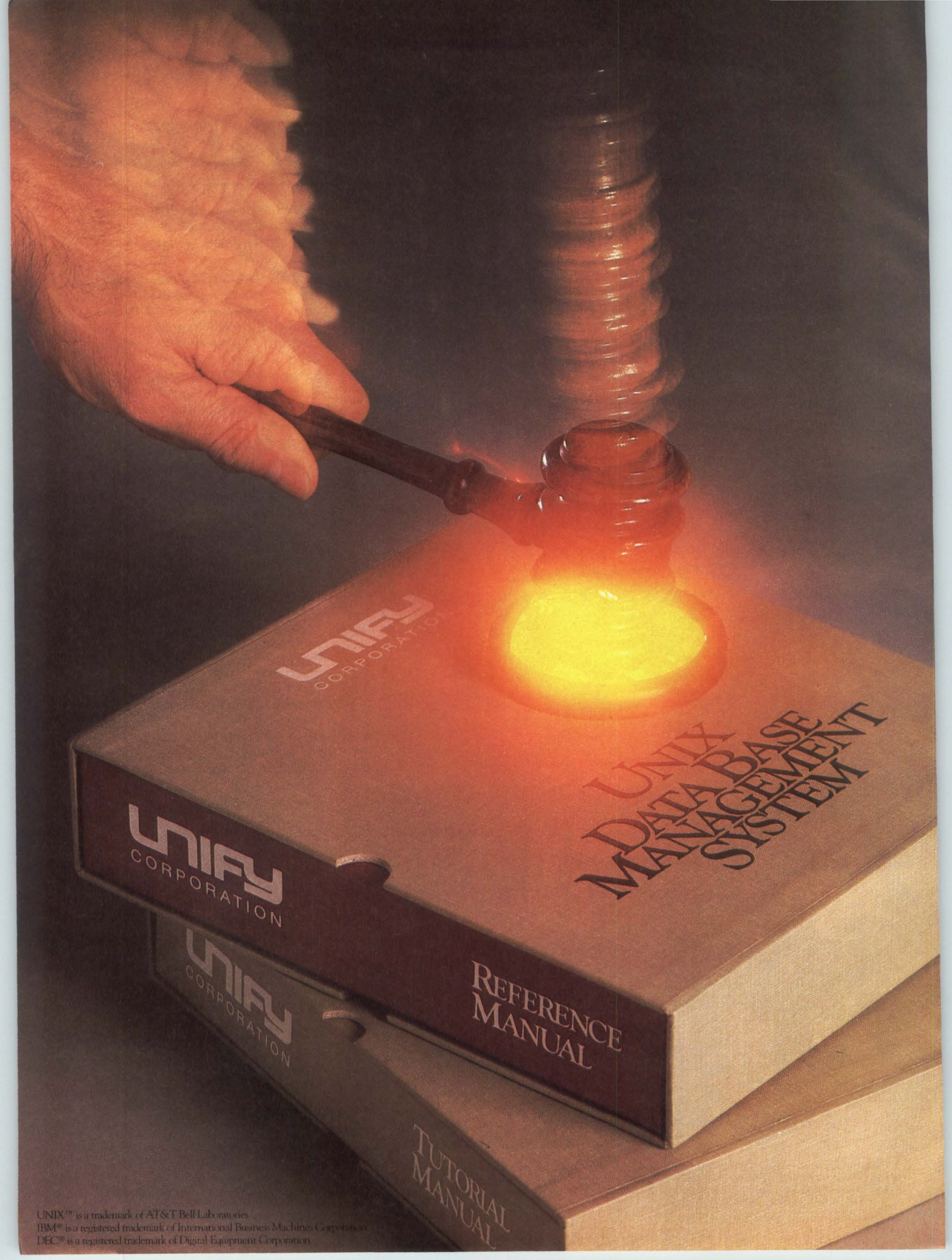

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WHEN March 11-14, 1986

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FEE The registration fee of $895.00 for the 2-1/2 day IPI Forum covers attendance at the scheduled sessions, a Delegate Information Binder containing the Speakers' presentations and other material, a Welcome Reception, 2 Luncheons, the Exhibitors Reception, 3 Continental Breakfasts, Cocktails and Buffet Dinner, refreshments during breaks, gratuities and taxes.

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

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CIRCLE NO. 8 ON INQUIRY CARD

EDITORIAL

THE HISTORY OF UNIX IS NOW

UNIX may be rivaled only by artifical intelligence as the most written about, and least applied, technology in the history of the computer industry. One of the oldest jokes in the industry has it that UNIX conferences consist of vendors gathered in little groups to ask one another, "I say, is anybody making any money yet? Other, that is, than by selling stock?"

My own joke is less kind. How many UNIX vendors does it take to change a lightbulb? Answer: 27. One to change the bulb and the other 26 to form a committee and agree that it wasn't done to standards. It's also possible to argue that the history of UNIX hasn't happened yet.

Its technical history is, of course, long but as a commercial product the operating system has been in a time warp. It was originally developed to deal with problems that no longer, strictly speaking, exist. For value-added resellers, the time-sharing market that governed the creation of UNIX's direct ancestors—such as Massachusetts Institute of Technology's CTSS system—has largely disappeared; monopolized at the top by IBM Corp. mainframes and overwhelmed at the bottom by a proliferation of personal processors.

Indeed, until recently UNIX's big problem wasn't the cliché about lack of application software but rather that, even if there had been applications, there was no place to sell them. Desktop technology couldn't support the operating system, and VM-based mainframes didn't need it. UNIX was simultanously ahead of its time and outdated.

What made this suspended animation all the more unusual was that UNIX was never more in marketing limbo than when "discovered" by market research companies, advertising agencies and computer journalists. Suddenly, people who had never used so much as an electric typewriter announced that UNIX would dominate the entire world of computing. No machine, said the researchers, would escape. Every silicon chip, from the core of mainframes to the heart of digital watches, would run on UNIX and nothing else. It was a victory of hype over common sense: One has to wonder how badly it may have damaged the credibility of UNIX forever. Certainly, it's difficult for companies that may have lost money on UNIX to overlook the fact that the only people to profit from UNIX, so far, seem to be would-be pundits—some of whom, having made their pile, now decry the operating system with as much vigor as they once proclaimed it.

Then again, maybe it's only fair that the pundits should now reject UNIX, should actually call it a "failed" and "unmarketable" technology—even though anyone can pick up a copy of the help-wanted pages of any large newspaper and find row upon row of employment advertisements for C programmers and UNIX specialists.

What's happened, of course, is the introduction of relatively inexpensive 32-bit systems. Making the power of minicomputers available to microcomputer users has opened up vast territories to what used to be minicomputer software—UNIX. Suddenly, UNIX iron is no longer particularly exotic. The year 1986 opens with a UNIX market crowded with departmental, network-serving and, even, desktop UNIX machines. Some companies are bundling 32-bit chips into multiprocessing computers and rewriting UNIX in the process. By putting UNIX-based hardware directly in the hands of developers, end users and high-school hackers, 32-bit chips have unleashed vast market forces almost certain to remake the operating system for better or worse, and probably both. It seems that the widespread availability of 32-bit systems is the most important event in recent UNIX history—perhaps the first real event in its commercial history.

Michael Tucker

Associate Editor

The VME BUS and OS-9:

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Modularity. Flexibility. High Performance. Future growth. These are probably the prime reasons you chose the VME bus. Why not use the same criteria when selecting your system software? That's why you should take a look at Microware's OS-9/68000 Operating System—it's the perfect match for the VME bus.

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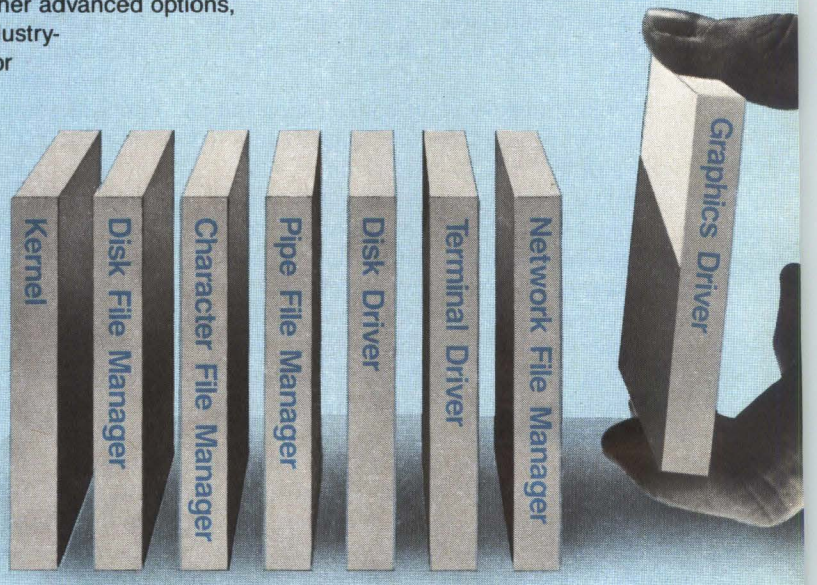

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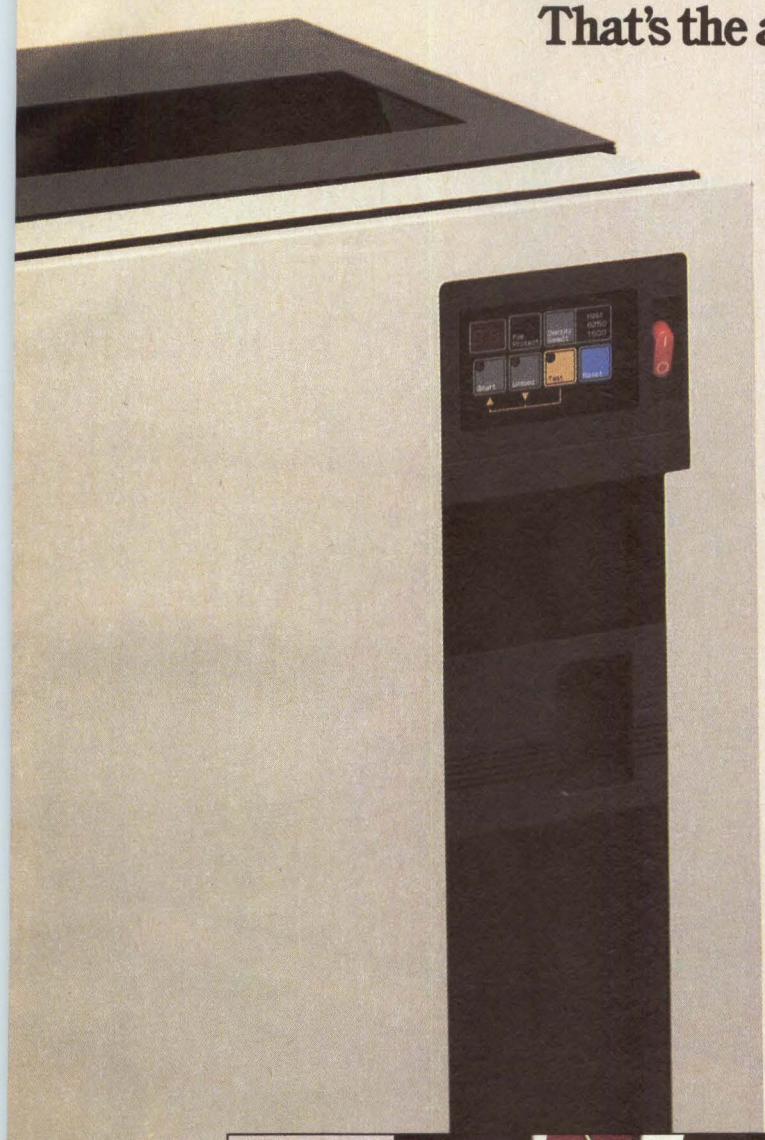

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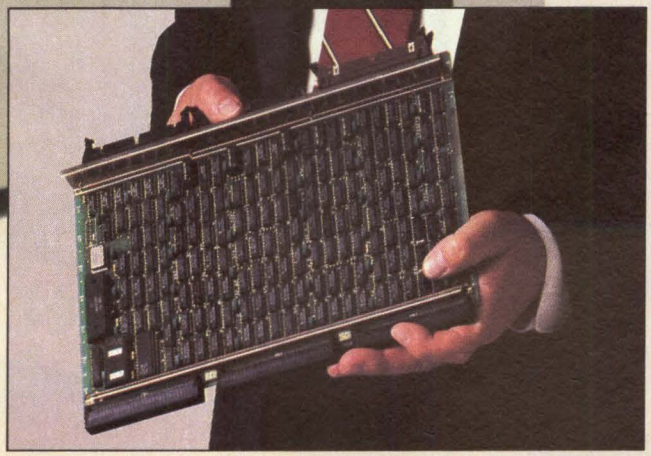

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Cache Buffer	256 KB	
Transfer Rate	Selectable from 60 KB/sec to 1 MB/sec	
Compatibility	IBM,® ECMA and ANSI	
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EQN(1)
UNIX Programmer's
NAME
eqn, neqn, checkeq - typeset mathematics
SYNOPSIS
eqn [-dxy] [-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 in
with the command-line argu
between .EQ and .EN. The left
are turned off by 'delim off'
between .EQ and .EN is passed
The program checkeq reports
pairs.
Tokens within eqn are separa
quotes, tildes or circumflexes.
ing, anywhere a single characte
tion enclosed in braces may be
the output, circumflex ^ half as
Subscripts and superscripts are
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
The keywords from and to introduce
$\lim_{n \to \infty} \sum_{0}^{n} x_i$ is made with lim from {n -> in
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
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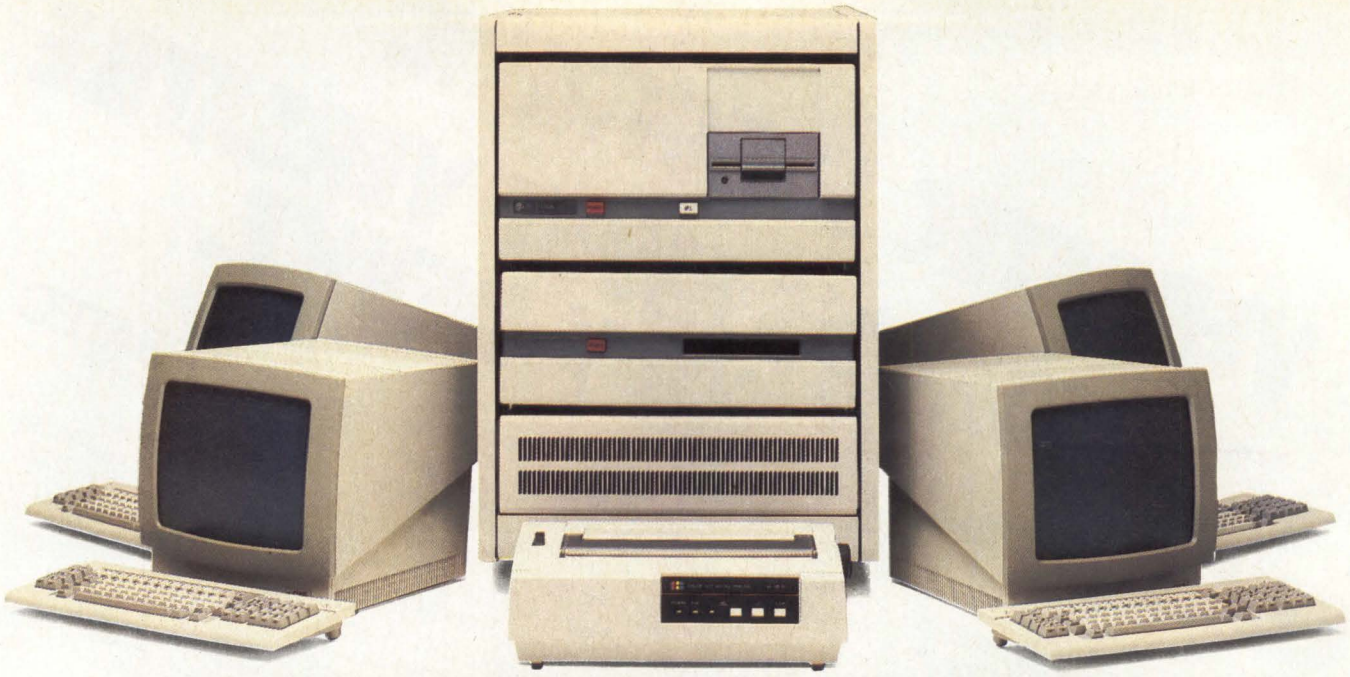

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BREAKPOINTS

AT&T TAPS HARRIS FOR SATELLITE DATA TERMINALS

AT&T Communications has chosen Harris Corp., Melbourne, Fla., as its supplier for small, 1.2-meter-diameter satellite earth stations to be used in a yet-unannounced AT&T service for the transmission of data and video signals. AT&T is expected to bundle the Harris-supplied earth stations and related transmission equipment and provide the service to corporations for both one-way and two-way data transmission—at speeds of up to 19.2K bits per second. AT&T, which has already leased for the service two satellite transponders on an RCA satellite now in orbit, said it intends to file with the Federal Communications Commission for a tariff on the new operation in the first quarter of this year.—*Stephen Shaw*

APPLE TO OFFER A MACHINE FOR INTEGRATORS

Apple Computer Corp., Cupertino, Calif., is expected to unveil the Macintosh II sometime this month, and word has it that it will look a good deal like the discontinued Lisa. Code-named "Big Mac," the new machine reportedly incorporates a small computer systems interface (SCSI) and a VME-like bus to accommodate add-in boards. The SCSI bus is the single-ended version, thus allowing peripherals to be placed up to 6 meters away from the host. Although details remain sketchy, the machine is said to use Motorola Corp.'s MC68020 microprocessor, which will give it full virtual memory and device access and a new display manager. Apple insiders warn, however, that users shouldn't expect existing Macintosh software to work on the new machine, as new microcode was required for a 12-inch display.—*Carl Warren.*

SOFTWARE TIES TOGETHER PC AND FAX

A California modem manufacturer claims it has developed software that allows Group III facsimile machines and IBM Corp. PCs and compatibles to exchange information. Gammalink of Palo Alto is selling GammaFax—software bundled with its 9,600-baud, dial-up modem and a synchronous data-link-control card—for $2,490. The company says that rasterized data, either text or graphics, can be sent from a facsimile machine to a PC and vice versa. Information sent from a facsimile can be viewed on the PC screen or printed on a PC-compatible graphics printer. Conversely, documents created on a PC can be sent to one or more facsimile machines in a batch mode using the auto-dial capability of the GammaLink modem and software. The company adds that it will customize the system for OEMs and system integrators.—*Mike Seither*

CORVUS BUYS PC MANUFACTURER

Corvus Systems Inc., San Jose, Calif., a vendor of local area networks, is acquiring Oemtek Inc., a manufacturer of IBM Corp. PC-compatible personal computers, also located in San Jose. Under the agreement in principle, subject to the approval of the boards of directors of both companies, Corvus will issue 3.75

million shares of common stock for all outstanding Oemtek capital stock. Oemtek will operate as a Corvus subsidiary upon completion of the acquisition. —*Stephen Shaw*

DEC ROLLS OUT ITS BIGGEST GUN

In what the company says is a program to develop smaller, faster VAX superminicomputers, Digital Equipment Corp. has brought out its speediest machine to date, the 8850. Reportedly 44 percent faster and 21 percent more costly than its previous top-of-the-line unit, the 8600, the new model is said to operate at up to 6.9 million instructions per second and carries a base price of $475,000. Look for more DEC introductions in the first half of the year: analysts predict the company will bring out a new engineering workstation, mid-range VAXes and a personal computer.—*Bruce MacDonald*

PLEXUS UNVEILS EXPANDABLE UNIX SYSTEM

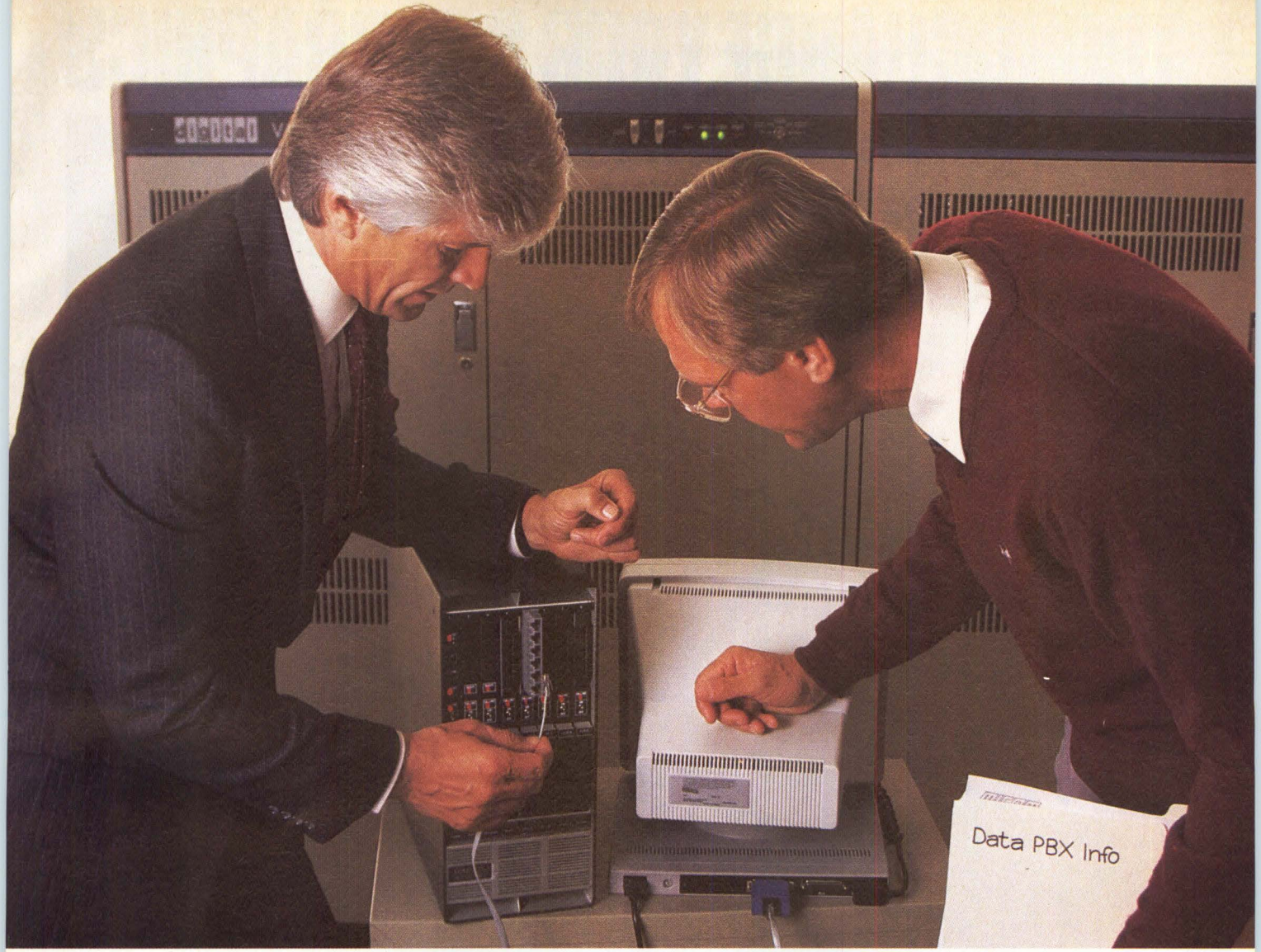
Plexus Computers Inc. has a New Year's baby: a UNIX multiuser system that can be expanded modularly from 16 to 80 users. The San Jose, Calif., company's new P/75 computer relies on the Motorola Inc. MC68020 32-bit chip for job processing. Single-board communications processors called ACPs, priced at $5,000 each, have one parallel printer and 16 serial ports, a direct-memory-access processor and up to 2M bytes of local RAM. As many as five ACPs can be loaded into the P/75 to build an 80-user system. A bare-bones system for $36,000 comes with one ACP, a 145M-byte Winchester disk drive, a 60M-byte cartridge tape, a 15-slot card cage and 1M byte of memory.—*Mike Seither*

EUROPEAN GROUP AIMS FOR WORLDWIDE CD-ROM STANDARD

While "High Sierra" companies like Digital Equipment Corp., IBM Corp., Microsoft Corp. and Reference Technology Inc. work toward a file-format standard for CD-ROM, a similar effort is being made in Europe. The Optical Disk Forum, which will have its first meeting this month in Luxembourg, aims for a worldwide file-format standard by midyear. The Forum plans to work closely with the Information Industry Association, Washington, now waiting to see what evolves from High Sierra's efforts. Yet a third group is active in the search for standards: the National Information Standards Organization, also in Washington.—*Keith Jones*

3COM, CONVERGENT TO MERGE BY MARCH

Officials of 3Com Corp. and Convergent Technologies Inc. expect a merger of the two California companies to be completed no earlier than March. 3Com, of Mountain View, makes local area networks, while Convergent, headquartered in San Jose, is an OEM computer manufacturer. Under the proposed $126.5 million deal, each outstanding share of 3Com stocks would be exchanged for three shares of Convergent common stock. Analysts, pointing to a trend toward building LAN hardware into computers, generally agree that the transaction may benefit both companies. The companies have had customers in common,



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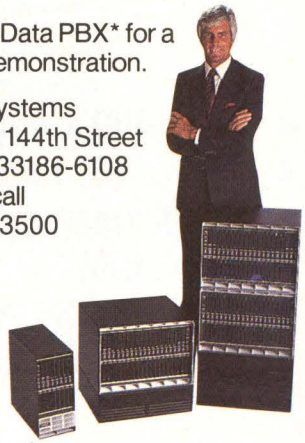

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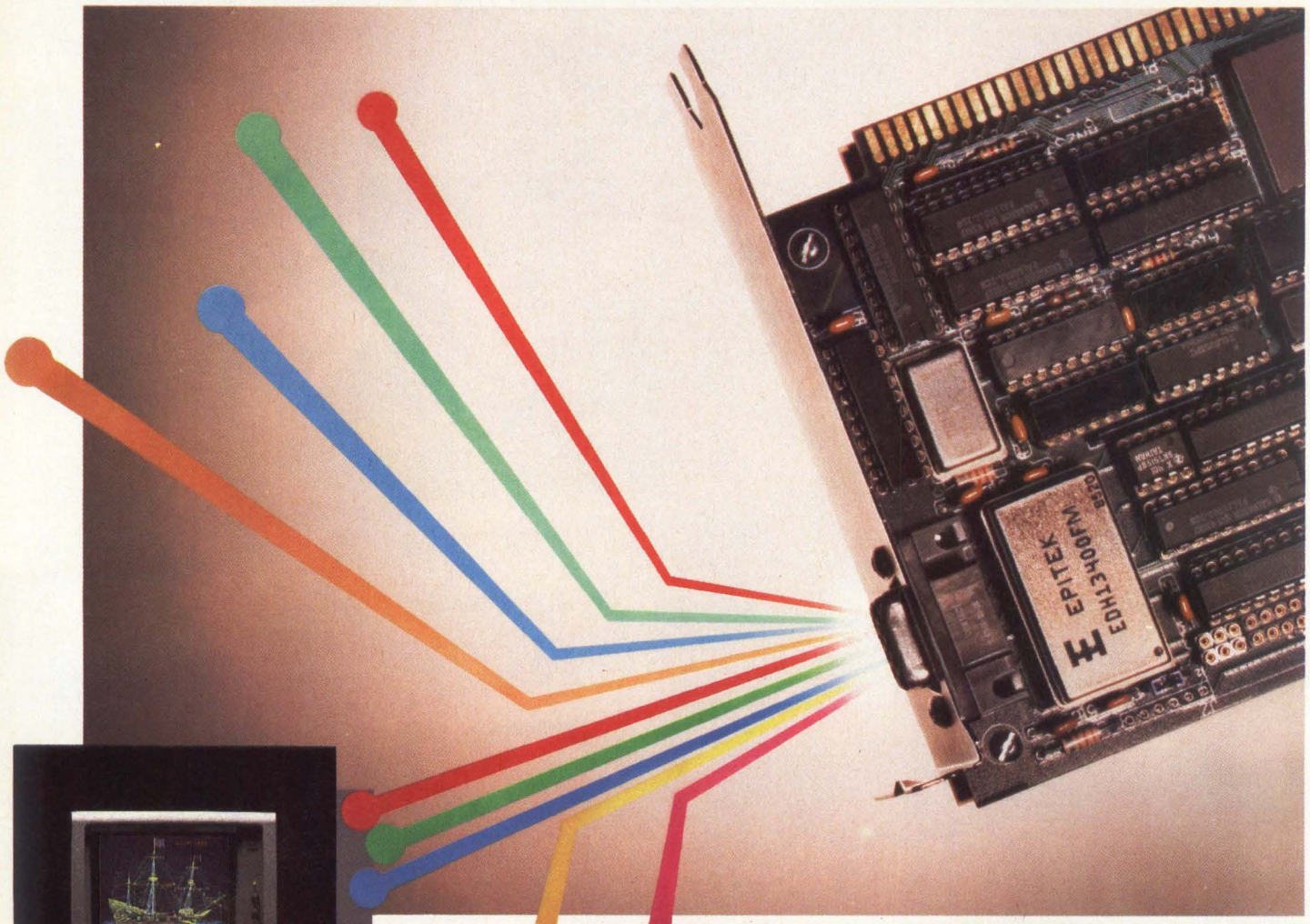

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such as AT&T Information Systems and NCR Corp., and 3Com supplies Convergent with a network adapter for its NGEN computer.—*Mike Seither*

OMNINET PLANS DATA SERVICE FOR MOBILE USERS

Los Angeles start-up Omninet Corp. intends to begin a pilot program early this year to provide nationwide, one-way data services to users requiring mobile and portable applications. For mobile users, data packets will be sent to alphanumeric terminals through small satellite antennas mounted on vehicle roofs. For portable applications, 3-inch-square satellite antennas will be incorporated into the lids of portable microcomputers and terminals to allow users to receive data broadcast from a central control station.—*Stephen Shaw*

WILL A PLESSEY TAKEOVER STRENGTHEN ITS CLOUT IN THE OFFICE?

Britain's largest electronics manufacturer, General Electric Co. Plc. (GEC), London, has targeted The Plessey Co. Plc., London, for a takeover. One consequence could be the merger of Plessey Peripheral Systems Inc., Irvine, Calif., with office-systems vendor A.B. Dick Co., Niles, Ill., suggests John Tysoe, electronics-industry analyst with London stockbroker Grieveson Grant & Co. Tysoe notes that A.B. Dick, a GEC subsidiary, is becoming increasingly active in the computer market with products that include word processors, the Videojet ink-jet printer and a computer line manufactured by Convergent Technologies Inc., of San Jose, Calif.—*Keith Jones*

SORD PLANS MAJOR U.S. PUSH

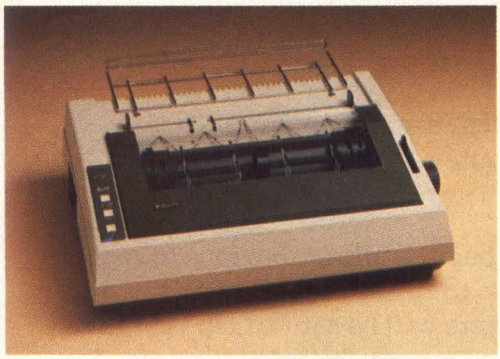
Already a major player in Europe, Sord Computer Corp., Tokyo, says it wants to boost current U.S. sales of less than $4 million to $200 million by 1990. A principal target will be the computer aided design/computer aided manufacturing market. Sord is shipping to U.S. customers the M68MX workstation, which offers up to 3.5M bytes of RAM; and CAD-BRAIN/mini, powerful CAD software that runs best on 2.5M bytes of RAM. Bucking the trend toward multiuser systems, the M68MX is a single-user, 10-MHz machine that runs on a Motorola Inc. MC68000 under the CP/M-68K operating system.—*James Donohue*

TECH FILES: A QUICK LOOK AT NEW PRODUCTS AND TECHNOLOGY

When it reintroduces its series of UNIX-based 3B systems sometime this spring, **AT&T Information Systems,** Morristown, N.J., will be using the small computer systems interface (SCSI) as the peripheral bus. Specifically, AT&T will incorporate the SCSI chip set from **Fujitsu Microelectronics Inc.** The Fujitsu chip set is said to be the first available to provide synchronous SCSI with through-parity, thus providing AT&T with a path to upgrading as new periphrals come on the market. AT&T is expected to introduce a full range of peripherals that will use the SCSI chip set, including optical-disk drives and laser printers, at the time of the 3B reintroduction.—*Carl Warren*

Making use of the new quarter-inch DC 2000 tape from **3M, Irwin Magnetics**, Ann Arbor, Mich., has quietly been showing a 40M-byte-capacity version of its mini tape drive to value-added resellers, OEMs and other customers. The current top capacity of Irwin's IBM Corp. PC-compatible Backup tape drives is 20M bytes, based on the capacity of 3M's DC 1000 one-eighth-inch tape. Unit price for the 40M-byte drive: about $1,000.—*James Donohue*

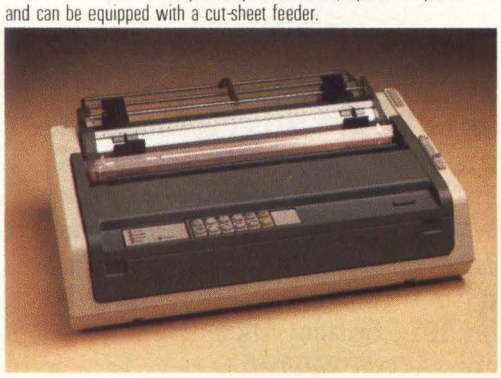
YOUR OFFICE PRINTER FAMILY



Tailored for your IBM PC or compatibles, the Facit 4509 provides graphics and multi-font printing at a budget price.

The 132-column Facit 4514 printer features NLQ as well as Epson FX and IBM PC character and command sets.

The fast Facit D2000 daisywheel printer is IBM/Epson compatible and can be equipped with a cut-sheet feeder.



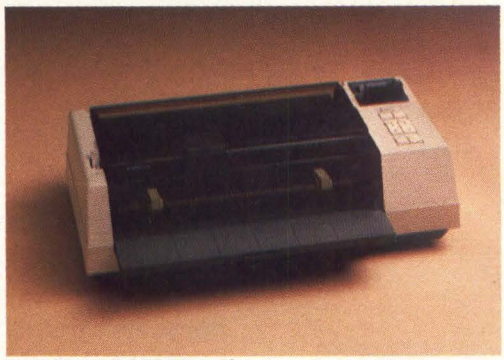
The C-line printers, Facit C5500 and Facit C7500, provide 250/400 cps, color graphics, multi-interfacing and flexible paper handling.

Meet eight representatives of the extensive Facit Office Printer family. Encompassing almost every aspect of quality printing, they make your printer choice easy. From dedicated PC-printers to extremely heavy-duty system printers for round-the-clock operation.

In addition to the Facit multi-purpose printer concept, the Office Printer family also includes printers for more specialized applications like bar-code/labels, word-processing and high-speed color graphics.

The full selection of standard interfaces, character sets and command protocols ensure that every Facit Printer will make friends with your system.

And, no doubt, with your budget, too.



For professional presentation graphics on paper and OH-transparencies, select Facit 4550/51 six-pen plotters.

Facit 4544 heavy-duty Paintbox Printer provides high speed printing as well as multi-color graphics/labels.

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CIRCLE NO. 15 ON INQUIRY CARD

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Quadram Corp., Norcross, Ga., plans to bring out this year a portable computer keyboard for less than $300 that plugs into both its Datavue portable computer and the IBM Corp. PC. The keyboard, Keystyle 80, has a flip-up screen and 32K bytes of RAM. The user can work away from his desk and plug the keyboard into his desktop computer when he gets back. Keystyle aims at the word-processing-laptop market now dominated by the Model 100 and 200 computers from Tandy Corp.—*James Donohue*

Venturing into waters hitherto dominated by Japanese manufacturers, **AT&T Technology Systems,** Berkeley Heights, N.J., is set to launch its first flat-panel product: a 10-to-1-contrast-ratio, AC, plasma display. The 1¼-inch-thick unit weighs only 1¾ pounds in its smallest, 192-by-320-pixel, version and provides a 3.19-by-5.31-inch, orange-on-black display area. The top-of-the-line, 400-by-640-pixel display measures 9.6 by 13.6 inches overall. OEM versions of the under-$600, plasma, panel display will come with a personal computer board containing a serial, CRT-type interface; CMOS drivers; power supply; timing and control circuits; and a DC-to-DC converter. Look for production quantities in mid-year.—*Jesse Victor*

Iris Graphics Inc.'s new Iris 2044 color ink-jet printer is capable of making hard-copy prints up to 34 by 44 inches directly from electronic color prepress systems or other computer-graphics systems, reports the Stoneham, Mass., company. A fully configured systems, including parallel interface capability, optional Motorola Corp. MC68000-microprocessor-based controller and software, and optional 60M-byte rigid disk is priced at $125,000.—*Lynn Haber*

NOTES FROM OVERSEAS: **Digital Equipment Corp.,** Maynard, Mass., and **COMAU** of Italy, a robotics and machine-tool subsidiary of Fiat SpA, have established a 50/50 joint venture to exploit the worldwide market for computer integrated manufacturing systems. Called SESAM, for Software E Sistemi per l'Automazione Minifatturiera, the new company will design and develop—but not build—CIM systems, says a DEC spokesman in the UK. Key competition will no doubt come from another large U.S. computer maker—IBM Corp., which recently invested 49 percent in Italian start-up SEIAF, which is also designing CIM systems.—*—Keith Jones*

Leading French component manufacturer **Thomson Semiconducteur,** Paris, says it is seeking collaboration with other major European chip makers for research into a microprocessor with a 64-bit word length. Thomson, currently speaking with Siemens AG of Munich and N.V. Philips, Eindhoven, the Netherlands, about the new machine, adds that it will be a RISC—a reduced-instruction-set computer.—*Keith Jones*

The Pentagon will embrace British research into the feasibility of optical computing, following the accord signed last month between the American and British governments endorsing British participation in the Strategic Defense Initiative. A spokesman for Ferranti Plc., London, says research carried out by its subsidiary, **Ferranti Computer Systems Ltd.** of Bracknell, England, will be brought into SDI along with similar work being done at Heriot-Watt University, Edinburgh.—*Keith Jones*

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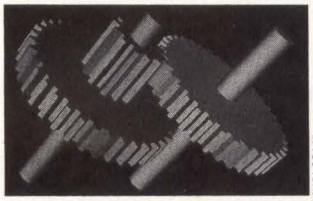

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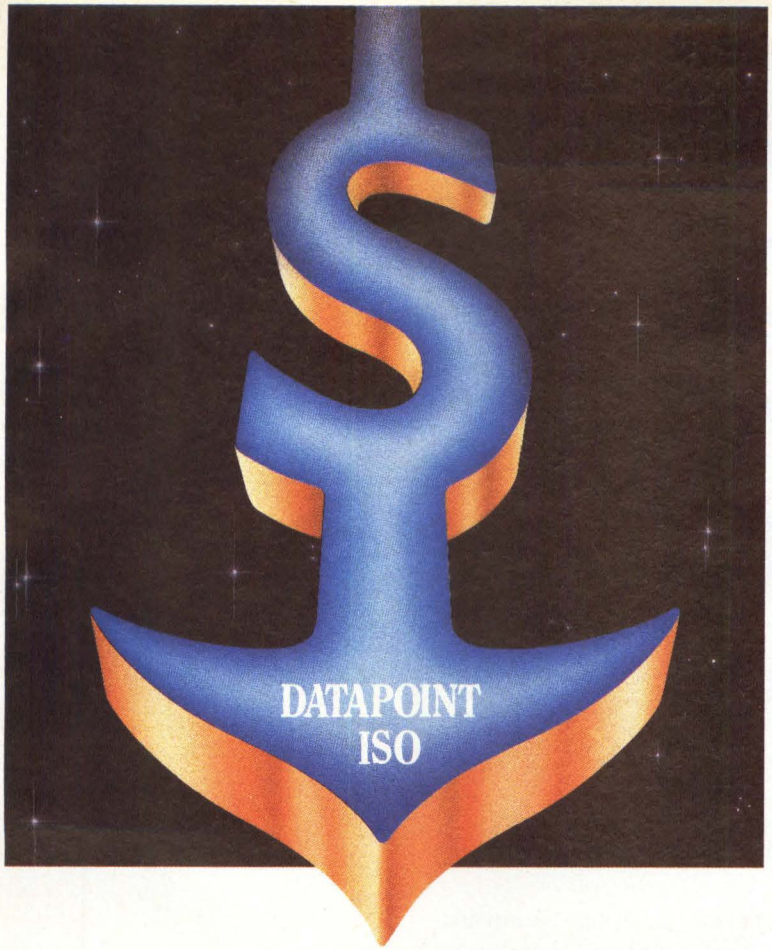

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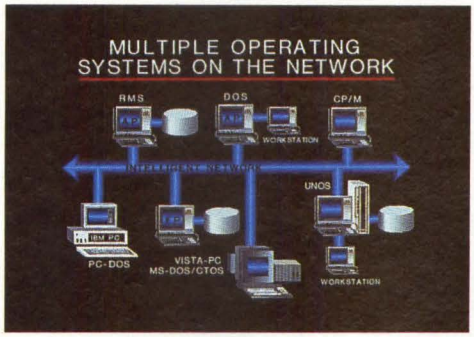

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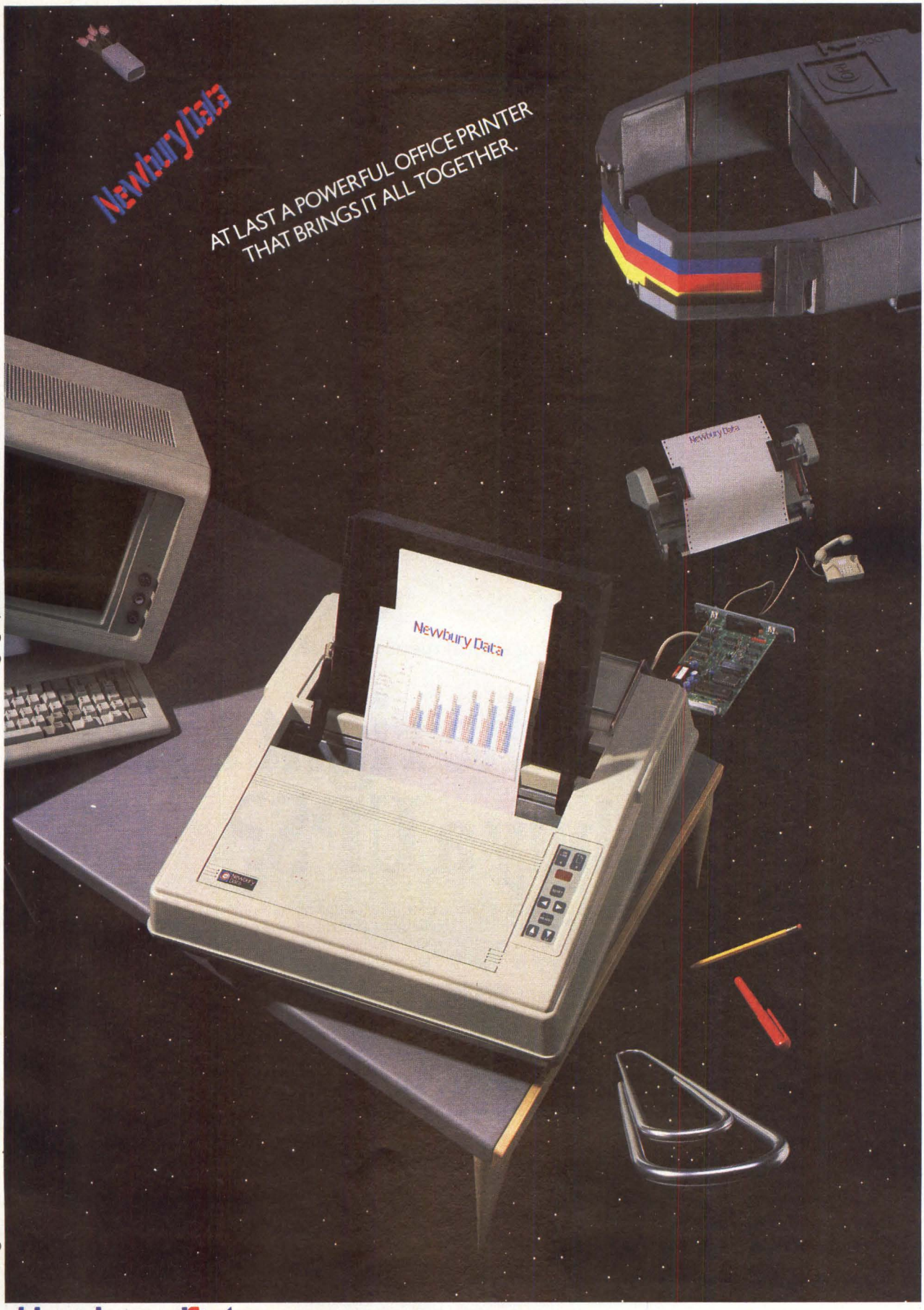

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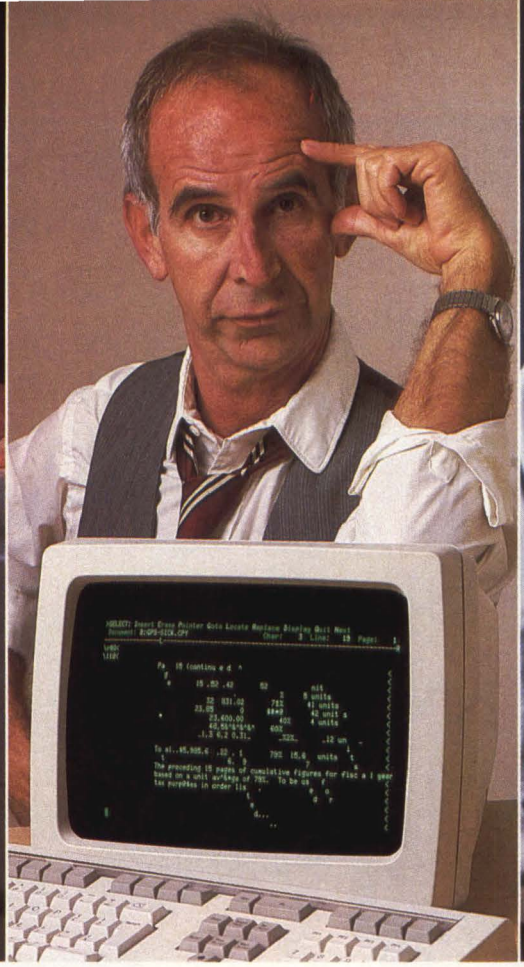
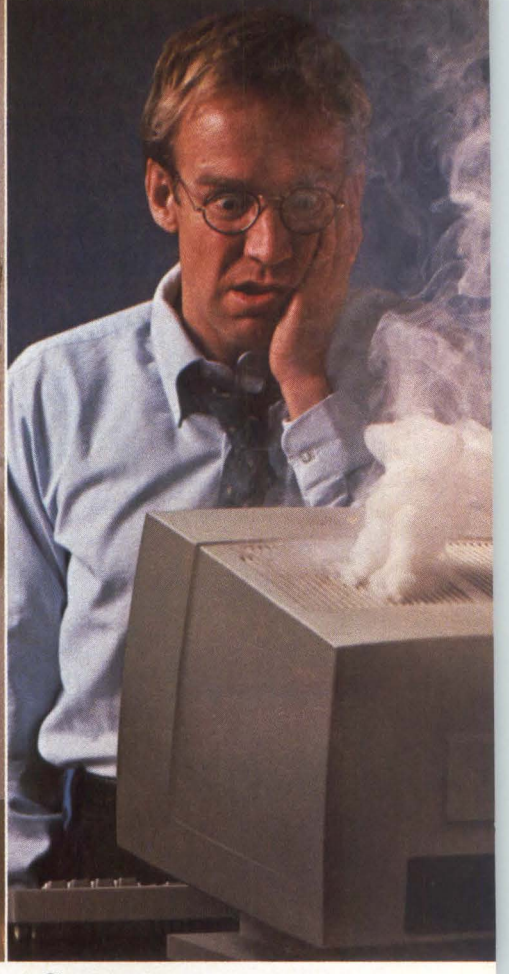
CIRCLE NO. 19 ON INQUIRY CARD

A. Once you're in the dark?



B. During a total memory loss?



C. After the smoke clears?

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D. None of the above.

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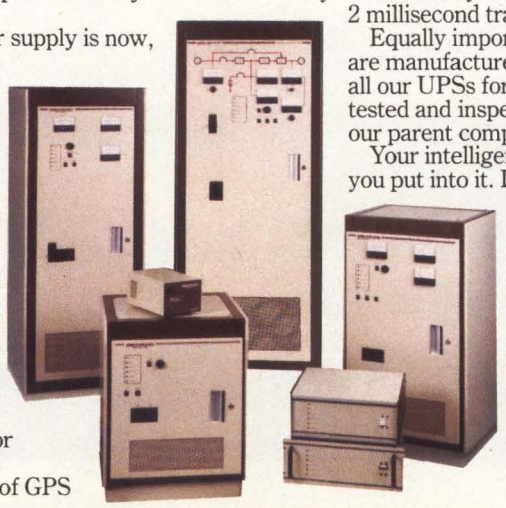

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CIRCLE NO. 20 ON INQUIRY CARD

Xerox boosts reliability, speed of color ink-jet printer

Mike Seither
Associate Western Editor

Xerox has positioned *its 4020 ink-jet printer for graphics applications in the business and engineering markets.*

Since their introduction, ink-jet printers have battled for credibility in the marketplace. Critics have duly noted problems of reliability and maintenance associated with the technology. Not only can ink be messy to install, but it can clog nozzles and impair print quality.

Xerox Corp., mindful of these concerns, has moved to resolve them with its latest color ink-jet printer, the Xerox 4020, priced under $1,500. The machine is a refined version of the Diablo C-150. (Xerox acquired Diablo Systems Inc. several years ago, but the Xerox name is only now beginning to replace the Diablo label on printers.)

Designed by Xerox's printing systems division in Fremont, Calif., and manufactured by Sharp Electronics Corp., Japan, the 4020 has double the speed and resolution of the C-150. Furthermore, Xerox has made considerable changes in the way ink is loaded and nozzles are cleaned, while at the same time sticking with "drop-on-demand" technology.

With drop-on-demand technology, electric signals control the action of a diaphragm, which pulls ink from a reservoir, moves it into a chamber on the printhead and sprays a precise amount onto the paper. Like other dot-matrix printing technologies, individual characters or graphic symbols are built by a series of dots. In the Xerox 4020, the dots are squirts of ink.

Xerox product manager Jeff Stenehjem claims the company has reformulated its inks, refined the nozzles and perfected the capillary action inside the printhead. "This [the 4020] represents the latest that technology can offer in terms of drop-on-demand," Stenehjem says. The result, he adds, is a printer that Xerox hopes will appeal to OEMs and system integrators selling into the business and engineering markets.

"The position we're taking is that anyone interested in color for transparencies or published reports wants quality," says Stenehjem. "That's the whole color message—impressing the viewer and communicating information as effectively as possible."

What's the market like for ink-jet printers? According to Datek Information Services Inc., a Newtonville, Mass., market-research concern, manufacturers shipped about 250,000 ink-jet printers in 1985. Of that total, 43 percent were color units. According to Jonathan Dower, a Datek analyst, ink jet lags behind a competing color technology—thermal transfer—in terms of unit shipments. Last year, 350,000 thermal-transfer printers found their way into the market, 77 percent with color capability.

There are several product categories besides thermal transfer against which ink jet has to compete: dot matrix, electrostatic and electrophotographic printers, as well as pen plotters and film recorders.

Taking off in 1986

Of all color products in those categories shipped in 1985, ink-jet printers accounted for only 7.3 percent of the

total, says Peter Testan of C.A. Pesko Associates Inc., a Marshfield, Mass., consulting company. But, Testan says, ink jet's share of the color hard-copy market will increase to 26.4 percent, or 727,000 units, by 1990.

"I believe 1986 will be the year ink jet takes off," declares Testan. "It's suffered in the marketplace because of poor reliability, but at this point that reputation is unfounded. Improvements like [those that] Xerox have made should improve overall reliability."

Another factor that will help the credibility of ink jet is IBM Corp., says Testan. The company has mounted a strong advertising campaign for its color Jetprinter, which Testan says "is doing pretty well in the marketplace." Similar to the PJ1080A from Canon U.S.A. Inc., Lake Success, N.Y., and built for IBM by Canon, the Jetprinter sells for about $750. Canon's color ink jet is priced at about $600.

Xerox's Stenehjem, however, does not consider IBM and Canon competitors. For one thing, those machines operate at 20 characters per second (cps) and have resolutions of 100 by 96 dots per inch (dpi) printing in black for near-letter-quality text. Xerox claims that the 4020 runs at 40 cps for NLQ text and 80 cps in draft mode.

In addition to printing at a resolution of 120 by 120 dpi like the C-150, the Xerox printer has an enhanced operating mode of 240 by 120 dpi. It accomplishes that by making a pass at 120 by 120 dpi, then stepping the platten 1/240 of an inch and repeating the pattern on a second, slightly offset, pass. That allows the 4020 to create tighter, more filled-in characters or denser graphics images than the C-150, or the IBM and Canon machines, says Stenehjem.

Automatic purging cleans nozzles

A major improvement on the Xerox 4020 is an automatic purge system to clean the printhead's 20 nozzles. (There are four nozzles each for the primary colors yellow, magenta and cyan, and eight for black.) On the C-150, purging was accomplished by hand, using a syringe and hose to force ink through the nozzles to unclog them or remove bubbles caused by "air ingestion." Should the 4020 become clogged, users need only push a button that activates a 4-minute purge cycle that cleans each nozzle.

Another improvement is the addition of a removable cartridge for the so-called maintenance fluid in which the nozzles rest while the printer is not in use. The fluid prevents the ink from drying in the nozzles. In the C-150, the fluid resided in an open reservoir. If the printer had to be moved or shipped, the fluid had to be emptied. That required removing several parts to get to the reservoir.

The upshot, according to Xerox, is that the 4020 ink-jet printer is twice as reliable as the C-150. Based on a 25 percent duty cycle (that is, it will be in operation only one-quarter of the actual work day), the 4020 has a mean time between failures (MTBF) of 4,000 hours. That compares with an MTBF of 2,000 hours for the C-150. The company claims the mean time to re-

Put Intel and Motorola on GM's MAP

Rick Dalrymple, Senior Editor

Declaring that making local area network products may become a bigger business than building microprocessors, Intel Corp., Santa Clara, Calif., and Motorola Semiconductor Products Inc., Phoenix, Ariz., have demonstrated network interfaces for the General Motors Corp. Manufacturing Automation Protocol (GM MAP). The demonstrations signal the entry of both vendors into the factory-automation segment of the LAN market, thus carrying the Multibus, VMEbus battle into a new arena.

Intel and Motorola connected board-level products to the 10M-bit-per-second (bps) portion of the IEEE 802.4 broadband GM MAP demonstration network at Autofact, an automated manufacturing show in Detroit's Cobo Hall.

According to an industrial LAN market study published by Venture Development Corp. (VDC), Natick, Mass., combined shipments of MAP broadband and MAP carrierband networks will reach $370 million in 1990. The 10M-bps backbone portion of the market is expected to account for 45.3 percent of the total spent on industrial LANs in 1990. Although most of the attention has been focused on the broadband version of MAP, work on the carrierband has been progressing rapidly.

MAP carrierband networks are expected to be used as subnetworks by users to integrate the collection of computer-controlled devices that make up a cell of factory automation. These subnetworks will be linked through gateways to a MAP broadband backbone network to achieve total plant integration. Carrierband networks use a 5M-bps single-channel modem, rather than the 10M-bps multichannel modem used in the backbone network.

MAP-making hand-in-hand

Intel and Motorola executives have separately expressed confidence in the LAN market opportunity. Both vendors expect that future revenues from LAN products will exceed those derived from microprocessors today. Intel and Motorola join Concord Data Systems Inc., Waltham, Mass., and Industrial Networking Inc. (INI), Santa Clara, Calif., as GM MAP-compatible networking suppliers.

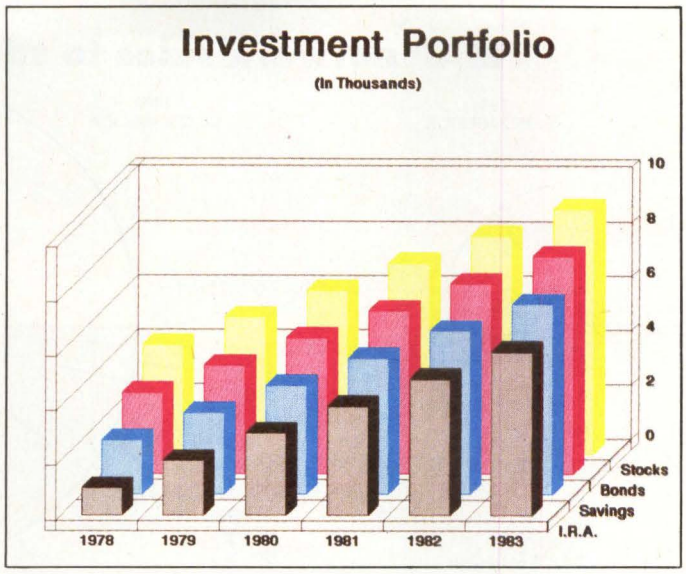
While these four vendors will be competing in the MAP marketplace in 1986, they are today more akin to fellow explorers than to fierce competitors. For example, the board-level products shown at Autofact under the Intel and Motorola brand names are manufactured by INI, a joint venture of the General Electric Co. and Ungermann-Bass Inc., of Santa Clara.

pair the 4020 is less than 30 minutes. Xerox has also increased the amount of ink the printer can hold and the method by which it's loaded. Prefilled ink vials holding 7 cc of black ink and 5 cc each of yellow, magenta and cyan have replaced smaller cartridges that held half those volumes. The vials are color-coded and keyed to prevent filling an ink well with the wrong color ink. According to Xerox, one vial of black ink will produce 250,000 characters, or about 200 pages of text.

Prints 4,000 color shades

The 4020 can combine the primary colors to create three secondary colors: red, green and violet. Xerox claims those primary and secondary colors combined can yield about 4,000 shades.

The printer will initially be available with five fonts: 10-pitch gothic, 10-pitch gothic italic, 12-pitch Roman, 12-pitch gothic and 17-pitch gothic. Superscript, subscript, underlining and a Centronics interface are standard. An RS232 interface is optional.



Twenty nozzles in the Xerox 4020 *ink-jet printer deliver black, yellow, magenta and cyan inks. When combined, the inks produce seven colors in approximately 4,000 shades. This is an actual sample of the 4020's output.*

Product manager Stenehjem says the more than 45 graphics software packages written for the C-150 will operate on the 4020 in the lower resolution mode of 120 by 120 dpi. He adds that the software manufacturers are altering the programs to take advantage of the 4020's 240-by-120-dpi resolution. Those enhanced programs are expected to be ready sometime after March. Graphic Software Systems Inc., Wilsonville, Ore., is designing a driver that will allow the 4020 to support the virtual device interface. □

INI develops and markets LANs and communications products for industrial applications and, in addition to its role as a network hardware supplier to Intel and Motorola, the company sells to large end users. INI was founded in October 1984 with Ungermann-Bass contributing 60 percent in the form of technology and services while GE provided $6 million in cash for a 40 percent share.

Both Intel and Motorola have signed separate agreements with INI to jointly develop hardware products that conform to GM's MAP specifications. Software products that implement the Network to Application layers (three to seven) of the specifications, however, have been developed separately by each vendor. The specifications correspond to the seven-layer open system interconnection (OSI) model of the International Standards Organization.

The hardware GM MAP network interface products sold by INI, Intel and Motorola include an intelligent controller board and a modem board, plus resident software implementing the Physical and Data Link layers (one and two) of the OSI model and GM's MAP 2.1 specification. INI's MM-400 two-board set for Multibus I is the Intel iSXM 554 MAP COMMengine, and INI's MV-400 two-board set for the VMEbus is Motorola's MVME370SET-1.

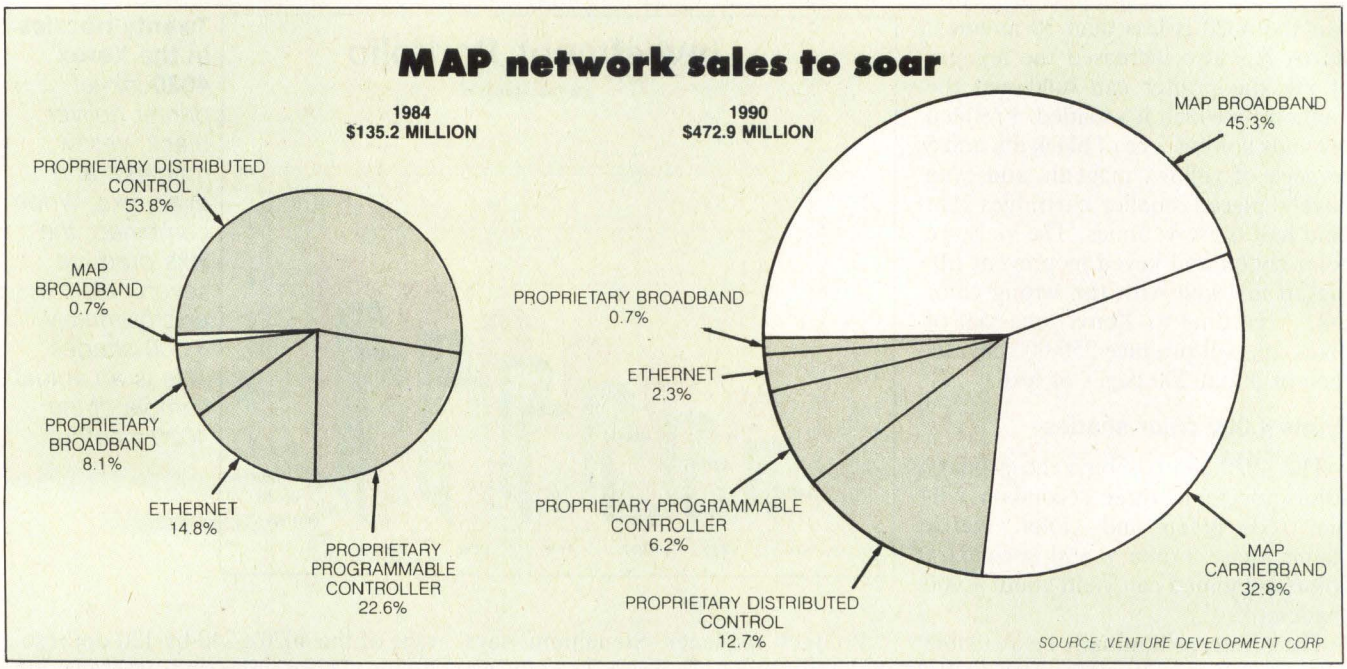
INI also offers MP-400 and the MG-400. The MP-400 provides a MAP interface for the IBM Corp. PC, PC/XT and PC/AT. The product occupies two card slots in the PC chassis. The MG-400 provides a general-purpose interface to the MAP network for any host system over a high-speed RS422 channel.

The INI agreement, according to Leonard Magnuson, Intel's OEM communications operation marketing manager, "is a typical case of minimizing both the time to market and the development risk, with an arrangement that is a win-win situation for each partner." Magnuson points out that all three vendors present different solutions to their respective customers by providing unique software and support services. "It is simply three vendors using the same basic hardware interface modules providing different forms of added value and competing in the marketplace," he says.

Kits produced in 1986

Both Intel and Motorola have announced that they will offer MAP developer kits in 1986. Motorola's kit is scheduled for delivery in the first quarter and Intel's in the second quarter. These kits include cabling, head-end remodulator and several MAP interface board sets useful in prototyping a network. Once again, the head-end remodulator is manufactured by INI. The INI MHR-40 Head-End Remodulator provides frequency translation between received and transmitted signals. One head-end remodulator is required for each IEEE 802.4 broadband channel group on the cable.

Also in the second quarter of 1986, Intel and Motorola will offer software



that implements all seven layers of the GM MAP 2.1 protocol. Software for layer three and for layer four, the Transport Layer, is currently available from INI, Intel and Motorola.

Beginning in the second quarter of 1986, Motorola will offer its own GM MAP-compatible VMEbus controller board based on the MC68824 Token Bus Controller and Motorola's MC68020 32-bit microprocessor. At the moment it is unclear whether INI will remain as Motorola's MAP modem supplier. INI's current policy does not allow the modem board to be sold separately.

INI's manufacturing LAN is called MAP/One and, in addition to the interface boards and head-end remodulator mentioned above, includes operating software, the MAP/One Network Management Console and the MAP/One System Software Products.

Motorola's Token Bus Controller

Motorola will be the second vendor to deliver a MAP-compatible VLSI product. INI was the first with a two-chip VLSI set. Motorola's MC68824 Token Bus Controller is the first single-chip VLSI implementation of the IEEE 802.4 Media Access Control sublayer of the ISO/OSI data link layer. The MC68824 conforms to GM's MAP 2.1 specification, supporting both broadband and carrierband physical media.

Extending beyond basic IEEE 802.4 requirements, the 68824 implements the real-time (PROWAY) extensions, including four classes of message priority. Both 10-MHz and 12.5-MHz versions of the 68824 are offered in 84-pin grid array packages. Motorola expects sampling of the 68824 to begin this month. Since INI does not offer its two-chip set for sale, Motorola will be the first vendor to offer other board-level manufacturers a VLSI GM MAP-compatible chip.

Concord Data already installed

Two IEEE 802.4 networks were shown at the Autofact GM MAP demonstration. Interface units on the 5M-bps IEEE 802.4 network were the exclusive domain of Concord Data. Before the September introduction of INI's GM MAP product line, Concord Data was the only supplier delivering GM MAP-compatible networking products. Concord Data's Token/Net LAN, introduced in March 1983, was the first LAN designed to meet the IEEE 802.4 broadband token-bus standard. Concord Data's primary interface unit, the Token Net Interface Module (TIM), is a box that includes three boards: a 5M-bps radio-frequency modem and a two-board, microprocessor-based controller. Each TIM can accomodate from four to 12 RS232 or RS449 ports.

Concord Data's Token/Net LAN is currently installed in over 75 sites. The most recent version of the GM-MAP specification, version 2.1, specifies a 10M-bps transmission rate. And so, Concord Data announced at Autofact that it would be delivering a second-generation 10M-bps modem in mid 1986. The company is currently developing a 5M- to 10M-bps upgrade board for all existing 5M-bps TIMs.

Concord Data also announced a 5M-bps carrierband modem and its intent to aggressively pursue the MAP carrierband LAN market. So far, Concord Data is the only vendor of GM MAP products with announced plans to offer both 10M-bps backbone and 5M-bps carrierband LANs. According to Tony Friscia, Concord Data's factory networks product manager, "Because more devices will be connected to the carrierband portions of a factory network, we expect the carrierband portion of the market, in dollars, to be significantly higher than that forecasted by VDC." Friscia expects that between 10 and 20 devices will be connected to each carrierband factory cell which, in turn, is connected to the factory backbone LAN. □

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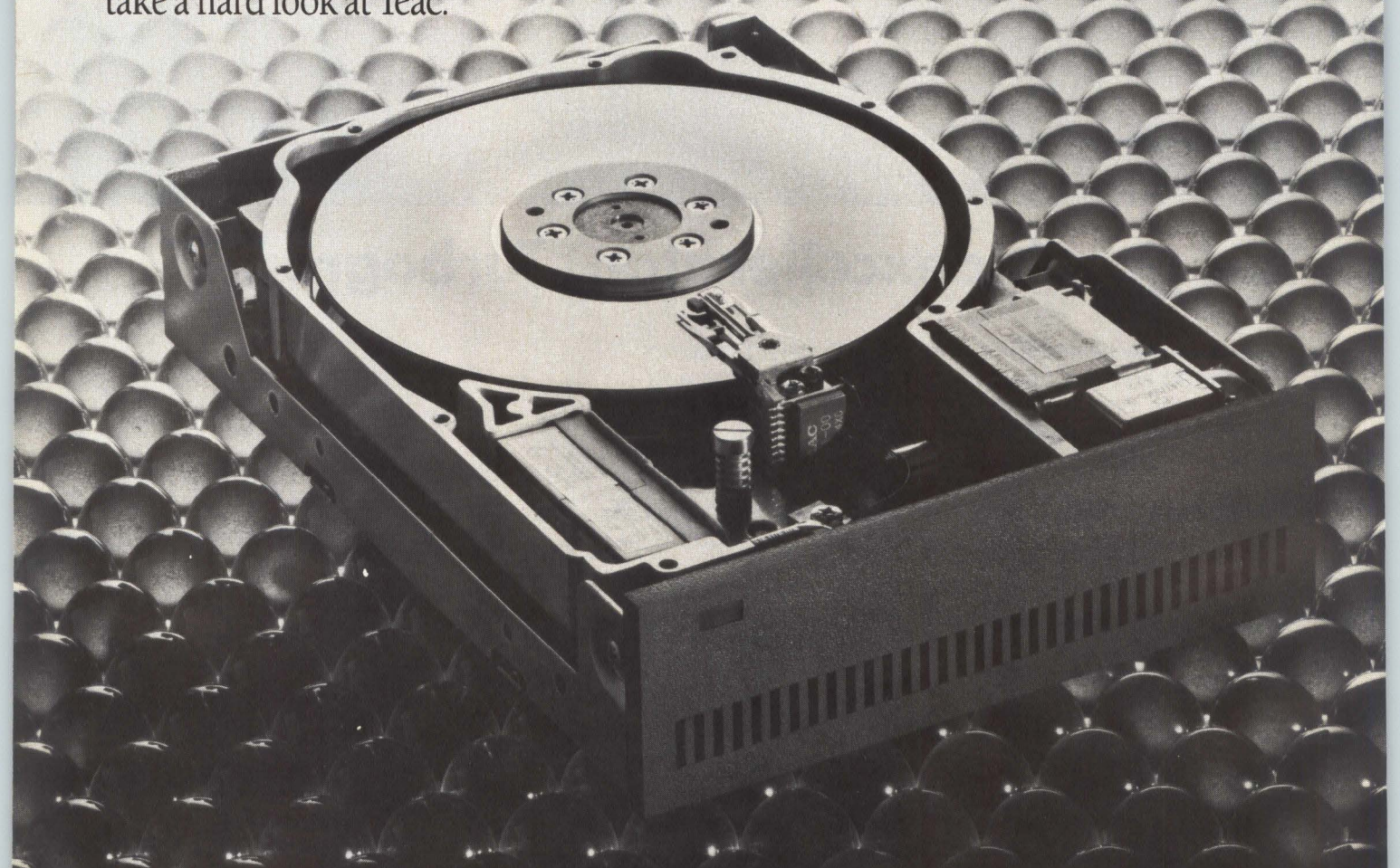

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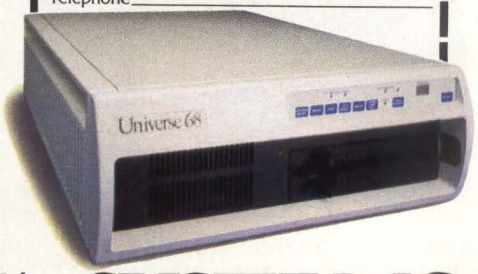

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CIRCLE NO. 23 ON INQUIRY CARD

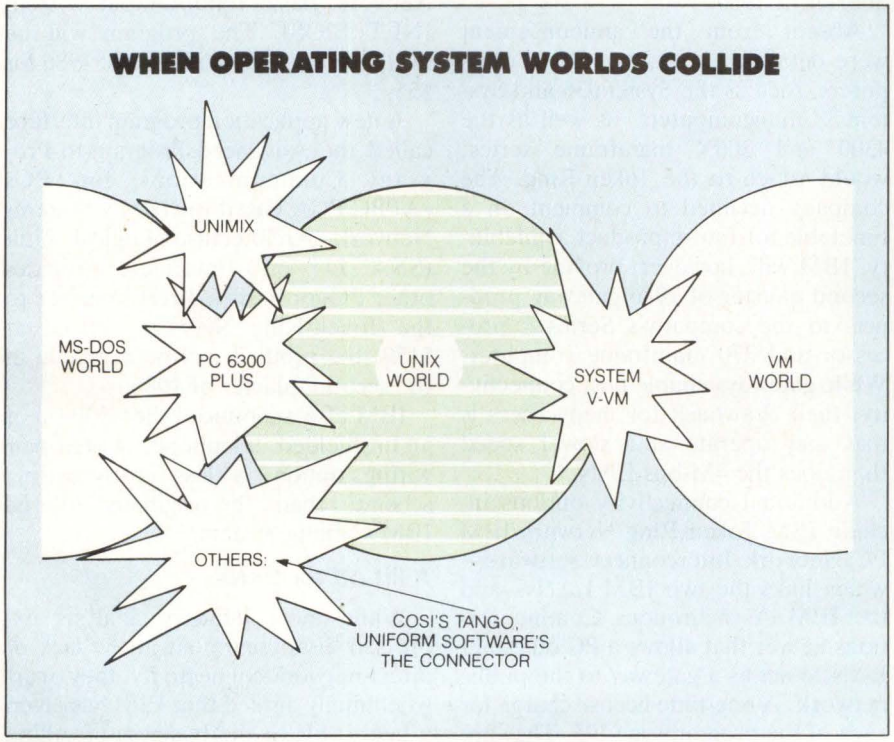
UNIX opens doors to IBM systems

Michael Tucker, Associate Editor

UNIX continues to open doors to other operating systems—particularly those of IBM Corp. machines. With a little help from IBM archrival, AT&T Information Systems, Summit, N.J., and a host of software innovators, UNIX is exploiting links to Microsoft Corp.'s MS-DOS and PC-DOS and IBM's VM. This means MS-DOS users can take advantage of UNIX's particular strengths, such as multitasking and superior memory management, and UNIX vendors can tap IBM's VM.

Because MS-/PC-DOS dominates the single-user microcomputer world, UNIX vendors have been working desperately to make DOS applications available to their customers. Indeed, an entire industry has sprung up in the last year to link the two operating systems. System integrators and software value-added resellers are already eagerly selling or reselling a host of terminal emulators, file-transfer programs and communications products whose aim essentially boils down to letting the customer run Lotus Development Corp. 1-2-3 under UNIX. Such products include Tango, from Computerized Office Services Inc. (COSI), Ann Arbor, Mich., and The Connector, from Uniform Software Systems, Santa Monica, Calif.

Furthermore, some vendors are actually blending the two operating systems rather than just linking them. For example, Unidos Systems Corp. of Bridgewater, N.J., markets an AT&T-licensed UNIX-variant known as Unimix for the IBM PC/AT. Says Unidos president Thomas Giacchi: "Essentially, our operating system has the ability to mount [non-UNIX] file systems in it. One of the file systems we'll be supporting is MS-DOS. This means that you'll be able to take data from MS-DOS applications and transfer it to UNIX."



Blending UNIX *with other operating systems has become an industry in itself. Products like the Unimix operating system and the AT&T PC 6300 Plus computer provide UNIX with doorways to MS-DOS (left). Products like AT&T System V-VM give UNIX a link to IBM's proprietary VM (right).*

In other words, MS-DOS applications could exploit the more powerful UNIX environment. "Our goal is to give UNIX the ability to run MS-DOS applications, and to run them well," says Giacchi. "A user could, for instance, run Lotus 1-2-3 with much larger files than MS-DOS allows." Without expansion boards, MS-DOS restricts users to 128K bytes at a time.

Products like Unimix have fueled speculation that MS-DOS and UNIX eventually will merge. As a matter of fact, Microsoft is in the enviable position of marketing XENIX, the most widely used microcomputer UNIX variant around, along with its own MS-DOS.

Nevertheless, Microsoft disputes the idea that UNIX/XENIX and MS-DOS will ever merge. "They address very different markets," says Jon Danskin, XENIX product manager for Microsoft. "MS-DOS addresses the single-user market, while XENIX is directed toward the multiuser environment. At this time, we don't intend to merge them."

Microsoft does say that it is making the two operating systems increasingly communicative with one another. "We have done some things to bring the two operating systems closer together," admits Danskin. "We've given XENIX the ability to do file transfers to DOS, for instance. We have also put together an application-development package where designers can actually write programs for a DOS environment, link them up and turn them into executable DOS files...all under XENIX, which is a far more powerful development environment than DOS could ever be."

Not everyone is convinced that only developers will benefit from a UNIX/DOS mix. Says Unidos' Giacchi, "I think the two will blend. And we're going to call the result 'UNIX' rather than 'MS-DOS' because AT&T happens to be supporting UNIX."

The imprimatur for such a permanent MS-DOS/UNIX connection may have recently come from—of all people—ATTIS. In October 1985, the company announced several new desktop machines based on the 16/32-bit

Intel Corp. 80286 chip. Among these was an upgrade of the company's rival to the IBM PC, the PC 6300, called the PC 6300 Plus. The machine is chiefly an MS-DOS box, but one that also runs UNIX. In fact, when it's running under UNIX, DOS runs as a job under UNIX.

Essentially, the PC 6300 Plus is running MS-DOS "on" a virtual machine. This would be difficult, if not impossible, were it not for the sheer power of 32-bit chips—which have the room for virtual machines. As such chips become more common, they could make it more likely that the two operating systems will become housemates, rather than incompatible operating systems.

ATTIS' determination to exploit IBM's installed base of hardware may be best shown by a product the company introduced last June: AT&T System V-VM. This software allows UNIX to run as a job under IBM's proprietary operating system VM on IBM and IBM-compatible minicomputers and mainframes. With it, developers that want to produce UNIX-based products, or that want to make use of UNIX's famed capacities for software production, can reportedly do so without having to sacrifice an existing investment in IBM hardware.

Moreover, an optional communications package, FDX, allows an IBM machine running System V-VM to communicate with other UNIX systems. In other words, a customer with an installed base of IBM machines running V-VM with FDX could network them with UNIX machines.

System V-VM is targeted for machines larger than those usually exploited by system integrators, but it could create new markets for them. Extremely powerful operating systems, such as UNIX and VM, have traditionally been beyond the reach of even the most sophisticated users simply because of the size of the machine necessary to hold them. The widespread availablity of powerful but relatively inexpensive 32-bit systems could change all that. It may be that the next window of opportunity for software innovators may lie in creating VM/UNIX links, just as the present one now lies in MS-DOS/UNIX connections. □

IBM's Token-Ring Network signals start for LAN vendors

Lynn Haber, Associate Editor

Despite the sparseness of IBM Corp.'s recently announced Token-Ring Network, the computer industry giant nevertheless gave local area network users and manufacturers a clear directive in unleashing its long-awaited product.

"The mystique surrounding the Token-Ring LAN is gone," says Kim Myhre, director of communications industry research at International Data Corp., Framingham, Mass. "IBM finally played its hand and independent manufacturers now know what IBM can and can't do."

In accordance with the IEEE 802.5 networking standard, IBM employed a star-wired ring topology with a token-passing access method.

The initial implementation of IBM's 4M-bit-per-second (bps) baseband Token-Ring Network accommodates the company's PC personal computer, portable computer, PC/XT and PC/AT. According to IBM, a 20-workstation configuration would cost $816 per station, excluding the PCs and cabling. Products will be available in the first quarter of 1986.

Absent from the announcement were details of how larger IBM computers, such as the System/36 and System/38 minicomputers, as well as the 4300 and 308X mainframe series, would attach to the Token-Ring. The company declined to comment on a timetable for future product availability. IBM will, however, provide by the second quarter of 1986 gateway products to the company's Series 1 processor and 370 mainframe computer. While gateways enable host connectivity, their drawback for many users is that they operate at a slower speed than does the 4M-bps LAN.

Additional connectivity options include IBM Token-Ring Network/IBM PC Network Interconnect software—which links the two IBM LANs—and the IBM Asynchronous Communications Server that allows a PC on either LAN to act as a gateway to the public network. A one-time license charge for each of the programs is $495. They are scheduled to be available in the second quarter of 1986 and the first quarter of 1986, respectively. The Token-Ring Network also interfaces with IBM's Network Basic Input/Output System (NET BIOS). The program will be available in the first quarter of 1986 for $35.

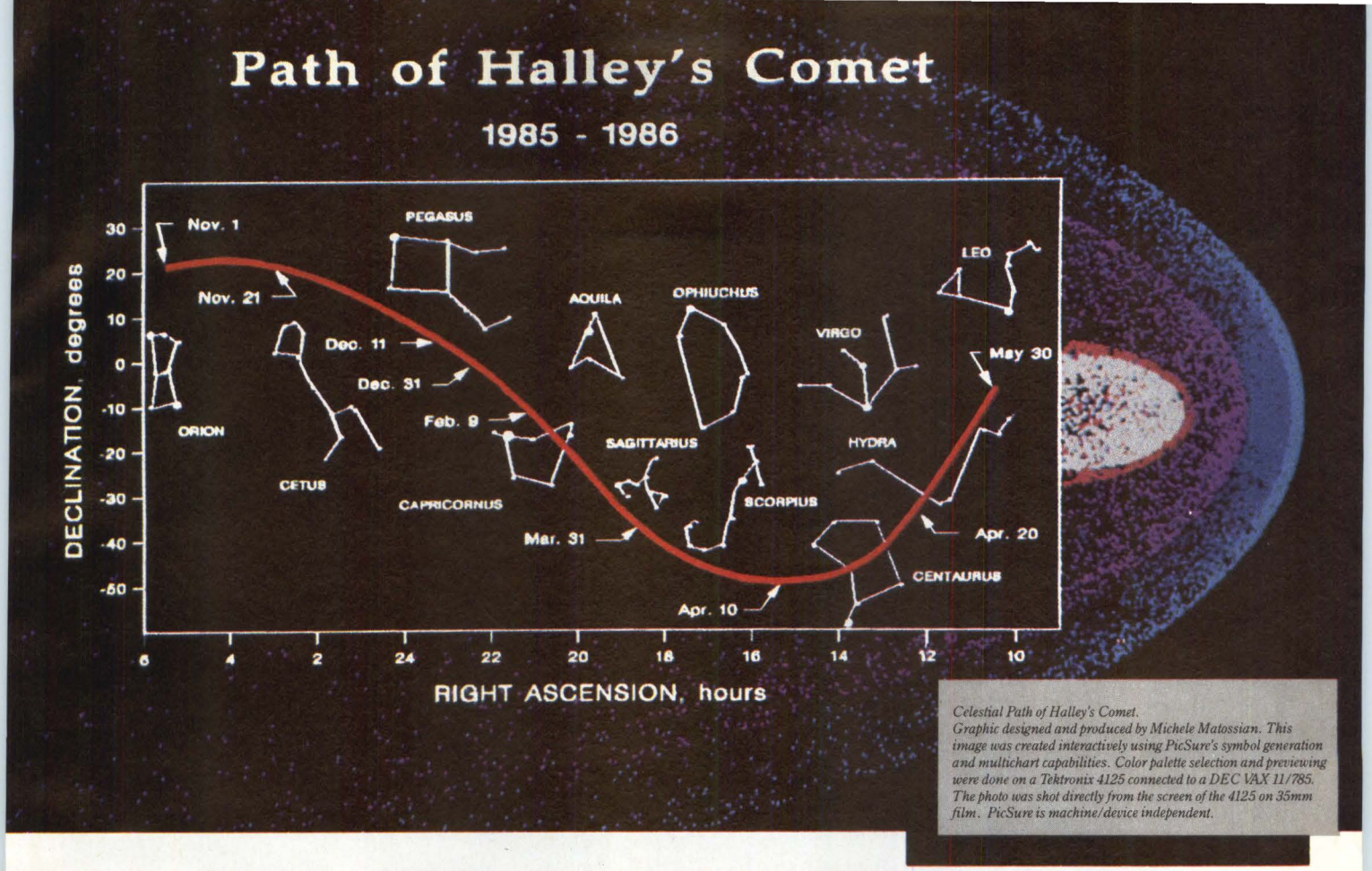
A new application-program interface called the Advanced Program-to-Program Communications for PCs (APPC/PC), based on IBM's Systems Network Architecture Logical Unit (SNA LU 6.2) interface, provides other PCs or hosts a direct interface to the Token-Ring Network. Priced at $150, the product will be available in the second quarter of 1986.

IBM also announced the addition of an unshielded, telephone, twisted-pair wiring option, a less costly wiring scheme than the originally offered IBM Cabling System.

A lift-off for LANs

While most industry analysts expressed disappointment at the lack of direct network connectivity, they overwhelmingly agreed that IBM has given a hearty lift to the business of selling LANs.

"For independent manufacturers, the important part of the IBM announcement is what wasn't said," con-



Celestial Path of Halley's Comet.
Graphic designed and produced by Michele Matossian. This image was created interactively using PicSure's symbol generation and multichart capabilities. Color palette selection and previewing were done on a Tektronix 4125 connected to a DEC VAX 11/785. The photo was shot directly from the screen of the 4125 on 35mm film. PicSure is machine/device independent.

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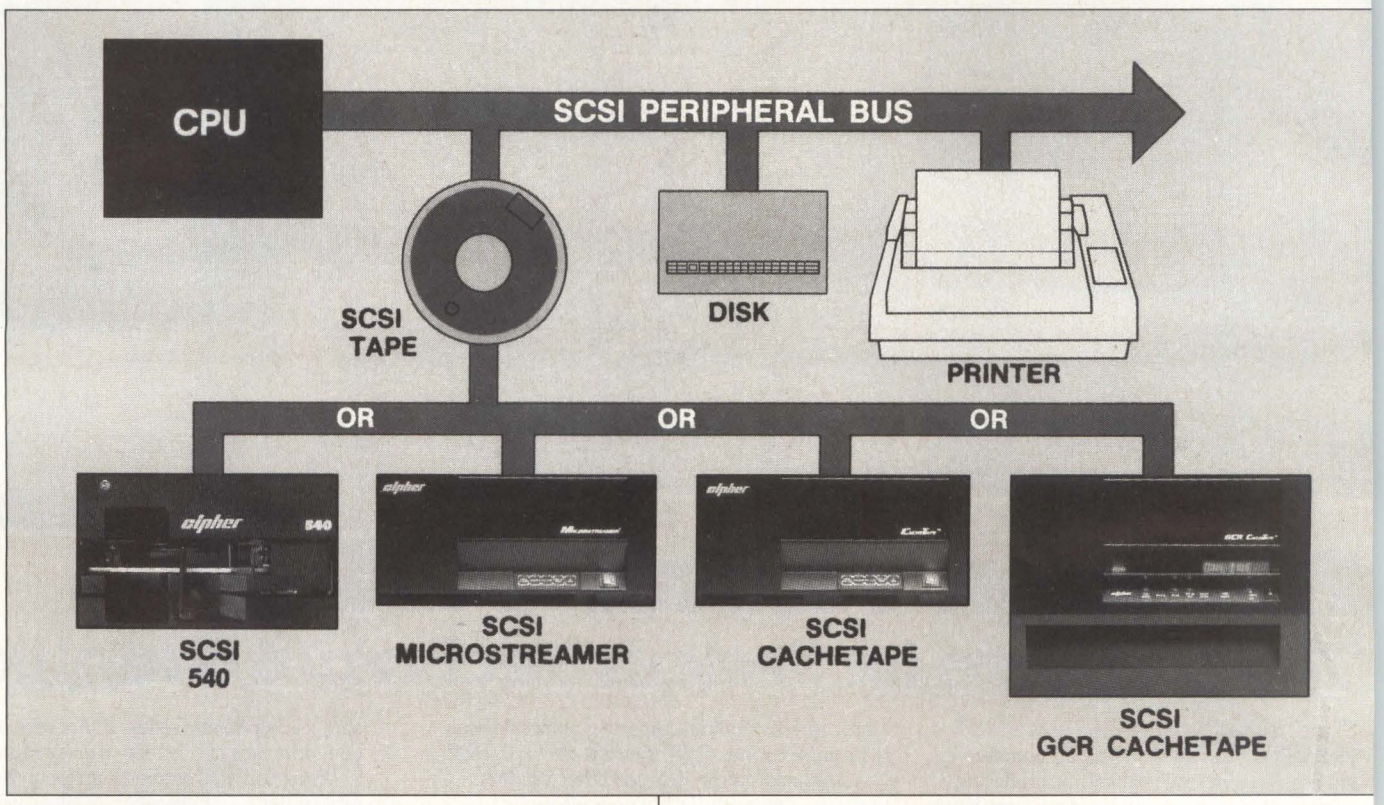
The Cipher



Cipher announces SCSI-compatible ½-inch tape peripherals.

SCSI, known as the new standard interface for small, low-end computer systems, is also gaining ground in the high-performance market. With the continuing delay in the development of the Intelligent Peripherals Interface (IPI) for disks, SCSI has found its way into larger systems as well.

Cipher has taken the lead in bringing a full line of easy-to-integrate tape drives to this emerging marketplace. In addition to the 540S ¼-inch streamer, three ½-inch products, the Microstreamer,® CacheTape® and GCR CacheTape,® are also available in SCSI-compatible versions.

SCSI enables integrators to use a single hardware interface, regardless of which drives are being used.

Cipher's SCSI option is a full implementation of the interface specifications being reviewed by ANSI. It offers all of the standard features found with most intelligent interfaces, plus ANSI-supported bus arbitration, disconnect/reconnect and copy command. Multiple initiator and multiple target features to improve tape management and backup efficiency are also included.

Cipher engineers can provide expertise to help you integrate tape drives into SCSI systems. For more information call 1-800-4-CIPHER, ext. 9.

Nixdorf cuts tape integration costs with CacheTape.

When Nixdorf Computer AG needed a new tape drive for their System 8850,™ their first choice was Cipher's Microstreamer. "It offered both streaming and 25 ips

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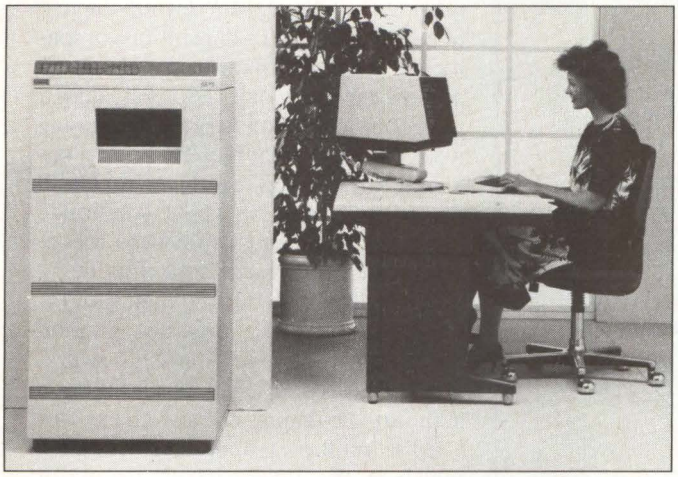

start-stop capability at a lower cost than the standard 25 ips drive we were using," said Rainer Muhlenweg, director of OEM product selection.

However, rather than spend time changing software to integrate the Microstreamer, Nixdorf found that Cipher's CacheTape could be integrated immediately, without modification.

"The intelligent cache memory enabled the drive's performance to be matched to that of the computer by managing the differences internally," said Muhlenweg. "And the additional cost of the cache memory was insignificant, compared to what the integration costs would have been without it."

As for the Microstreamer, Nixdorf will be using it in three other systems whose software already allows streaming.

Cipher introduces mainframe-to-PC connection.

If you have an IBM PC,® XT® or AT® you can now access 9-track tape. Just insert the tape into any Cipher Series 9000 ½-inch Tape Subsystem.™ From there, you can upload and download data directly with your PC.

These subsystems act as low-cost, transportable links to large computers and tape libraries. They allow you to freely access and manipulate data, without accessing the mainframe.

Because they are tape devices, there are no expensive data communication costs, or the physical restrictions of micro-to-mainframe networking.

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CacheTape: The streamer for systems that can't stream.

Adding a streamer to systems that can't stream leaves integrators with a difficult choice. They can modify the software to fit the streamer. Or they can keep the software the same and sacrifice streaming performance.

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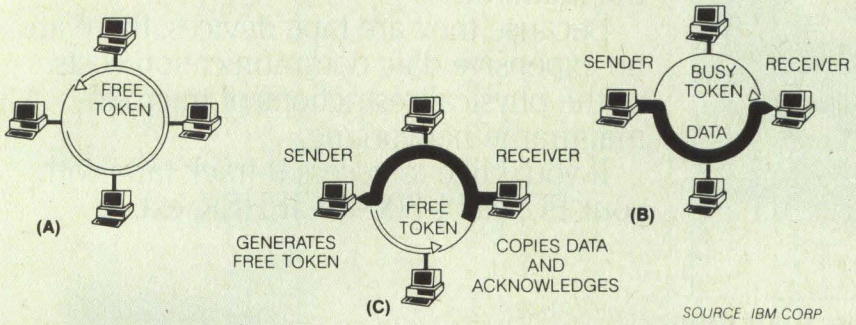
CIRCLE NO. 90 ON INQUIRY CARD

How token-passing access works

The token is an access-granting message that circulates from node to node. A sender on the network waits for a free token to pass by on the ring (A).

The sender inserts data on the token, which then changes to a "busy" signal and continues around the ring until it reaches the data's destination. The receiving node copies the data and acknowledges its receipt (B).

The token is then free to repeat the message-sending process (C). Only one node can control the token at a time.



SOURCE: IBM CORP

tends Myhre. "What's to stop someone, other than IBM, from now developing a System/36 connection, for example?"

Almost immediately following the Token-Ring debut, a handful of networking companies announced intentions to support the token-ring technology. Those vendors include four California companies: Bridge Communications Inc. and 3Com Corp. of Mountain View; Corvus Systems Inc., San Jose; and Nestar Systems Inc., Palo Alto.

Meanwhile, Texas Instruments Inc., Dallas, will market the TMS380 Token-Ring LAN adapter chip set. TI predicts that more than 25 companies will announce over 100 token-ring LAN products by the second quarter of 1986.

Already one step ahead of the game, Proteon Inc., Natick, Mass., announced its ProNet 4, an IBM-compatible 4M-bps token-ring LAN, shortly after the IBM product briefing. "We were glad to see IBM announce their product because it legitimized what we've been doing since 1981," says Charles Johnson, vice president of marketing at Proteon. Other token-ring LANs included in Proteon's ProNET product family are the ProNET-10 and the ProNET-80, a 10M-bps and an 80M-bps LAN, respectively.

Proteon also announced a LAN gateway that connects ProNET-4, or any IEEE 802.5-compatible token-ring network, to the company's own token-ring LANs, Ethernet networks and public, wide-area networks.

And, utilizing the TI chipset, Proteon will offer, at the end of the first quarter of 1986, host interfaces to Multibus, VMEbus and Digital Equipment Corp.'s Unibus and Q-bus.

IBM has made available to independent manufacturers the technical specifications of the Token-Ring Network. But this move, contend some industry analysts, is in the nature of a double-edged sword.

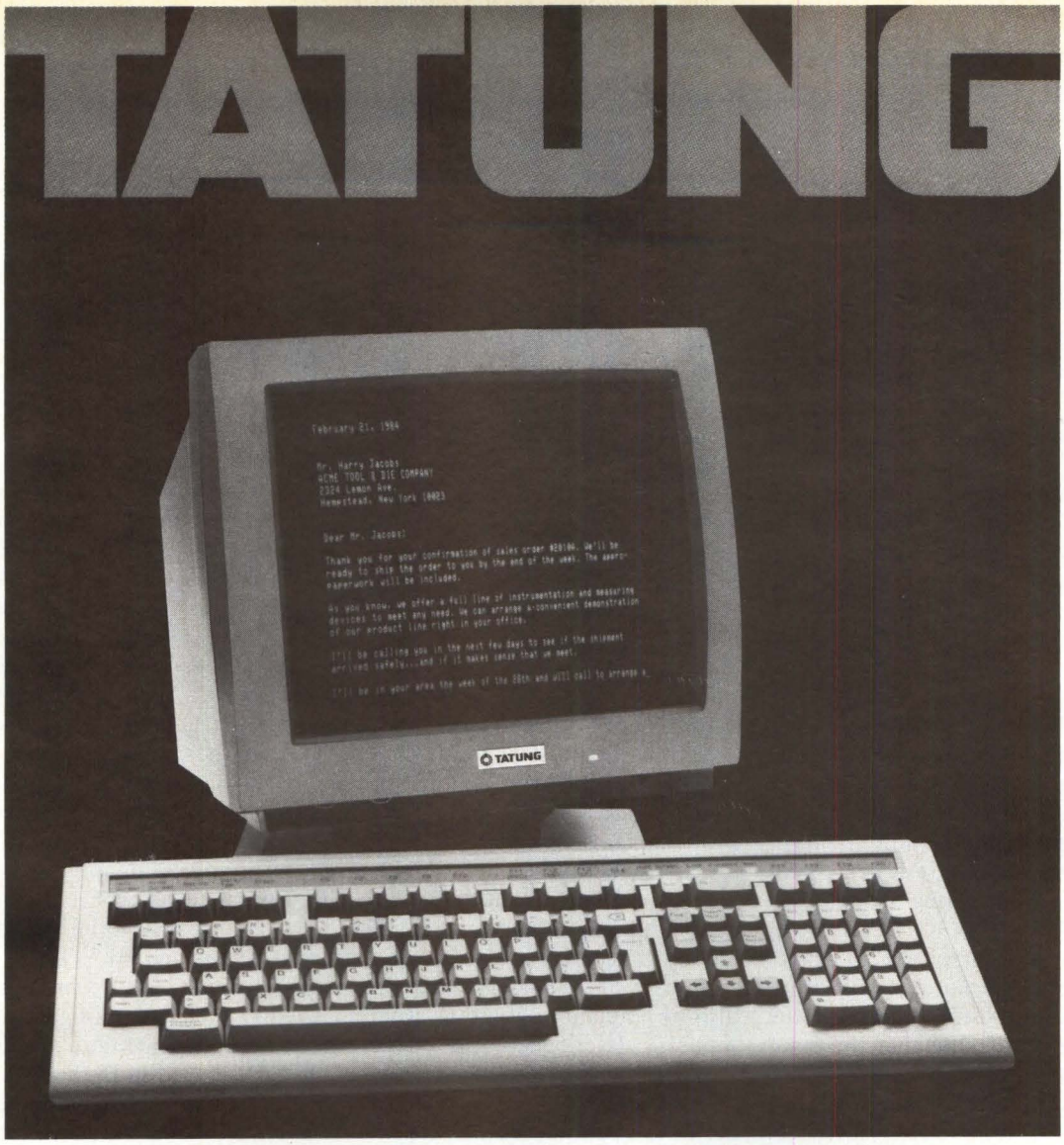
"For IBM, the strategic importance of this product is to ultimately allow them to penetrate the office at the departmental level," says Dixon Doll, president of the DMW Group Inc., a telecommunications consulting company in Ann Arbor, Mich. "And, to accomplish that goal, IBM is stealing a page out of its own book by giving independent manufacturers the go-ahead to develop products that will provide a complete LAN solution—because the company simply recognized that they couldn't do it alone."

IDC's Myhre concurs that the Token-Ring Network provides a good vehicle for IBM to sell more hardware. He also sees the LAN as providing a standard communications base for IBM's multiple operating systems, which by their diversity pose a major obstacle to any IBM attempt to penetrate the department, in the opinion of many analysts.

"The LAN will help migrate the variety of IBM's computer operating systems into a common operating system and serve as a vehicle for porting the operating systems across a network—a capability that IBM currently lacks," contends Myhre. "I see it as part of IBM's overall scheme to corral the PC environment back into the larger mainframe base." At a time when users are crying for solutions that will allow their computer systems to communicate, IBM's token-ring announcement creates the impetus for gateway products and "gives users a warm feeling that their IBM investments are protected," says Mhyre. □

EQUATORIAL OFFERS EARTH-STATION TRIAL

Equatorial Communications Co., Mountain View, Calif., is offering a free, 60-day trial of a micro-earth-station network in an effort to convince hesitant customers that satellite communications is a reliable, cost-effective way of distributing data. With Equatorial's 24-inch-diameter earth stations, users can transmit data at up to 1,200 bits per second (bps) through Equatorial's satellite transponders as part of its "Step Ahead" program. Equatorial will provide, at no charge, all network-design and installation assistance needed to place the earth stations at requested customer sites.



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CIRCLE NO. 26 ON INQUIRY CARD

International group prepares worldwide CAD/CAM standard

Keith Jones, European Editor

System integrators on both sides of the Atlantic are cooperating to achieve a worldwide standard for the exhange of data between the computer aided design and computer aided manufacturing systems of different vendors.

A proposed universal standard called STEP—Standard for the Exchange of Product data—is intended to eventually replace standards that have been separately defined in the United States, France and West Germany. An initial definition of the requirements of STEP adherence has just been published by a subcommittee of the International Standards Organization, which is currently preparing STEP.

Subcommittee chairman Bradford Smith expects a working draft by the end of 1986, believing that the standard should be sufficiently stable by then for CAD/CAM system vendors to begin implementing STEP software. But he also acknowledges that wide use of STEP is unlikely before the end of the decade because of the ongoing substantial use of files employing the ANSI standard, Initial Graphics Exchange Specification (IGES), France's Standard d'Echange et de Transfert (SET) and West Germany's Verein Deutscher Automobilbauer—Flächen Schnittstelle (VDA-FS).

Smith explains that STEP will be influenced by all these standards, but will go much further. "Our goal is the complete representation of any product from an ashtray to an airplane as a CAD/CAM database, in neutral format, for data exchange between different CAD/CAM systems. A STEP file should be able to tell a factory all the information needed to build the project."

Smith, the head of the CAD/CAM research group at the National Bureau of Standards (NBS), Gaithersburg, Md., explains that existing standards are restricted to the definition of wireframe models. In contrast, STEP will aim at defining constructive solid models by a combination of geometric primitives like cylinders and cones and also by boundary definition, wherein a model is described by the boundaries that enclose it.

Separate aspects of the STEP project have been assigned to representative groups to hasten the project's completion. A U.S. group is defining the different types of data elements that need to be transferred between systems. A British group is looking at the entities that will describe data elements, and French contributors are working on the format of files that will transfer data between systems. A German group is working on the required documentation.

Dr. Richard Schuster, manager of CAD/CAM systems at the car manufacturer BMW AG, Munich, acknowledges that STEP will differ radically from the German VDA-FS standard. He notes that VDA-FS is used primarily to represent the sculptured surfaces in car design. "STEP will be a new approach," he says, "with new entities, structures and formats." He adds that the graphical kernel system, the West German-originated interface between graphics systems, now an ISO standard, only defines the lowest levels of graphical data and cannot describe complete objects. It is, therefore, not an alternative to IGES, VDA-FS, SET or the proposed STEP.

Schuster also represents within the ISO STEP working group the West German national standards body, DIN, based in Berlin.

Howard Mason, who represents the British Standards Institution of London within the STEP working group, believes an international standard like STEP is essential and that the existing standards will migrate toward STEP.

But Guy Stil, of the French national standards body Association Francaise de Normalization, Paris, is somewhat skeptical about STEP's acceptability by the European aircraft industry. He points to the growing use of SET in pan-European aircraft development projects. "There will be thousands of drawings in SET format by the time STEP is ready," Stil cautions. "It will be a big problem translating them."

However, Philip Diacono, manager of the systems technology center of Intergraph Ltd., Newbury, England, believes that his company and other CAD/CAM system vendors will be obliged to support STEP, if the user community demands it, in the same way they support existing standards.

Klaus Behrendt, manager of application product marketing at Computervision GmbH, Munich, concludes, "STEP could kill everything else."□

Standards threatened by STEP

Major data exchange standards may be superseded by STEP, the Standard for the Exchange of Product data. Those major exchange standards are:

- **IGES:** Initial Graphics Exchange Specification. Emerged in 1979. Version 1.0 is now ANSI standard Y14.26M. It was followed in 1982 by Version 2.0 and in 1985 by Version 3.0. Version 3.0 is scheduled to become a new ANSI standard.
- **VDA-FS:** Verein Deutscher Automobilbauer—Flächen Schnittstelle (Association of German Automobile Builders—Surface Interface). Adopted in 1984 and now a West German national standard, DIN 66301.
- **SET:** Standard d'Echange et de Transfert. Released in 1984, SET is now a draft French national standard, Z68300.

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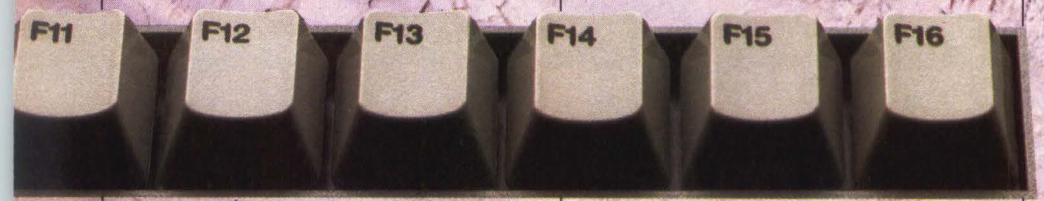

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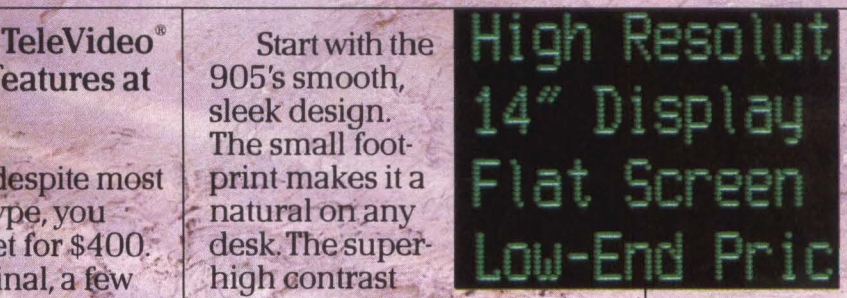

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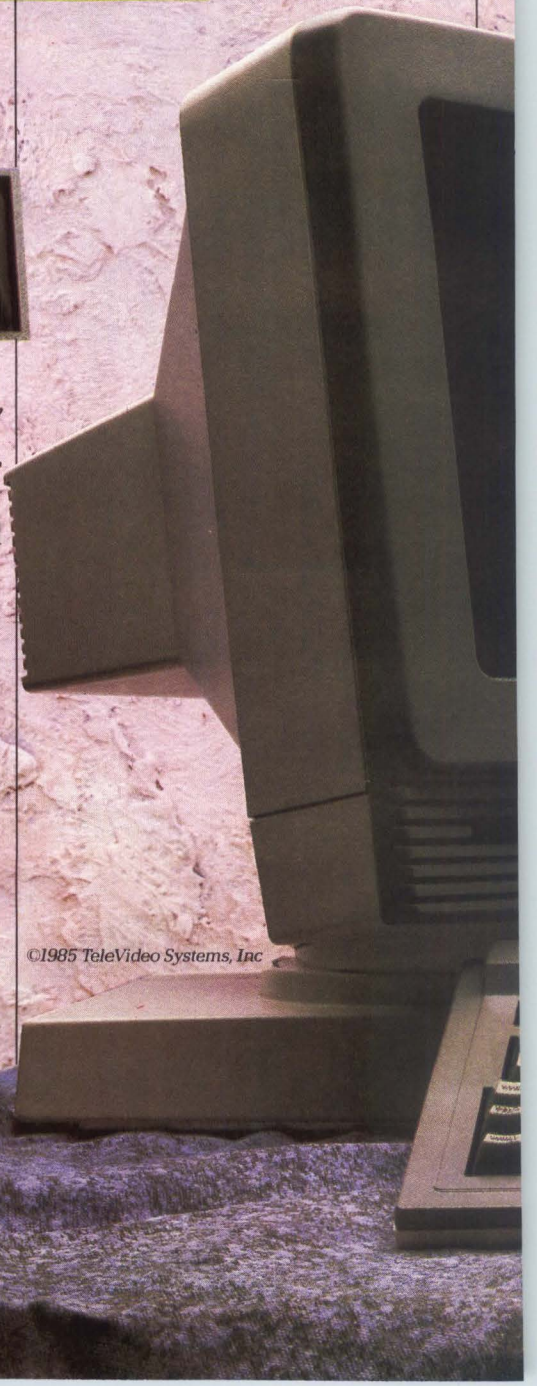

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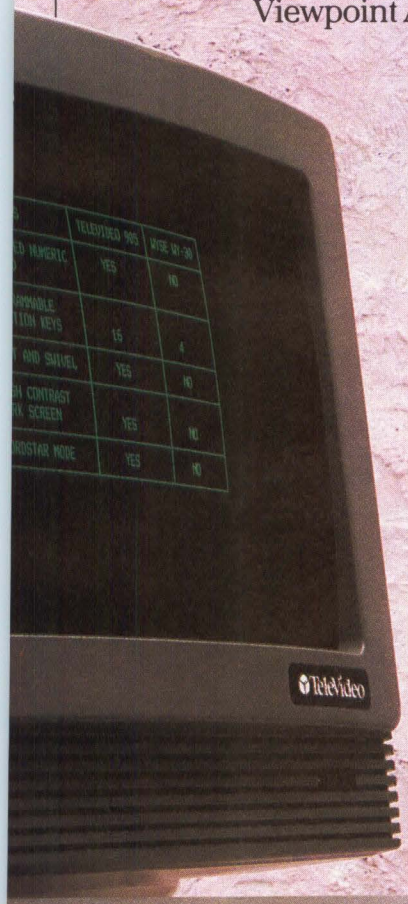
TELEVIDEO 905 VS. WYSE WY-30

FEATURES	TELEVIDEO 905	WYSE WY-30
ENHANCED NUMERIC KEYPAD	YES	NO
PROGRAMMABLE FUNCTION KEYS	16	4
TILT AND SWIVEL	YES	NO
HIGH CONTRAST DARK SCREEN	YES	NO
®WORDSTAR MODE	YES	NO



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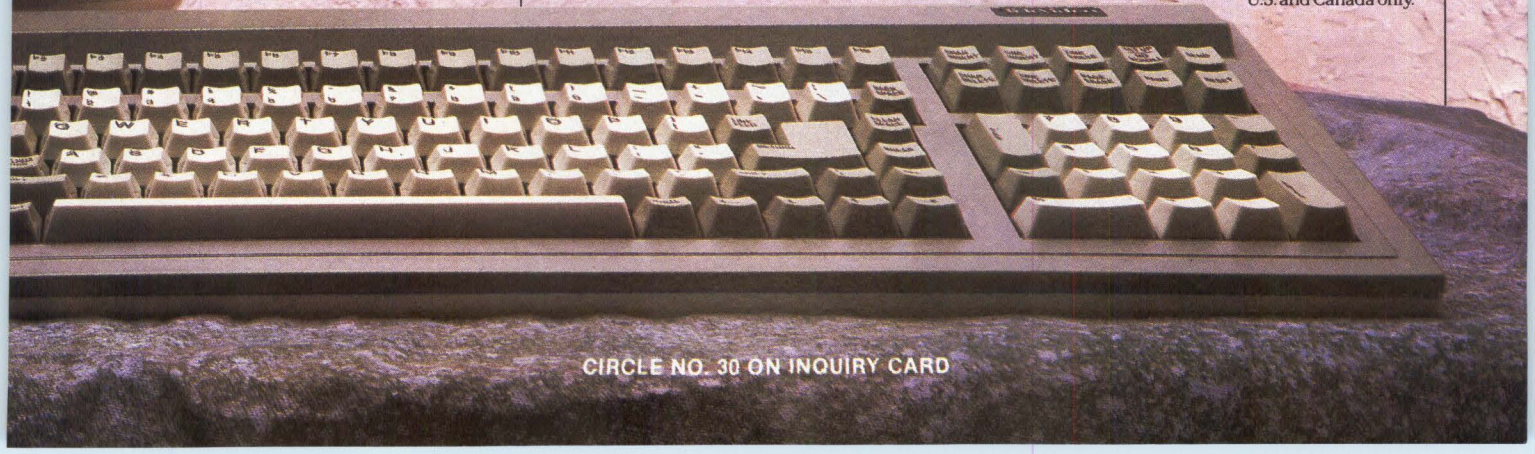

CIRCLE NO. 30 ON INQUIRY CARD

THE GREATEST ADVANCE IN COMPANY NETWORKING SINCE THE WATER COOLER.

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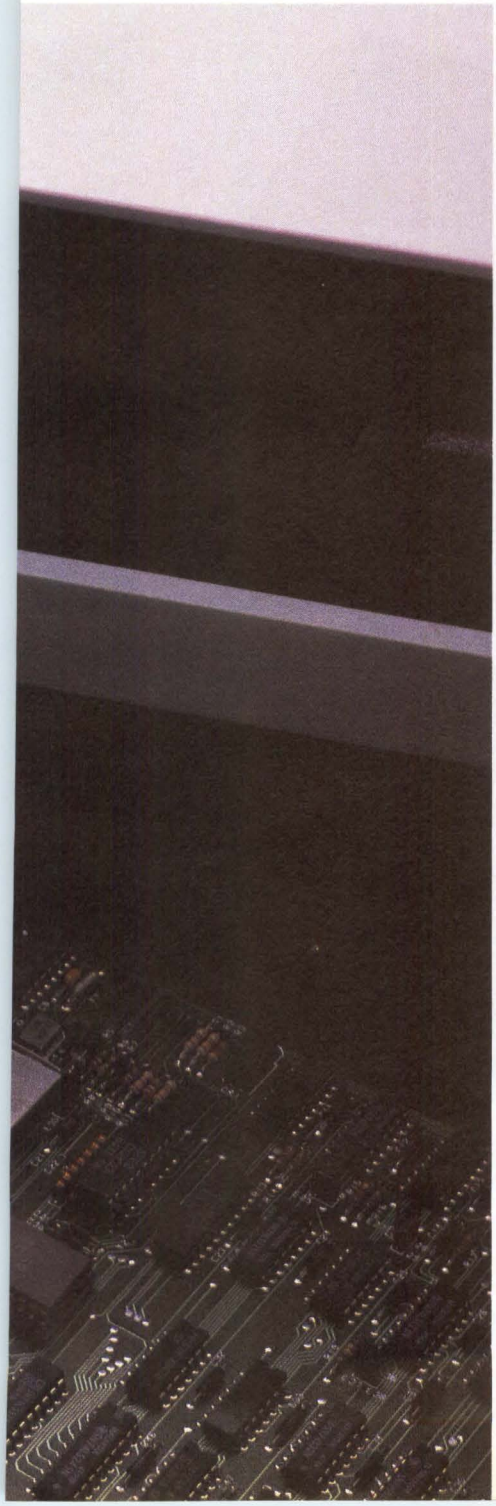
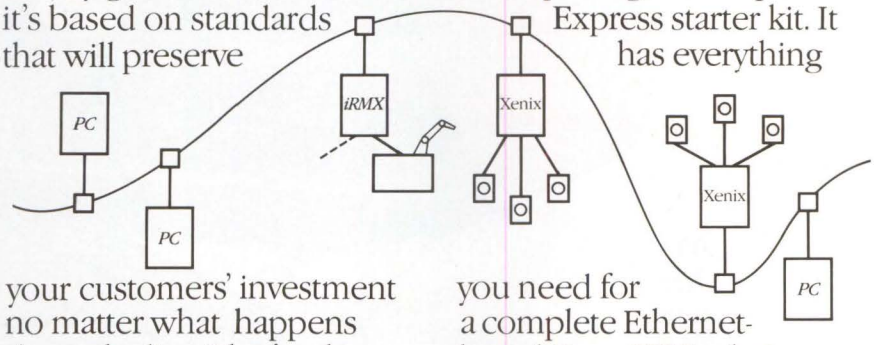


So by using his PC, the president of a company can get real time data out of his factory control manager's iRMX system real fast. And just as easily, pull a file from the lab where they use multi-user systems.

In effect, OpenNET lets iRMX, XENIX and MS-DOS speak a common language. Which opens up a better line of communication across the entire network.

But better communication is only good for business if it's based on standards that will preserve your customers' investment no matter what happens down the line. That's why OpenNET was designed to meet standards set by ISO, IEEE and IBM.



For instance, based on the ISO 7 layer model, OpenNET offers the most complete product solution at every level of integration. Layers one and two are supported by Intel's IEEE 802.3 Ethernet board; three and four by our iNA 960 Transport Software (ISO 8073); and layers five, six and seven are covered by XENIX, iRMX, and Microsoft networking software, whose software protocols were developed by Microsoft, IBM and Intel.

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Even as standards and technology grow and change, your customers' systems can, too. Because OpenNET is modular, it will support emerging standards like MAP. At every level with both hardware and software products.

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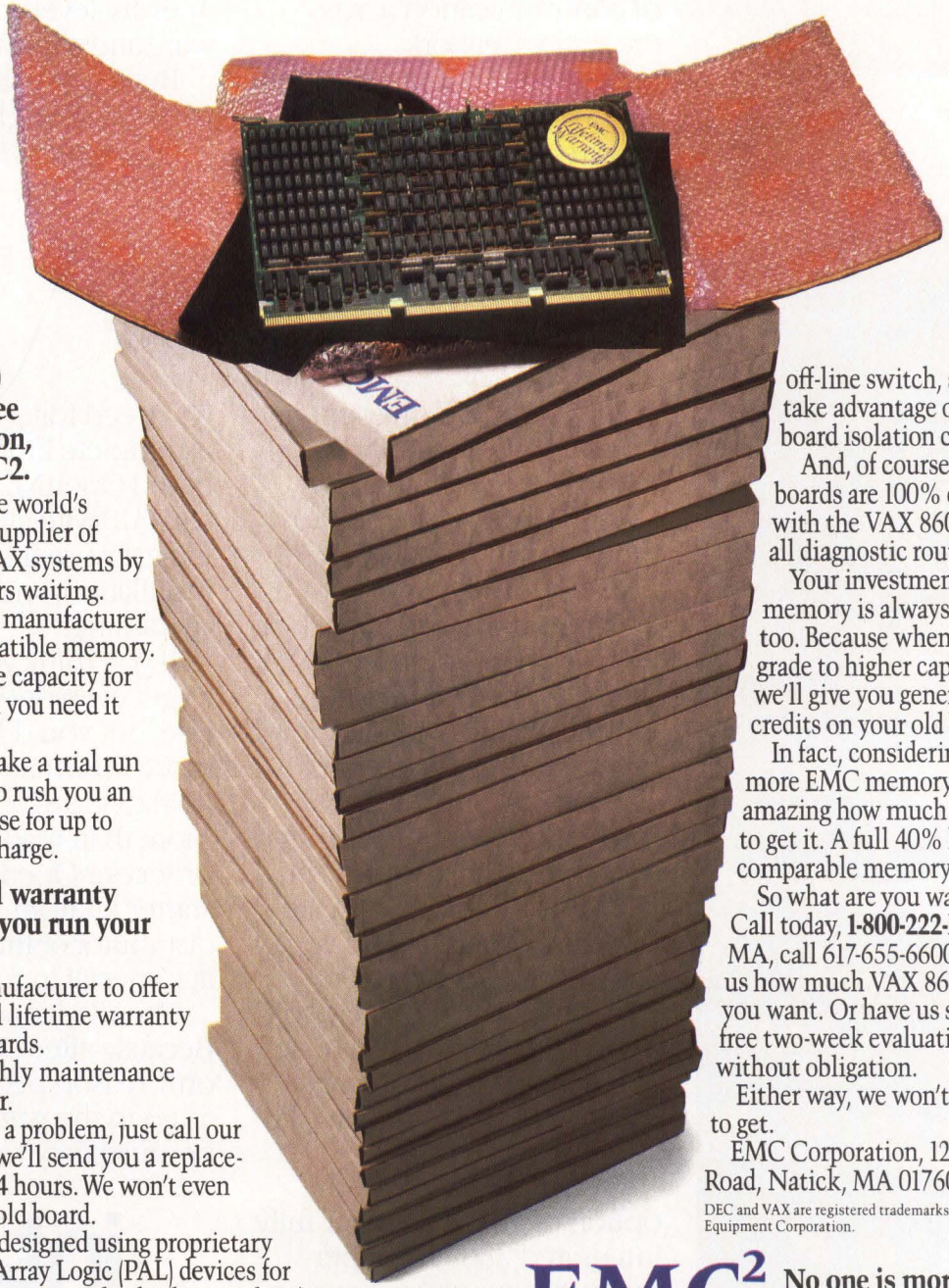

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CIRCLE NO. 32 ON INQUIRY CARD

SOFTWARE MAKER CREATES MANUALS IN-HOUSE

MC68010 microprocessor-based electronic publishing system cuts time and cost of producing technical documentation

George D. Potter, Interleaf Inc.

Until 1984, Marcam Data Systems Corp., a 4-year-old Needham, Mass., software company, used an external typesetter to create, lay out and draw the artwork for its software manuals. Marcam, which offers enhancements of IBM Corp.'s manufacturing accounting and production information-control system (MAPICS), prints an operators' manual and a programmers' logic manual for each of seven enhancement programs. What's more, the company produces a separate version of MAPICS' seven programs for each system the software runs on—IBM's System/34, /36 and /38 minicomputers.

In addition, the company's software engineers were responsible not only for product development but also for writing the documentation for those products—all under tight deadlines. As a result, manuals were too expensive to produce and took too long to reach customers.

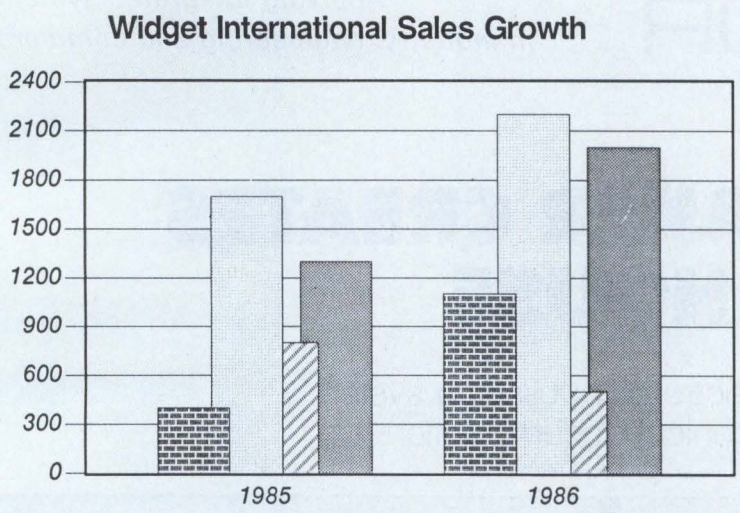
In August 1984, Marcam began looking for a more efficient document-production method. At the same time, the company hired Joan Smith as a full-time technical documentation manager. Smith, along with the marketing communications manager and the vice president of development, evaluated several offerings before choosing an electronic publishing system from Interleaf Inc., Cambridge, Mass.

Marcam chose the Interleaf system for several reasons. For one thing, says Smith, the other systems Marcam evaluated were glorified cut-and-paste word-processing systems. "The other companies said, 'If you take our system and add this printer and that peripheral, we can sort of do it,'" Smith says. "But Interleaf already had a solution specifically tailored to our needs—technical documentation."

The electronic publishing system allows Marcam to produce typeset-quality, illustrated documents less expensively and faster than could an external typesetter (see Table). In addition, the company can create documents at a single workstation, with one writer having full control over book design and quality. "It's not quite the same as phototypesetting," says Smith, "but when we sent the books out for production, there was no way to control the overall quality. Now that we're publishing them ourselves, the quality has greatly improved."

The company was looking for a system that would eliminate the costly and time-consuming

A technical writer at Marcam *views, edits and illustrates documentation on the screen of Interleaf's electronic publishing system.*



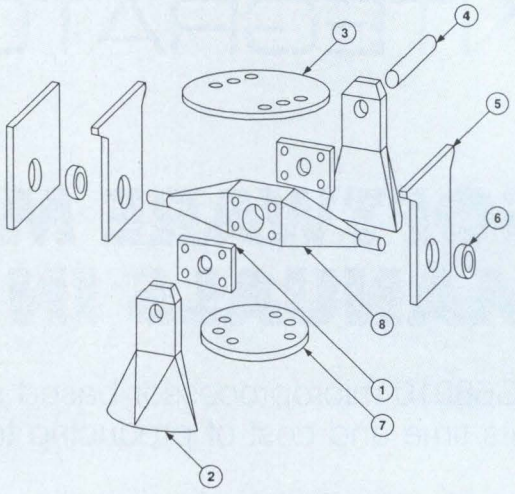


Figure 3–2. Widget Assembly

The Interleaf electronic publishing system *allows users to create business charts (left) and free-form drawings (right) and insert them just as they will appear in the printed document.*

back-and-forth process of using external graphics artists and typesetters. And, as a relatively new company with a limited budget, Marcam wanted a system that would cost around $50,000. What's more, the Interleaf system could be networked with the technical writing department's already-installed IBM PC. The technical writing department now has three writers who use three System/38s and share the PC, the electronic publishing system and a laser printer. A local area network connects the various components. The Interleaf system and the printer are located in an office across the hall from the IBM PC. The System/38s are approximately 40 feet down the hall.

Despite the installation of the Interleaf system, the department still uses System/38s for initial documentation input. The technical writers then download the documentation to the PC and then from the PC to the Interleaf system. They could input text directly on the Interleaf system if they so desired, but they use the System/38 because it is the same type of system that the Marcam programmers use to write software. As a result, the technical writers can easily refer to the programs they are documenting, using the System/38's text-management software.

Marcam could not afford to buy three Interleaf workstations—one for each technical writer. However, at $37,500, plus $14,500 for a laser printer, a single system fell within Marcam's price range.

The Interleaf system integrates advanced multiple-font word processing, business graphics, diagraming, laser printing and, in high-end configurations, a tabletop scanner. The scanner and its associated memory jacks up the system's total price to around $120,000. However, Marcam cannot justify the cost of a scanner, so the writers "draw" the artwork using the graphics tools that come with the Interleaf system.

Marcam outputs the drawings to an Interleaf laser printer with a controller from Imagen Corp. The printer provides multiple-font text and graphics and print speeds as high as 8 pages per minute (ppm) vs. a daisywheel's 1 ppm. Laser printers have another advantage over daisywheels, especially in publishing applications: Because they do not use printheads, lasers are not limited to a single typeface or point size.

The Interleaf system runs under the UNIX operating system on 32-bit Motorola Inc. MC68010 microprocessor-based workstations from Apollo Computer Inc. or Sun Microsystems Inc. or on the Digital Equipment Corp. VAXstation II. It also offers an icon-based user interface, a mouse and a "what-you-see-is-what-you-get" display on a high-resolution bit-mapped screen. These features virtually eliminate the use of keyboard commands and make it easier for inexperienced users to learn the system. Smith, a computer novice when the system was installed, says, "After a day and a half, I felt completely comfortable working with the machine." Smith claims there were no problems with the installation, training and support for the system, which Interleaf provided, and that re-

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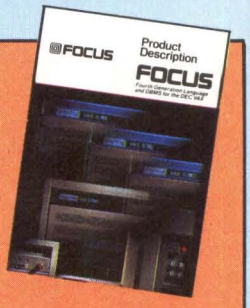

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CIRCLE NO. 33 ON INQUIRY CARD

sponse times for the few times the system has broken down have been within a day.

Writers control design, quality

Before Marcam installed the system, a software engineer would input the manuals on a System/38 and back them up on flexible disks on an IBM PC. The company then delivered these disks to a printer for typesetting and production. At the same time, Marcam sent the printing company screens and reports to be photographed and placed in the software manuals. The next six to eight weeks were spent in a long, expensive and inefficient process.

First, the printing company's art department created the artwork and did the manual typesetting. To produce art, the department would photograph screens and reports and drop in gray screens shaped like computer screens (indicating screens) or like computer paper (indicating reports). For logic manuals, the artwork included several flowcharts rather than screens or reports.

The printer then delivered the completed artwork to Marcam in galley form. Marcam employees proofread the galleys and made a dummy of the manual from them. From these dummies, Marcam produced mechanical layouts of the pages, which Marcam employees would again proofread. Marcam then incorporated any corrections of the mechanicals onto a "salt," or preprint, of the manual. After Marcam proofread this salt print, the printer produced the manual. However, extensive corrections would require the printer to produce another salt,

How an electronic publishing system reduces costs

Most manuals that Marcam Data Systems Corp. has created on the Interleaf Inc. electronic publishing system are larger than those the company created before installing the Interleaf system. As a result, it is not possible to compare costs precisely. Nevertheless, as the table illustrates, significant cost savings have resulted from using the system.

The cost estimates shown assume that the "old" printing process, after the writing was completed, required two weeks of a writer's time for proofreading. Marcam estimates that using the Interleaf system requires five weeks of the writer's time—from start to finish—for a typical manual. This extra time is included in the "new method" estimates for reference manuals by allocating the writer's time at $20 per hour, 40 hours per week to the "art and type" category.

For each manual, the actual Interleaf time used is specified, minus the two weeks for proofreading used in the old method. For example, reference manual C is long and required eight weeks of Interleaf time. Subtracting the two weeks that would have been used by the old method anyway, manual C would have required six extra weeks of the writer's attention.

Old Method - Reference manual A, 300 pages, 200 copies

1. Art and Type	$11,043.00——>	bulk of cost
2. Printing of 200 Copies	4,180.00	typesetting
		and art
3. Total cost	$15,223.00	
4. Cost per copy	76.11	

New Method - Reference manual B, 500 pages, 1,000 copies

1. Art and Type	$ 2,400.00	(3 weeks)
2. Printing of 1,000 copies	5,540.00	
3. Total cost	$ 7,940.00	
4. Cost per copy	7.94	

New Method - Reference manual C, 1,000 pages, 200 copies

1. Art and Type	$ 4,800.00	
2. Printing of 200 copies	8,984.00	
3. Total cost	$13,784.00	
4. Cost per copy	68.92	

New Method - Reference manual D, 425 pages, 200 copies

1. Art and Type	$ 2,400.00	(3 weeks)
2. Printing of 200 copies	3,435.00	
3. Total cost	$ 5,835.00	
4. Cost per copy	29.18	

Old Method - Logic manual A, 300 pages, 200 copies

1. Art and Type	$13,250.00
2. Printing of 200 copies	4,180.00
3. Total cost	$17,430.00
4. Cost per copy	87.15

New Method — Logic manual B, 260 pages, 200 copies

1. Art and Type	$ 0.00	(0 weeks)
2. Printing of 200 copies	2,148.00	
3. Total cost	2,148.00	
4. Cost per copy	10.47	

which would again be proofread before the manual finally could be printed.

Revisions during this process—the back-and-forth with outside typesetters, proofing and correcting galleys, cutting and pasting the artwork into the dummies—cost Marcam $100 to $800 per manual, depending on the number of changes required. Flowcharts were more complicated and hence more expensive and time-consuming to produce than were screens and reports. It typically took the printing company's art department five weeks to prepare the flowcharts for one logic manual. In contrast, a similar number of flowcharts for a comparable manual takes four days on the Interleaf machine.

System reduces lead time

The Interleaf machine reduced Marcam's six- to eight-week typesetting process to four or five weeks. Before installing the Interleaf system, each of Marcam's manuals was a one-person project, and that is still the case. However, the system saves time by reducing the lead time for each manual rather than by reducing the number of people involved. Smith emphasizes that the company now meets its deadlines. Using the system, she adds, has resulted in significant cost savings. For example, the company has reduced the per-copy cost of 200 300-page manuals by as much as $70—a $14,000 savings.

To produce a manual on the system, a technical writer first inputs the text and inserts codes indicating paragraphs, headings and other units of text. This process usually takes about a day.

The writer next downloads the manual from the System/38 to the IBM PC, which also provides a flexible disk backup. The PC in turn downloads the information to the Interleaf machine. A program on the Interleaf system converts the ASCII text from the System/38 into documents. The converted documents include pre-defined components that the writer indicated earlier by inserting codes. For example, if a paragraph is preceded by the code ";id;" and followed by ";ql;," the program places the text enclosed in those codes into an "indent" component with specially defined attributes. Such attributes might indicate that the left margin should measure 3.05 inches; the right margin, 0.20 inches. If the writer does not wish to insert codes, formatting can be done on the screen after the document has been transferred.

The next step, in which the writer creates drawings for the manuals, typically takes two to three weeks. The writer prints a copy of the screens and reports to be used in the document and manually draws them on the screen using Interleaf's diagraming tools. To create a diagram, a writer selects a series of graphics components, such as lines and circles, from a menu and positions them on the screen. The writer can electronically manipulate, size and position the graphics in the document.

Marcam's writers have found drawing diagrams on the screen to be tedious, but drawing them is less expensive than photographing them with a scanner. The scanner takes an electronic "picture" of anything—a drawing or a photograph, for example—as large as 8½ by 11 inches and converts that picture into binary digits that the computer can store on disk, manipulate on the screen and send to the laser printer. The scanner also allows sizing, rotation and distortion of the scanned photos.

Next, the writer spends approximately two weeks inserting the screens and reports into the appropriate places in the manual, editing and going over the text to make sure the manual looks right. The document is then printed.

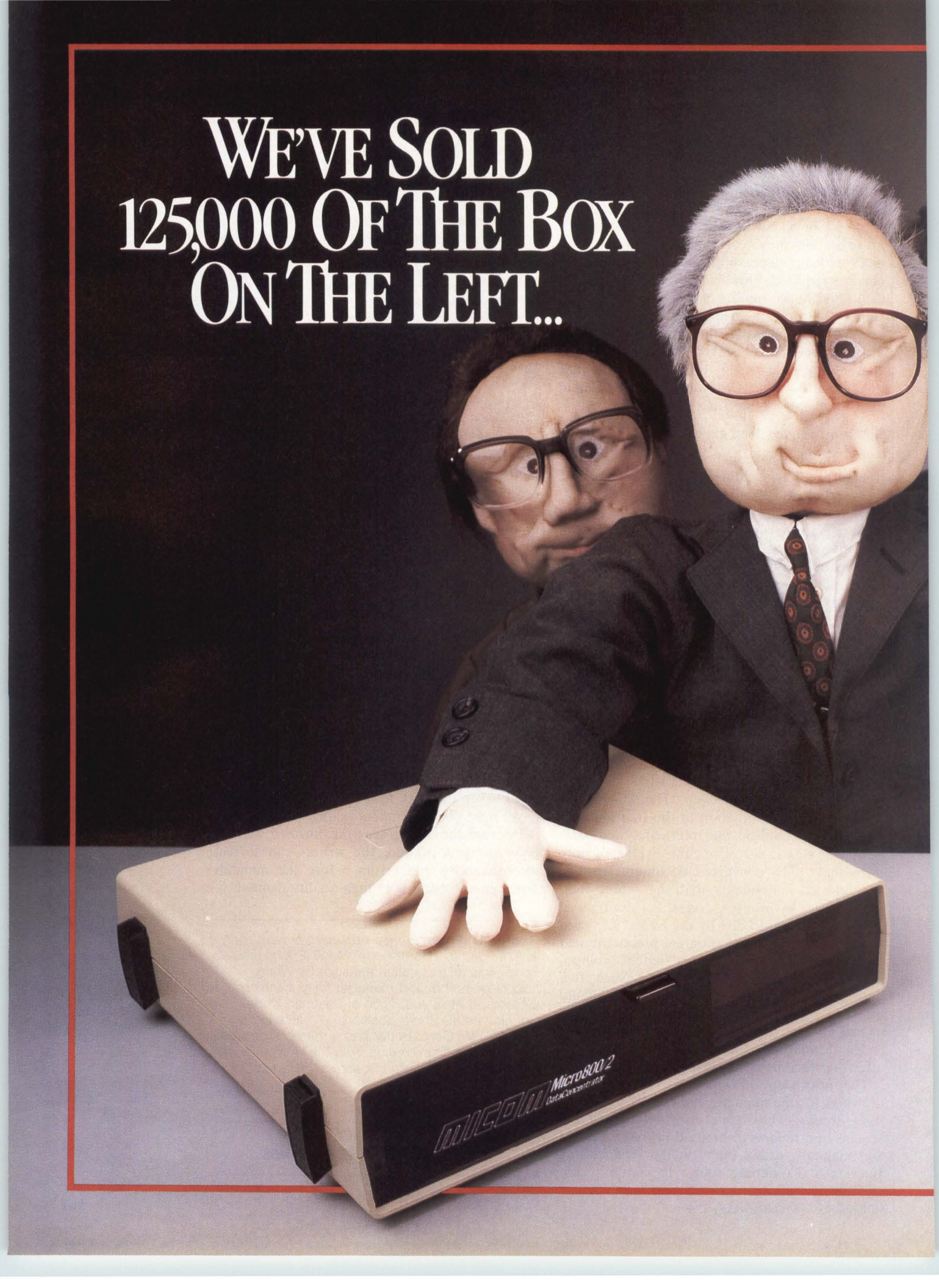
Because the writer sees the finished manual before it gets printed, the writers can correct inconsistencies and errors before the manuals are printed, resulting in high-quality manuals.□

Spec summary

- **Model:** Electronic publishing system
- **Manufacturer:** Interleaf Inc., 10 Canal Park, Cambridge, Mass. 02141
- **Operating system:** UNIX
- **Software:** TPS technical publishing software
- **Workstations:** Apollo Computer Inc.'s Domain, Digital Equipment Corp.'s VAXstation II, Sun Microsystems Inc.'s SunStation
- **Microprocessor:** 32-bit Motorola Inc. MC68010 (Apollo, Sun), MicroVAX (DEC)
- **Peripherals supported:** Imagen Corp.'s and Dataproducts Corp.'s laser printers, ImagiTex Corp.'s optical scanners

George D. Potter is vice president of marketing at Interleaf Inc., Cambridge, Mass. Previously, Potter was district sales manager for Wang Laboratories Inc. and manager for publishing systems at Atex, a division of Eastman Kodak Co. He has also held positions in marketing and sales at IBM Corp. Potter has a master's degree in business administration from the University of Pennsylvania's Wharton School in Philadelphia.

Interest Quotient (Circle One)
High 456 Medium 457 Low 458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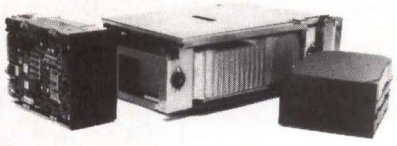

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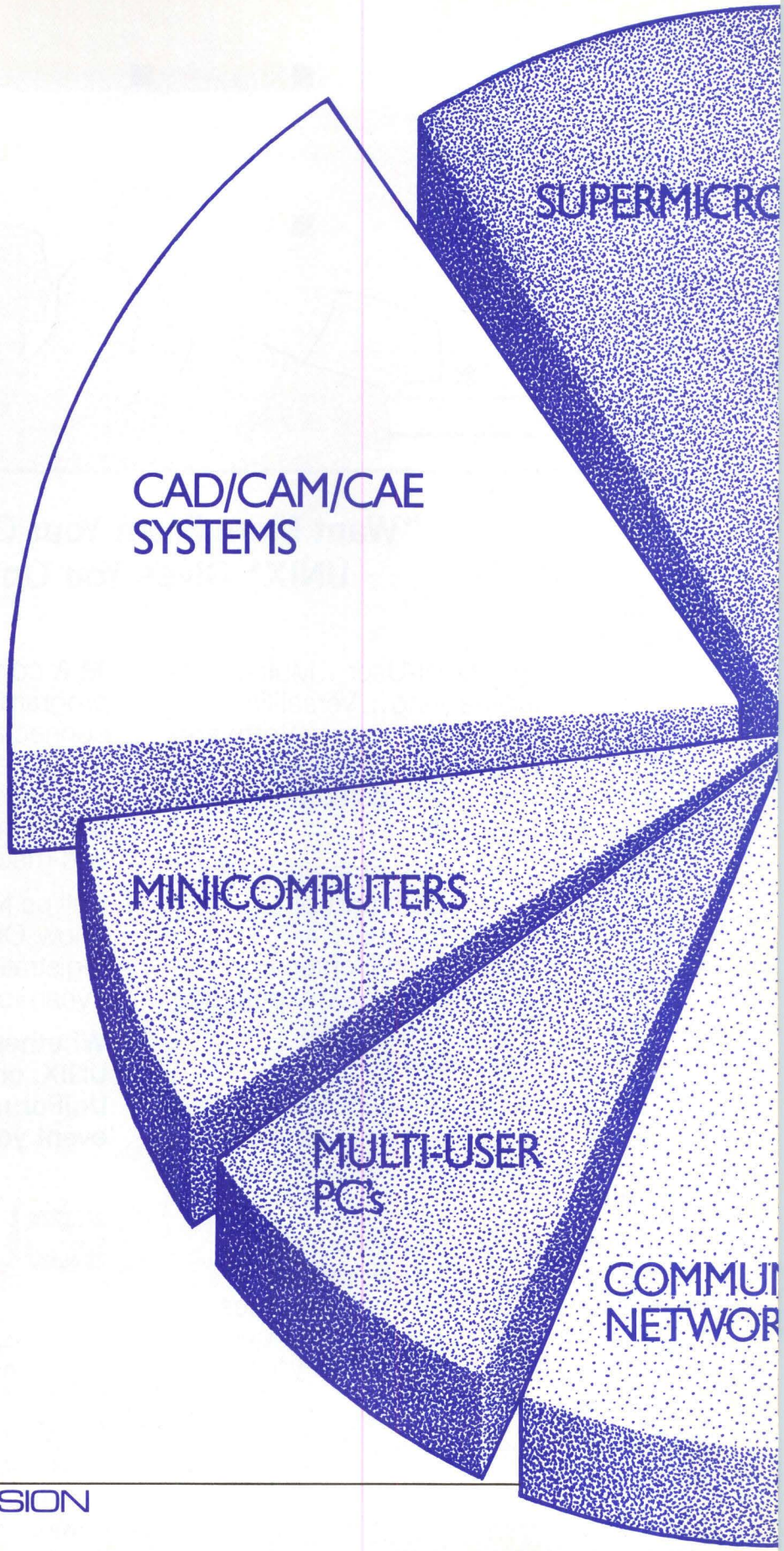

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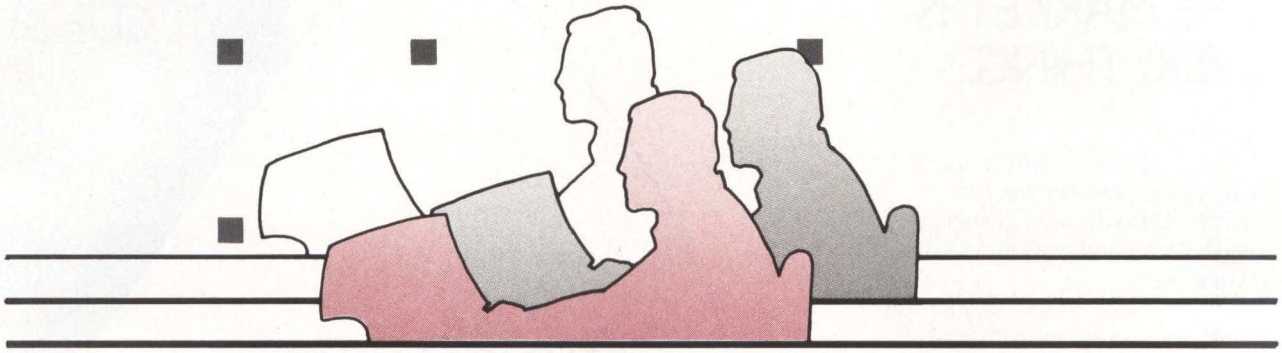

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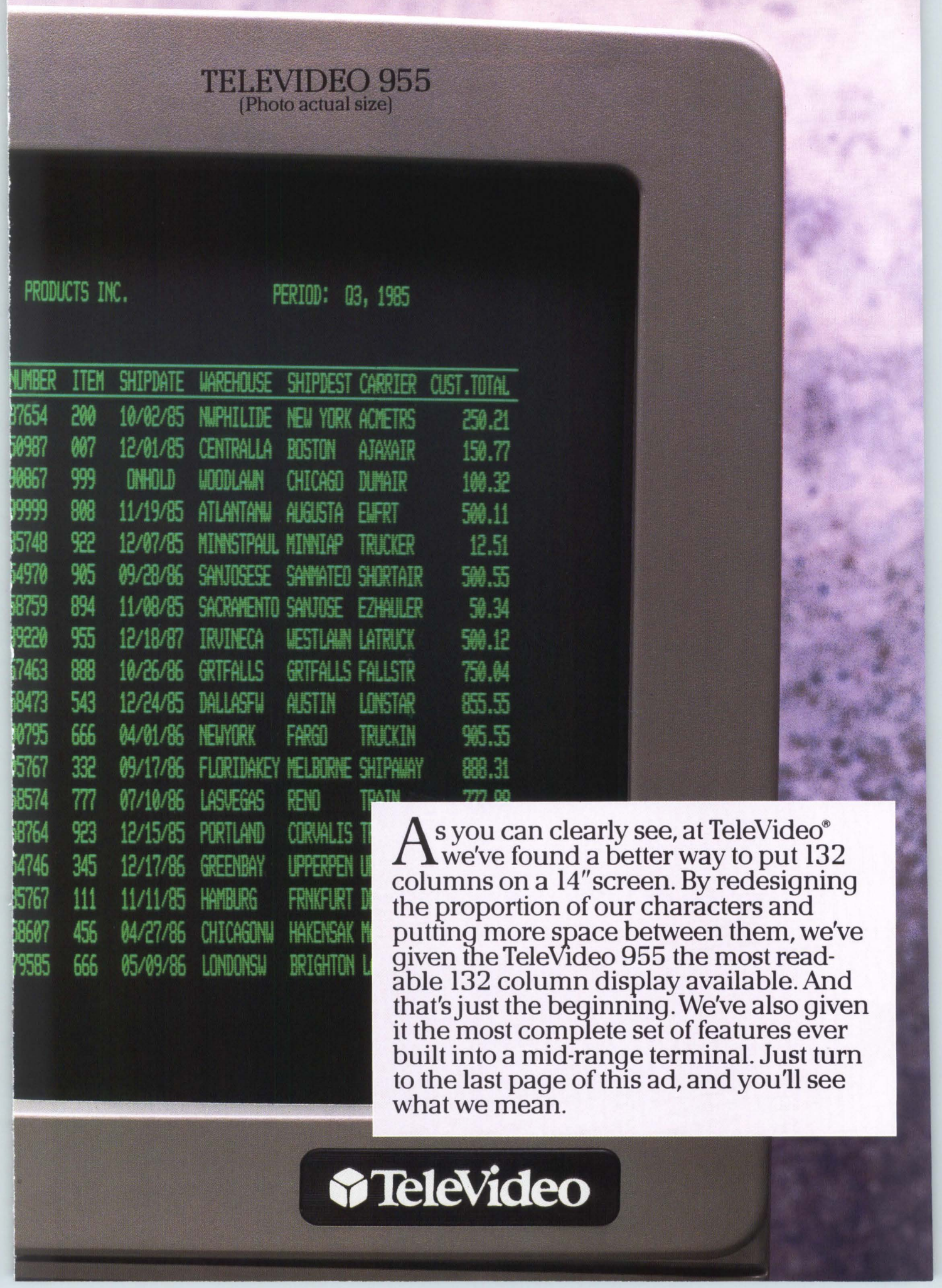
CIRCLE NO. 37 ON INQUIRY CARD

An eye-opening comparison between two $600 terminals.

TELEVIDEO 955

(Photo actual size)



As you can clearly see, at TeleVideo® we've found a better way to put 132 columns on a 14" screen. By redesigning the proportion of our characters and putting more space between them, we've given the TeleVideo 955 the most readable 132 column display available. And that's just the beginning. We've also given it the most complete set of features ever built into a mid-range terminal. Just turn to the last page of this ad, and you'll see what we mean.

TeleVideo

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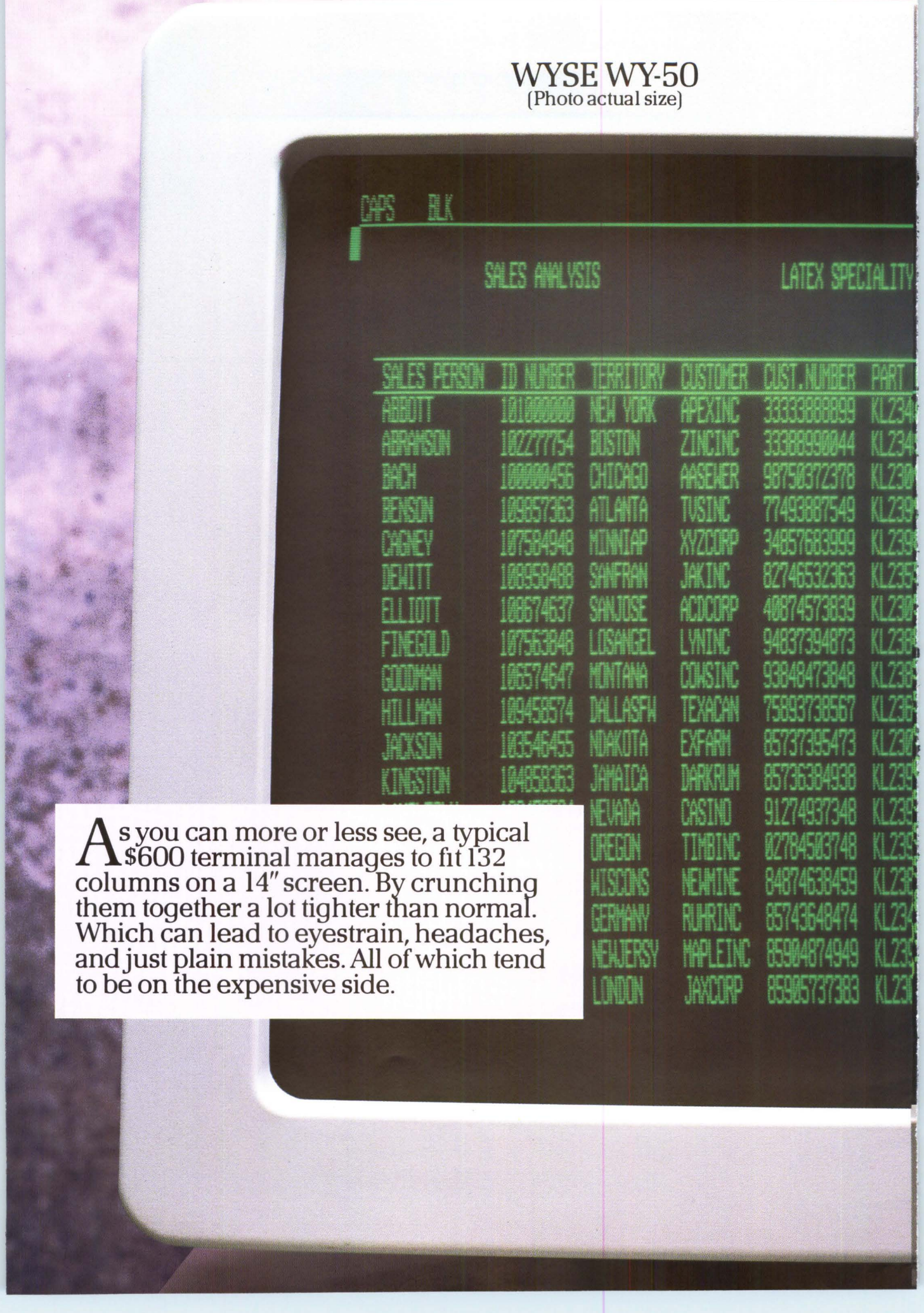

As you can more or less see, a typical $600 terminal manages to fit 132 columns on a 14" screen. By crunching them together a lot tighter than normal. Which can lead to eyestrain, headaches, and just plain mistakes. All of which tend to be on the expensive side.

Most 132 column terminals are designed to crunch a lot of numbers.

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TELEVIDEO 955 VS. WYSE WY-50 AND WY-50+			
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High contrast dark screen	Yes	No	No
Programmable function keys	16/64	16/32	16/32
Dynamically allocated function key memory	512 Bytes	128 Bytes	128 Bytes
Maximum bytes per function key	Unlimited	4	4
Graphics upgrade	Yes	No	No
User ROM Slot	Yes	No	No
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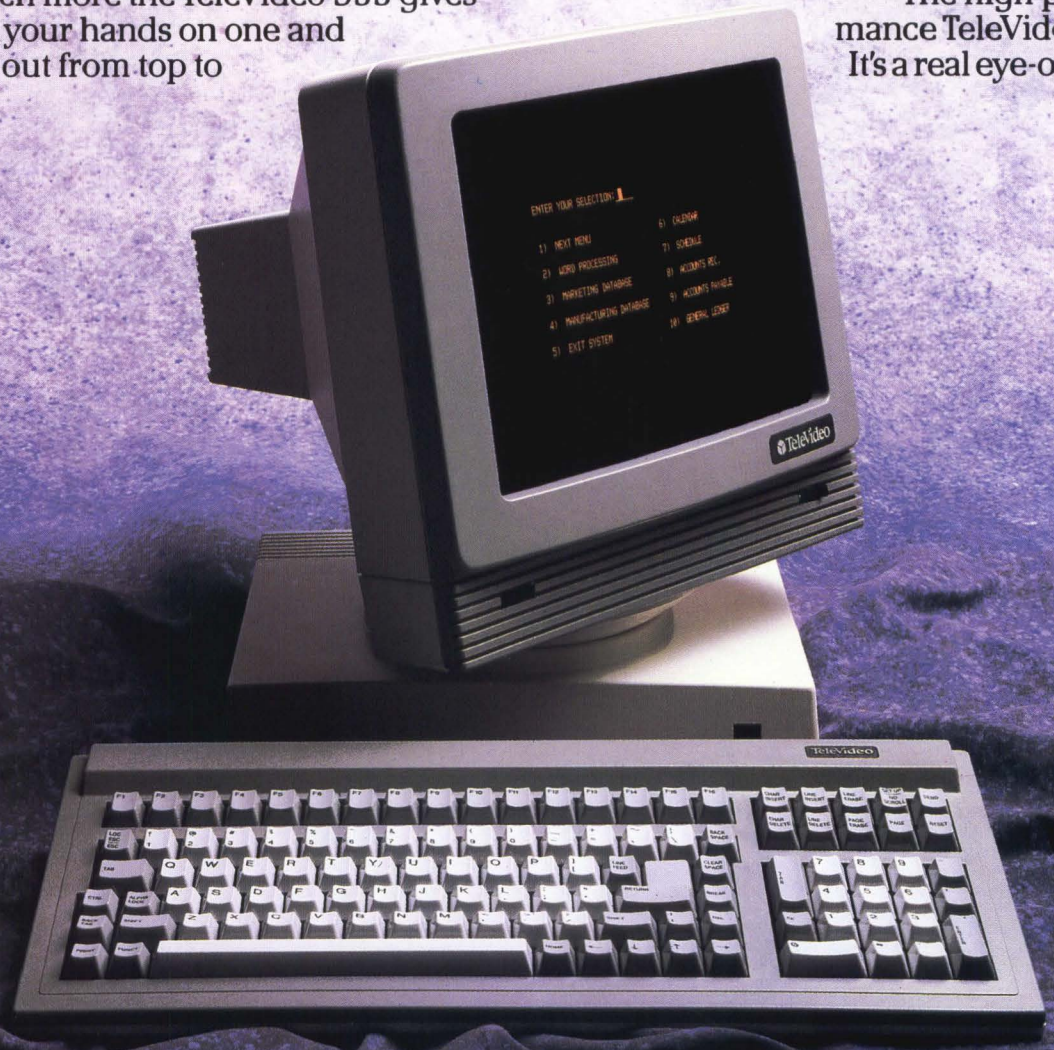

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FEATURE HIGHLIGHTS

p. 69 . . . . . Reshaping UNIX

p. 102 . . . . . Thermal printing surges

p. 117 . . . . . UniForum preview

32-BIT CHIPS RESHAPE UNIX INDUSTRY 69

The UNIX market is changing and the operating system, itself, is being modified to make it useful in applications not remotely related to those for which it was originally designed. The big battle now is among the various 80286-based machines, but it will be equally interesting to see how the new 32-bit chips affect the market, as well as the operating system.

PC-UNIX LINKS PENETRATE OFFICE 83

As organizations begin to outgrow their personal computers and start to crave the power of larger UNIX machines, VARs and system integrators face a tough challenge: how to get UNIX into markets saturated with PC-DOS machines. One solution is the PC-UNIX link—software that enables users to pass data back and forth between PC-DOS and UNIX systems.

MICROS GAIN SIGHT WITH IMAGE BOARDS. 92

Add-in/add-on image-processing products range from basic "frame-grabber" boards without processing software to add-on boards and boxes with integral power supplies. System integrators can now configure a $10,000, personal computer-based image-processing system that rivals a $20,000-to-$30,000 standalone system in performance.

THERMAL PRINTING HEATS UP COLOR HARD-COPY MARKET 102

Thermal, ink-jet and color electrostatic technologies have long competed in the hard-copy market. But recent improvements in electromechanical design, printing components and raster-image processors are pulling thermal printers ahead in the race to develop low-cost color output.

COPIER/PRINTER MARKET TO EXPLODE BY 1990 111

Intelligent copier/printers—non-impact devices that accept electronic and hard-copy input and produce output of at least correspondence-quality—are expected to go from a $2 billion market last year to almost $7 billion by 1990.

UNIFORUM '86: THE UNIX CONNECTION. 117

This year's UniForum show (Feb. 4-7, Anaheim, Calif.) focuses on interconnecting diverse applications and machines within the UNIX arena. Notable sessions include "Emerging Standards," "UNIX on PCs" and "Multivendor Networking." Approximately 200 vendors will be on hand with UNIX products and services.

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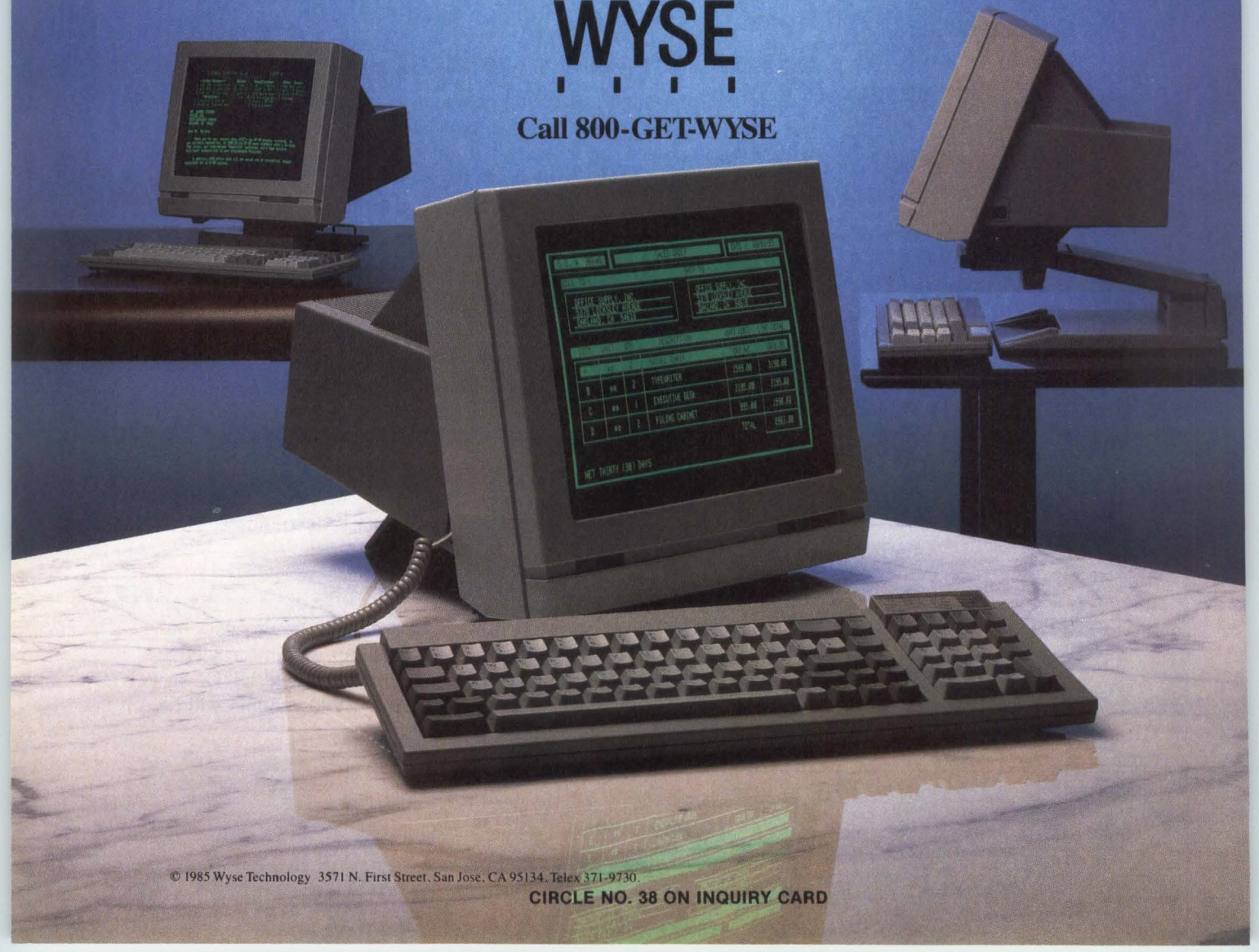

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CIRCLE NO. 38 ON INQUIRY CARD

32-BIT CHIPS RESHAPE UNIX INDUSTRY

Powerful 32-bit processing chips propel UNIX into unexpected applications, but the process might change the system beyond recognition

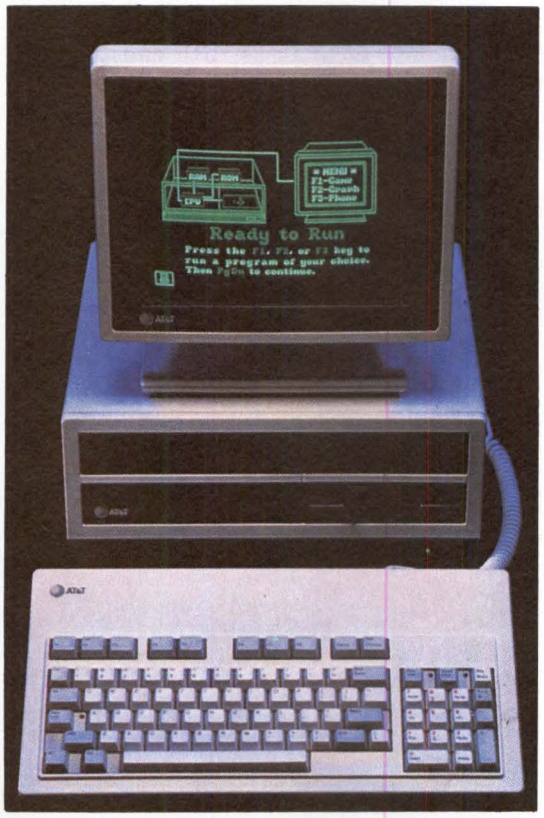
Michael Tucker, Associate Editor

The UNIX market is mutating dramatically under the pressure of new, inexpensive 32-bit microprocessors. For the first time, UNIX partisans have access to single chips sufficiently powerful to exploit the operating system and yet so cheap that processors can be assigned to individual users and even individual tasks.

As a result, UNIX may finally be about to achieve the commercial success that's escaped it for so many years. The price of that success, however, is that both the operating system and the ground rules that have governed its sales are changing almost beyond recognition. Meanwhile, UNIX is being substantially modified to make it useful in applications not remotely related to those for which it was originally designed. "These days," notes Roger Fordham, UNIX planning manager for Motorola Inc., "UNIX is looking far more like a system architecture than an operating system."

Desktop UNIX comes of age

The big news about UNIX in terms of markets is that it's starting to show up in the one place that even some of its most devoted supporters never thought it would—the desktop personal computer. UNIX is simply so large that few observers expected it to appear in machines smaller than high-end, technical workstations. But, the new 32-bit chips—such as the Intel Corp. 16/32 80286 and its successor, the 32-bit 80386, Motorola's MC68000, National Semiconductor Corp.'s 32000 series and Zilog Inc.'s Z8000—changed all that. They're cheap, big enough to hold UNIX and its applications (or even UNIX, it's applications and another operating system running as a task) and relatively easy to integrate into existing systems.



The UNIX battle of the century *looms over 80286-based machines, like this 6300 Plus from ATTIS. Although more an MS-DOS machine than anything else, it is still among the cheapest, most plentiful UNIX boxes around.*

Not surprisingly, the last year and a half has seen a flurry of 32-bit computers coming to market as departmental machines—scientific and computer aided design machines such as Computer Consoles Inc.'s Power 5/32, Digital Equipment Corp.'s MicroVAX II, Integrated Solutions Inc.'s Optimum V machines, Plexus Computers Inc.'s P/75 and several new machines from Perkin-Elmer Corp. These machines run UNIX either as a solitary operating system or as an option. "You really should have a 32-bit

system to run UNIX," says Jim Isaak, director of product marketing for Charles River Data Systems Inc. and chairman of the IEEE P10003 Operating System Committee, "but the other side of that is that you really need UNIX to deliver the power you want in a 32-bit system...a 32-bit machine running on something like [Microsoft Corp.'s] MS-DOS is, well, I'm tempted to say, insane. It's like mating a mouse with an elephant."

What is surprising has been the introduction of desktop UNIX machines for small groups or even single users—including the Altos Computer Systems Inc. 886 and 1086, the portable Integral Personal Computer from Hewlett-Packard Co., the XENIX-based Tandy 6000 from Radio Shack, the tiny but powerful s/375 from Symmetric Computer Systems Corp. and a group of UNIX personal computers from AT&T Information Systems, such as its 3B1 and 3B2/310. Indeed, what could be the UNIX battle of the century seems to be shaping up among the 80286-based IBM Corp. PC/AT, its 80286-based compatibles, and its particularly ambitious 80286-based rivals, the ATTIS 6300 and 6300 Plus.

As UNIX machines, the PC/AT, the 6300 and their compatibles are improbable boxes at best. They fall squarely on the dividing line between machines that should run only MS-DOS and those that should run only UNIX. (ATTIS officials have openly called the 6300 Plus a souped-up DOS machine for people who would occasionally like to run UNIX applications.) Still, IBM has given its corporate blessing to XENIX, the Microsoft UNIX variant, as the multiuser operating system of the PC/AT; the ATTIS machines run XENIX and ATTIS' own UNIX. As such, they will be among the cheapest and most plentiful UNIX boxes ever built. They could provide unparalleled opportunities for both the operating system and its vendors.

The machines may provide the installed base necessary to make UNIX a retail product. Moreover, because the machines are all based on the Intel chips, some industry observers are serious-

Single- and multiuser machines *exploiting 32-bit technology and UNIX include ATTIS' UNIX PC Model 3B1 (top left) and the 14-user 3B2/310 (bottom left), the Power 5/32 from Computer Consoles (top right), and the portable Integral Personal Computer from HP (bottom right).*

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CIRCLE NO. 87 ON INQUIRY CARD

ly discussing binary compatibility for UNIX applications.

The Binary Liberation Front

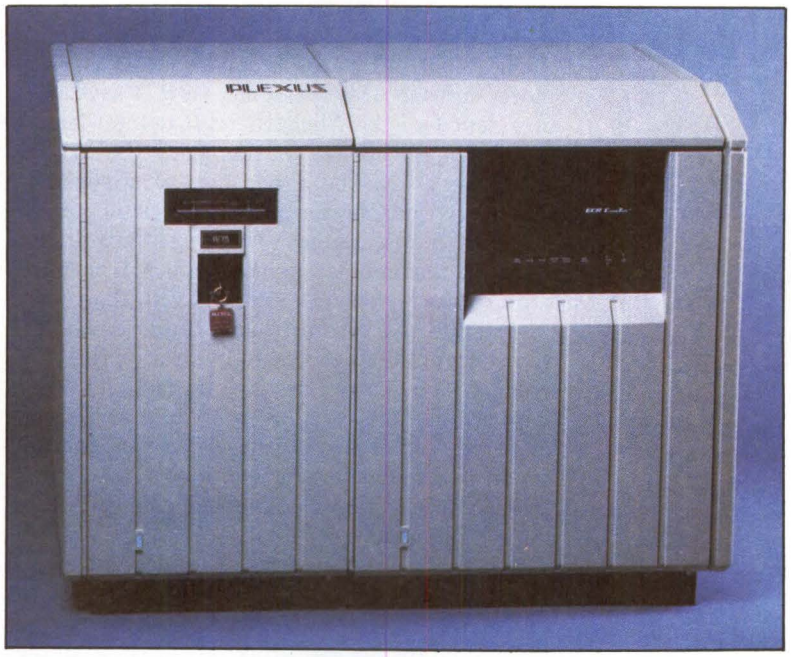
UNIX has long suffered from the fact that there are many variants of the operating system, which differ widely from machine to machine. Whereas software based on MS-DOS could generally be expected to run on any MS-DOS- or PC-DOS-compatible machine with only minimum modification, UNIX lacks binary compatibilty. In other words, an application that runs under one UNIX System V version on a particular machine almost certainly won't work on another vendor's computer, even if that other computer has the same type processor and also runs a version of UNIX System V. Though the operating system is the same, it might address the hardware in different ways.

Outside the desktop market, absence of binary compatibility isn't a serious handicap because compatibility takes a backseat to performance. In high-end applications, the emphasis is on squeezing the maximum performance out of a particular piece of hardware. Therefore, the multiuser computer vendors who have been UNIX's traditional patrons have focused instead on achieving source-code-level compatibility. Binary compatibility is regarded as an improbable goal for an operating system more complex than MS-DOS or Digital Research Inc.'s CP/M.

Now, however, what might be called a "Binary Liberation Front" of desktop UNIX advocates is challenging that assumption. Their arguments are basically summed up by Charles Hickey, president of Microport Systems Inc., the software house responsible for the System V port to the 80286. Says Hickey: "When Intel developed the 286, they put the memory-management unit on the chip itself...a computer designer would tell you that's not particularly smart...but it solves a problem for UNIX...a [software] developer can assume that the MMU will never change. That means you can get binary compatibility of applications."

Needless to say, one of the most energetic supporters of the Binary Liberation Front is Intel itself. Explains Richard Wirt, Intel's director of central software: "With the 286, all the variables that otherwise could change are fixed...when a customer ports the OS from one 286-based system to another, UNIX doesn't get changed...From now on, I don't think the question [of a retail UNIX] is so much of technology as of marketing. Will, for example, Computerland be willing to give up MS-DOS shelf space to UNIX?"

Equally enthusiastic are Microsoft and the Santa Cruz Operation Inc. (SCO), vendors of XENIX, one of the oldest, and most widely used microcomputer-oriented UNIX variants. "Any machine with a 286 running XENIX will have the same binary format," says Jon Danskin, XENIX product manager for Microsoft. "What this means is that applications can be boxed up and distributed in binary form for a market of 286 machines...and that 286/386 marketplace is going to be huge. It's anticipated to be in the



A flurry of desk-side UNIX machines, *like the P/75 from Plexus Computers, is one of the first results of the introduction of the new 32-bit chips. Plexus plans to introduce the P/75 at UniForum, the UNIX /usr/group conference, next month.*

Desperately seeking System V.3

The industry quietly awaits the third release of System V supposedly "sometime this year," from AT&T Information Systems.

No one knows what to expect, but it's widely believed that UNIX System V.3 will contain many of the networking features of Berkeley UNIX Version 4.2. "The current AT&T release doesn't have any capacity for networking at all," says John West, director of marketing support for Computer Consoles Inc., Rochester, N.Y., "which is why we use 4.2 in our machines."

West argues that data communications will be vital to UNIX: "It's a growth area...because when you think about it, UNIX's market is between other systems. The role of UNIX is to fill the space between IBM PCs and IBM mainframes. Everything between those two points is a candidate for UNIX."

"It's a little questionable *to continue making incremental changes to UNIX," says Paul Rubin, manager of development software for Flexible Computer Corp. "I think we're going to eventually see a UNIX that's completely rewritten."*

millions in the next few years."

The SCO, XENIX's second source, is even more bullish. "My personal view," says vice president Douglas Michels, "is that Intel-family XENIXes are going to dominate the UNIX world very fast, both because of application portibility and because the hardware prices everywhere else in the UNIX world are driven by the minicomputer market, which is a more sophisticated, lower volume world than that crazy DOS market out there. Because the 286 comes from the DOS world, hardware prices are going to be lower...in the one- to eight-user market, the 286 is going to pretty well dominate...if you're a software developer for the small, multiuser market, and you're not writing XENIX applications, you're not going to be in business in a year."

The Front is not without its critics, however. Many UNIX supporters take strong objection to the notion that the operating system will be dominated by any one processor, least of all the 80286. "The 80286 has been no end of frustration to the UNIX community," says Charles River's Isaak. "The newer 80386 addresses some of the 286's problems, but not all of them...I don't think either is really going to provide binary compatiblity."

Jean Yates, of the UNIX market research company, Yates Ventures Inc., Palo Alto, Calif., also advises integrators to be cautious about 80386, "The future of the chip will be highly dependent on IBM's willingness to incorporate it in their hardware."

However, the overall effect of the 32-bit chips on UNIX technology may be even greater than their effect on the UNIX market, although the chips, themselves, do not change the basic operating system. After all, UNIX got its start on 32-bit machines.

But burgeoning 32-bit applications are forcing genuine changes. Because real UNIX machines are now cheap enough for almost any application, the system must meet requirements far beyond those envisioned by its creators. As a result, even as UNIX's user interface is being standardized, it's kernel is beginning to break apart into proprietary implementations. In recent months, UNIX variants have appeared for such diverse purposes as real-time processing and fault-tolerant systems (MMS, December 1985, Page 31).

But the classic example may be parallel processing. When 32-bit processors hit the market, system integrators almost immediately discovered they could build machines that approached supercomputer performance simply by bundling several chips in the same box. Moreover, they could do so relatively inexpensively. In effect, the 32-bit machines opened the world of sophisticated, "non-Von Neumann," computing to users who before might have been trapped in the single-user, 16-bit world by economics.

Most multiprocessing vendors went with UNIX rather than attempting to develop their own parallel-processing operating system because of cost. "It would be very hard to justify any other choice," notes Thomas Teixeira, operating systems development manager for Massachusetts Computer Corp. (Masscomp), which markets a line of computers that use up to four 32-bit processors to obtain supercomputer-like performance. "UNIX has proved itself repeatedly. It's just flexible enough to do anything you want to do with it."

But UNIX is a product of the late 1960s and

End users take their PICK

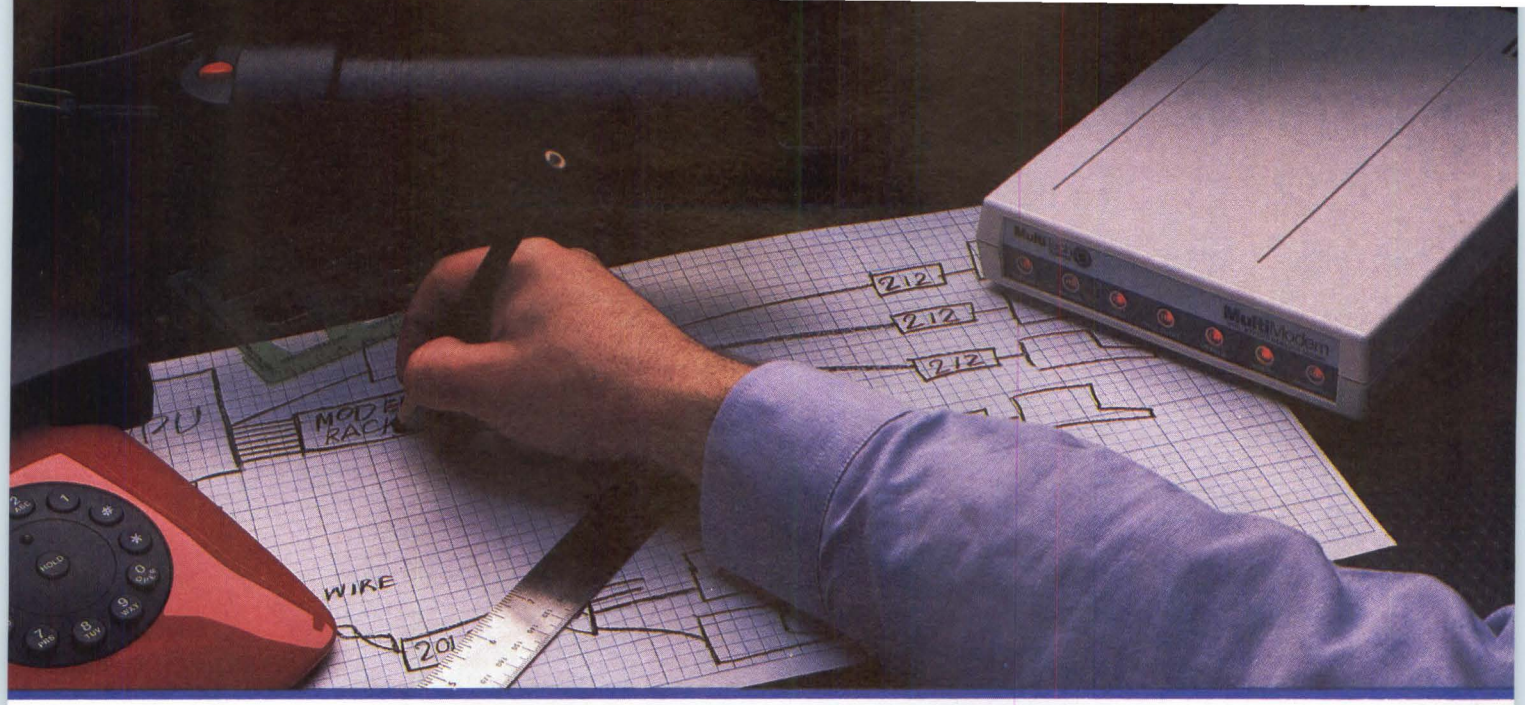
UNIX still has competition.

When UNIX first emerged as a commercial product in the early 1980s, some analysts claimed it would soon drive every other operating system into extinction. But nothing of the sort happened. Dozens, perhaps hundreds, of competing operating systems are still doing well on the open market. One of the most successful, and one that has met UNIX head-on is the PICK operating system from Pick Systems, Irvine, Calif.

Unlike UNIX, PICK was specifically designed for the single-user and small-multiuser commercial market. It is easy to use, forgiving of, and friendly to, the nonprogrammer, comes with its own BASIC and can be had on a spectrum of machines stretching from personal computers to IBM Corp. mainframes. It is also the personal creation of Dr. Dick Pick, president of Pick Systems, and as a result has a focus and coherence that UNIX users dream about.

In fact, UNIX is not so much competing with PICK as exploiting links to it. In April 1985, for instance, VMark Computer Inc., Natick, Mass., introduced a product known as Universe, a combined fourth-generation language and relational database management system that allows PICK applications to run on UNIX equipment. Products like Universe, which link UNIX to other operating systems or their applications, enjoy a boom market at the moment.

Maybe UNIX has more to gain from encouraging other operating systems than suppressing them.



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CIRCLE NO. 41 ON INQUIRY CARD

early 1970s, when CPUs were expensive and users competed for queue-position on time-sharing systems. "If you look at all the standard kernels," says Robert Beck, senior staff engineer for Sequent Computer Systems Inc., makers of the multiprocessing Balance 8000, "they all have a basic simplifying assumption...that is, they assume a single processor...to make UNIX a multiprocessing operating system, you have to break that assumption."

Choice of ways to multiprocessing

Sequent broke that assumption directly in the kernel. "Basically, our task was to understand the operating system," says Beck. "Virtually every algorithm had to be examined...A number of them had to be completely rewritten [for parallel processing]."

An additional complication was that Sequent felt bound to make it's multiprocessing UNIX compatible with ATTIS System V. "Fortunately, it turns out there is a lot of parallelism already in UNIX," Beck notes. "In fact, I tried to keep the interfaces the same, specifically to avoid changing the vast majority of the code."

Other companies have taken different approaches to multiprocessing. Flexible Computer Corp., for example, markets a multiprocessing machine known as the Flex/32, which contains up to 20 32-bit microcomputers running under UNIX. Flexible's method of making those 20 microcomputers act as parallel processors is to configure the entire machine as a "local area network in a box"—that is to say, each processor can operate as a separate computer and they are linked as though they were in a network.

"Our approach is not to have one copy of the operating system in the machine's common memory," explains Paul Rubin, manager of development software for Flexible. "Instead, each node has its own copy...and the nodes can pass messages among one another." To make this possible, Flexible has grafted what is effectively file-serving and networking software directly to the operating system itself at the kernel level.

Flexible says it took the networking approach,

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"These days, *UNIX looks a lot more like a system hardware than an operating system," says Roger Fordham, UNIX planning manager for Motorola.*

rather than attempting to implement multiprocessing in the operating system itself, because it doubts UNIX's ability to be truly multiprocessing without a fundamental rewrite. "I would say that it's perhaps a little questionable to continue making incremental changes to UNIX to make it actually distributed," says Rubin. "What we did to UNIX to make it multiprocessing works well because it fits our particular model of computing...but for more general distributed computing schemes it won't be so easy...I think we're going to eventually see a UNIX that's completely rewritten. It'll still look like UNIX to the programmer, but will be completely different."

Sequent's Beck disagrees, "We have proof by example...you can get multiprocessing without junking the existing kernel....In fact, it turns out there is a lot of inherent parallelism already in UNIX. If you've got a time-sharing environment, you've got what amounts to the beginnings of parallel processing anyway."

UNIX grows up

But, beyond multiprocessing, real-time applications, fault-tolerant systems and all the other areas where UNIX is being trimmed or inflated to fit, 32-bit machines could most impact UNIX simply by opening the system to basic improvements.

As a technology and as a commercial product, UNIX has always been crippled by its own size. Since it originated in Bell Laboratories and academic institutions—rather than develop according to a set plan—it developed haphazardly. This meant it was remarkably robust, but was difficult to sell to end users. Increasingly, the UNIX community has been calling for fundamental reforms of the operating system.

"UNIX has serious problems," charges Microport's Hickey. "Problems which the leaders of the industry seem unwilling to address...UNIX's problem isn't its user interface, nor its documentation, nor anything else like that. Instead, it's the sheer size of the system...it's just too complex...the kernel needs to become modular on a strategy of divide and conquer...in effect, UNIX needs to be designed—intelligently. It wasn't really designed. It just happened. And now, the day of reckoning is at hand."

But, there is a Catch 22. If UNIX is too complex to be a commercial success, then it can't be simplifed until enough UNIX finds its way into the hands of developers and end users to force major reforms. Erwin Morton, president of Syntactics Corp., makers of the UNIX word processing software, CrystalWriter, puts UNIX's problems bluntly: "Users don't care about operating systems. They want applications. They want to be able to solve real problems. You always come back to the solutions issue. As it is, vendors have been trying to sell UNIX as a technology...and buyers have had enough of technology for technology's sake."

Breaking that unfortunate cycle could be 32-bit systems. Says Charles River's Isaak, "The real significance of 32-bit systems is that they are driving down the cost of UNIX. That means you are going to see an explosion of UNIX software."

If Isaak is right, then UNIX will finally have the oportunity to change. Moreover, UNIX machines will be inexpensive enough for small-system developers, who have traditionally been among the most innovative in the computer industry. In the opinon of Microport's Hickey, "A lot of people are going to make a lot of money [in UNIX]...then maybe the industry will have the energy to address the real problems of the operating system." □

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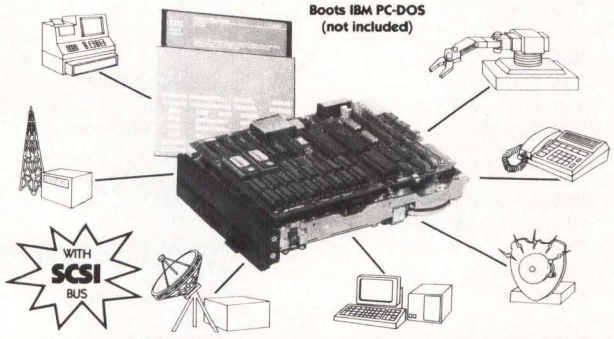

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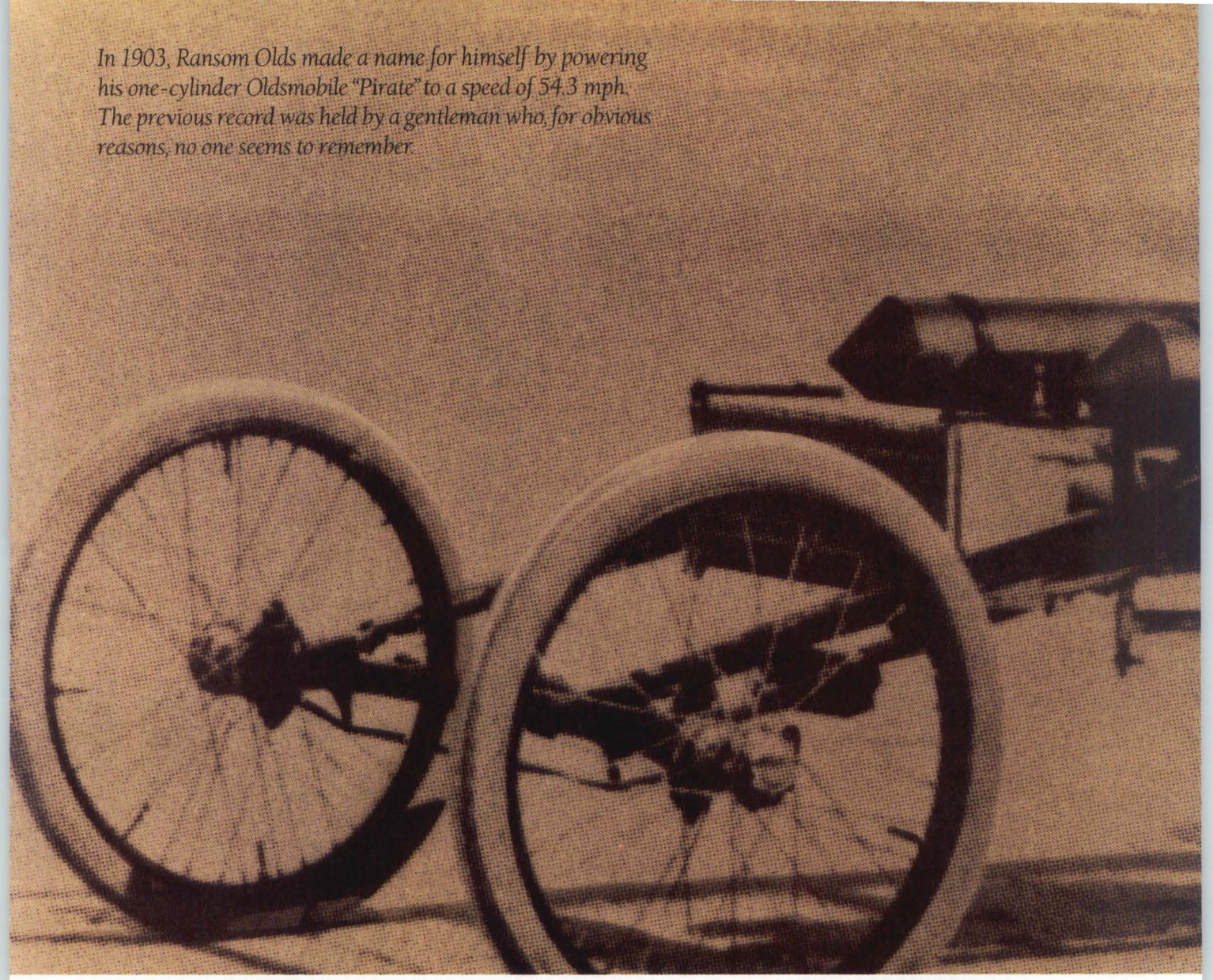

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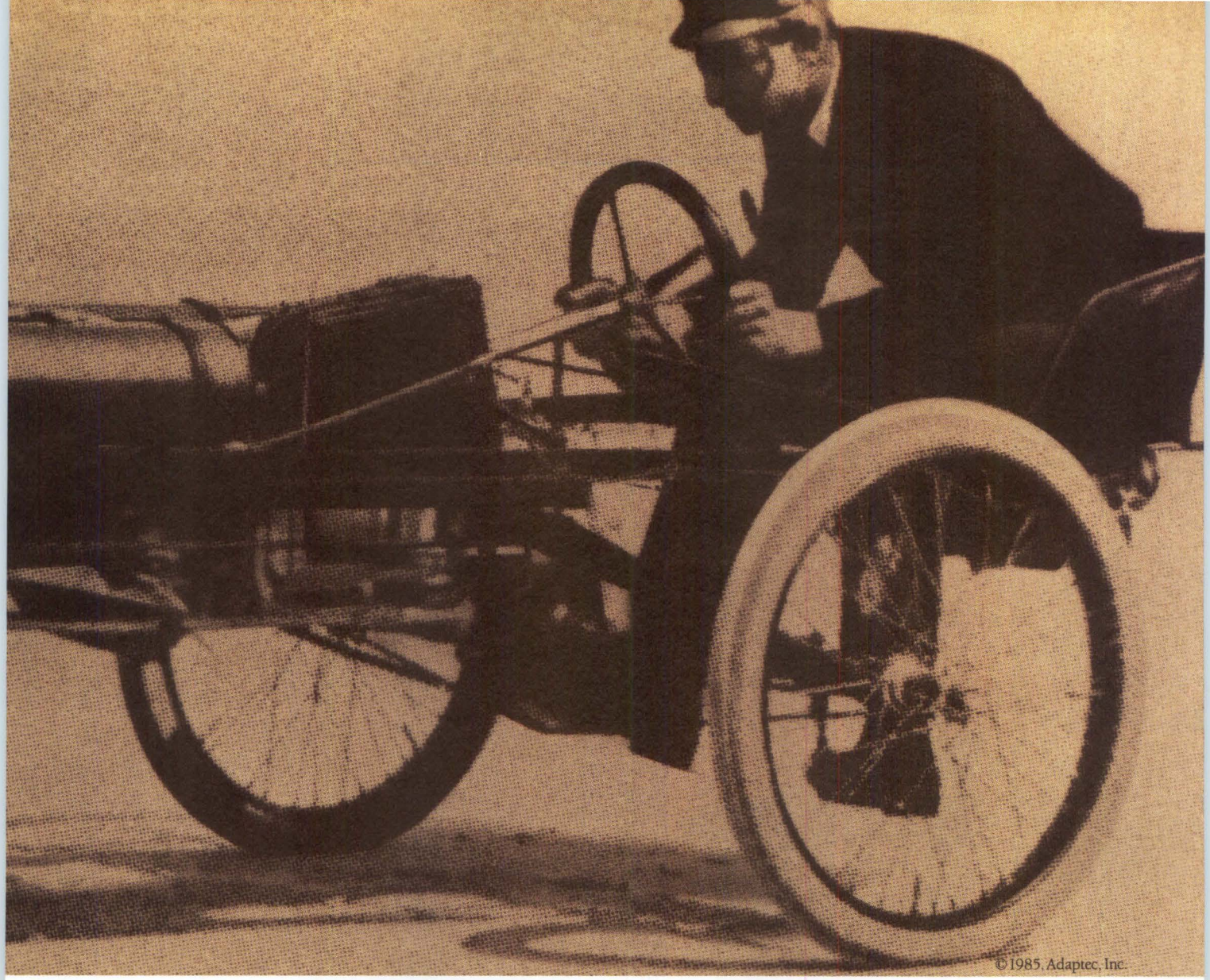

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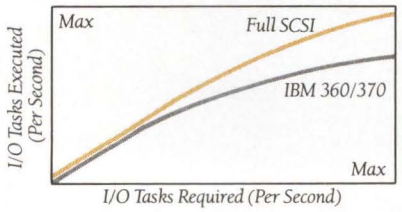

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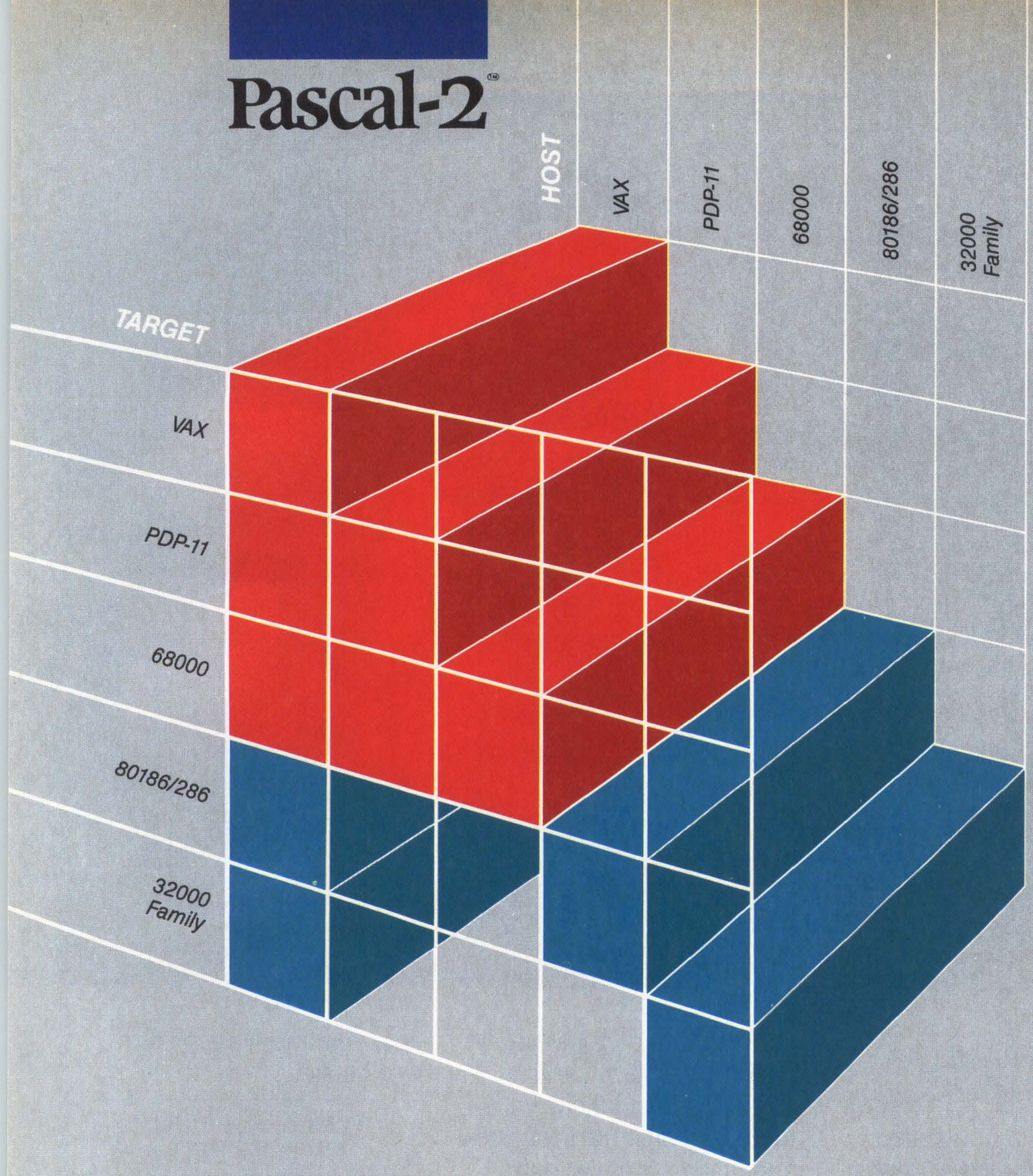

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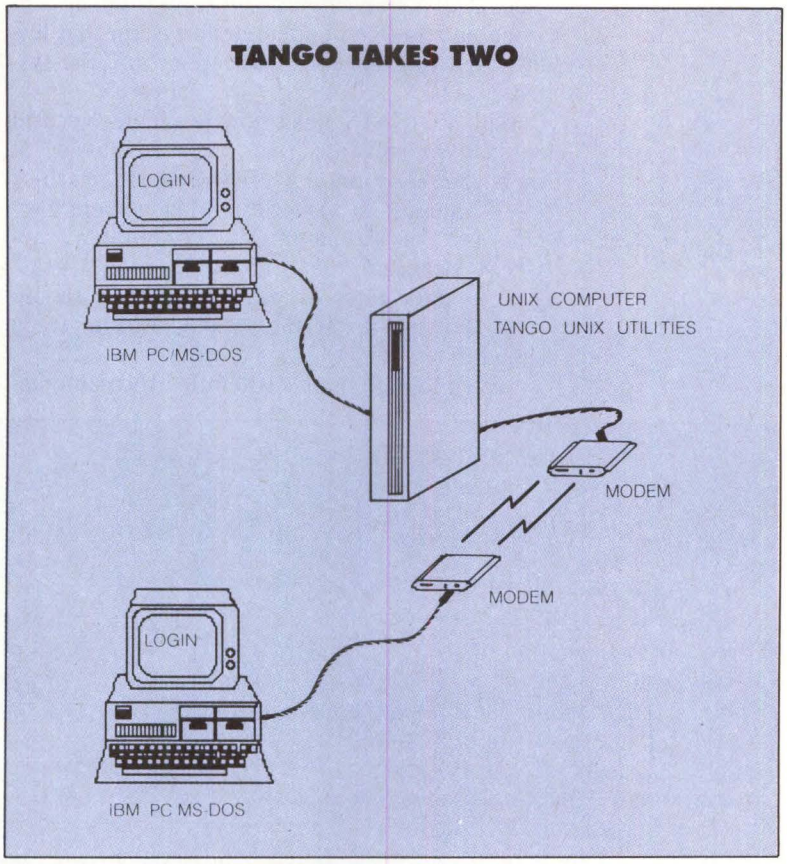
But now, many organizations have started to outgrow their entrenched IBM Corp. PCs and compatibles. This situation creates potential customers for VARs who want to sell departmental UNIX processors—and one of the keys to this market is a PC-UNIX link.

In seeking to turn this key, VARs have to compete against the major computer companies sweeping into the distributed-office-systems market. For example, IBM has introduced networks for their PCs and PC/ATs and a new, smaller, System/36. Sperry Corp. offers a personal computer local area network with 80M bytes of storage on a central server. And AT&T Technologies Inc. has loaded its marketing juggernaut with a set of UNIX machines that act as file servers for their PC compatibles.

These companies know that organizations that bought, and continue to buy, standalone PCs will need larger departmental processors. They also know that few organizations will throw away their PCs in order to get departmental systems, nor will they give up the compatibility of their PCs. If VARs, too, keep those facts in mind, they will successfully compete with the major players.

Even though UNIX has so far failed to dent the desktop computer market, VARs are finding it can be an entry to offices already saturated with standalone personal computers.



Turning IBM PCs *into extensions of a UNIX computer, Tango converts files and passes them back and forth among systems.*

For example, Bradley Morse, director of marketing at Touchstone Software Corp., says the company originally developed its line of UNIX-to-PC products as tools for salespeople who were trying to knock down customer resistance to UNIX. "We found that customers were concerned about saving that physical box—they didn't want to lose the hardware investment. Salesmen were spending a half hour out of an interview discussing UNIX vs. MS-DOS. Now, you can walk in and say, 'Hey keep everything you've got.'"

It didn't hurt that AT&T set out to advertise UNIX as an open-ended operating system, says

Morse. "For over a year, AT&T had an IBM PC in the booth working with their systems at trade shows. This was a brilliant marketing move."

VARs can exploit the PC-UNIX combination with software from a number of sources. Centennial Systems Inc., for example, markets UNIX office-automation software that includes a PC link. "We're offering the 'glue' that allows [the VAR] to bring together a number of packages," says James Blake, formerly Centennial's director of technical resources and now a UNIX office-automation consultant. Included in Centennial's glue is communications software from Touchstone and an open-ended menu system that lets the VAR plug specific applications into the system.

With PC-UNIX links now available, vertical application software that takes advantage of them should soon follow. Bob Comeau, a senior UNIX analyst at American Management Systems Inc., an Arlington, Va., consultancy, says UNIX packages that offload front-end tasks, such as data entry or word processing, should start showing up at the 1986 Uniforum trade show.

"Even though there's still little office-automation or vertical-market software for UNIX," Comeau notes, "you can build good distributed database systems with a UNIX box as a file server for the PCs. You already have products like [Ashton-Tate's] dBASE III and [Relational Database Systems Inc.'s] Informix that run in both MS-DOS and UNIX environments."

The VAR market thrives in providing precisely tailored systems and services to their clients; adding PC-UNIX links to that picture is a natural move. VARs who have been selling an "office solution" that includes a UNIX system and training may soon find themselves able to sell the more extensive training required to operate distributed systems. If they were previously selling PCs, they may now start working on their clients' central UNIX systems and the people responsible for them. Of course, the more time spent training and working with a client, the better the chances of follow-on sales.

The PC-UNIX communications schemes all have some things in common: a means of passing data back and forth between PC-DOS and UNIX systems; the ability for either a user or a program to control the process; and separate pieces of software for both the PC and UNIX

The anatomy of

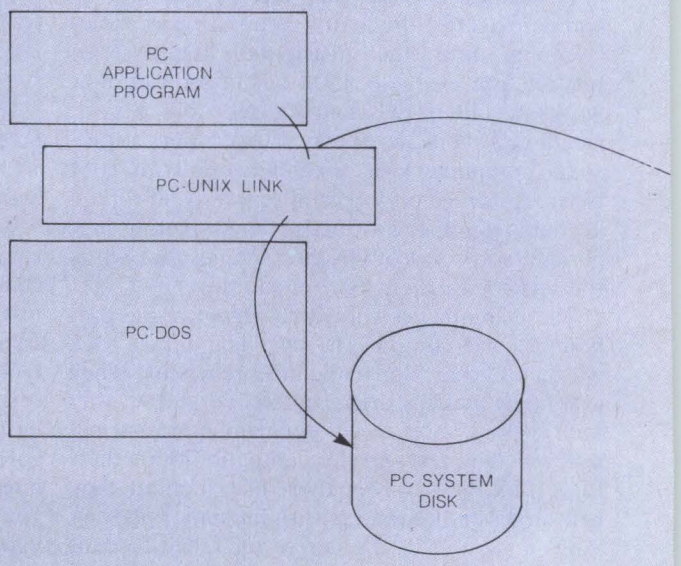
The three key parts of a IBM Corp. PC-to-UNIX link are:

- The user interface
- Data communications
- File conversion.

The user interface is the set-up screens, graphics and text that the user sees when operating the package. The interface is important if the package is primarily intended to let the PC user have simple access to the complex UNIX operating system.

For example, Network Innovations Corp.'s Multiplex-PC, Touchstone Software Corp.'s PC-Works and Computerized Office Services Inc.'s (COSI's) Tango give the user PC-DOS menus for the UNIX system (left). The application running on the PC-DOS system can be personal computer software (spreadsheets, word processors, etc.) or an extra module of the UNIX link, such as UNIX-based menus. (Multiplex-PC, in fact, functions as an application on the PC.) The PC-UNIX link, meanwhile, interprets where data should go—to the local, or the UNIX, system.

All linking packages provide some form of data communications between PC-DOS and UNIX processes. If developers want to build one, they can start with communications software from a number of places, such as Fusion from Network Research Corp.



system (see "The anatomy of a PC-UNIX link," below).

What's available?

Locus Computer Corp. markets a PC-UNIX tie-in named PC Interface. Judy Uttal, Locus' marketing manager, says "Through this year, we've been focusing on large systems manufacturers. We're starting to move in a new direction...more toward the system integrator. We're focusing on common hardware they may use, such as the PC/AT and the DEC [Digital Equipment Corp.] VAX running UNIX."

PC Interface provides a "virtual disk" on the UNIX system, that the PC can address. The program works through either the PC's RS232C port or over an Ethernet link. The Ethernet link is much faster, but it requires an expensive controller board in the PC.

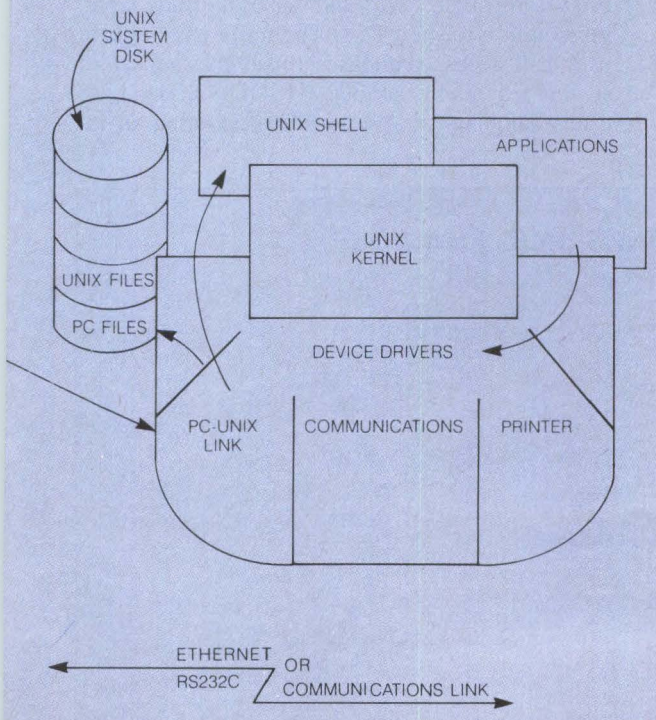
Currently, PC Interface uses a proprietary communications protocol, which may make it difficult to integrate into some environments. However, Locus plans to accommodate more industry standards. The Berkeley UNIX Version 4.2 edition of PC Interface, for example, will use the U.S. military's transport control protocol/internet protocol (TCP/IP) communications standards. Uttal says their plans are "dependent on what people want us to do," but current indications are that they will move more closely toward the IBM-Microsoft Corp. MS-NET protocols.

Having PCs address virtual disks on a central UNIX system provides many advantages of a centralized data-processing operation: an operator can do file backups, the data-processing shop can control access to the system, and it's easy to get a good idea of the quantity of data users are storing on their systems.

Computerized Office Services Inc.'s (COSI's) Tango, Touchstone's PC Works and Network Innovations Corp.'s Multiplex-PC allow the user to access UNIX from a PC, but from different perspectives.

Paul Stutler, COSI's product manager for Tango, says their product is aimed at management information system (MIS) managers who want to get PCs "by the throat" when they access a central system. Once Tango has been booted up on the PC, "the PC becomes an extension of the UNIX computer." For example, commands can pass directly to the PC from a UNIX shell

a PC-UNIX link



But developers would have to build the rest for themselves.

Either way, the UNIX system disk sets up separate segments for PC files. The PC-interface uses those special segments to set up a virtual disk on the UNIX system that the PC uses as one of its own. File communications or passing of data then consists of transferring information to the virtual disk via PC-UNIX link software running on both computers. Local, PC data and UNIX data being transfered to the PC, meanwhile, is stored on the PC's disk.

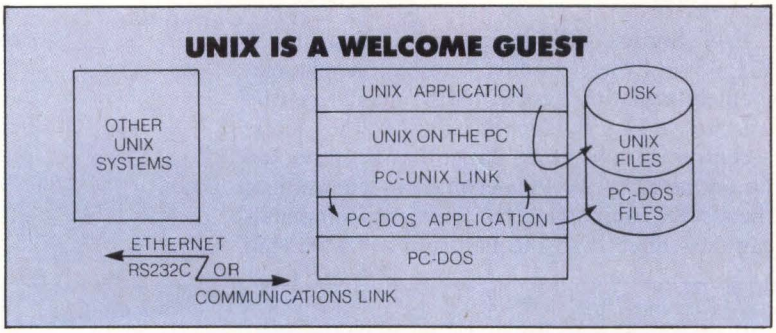
The UNIX system (right) treats its end of the PC-UNIX link as just another device to deal with through a module of software (i.e., a device driver). The UNIX shell controls processing—some links remotely access, some are remotely controlled by, the shell. Tango, for instance, allows the shell to control the PC.

File conversion between UNIX and PC-DOS can happen at the system level or at the application level. At the system level, files are put in a proper format to be manipulated by one of the two operating systems, either PC-DOS or UNIX. At the application level, files are directly converted so that data from one operating system can be dealt with by the other. Some packages, for example, allow Lotus Development Corp.'s Lotus 1-2-3 on the PC to handle data from Unify Corp.'s Unify DBMS software.

program. Under Tango, the UNIX systems can remotely start and run PC applications.

Tango can convert files and automatically pass them back and forth between systems. It also permits the UNIX system to check, in a limited fashion, the contents of the PC's disk and use the results to make programmed decisions—such as whether to download new spreadsheet data for the PC user.

The idea of centralized control isn't new, but it's hard to achieve in a distributed environment. A product like Tango is useful to the VAR who wants to build a system that spares the PC user much of the worry—and freedom—of interacting with UNIX. It also offers a way to get into shops where the MIS manager has placed a high priority on centralizing data control or where the users don't want—or need—to become UNIX-literate.



UNIX and PC-DOS can share *a PC as well, with both as coresident operating systems. In this way, PC-UNIX applications can swap data with PC-DOS applications. Products like Uniform Software's The Connector allow a user to cut and paste between UNIX and PC-DOS. Moreover, a PC running UNIX can communicate on many of the same networks other UNIX systems use.*

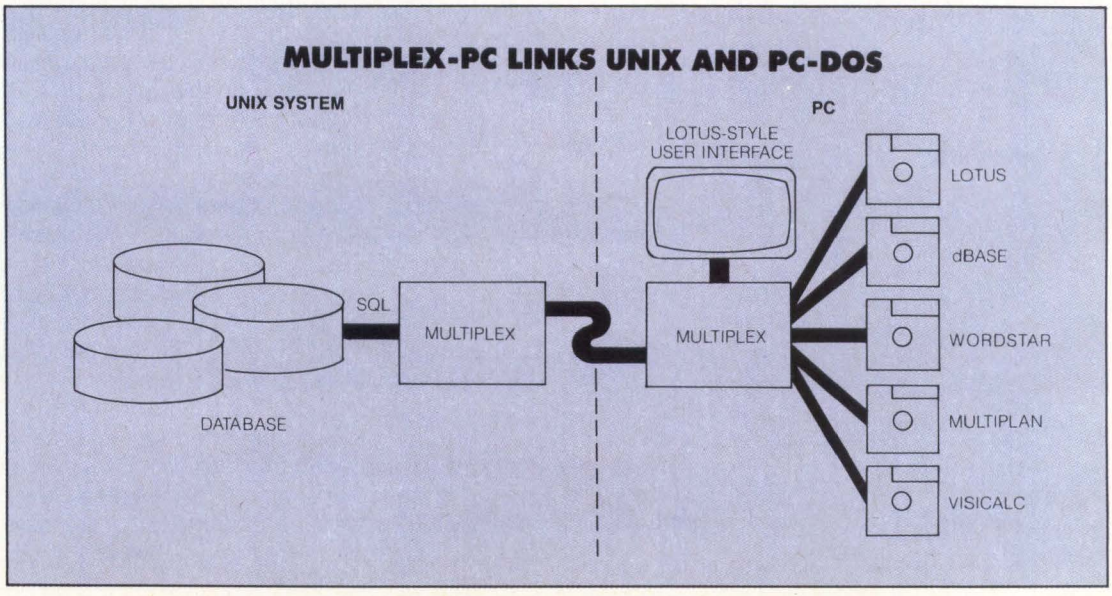
Although Tango is oriented toward the UNIX system and its managers, Touchstone's PC Works is oriented toward the PC and its end users. "PC Works is designed for the businessman," says Morse. "We changed it by maybe 40 percent when it came out of beta tests [to make it simpler to use]. Our programs 'presuppose' things, so that all you have to do is push a key or answer 'yes' or 'no' to something to use it."

PC Works allows PCs and Apple Computer Inc. Macintoshes to share data between each other and UNIX systems. It can be programmed by the user to execute functions automatically. Several of Touchstone's competitors agree that its good user interface is its primary advantage.

Network Innovations is another company that's building a specialized PC-UNIX link, Multiplex-PC. The company founders realized that there was a niche market that other PC-UNIX link suppliers weren't filling. "If I could characterize their requests in one phrase, it would be 'Let me use [Lotus Development Corp.'s] Lotus 1-2-3 to analyze data on the UNIX system,'" says Paul Weinberg, Network Innovations' vice president.

Multiplex-PC provides a set of menus, similar to those in Lotus 1-2-3, that allow the user to browse through UNIX databases and download information to their PCs. The more experienced user can access databases through a subset of structured query language (SQL), a database query language that is rapidly becoming an in-

Multiplex-PC provides menus *similar to those in Lotus 1-2-3. The more experienced user can access databases through a subset of SQL, a database query language rapidly becoming an industry standard.*



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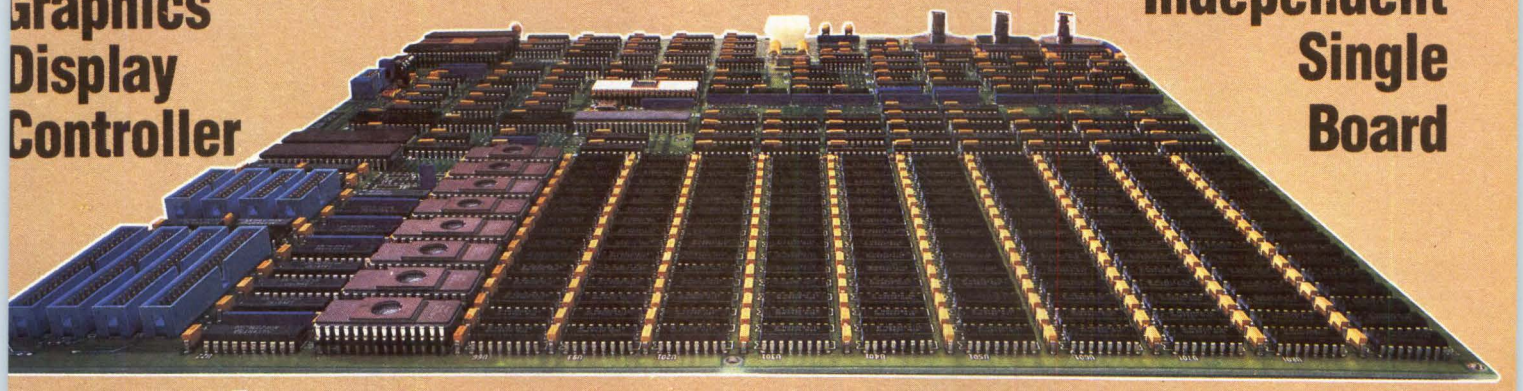

Features

The OMNI 1000 GDC is a 16 x 16-inch single-board graphics controller with a display resolution of 1024 x 1024 by 8 planes. The board houses Intel's 8086 CPU, 8087 NDP, 8089 IOP, and the 7220 graphics processor for local drawing and list processing. The support for eight image memory planes allows simutaneous display for 256 colors from a palette of 4096 colors. Also included on board are 256KB of list-processing RAM, and 64KB of EPROM.

Benefits

Overall system performance is enhanced by the OMNI 1000 GDC multiple processor design. Local scale, rotate, translate, polyfill, drag, clip, highlight, rubberband, etc. are provided by the display list processor.

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Conclusions

High performance graphics, segmented display list architecture, BUS independence, GKS firmware compatiblity, and an extraordinary high level of field proven reliability are hallmarks of the OMNI 1000 GDC.

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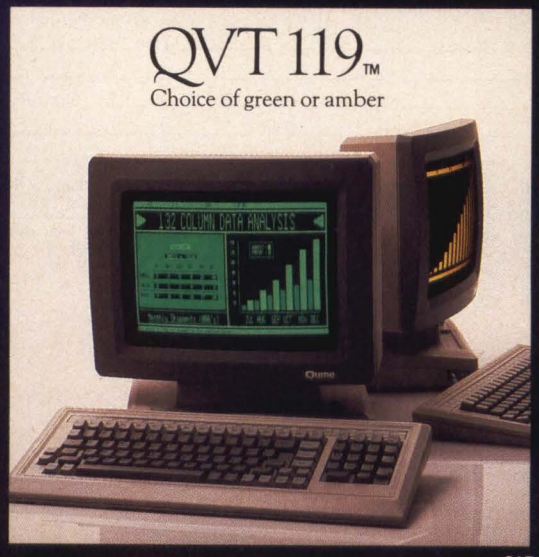

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dustry standard.

Multiplex-PC communicates in the same way that most of the other packages do: over either an RS232C direct-cable hookup to the UNIX system, or over an Ethernet link. Multiplex-PC's Ethernet link incorporates Network Research Corp.'s Fusion software, which makes a number of industry-standard communications protocols and utilities available as part of the package.

Uniform Software Systems Inc. takes a somewhat different approach to making the PC-UNIX link. Their Connector software allows UNIX and PC-DOS to run together on the same PC. PC-DOS programs run in a window of UNIX variants—VENIX, from Unisource Software Corp., or PC-IX, from Interactive Systems Corp. In addition, IBM's TopView PC windowing software can run as a PC-DOS application with The Connector. Users can then use TopView to cut and paste parts of PC-DOS screens into VENIX and PC-IX screens, although word-processing tasks do not run efficiently on anything less than the PC/AT's Intel Corp. 80286 chip.

Still, The Connector bridges the gaps between PC-DOS and UNIX and may be a good option for VARs. John Roseman, president of Urban Software Corp. and publisher of the *UNIX Market Directory,* says that The Connector is "an interesting option, at least for 80286-based machines," and that, right now, there isn't anything else quite like it.

AT&T is trying to introduce something similar on the AT&T 7300 UNIX PC using UNIX System V and an 8086 that supposedly has hardware enhancements to make PC-DOS and UNIX run effectively side by side. However, the system cannot run Lotus 1-2-3 and some other popular PC business programs due to technical problems at production time. The Connector, or a similar package, may therefore provide VARs with a viable short-term complement to AT&T's current offerings, and perhaps a competitor for future offerings.

PC-UNIX links give the VAR new options to market UNIX to a wider audience than ever before. But that also means that a lower percentage of those buyers will be the "computer literati" who are willing to learn a complex product like UNIX.

Appealing to a broader market requires that VARs provide simple answers to difficult questions. A company that employs hundreds of part-time clerical personnel doesn't want a training course in UNIX; they want a packaged solution that is as "goof-proof" as possible. A federal agency on a tight budget wants to keep its PCs and existing dBASE II applications, and still have access to electronic mail and office automation.

There are software-development opportunities as well as system integration options. For example, a time-and-billing system for attorneys might easily be distributed, giving each attorney private reporting or word-processing software on a PC, with docket scheduling and electronic mail on the central UNIX system. Each attorney could have the advantages of the central function, as well as absolute security in the privacy of case notes.

The examples could go on, but one thing is clear: The VAR's opportunity lies not just in being able to address a broader market, but in being able to offer a better, more competitive product. □

Companies mentioned in this article

AT&T Technologies Inc.
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(301) 984-9120
Circle 395

Computerized Office Services Inc.
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Circle 396

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Urban Software Corp.
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New York, N.Y. 10036
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Circle 402

Interest Quotient (Circle One)
High 462 Medium 463 Low 464

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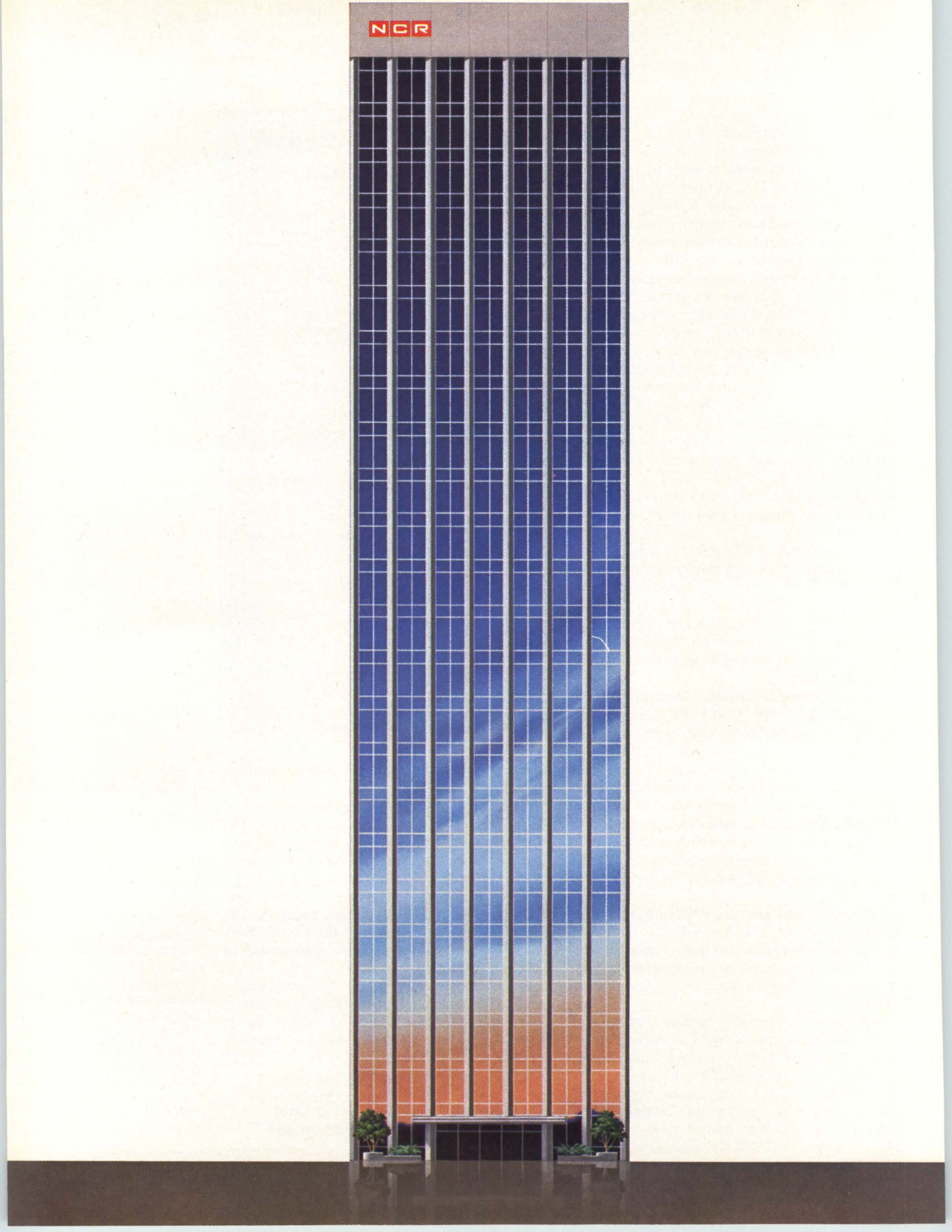
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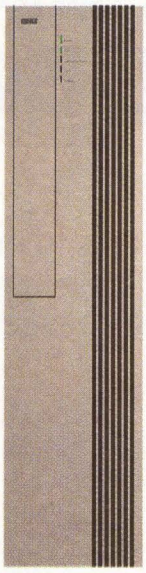

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MICROS GAIN SIGHT WITH IMAGE BOARDS

Medical imaging, industrial parts inspection, pattern-recognition and teleconferencing applications highlight the diverse uses of microcomputer-based image systems

Jesse Victor, Associate Editor

Microcomputer-based image-processing boards and add-on modules are finding increased use in a wide range of industrial and scientific applications. These include:

- Enhancing the gray-scale detail in images produced by ultrasonic, X-ray and other medical imaging devices
- Recognizing patterns for real-time decisions in industrial parts inspection or other production-floor operations
- Comparing several digitized images, or different aspects of the same image, with a reference image
- Detecting motion for industrial control or security applications
- Transmitting images in-house or to remote sites for teleconferencing.

Modularity and increased circuit integration provide the same benefits for image systems that they do for data-acquisition boards. For example, system integrators can configure a $10,000 personal computer-based image-processing system that rivals a $20,000 to $30,000 standalone system in performance by specifying the features and capabilities required for a particular application.

Add-in/add-on image-processing products run the gamut from basic "frame-grabber" boards without processing software to add-on boards and boxes with integral power supplies. Complete, integrated hardware/software systems with video cameras, filters, lenses and high-resolution monitors also are available.

Most video digitizing boards contain high-speed (flash) analog-to-digital (A/D) converters, input RAM lookup tables (LUTs) for image preprocessing, on-board buffers for video-frame storage and output digital-to-analog (D/A) converters. Some boards also provide output RAM LUTs for rapid changes in color or shading made before the final image is displayed. On-board microprocessors and/or direct connections to array processors increase throughput for real-time applications.

However, several factors beyond basic board parameters can influence image-processing-board selection. They include:

- Memory requirements. Image processing uses a lot of memory. Manipulating a "standard" 512-pixel-by-512-pixel image with 8-bit-per-pixel resolution and 256 gray levels requires 1.4M bytes of data for each image frame. Boards that don't use the microprocessor's memory as a frame-storage buffer might need add-in memory modules to increase the storage beyond that provided by the on-board buffer.
- Power consumption. Most personal computer-based add-ins plug only into the IBM Corp. PC, PC/XT and PC/AT. However, the PC's small, convection-cooled power supply might not be able to handle the power requirements of an image-processing board and additional memory—particularly if other expansion

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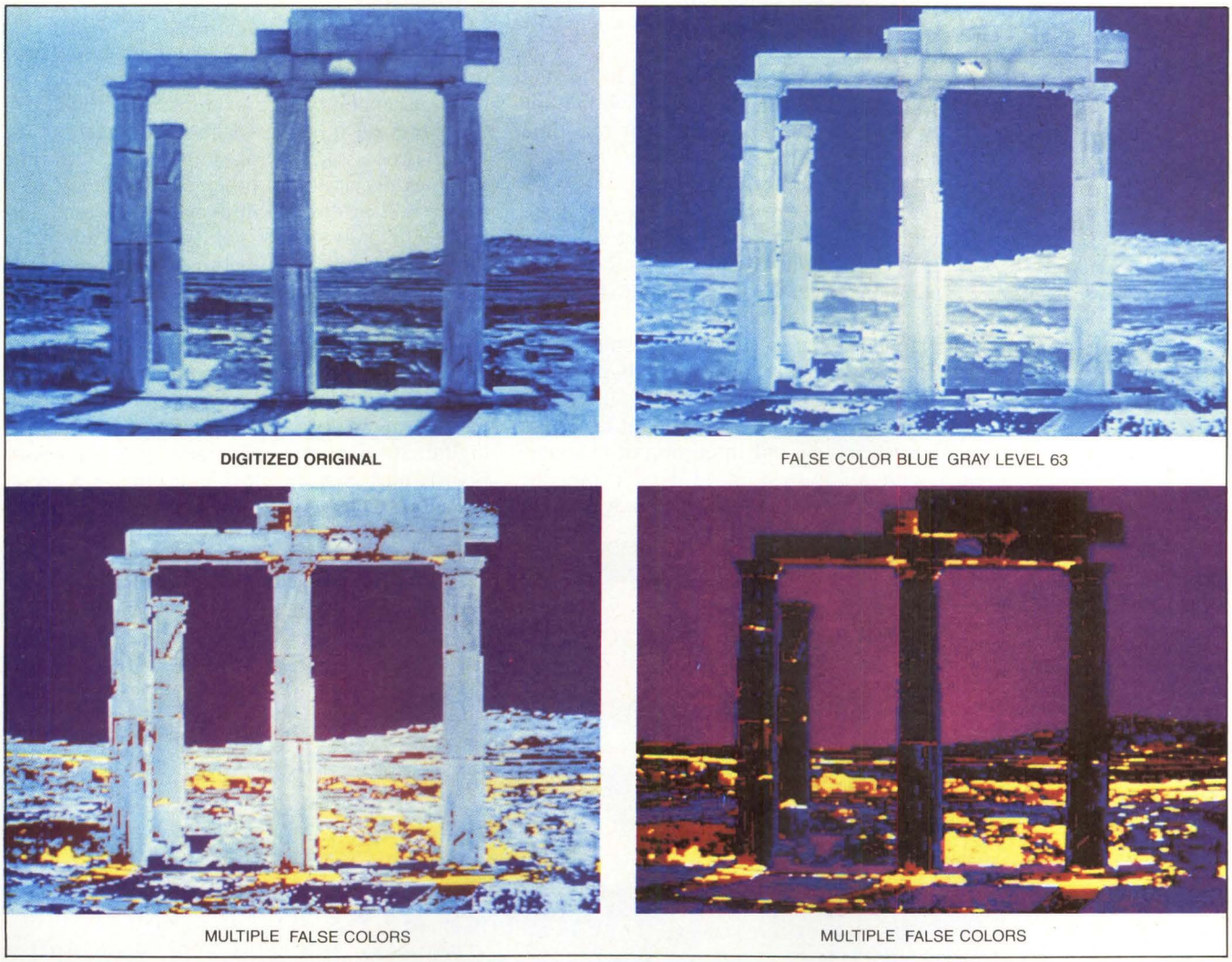
This is the second of two articles on microprocessor-based add-in/add-on boards. The first article, focusing on data-acquisition and coprocessor cards, appeared in the October 1985 issue of Mini-Micro Systems.



slots are already filled.

- Real-time processing. Boards that process a video image line-by-line and not one frame at a time (in one-thirtieth of a second) can introduce "jitter" in real-time video output.
- Full-color imaging. Although add-in boards with three D/A converters can produce pseudocolor outputs with "false" colors highlighting areas of interest, three image-processing boards are required for true color images.

International Resource Development Inc. (IRD), Norwalk, Conn., sees two factors driving the personal computer-based image-processing market. "Add-in boards allow you to do image-processing applications at a much cheaper cost than with dedicated, standalone systems," says the research company's president Ken Bosomworth. In addition to spurring the replacement of standalone systems, add-in systems' relatively low prices have attracted new end users who are now considering microprocessor-based image-processing applications. Bosomworth says the image-processing market will grow more than 70 percent a year. Worth approximately $70 million in 1984, the market is expected to total between $600 million and $700 million by 1988.

Bob Birenbaum, manager of product market-

Output LUT-controlled pseudocolor processing, *using Data Translation's DT2803 board, highlights key sections of a digitized video image by adding "false" colors and manipulating gray-scale levels.*

ing at video-digitizer vendor Imaging Technology Inc., lists high functionality and low cost as significant factors driving the market. "Hardware costs are obviously coming down. Software is increasing the functionality of imaging boards. With a PC/XT, our PCVision module, monitor and camera, you can put together a system for less than $10,000. A dedicated system would cost significantly more."

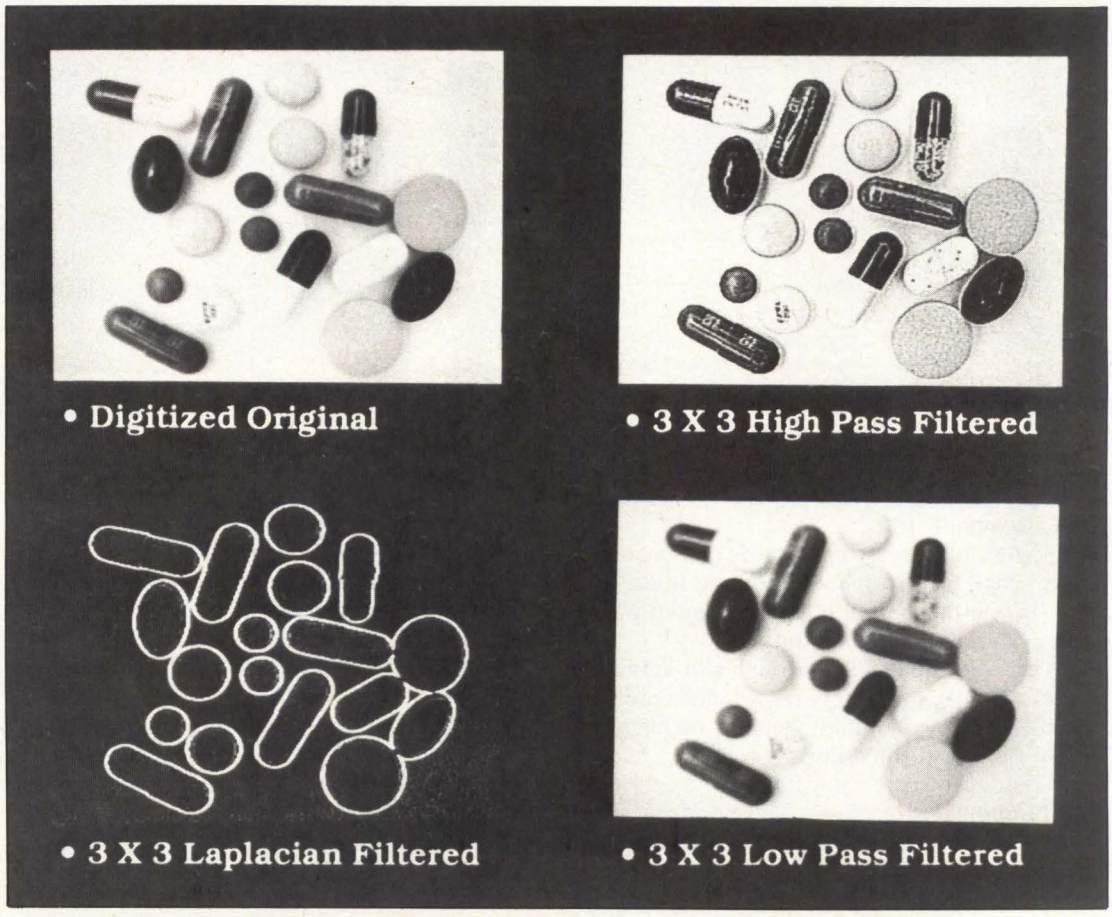
Accepting a U.S. standard RS170 analog video signal, PCVision digitizes it with 8-bit accuracy at 30 frames per second for real-time applications, stores the image in an on-board 512-pixel-by-512-pixel-by-4-bit frame memory and simultaneously displays the 256-gray-scale image on an external monitor. Under software control, one quadrant of frame memory (64K bytes) at a time is memory-mapped into the PC's memory.

An Extended Memory plug-in module allows the frame storage to retain the 8-bits-per-pixel resolution afforded by the input A/D converter. A Pseudocolor Module adds four input LUTs for image preprocessing and three output channels —each with a 256-by-8-bit LUT—for pseudocolor processing. Menu-driven ImageAction software furnishes an extensive list of image filtering, processing, analysis and graphics functions. End users can define an area of interest on the image and, with a mouse, choose convolution, low-pass filtering or other required image-enhancement operations.

Extra bit planes boost performance

"Bells and whistles" on many image-processing boards go beyond basic functions for increased capability. For example, the four extra bit planes on Imaging Technology's new PC/AT image-processing board implement real-time graphics overlays and other enhancements to a 512-by-512-pixel-by-8-bit image. Surface-mounting techniques piggyback the required extra memory directly onto the board.

Recognition Technology Inc.'s add-on RTI-Station's extra bit plane allows end users to add graphics overlays and stop or change processing criteria "on the fly." The modular 10-MHz system for the IBM PC comprises different combinations of analog video I/O, memory-mapped digital storage and pipelined pixel-processor boards plus power supplies and image-processing subroutines written in C.



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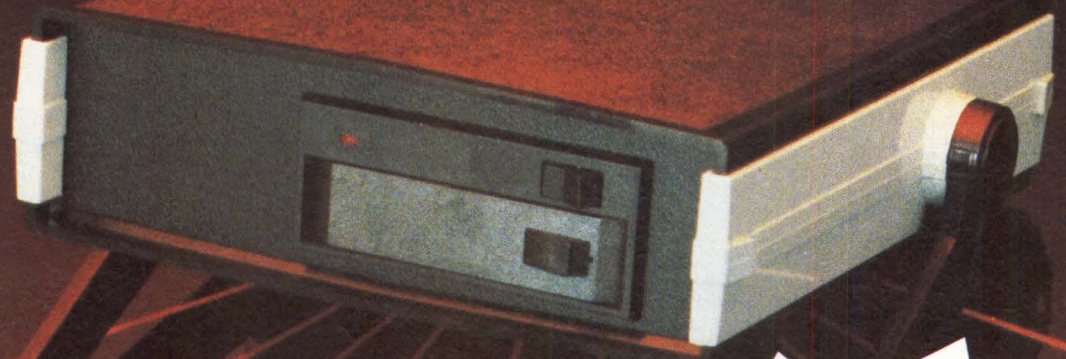

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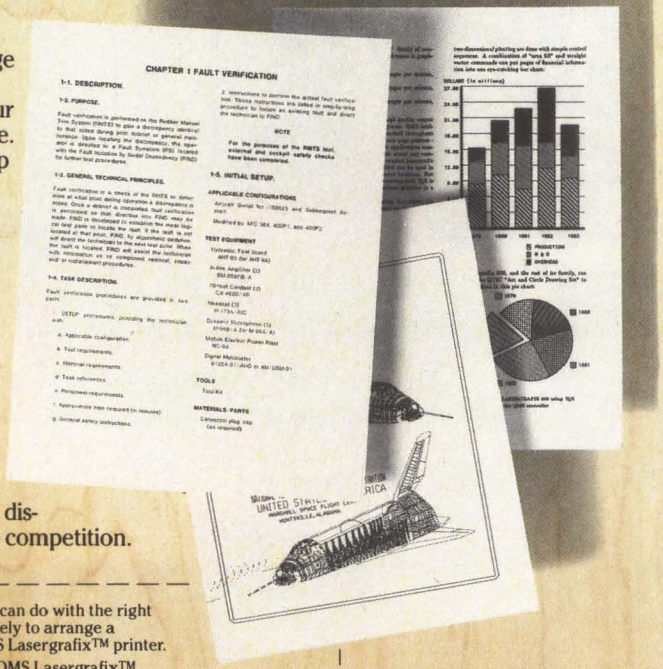

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Accepting simultaneous input from up to four video sources, the video I/O board contains a signal-conditioning front-end that provides software-programmable gain and level control and a direct-current restoration system that automatically corrects the black reference level of the signal after each horizontal scan. The 10-million-instructions-per-second, 16-bit, pipelined pixel processor performs real-time frame integration and summation, background subtraction and other image-enhancement operations. The processor can complete two different operations on a single pass through the image data; two processors can be cascaded for doubled throughput.

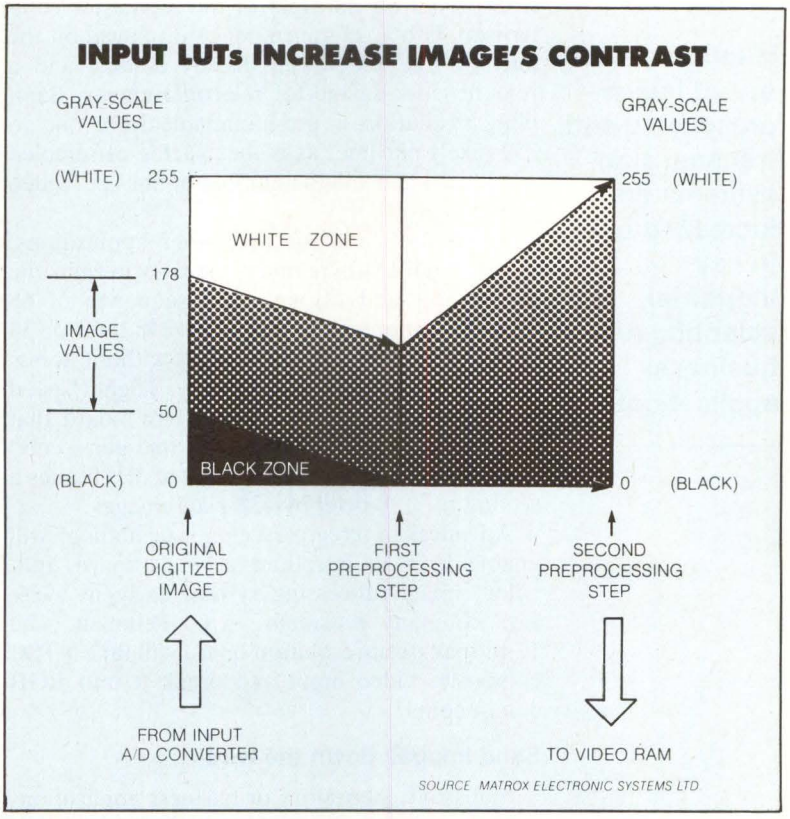
Because array processors dramatically increase throughput for real-time image-processing applications, several boards have high-speed ports for direct connection, which permits bypassing the host PC. For example, Sky Computers Inc.'s Sky Scout real-time video image processor for the PC/XT interfaces via 3.5M-byte-per-second auxiliary ports to the company's SKY320-PC video array-processor board. Processing at a 5-million-operations-per-second maximum rate, it performs a 32-point convolution in 960 μsec and a 64-point convolution in 2 msec.

Software controls the number and spacing of sampled pixels on a line to reduce the amount of processed data when, for example, the border of an image can be sampled at a lower rate than can the center. Image-processing and data-compression software also perform addition, subtraction, difference or insertion operations between two images, place the result in a third image file or print a histogram of the number of pixels at each of 256 gray-scale levels.

Data Translation Inc.'s DT2803 board connects directly to high-speed coprocessors through digital ports. Accepting RS170, National Television System Committee (NTSC), RS330, Comité Consultatif Internationale Radio (CCIR) and Phase Alternation Line (PAL) video inputs, it provides 6-bit-per-pixel resolution, eight 64-by-8-bit input LUTs and four 256-by-12-bit output LUTs, producing 64 gray levels and 256 combinations of red-green-blue (RGB) output color values. The IVG-128 board from Datacube Inc. also accepts European 50-Hz CCIR interlaced video inputs. Its 384-pixel-by-485-pixel-by-8-bit image permits selection of 256 shades of gray or color values per pixel.

CMOS keeps power consumption down

System integrators concerned with overloading their PCs should consider the PIP-512 or PIP-1024 cards from Matrox Electronic Systems Ltd. for the IBM PC, PC/XT, PC/AT or plug-compatibles. Extensive use of CMOS keeps power consumption at less than 15W. "The typical figure is twice as high," contends David MacRae, product manager at Matrox. "You can load up a PC/XT with three boards for true color output. You might not be able to do that with other systems."



Eight input RAM LUTs *on Matrox's PIP-512 image-processing board enhance contrast when most of the information is concentrated in a narrow range as, for example, between 50 and 178 input gray-scale values as shown. In the first preprocessing step, the lowest gray-scale value (50) for each pixel of the digitized image is mapped to zero (black). The other values shift correspondingly. The 128 gray-scale values are then mapped over an expanded 255-level range.*

The PIP-512 provides 512-by-512-pixel resolution with 256 colors or gray-scale intensities per pixel. The PIP-1024's 1,024-by-1,024-pixel read/write area can be organized as one 1K-by-1K image or four separate 512-by-512-pixel images. Eight input LUTs can increase the contrast of an image—in which most of the information is concentrated in a narrow range of intensity values—by mapping the gray-scale values over a wider range.

The Silicon Video board for the PC, PC/XT, PC/AT or compatibles from Epix Inc. is notable for its split-screen capabilities. A digitized image

Microcomputer-based image-processing and transmission systems find increased use in key industrial, scientific and business applications.

is displayed on the right of the screen for comparison with a reference image displayed on the left, or the screen can display a local and a remote video image for teleconferencing. Sampling resolution is programmable from one to 752 pixels per line, as is the spacing of sampled pixels on a line and the number of lines per video frame.

For motion analysis and other applications, the optional 1M-byte image memory permits the digitization and display of a sequence of 68 images, comprising 64 pixels by 240 lines or 34 images of 128 pixels by 240 lines without access to the disk or the PC's memory. Higher speed motion analysis is served by a new board that surmounts the RS170's 30-frame-per-second scanning-rate barrier. It digitizes at 380 frames a second for 128-pixel-by-128-pixel images.

Advances in integrated-circuit technology will enable Epix to introduce a single-board, full-color, image-processing system early in 1986, says company president, A.C. Petersen. The 12-bit-per-pixel-resolution board will take NTSC composite video input and break it into RGB components.

Send images down the wire

Industrial, laboratory or business applications might require transmitting compressed, digitized images or DOS, ASCII or binary files over telephone lines, a capability of several video boards. System integrators can use Chorus Data Systems' PhotoMail software, PC-Eye digitizer boards and 1,200- or 2,400-baud modems, for example, to transmit full-color images directly to another PhotoMail system for real-time applications. The images can also be stored in an electronic "mailbox" for later use. Users can capture IBM 320-pixel-by-200-pixel four-color graphics from programs such as Lotus Development Corp.'s Lotus 1-2-3.

SKYVID software for Sky Computers' Sky-Scout-PC board implements the transmission of a 128-pixel-by-240-line image or text files over 2,400-baud modems. Received images can be saved on disk. Typed messages, text files and image files similarly can be sent between two Epix video-board configured PCs equipped with Virtual Video software. A 256-pixel-by-240-line image transmits in 60 seconds over 2,400-baud modems.

Such microcomputer-based image-processing and transmission systems find increased use in key industrial, scientific and business applications. Although the market for these systems is still in its infancy, IRD expects it to grow from sales of $300 million in 1985 to possibly $4 billion by 1990, and "devastate" the facsimile and photocomposition markets.

Real-time image transmission over U.S. telephone lines will get a significant boost in 1987 when AT&T Communications implements its integrated services digital network T-1 interface. It will supply 23 64K-bit-per-second (bps) clear channels for video, voice and data and overcome the limitations of today's 9,600-bps telephone lines, which only permit relatively slow, still-frame image transmission.

IRD's Bosomworth sees the wider use of high-resolution image transmission as favoring broadband local area networks over baseband LANs and spurring the installation of high-bandwidth fiber-optic LANs and optical-disk storage.

"If you are going to ship any amount of data over a LAN you need as wide a bandwidth as you can get," Bosomworth asserts. "Fiber optics and optical disks go hand in hand. Fiber optics makes transmission cheap; optical disks make memory cheap. With fiber-optic links you get much faster transmission without a significant increase in cost." □

Companies mentioned in this article

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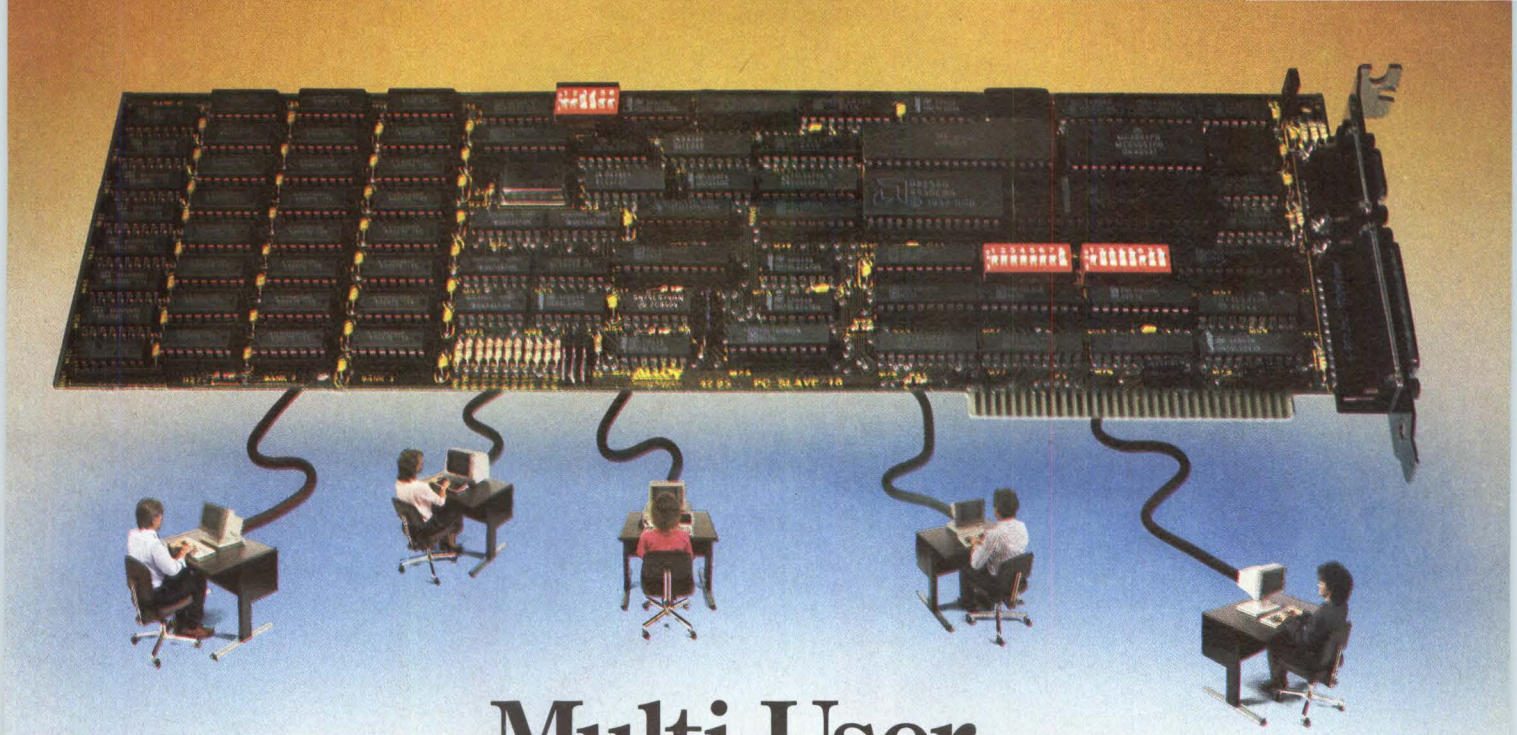

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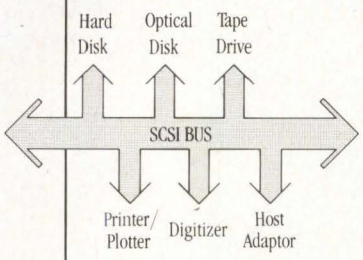

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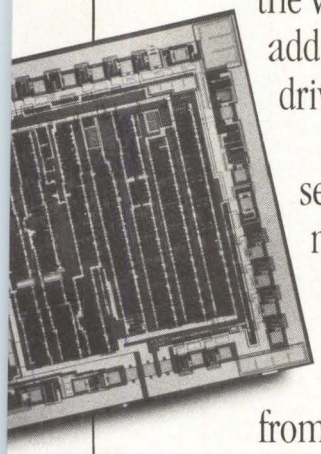

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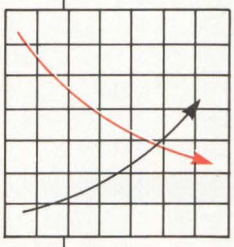

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THERMAL PRINTING HEATS UP COLOR HARD-COPY MARKET

Thermal printing forges ahead of ink-jet and electrostatic technologies in producing low-cost, color hard copy

Jerry Borrell
Senior Western Editor

As the use of color displays grows in applications ranging from business to computer aided design, so does the need for color hard copy. Since 1982, ink-jet, color electrostatic and thermal technologies have competed for market share in the hard-copy arena. However, recent improvements in electromechanical design, in printing components such as color ribbons and paper, and in raster image processors (RIP) have nudged thermal printers ahead in the race to develop low-cost color output.

Ted Charter, business unit director with CalComp, asserts thermal has grown faster than ink-jet or electrostatic technologies due to its reliability and durability. In the opinion of Bill Ewer, vice president of printer-controller manufacturer Lasergraphics Inc., thermal technology will "dominate the color hard-copy market over the next several years."

Seiko Instruments U.S.A. Inc. and Okidata America Inc. are the leaders in bringing thermal technology to the fore. Okidata has sold more than 300,000 of its $200 Okimate thermal printers, while Seiko has sold over 3,000 of its $10,000 D-Scan products. Their success in solving thermal printers' technical problems has encouraged other manufacturers to follow their lead.

Thermal printing uses one of two techniques: direct transfer and indirect transfer. Direct-transfer thermal printing produces images on chemically impregnated paper. When the print head raises the temperature to a "blush point," two chemicals in the paper combine, creating the printed image. Direct-transfer thermal printers are well-suited for geophysical and medical-diagnostic applications, which utilize their gray-scale capabilites.

The major method of indirect thermal transfer employs liquefaction. Liquefaction, in which heat liquefies a wax-based ink on a polymer substrate, is the ascendant low-cost, color hard-copy technique. The printing mechanisms use serial or line-printer heads. Serial printers are represented by Okidata's Okimate and Mitsubishi Electronics America Inc.'s S-300 machine. Serial printers move both head and ribbon perpendicularly to the platen, like dot-matrix printers. Line-printer heads employ arrays of 100, 200, 300 or 400 elements or "nibs" per inch, and print one line at a time. (IBM Corp. developed an alternative indirect approach, resistive technology, for its Quietwriter typewriters.)

Beats registration problems

Thermal-printer manufacturers must solve, however, the problem of combining three process-ink colors—yellow, magenta and cyan—to produce a range of secondary colors. Vendors address this problem by using ribbons divided into yellow, magenta and cyan components. This approach, unfortunately, requires a relatively complex mechanism with the ability to overprint in each of the three colors. Overprinting demands precise paper handling to achieve true color registration, or precise overlap of differ-

CalComp's ColorMaster thermal printer. Photograph by Rick Dressler.

Producing B-size output, *Panasonic's 400-dpi thermal printer uses a half-tone dither technique to generate 256,000 color shades.*

Intensity variations *that adjust color brightness and richness enable Mitsubishi Electronics' G-500 thermal device to print quality photographic images at 300 dpi.*

ent-colored dots, which is crucial in determining the quality of the final image.

Gary Marsh, product specialist at Panasonic Industrial Co., emphasizes that problems with registration grow as resolution increases. "At 200 dpi, problems are not too rough," he says, "but they're five times more difficult [to solve] at 400 dpi. At that resolution, paper and ink registration must be controlled to within one half of a dot."

With most thermal printers, paper handling and ribbon advance are handled separately by independent motors. Friction-feed mechanisms are not subject to the misregistration problems encountered with tractor-feed mechanisms. Either system must advance the ribbon, while simultaneously advancing or retracting the paper for each of the three color passes—increasing the difficulty of exact registration and the time required to produce copy.

CalComp's Colormaster thermal printer employs a different solution to paper handling, according to Ron Morgan, director of product development. The printer uses an A-size drum that moves paper in only one direction, thus improving speed and registration, the company claims.

Multiple-colored ribbon, though, presents several considerations for the system integrator. The chemical properties of the ink, the composition and thickness of the film substrate holding the ink, the platen mechanism on which the paper and ink are pressed against the thermal head, and the printhead itself are interrelated factors that determine print quality. "Ink, ribbon and head mechanisms are inextricably related," emphasizes Panasonic's Marsh.

Mitsubishi Electronics plans to introduce the first cartridge-based ribbons for A- and B-size output, making it easier to switch between ribbons. It also allows a user to print two copies of an A-size document with B-size ribbons.

The longevity of thermal inks is a plus for the technology, claims Andrew Wei, president of Seiko. To demonstrate this point, Wei has exposed ink-jet and thermal copies to the sun for several months. Although the thermal copies are somewhat faded, the ink-jet copy retains just a shadow of original imprint. On the negative side, wax-based inks do not imprint on transparency film with the same vivid chromaticity or luminance as they do on white paper.

Output size can be a problem for certain thermal printers. Although many manufacturers produce linear arrays of elements 8 inches in width, suitable for A- or A4-size paper, B-size printers are available only from Mitsubishi Electronics, Panasonic, Seiko, Benson Inc. and Shinko Electric Co. Ltd.

Gulton Industries Inc. will demonstrate a C-size printer this year. Built with Ricoh Corp.'s thermal heads and sold in the United States by Panatech Semiconductor, the printer will join two 10-inch heads end-to-end to support 400-dpi printing.

Printer vendors disagree on the relative merits

These days, computer printer technology appears to advance at a rate faster than the speed of most computer printers. And just trying to keep pace could easily keep a battalion of engineers occupied on a full-time basis.

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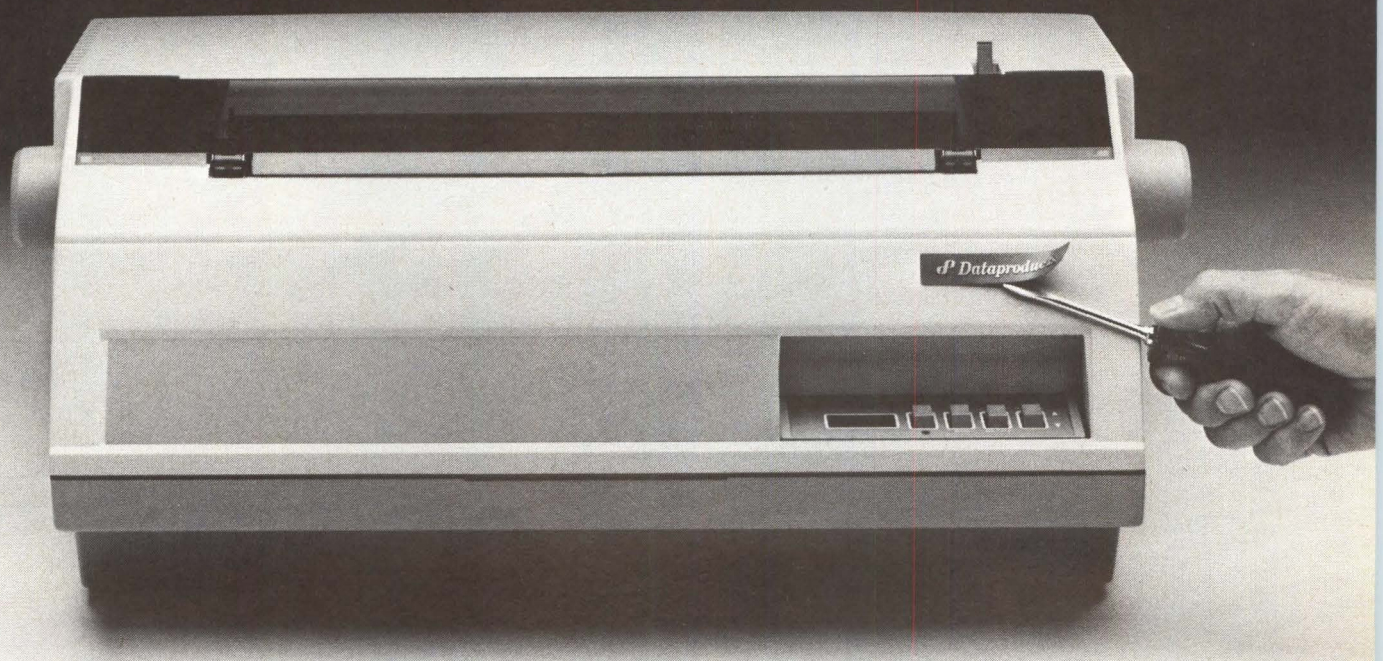

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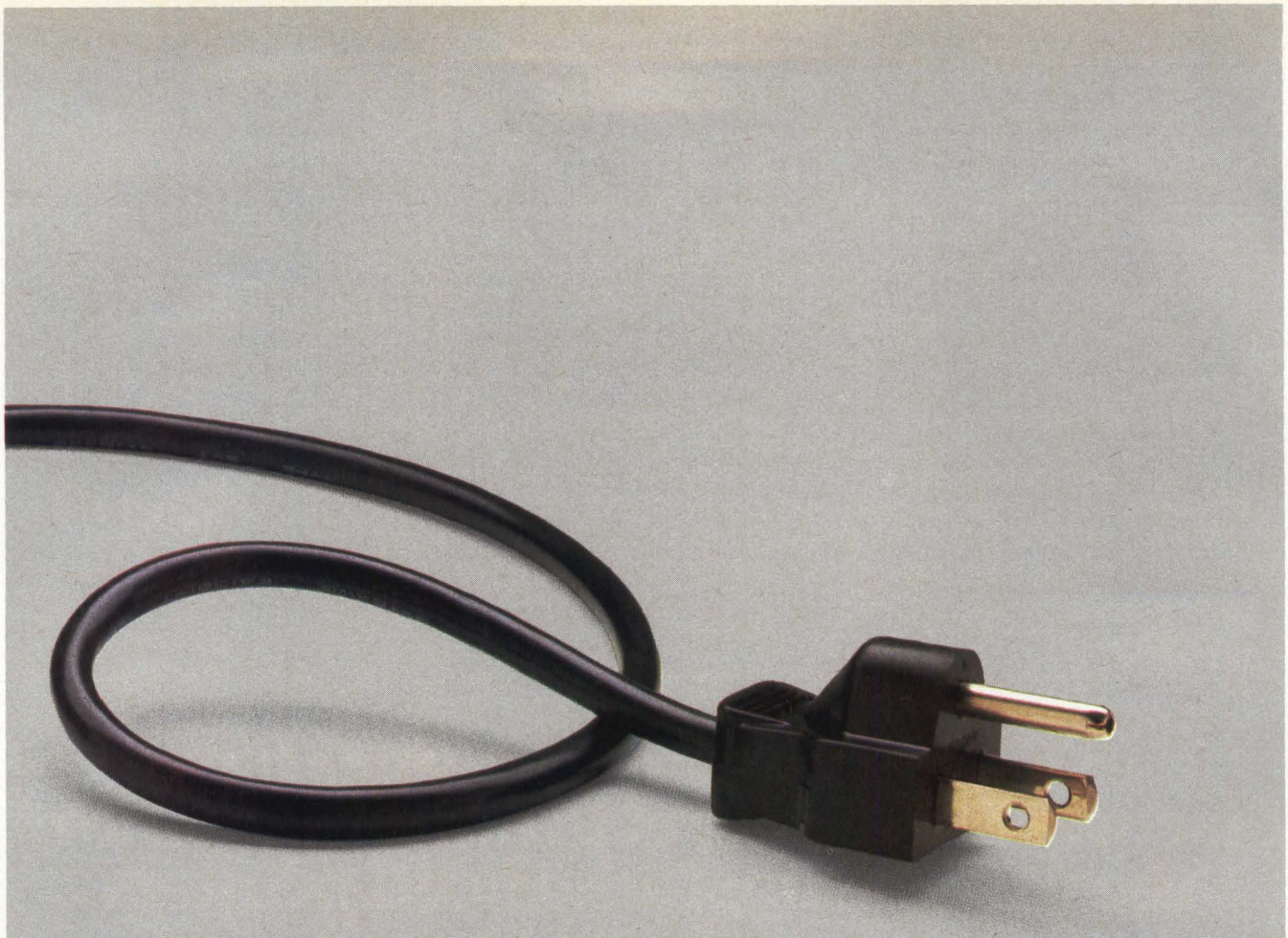

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of thick- or thin-film printheads. Panatech's thermo printhead marketing manager Richard Bartlett contends that thin-film heads provide faster response and, therefore faster printing, due to their lower mass. However, thin-film heads have a lower profile than thick-film heads, making them less suitable for printing on rough paper.

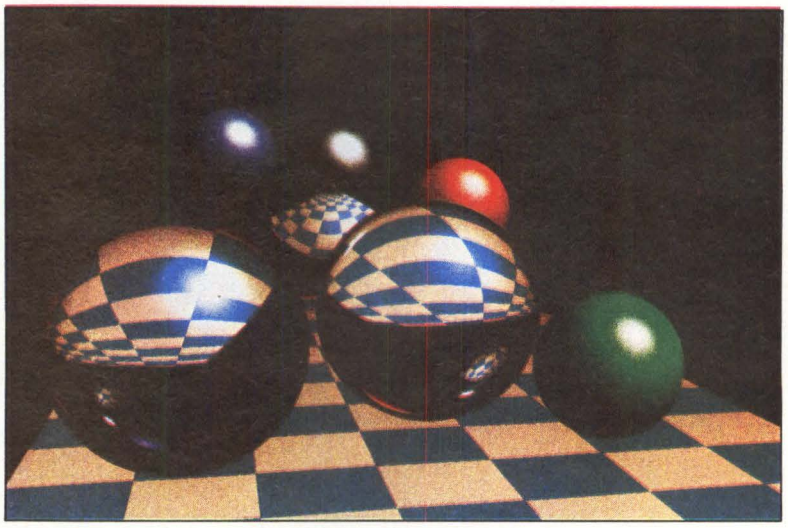
Dot matrices produce continuous tone

Even low-cost thermal printers can produce the three primary and three secondary colors (green, orange and purple) using the yellow, magenta and cyan ribbons. The six colors, plus black and white, serve a significant portion of color hard-copy needs. But because users demand greater color capability, thermally printed dots in the primary colors are combined to create the effect of continuous tone.

Unlike process printing, thermal printers cannot control or "modulate" the size of the dot or the angle of its deposition on paper. With these limitations, the eight available colors are combined in patterns or matrices to simulate the effect of screening in process printing.

Dot-matrix size, however, varies with the vendor and most manufacturers offer several patterns. The effective use of a dot matrix depends on complex software that interpolates the binary values representing colors held in memory by a host computer or by the printer. Algorithms interpolate information about color for the printer controller, which determines what combinations of dots are deposited in each of the three passes over the printhead. Thus the range of colors available from the printer depends on the intelligence of the printer controller.

Thermal printers are raster devices requiring conversion of vectors and primitives from application packages to a bit-map format. Printer manufacturers must decide whether to allow a host computer to perform the rasterization or whether to make their printers intelligent by



A variable dot pattern *creates high-quality color images at 160 dpi on Seiko Instrument's D-Scan thermal printer.*

Companies mentioned in this article

AMF Logic Sciences Inc.
10808 Fallstone Road
Houston, Texas 77099
(713) 879-0536
Circle 411

Benson Inc.
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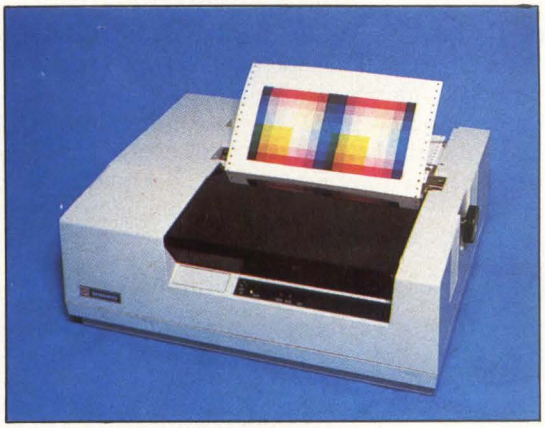
(212) 605-2344
Circle 426

Toshiba America Inc.
Industrial Electronics OEM Div.
2441 Michelle Drive
Tustin, Calif. 92680
(714) 730-5000
Circle 427

A rasterizing computer *from Lasergraphics and West End Film's Artwork package combine with Toshiba America's TN-5400 thermal printer to produce 200-dpi color output.*



Accepting Centronics, *TTL-video or RGB video inputs, Shinko Electric's thermal-printing unit creates A- and B-size plots.*

incorporating RIPs.

Most Japanese manufacturers sell as OEMs to the U.S. market, allowing U.S. companies to develop controllers and device interfaces. Gulton, Mitsubishi Electronics and Toshiba America Inc. printers have internal capability to add controllers. Hitachi America Ltd., according to Jeff Thompson, product specialist, has decided to "rethink" its approach and may enter the market with an intelligent printer. CalComp offers both non-intelligent OEM printers and a RIP-based printer.

The cost advantage gained by host-computer-based rasterizing comes at the price of host time lost to processing. Nevertheless, Frank Lodge, product manager for non-impact printers at Okidata, points out that this may not be a significant factor for simple images. Okidata provides a free disk of more than 40 software application drivers on several host computers. Because Okidata's thermal printer prints only 160 by 140 dpi, and dithers for 64 colors, host processing time compares favorably with that needed for large 8M-byte images.

Many thermal-printer vendors choose stand-alone rasterizing computers such as those built by Lasergraphics. These devices use a proprietary language that must be incorporated into the application. The language builds an image in the buffer of the controller, which has a driver dedicated to a specific printer.

Gabriel Ryan, vice president of marketing at AMF Logic Sciences Inc. points out that while the company's RIPs rasterize, they also accept Hewlett-Packard Co. graphics language and Houston Instrument's graphics language plotter commands. This capability allows over 250 application packages to write directly to AMF RIPs. But the trade-off is that fewer colors are available via pen calls on plotters.

Seiko has championed another approach to hard-copy output that avoids rasterization problems: a video interface. Benson, Shinko Electric and Toshiba plan to support similar interfaces.

Still, video interfaces' analog signals can pose their own problems, notes Duane Clutts, technical marketing manager at Shinko Electric. "Because there are no standard signals from graphics displays, adjustment to the printer is required for every type of display, and the adjustment has to be done frequently," Clutts maintains. Shinko Electric's printer, sold on the OEM market by Gulton, supports three interfaces: Centronics, TTL video and red-green-blue video. Seiko has addressed the matter with a user interface that allows the printer to be set for more than 100 devices.

Future developments in thermal printers are foreshadowed by trends in CAD usage. CAD users are rapidly demanding 3-D and smooth-shaded images. CalComp's Charter believes that thermal printing's high cost per page—30 cents to 40 cents—prices thermal technology out of large-volume xerography markets. Nevertheless, he emphasizes thermal printing's advantages in CAD, publishing and business graphics applications where but few proof copies are needed.

High-resolution film-recorder manufacturer Matrix Instruments Inc., for example, combines its QVP rasterizer with Panasonic's 400-dpi thermal printer. John Patberg, director of marketing at Matrix, sees the two technologies dovetailing, allowing the printer to make high-quality proofs of computer graphics at a lower cost and with a faster turnaround time than film recorders. □

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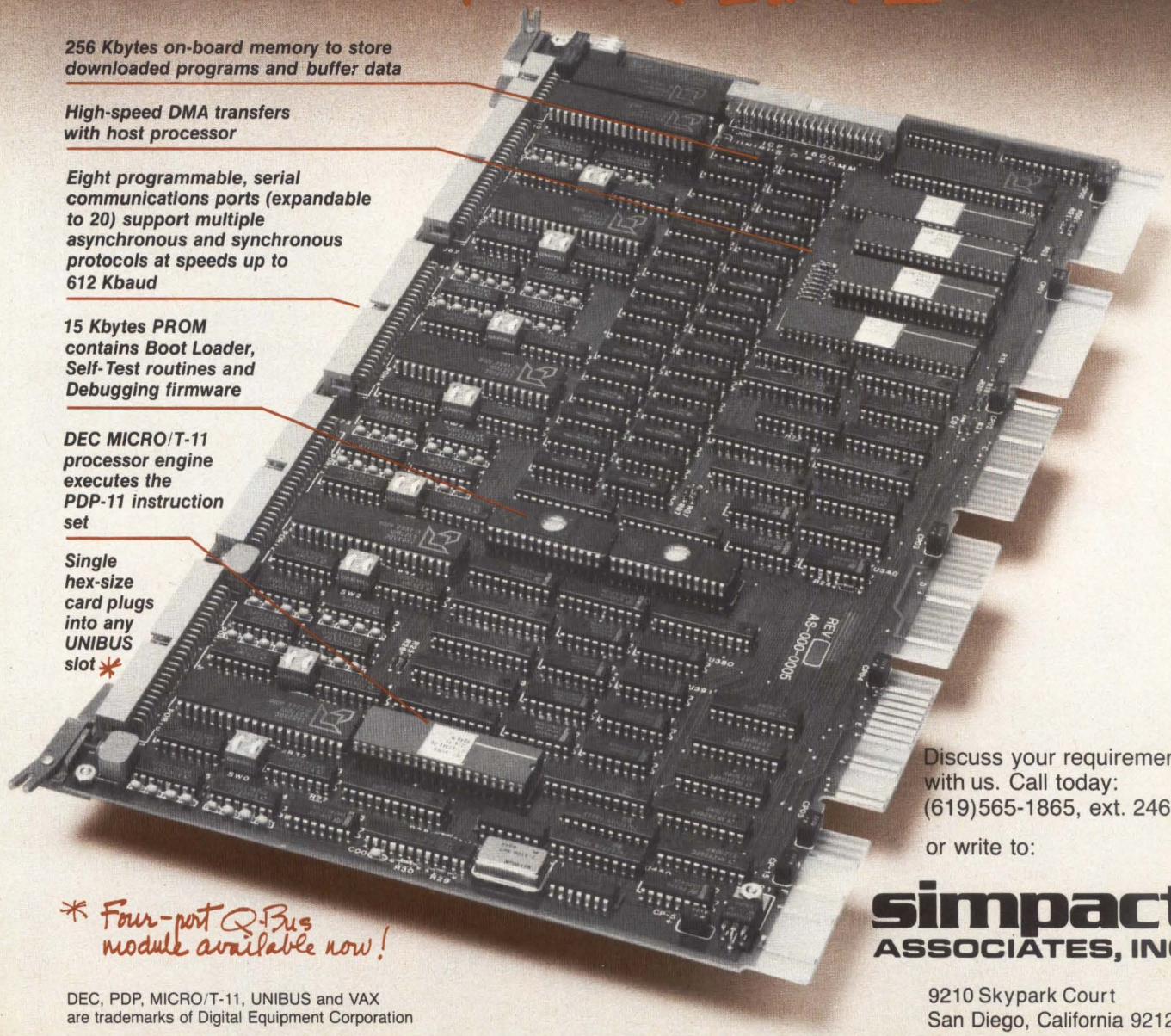

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COPIER/PRINTER MARKET TO EXPLODE BY 1990

With numerous less expensive units in the works, intelligent copier/printers will become more feasible for low-volume operating environments

Stephen M. Pytka
C.A. Pesko Associates Inc.

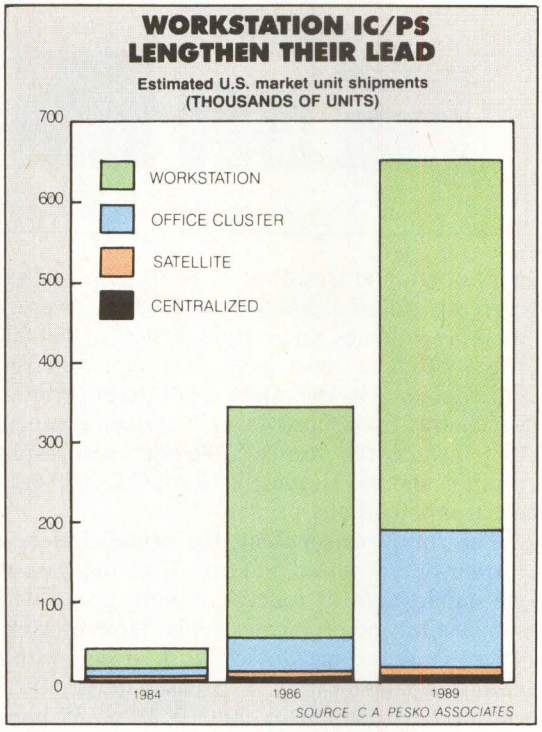
Following a lucrative year of numerous product introductions, the intelligent copier/printer (IC/P) market seems poised for meteoric growth in the late 1980s. Most printer manufacturers have, or soon will offer, IC/Ps that can produce complex printouts, including graphics, images and typographic-quality documents. Because IC/Ps are becoming easier to use, they also suit a broader range of environments.

C.A. Pesko Associates Inc., Marshfield, Mass., defines an IC/P as a non-impact output device that accepts electronic and hard-copy input and produces hard-copy output of at least correspondence-quality print. IC/Ps sometimes have document-scanning ability, which distinguishes them from page printers, which ordinarily do not. IC/Ps are generally at their best in printing standard, letter-sized documents on plain bond paper. In addition, some IC/Ps offer user-selectable fonts and document-formatting capability, and the capability of printing graphics and images.

Two elements are particularly useful in analyzing the IC/P market: the operating environment and the major application area.

IC/Ps are basically used in four operating environments, which vary on the basis of production needs and the physical proximity of the machine to the user. They are the centralized, satellite, office-cluster and workstation environments.

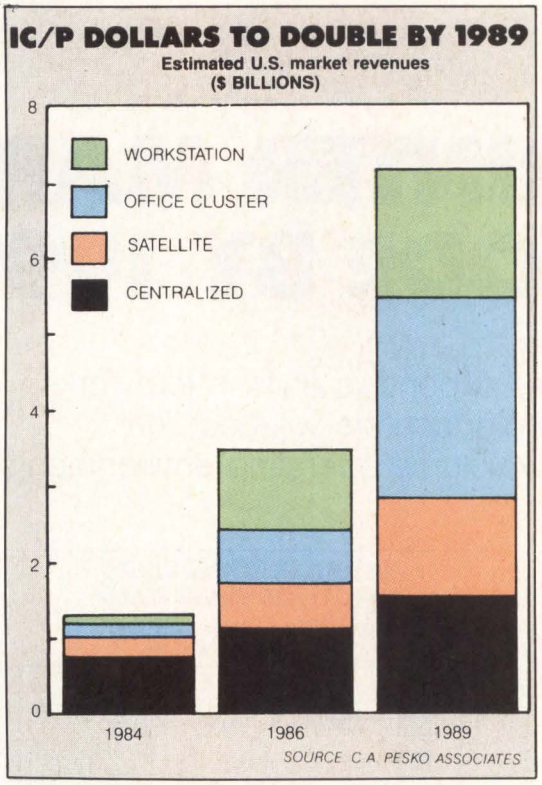
The first of the operating environments, the centralized environment, entails a centralized data-processing facility or central reproduction department. Usually, there are only one or two of these centralized sites per company. IC/Ps used in this environment typically produce more than 1 million pages per month. This segment is dominated by high-priced, high-volume products that run at speeds in excess of 80 pages per minute (ppm) and sell for over $300,000. The Xerox Corp. 9700 laser xerography printers and IBM Corp. 3800 laser electrophotography printers clearly have dominated this centralized segment to date.



As workstation intelligent copiers/printers *increase their dominance in the U.S. market, the overall number of units shipped should increase from 42,700 in 1984 to an estimated 653,000 in 1989.*

Satellite environments have remote printing departments or distributed data-processing sites that are connected with or controlled by centralized environment management. Typically, one or two of these environments might be found in each major company location. IC/Ps in this cate-

Intelligent copiers/printers will create *an estimated $7.1 billion industry by 1989, with the higher cost of satellite and centralized printers compensating for their shrinking market share.*



gory operate at speeds of 35 to 80 ppm and are currently priced at $40,000 to $100,000. Average monthly volumes range from 20,000 to 400,000 pages. Today's most popular product in this environment is the IBM 6670 laser printer, which was introduced in 1979. Other competitors include the Xerox 5700 laser xerography printers and the Hewlett-Packard Co. 2680 laser electrophotography printer.

The third environment, the office cluster, is further decentralized and usually contains a single department or functional work group with similar files and producing similar types of work. There could be many such work groups within each company location. IC/Ps used in the office-cluster environment operate at 10 to 35 ppm. Currently, these products are priced at $12,000 to $35,000.

The first major product offering for this environment was the IBM 6640 ink-jet printer, followed by the Canon U.S.A. Inc. LBP-10 laser printer. The Xerox 2700 laser xerography printer and its major OEM counterparts have become popular products in this environment. This market segment has become crowded with products from Canon, IBM, Minolta Corp. and Ricoh Corp., to name a few. IBM recently announced its 12-ppm, 3812 page printer, which may set a new price/performance barrier (at $7,490). Most current products in this segment are based upon laser technology and incorporate low-speed, xerographic marking engines inherited from copier technology.

The fourth environment is that of the personal workstation. In this environment, a one-on-one situation exists between the worker and the automated office equipment. There is, of course, the potential for literally thousands of workstations within each Fortune 1,000 corporation. Printers in the workstation environment operate at speeds below 10 ppm. In fact, even as this segment matures, most products will continue operating at only a few pages per minute, because this is not a high-production environment. Typical volume is between 500 and 3,000 pages per month.

New products boost market

The most popular workstation products are based on the Canon LBP-CX laser engine: the HP LaserJet 2686A for daisywheel emulation and the QMS Inc. Lasergraphics 800 and the Imagen Inc. 8/300 for full bit-map text graphics and image merging. The Apple Computer Inc. LaserWriter is aimed at customers who require near-typeset-quality text integrated with graphics. IBM's recently introduced Quietwriter, with thermal-transfer technology, is a major low-end product priced at $1,395. Competition is heightened by many new products such as the LCS-2400 by Casio Inc., the 4045 by Xerox Corp., the FBP-01 by Kyocera Corp. and the LN03 by Digital Equipment Corp.

The workstation environment, followed by the office cluster, currently leads other environments in units shipped, while the high-end centralized and satellite environments generate more revenue.

Four major application areas exist for IC/Ps today, and these applications should dominate the market over the next five to 10 years: data processing, word processing, office information systems and electronic printing and publishing.

IC/Ps compete on a cost/performance basis to replace impact line printers for data processing and fully formed character printers for word processing in traditional work situations. The existing population of impact printers in both of these application areas is large, but growth rates are decreasing. Although the majority of IC/P placements to date has been primarily in centralized data-processing and satellite data- and word-processing environments, the availability of lower priced models is opening up the market for these products to perform these functions in the office-cluster and workstation environments as well.

The office information systems and electronic printing and publishing application areas will

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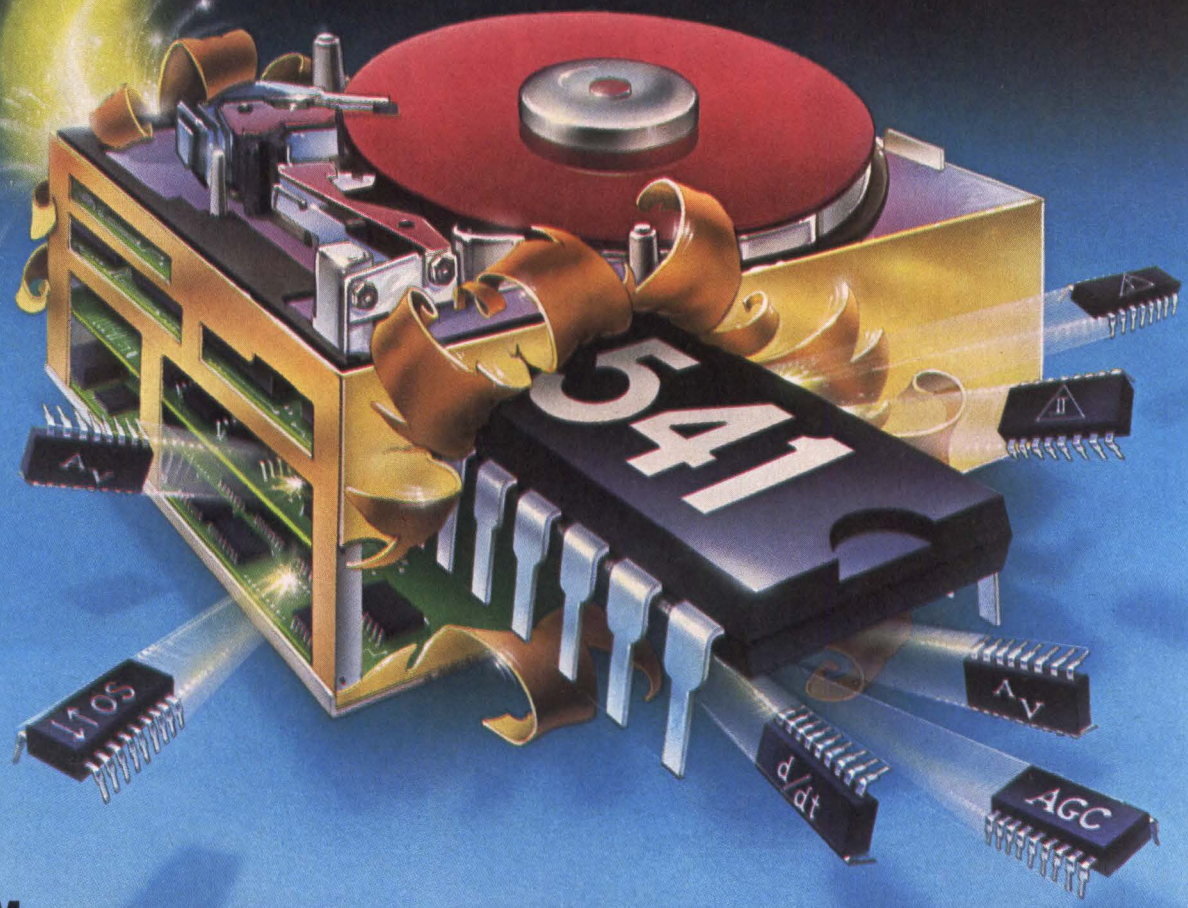

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begin to represent a larger placement opportunity shortly, as these two applications are rapidly emerging.

Various types of electronic office equipment in office information systems are linked through local area networks. As the development of the office information systems market picks up steam, there will be significant demand for IC/Ps. There is a growing need now in many of these companies to print high-quality, hard-copy output on standard, business-size documents for company-wide networks.

Because IC/Ps are being used within these networks to handle several tasks, these products must be versatile enough to meet the various printing requirements. Some applications within the office information systems area include electronic mail, facsimile image transmission and business graphics, as well as traditional word processing. While this market segment may have been relatively slow compared to word- and data-processing applications, by the late-1980s, office information systems should be one of the major forces escalating the IC/P market.

Expansion of the electronic printing and publishing segment, like the office information systems area, will require significant market development. Electronic printing systems will begin to replace existing printing and duplicating equipment for both in-house and commercial printing. These new systems will offer substantial labor savings by displacing many manual steps in the traditional pre-press (composition, platemaking) press (printing) and post-press (collating, binding, distribution) areas. Consequently, electronic printing systems will represent a revolutionary change in the way in which printed matter is produced.

Market boom due by 1990

Market estimates indicate accelerated overall market growth for IC/Ps over the next few years. Until now, the market has been evolving at a relatively slow rate. The growth of both shipments and revenues is beginning to speed up.

In 1986, total revenues will be approximately $3.5 billion. Projected market revenues are expected to increase to $7.2 billion by 1988. These estimates include revenues generated from equipment sales, rentals and services.

The number of units shipped is expected to grow from 43,000 in 1984 to over 653,000 units by 1989. The workstation environment promises the greatest growth. In 1983, only 8 percent of all IC/P shipments were in the workstation environment. Workstation shipment share is forecast to reach 66 percent by 1990, due to a proliferation of new products based on low-priced laser/electrophotographic engines such as the Canon LBP-CX, and low-priced (below $1,400) thermal-transfer-based products. But, while the workstation shipment share should increase dramatically, revenue will not because of low average unit prices.

IC/Ps WORK IN A RANGE OF ENVIRONMENTS

Operating environment	Printing speed (pages per minute)	Typical end-user price ($)	Typical volume (pages/month)
centralized	80 +	300,000 +	1,000,000 +
satellite	35-80	40,000-100,000	20,000-100,000
office cluster	10-35	12,000-35,000	5,000-20,000
workstation	under 10	2,500-10,000	500-3,000

Source: C.A. Pesko Associates Inc.

The Canon LBP-CX and related products sparked a workstation IC/P revolution in 1984. For the first time, laser electrophotographic products were competitive on a price/performance basis with daisywheel and dot-matrix printers. The HP LaserJet, at $3,495, set a new benchmark in 1984 for IC/P pricing. They continued setting price trends with the introduction last summer of the LaserJet PLUS, while dropping the LaserJet to $2,995. In 1985, more products mimiced the same functionality, i.e., daisywheel performance, for $2,500. Sophisticated products with graphics and image capability will be priced from $6,000 to $10,000. At $6,995, the Apple LaserWriter has also brought typographic-quality output within the reach of office automation system users.

The IBM Quietwriter is aimed squarely at low-end daisywheel and dot-matrix printers. With the IBM blessing, more thermal-transfer products will emerge in the $900 to $1,400 price range.

Laser electrophotographic products still dominate the office-cluster environment. All major suppliers of printing engines have spawned products based on electrophotography, including the Xerox XP-24, Canon LBP-20, Kentek Information Systems Inc. K2 and Minolta SP-50B. The majority of new products in 1985 were based on these engines. Two new technologies are also being utilized—ink-jet and magnetography. Diconix Inc., Dayton, Ohio, has the Dijit 1 ink-jet printer, and Ferix Corp., Fremont, Calif., has the Model 800 magnetic printer. These two products will start to challenge the dominant electrophotographic printers in 1985. □

Whereas intelligent copiers/printers were once *exclusively used in high-volume, centralized operating environments, new lower-priced machines have put IC/Ps within the grasp of smaller, less demanding sites.*

Stephen M. Pytka is vice president of C.A. Pesko Associates Inc., Marshfield, Mass., a market research and consulting company for the information-processing industry. He has worked as marketing manager of peripheral and graphics system development at Wang Laboratories Inc. and was a manager of strategic planning and product development at Xerox Corp.

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UNIFORUM '86: THE UNIX CONNECTIONS

New products demonstrate UNIX's ability to interconnect diverse applications

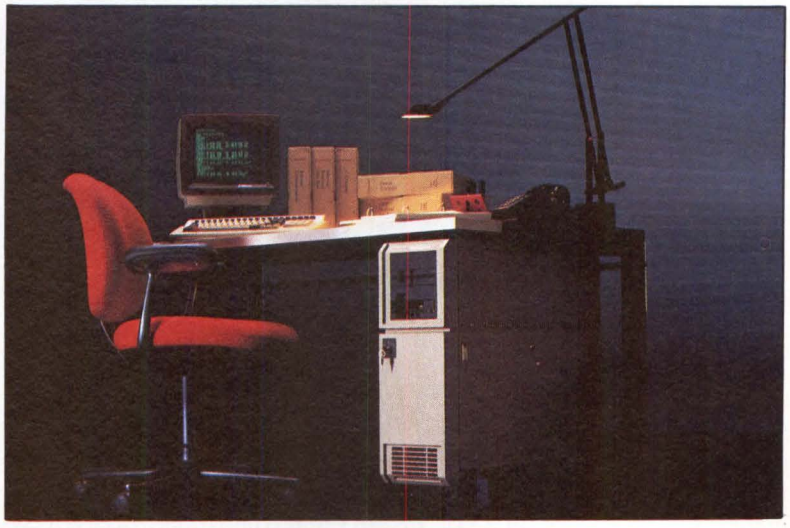
Frances T. Granville, Associate Editor

"The UNIX Connections" is the theme of the third annual UniForum conference, sponsored by /usr/group, the international UNIX users network. UniForum will take place Feb. 4-7 at the Anaheim Convention Center, Anaheim, Calif. The "connections" theme refers to how UNIX provides an interface between user and machine and between machine and machine, allowing users in diverse applications to communicate.

UniForum's keynote speaker will be Roland Pampel, vice president of marketing and development for AT&T Information Systems. In addition, the conference will feature 14 day-long tutorials and approximately 20 panel sessions on the latest marketing developments. For example, Jean Yates of IDC/Yates Corp., Palo Alto, Calif., will chair a session entitled "AT&T Strategies & Directions," and Heinz Lycklama of Interactive Systems Corp., Santa Monica, Calif., will chair "Emerging Standards." Other topics include "UNIX on PCs" and "Multivendor Networking." Six in-depth technical presentations will provide some 18 papers on such topics as the "Document Interchange Architecture" and "UNIX in a Multicomputing Environment," and nine free workshops will offer introductory overviews of UNIX II, the C language and other subjects.

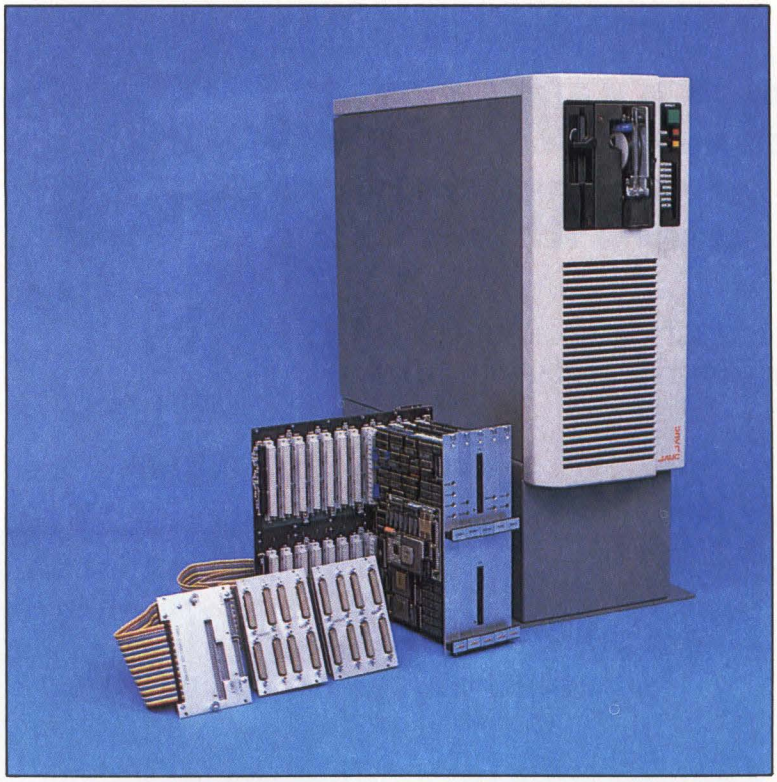
In addition to the panels and technical sessions, attendees will be able to examine the wares of approximately 200 vendors of UNIX products and services.

For example, Relational Database Systems Inc., Menlo Park, Calif., will give its first public demonstration of the Informix-4GL relational database management system, which will be announced this month and shipped in February. Informix-4GL combines IBM Corp.'s Structured Query Language with a fourth-generation language. Because it mixes procedural and nonprocedural languages, it allows programmers to use the syntax that best suits the application at hand.



Cromemco will introduce *a CPU option to its previous high-end series, the System 400, along with an upgrade to that series.*

Also noteworthy is the multiuser, multitasking XENIX System V operating system from The Santa Cruz Operation, Santa Cruz, Calif. The company will demonstrate XENIX System V on an ATTIS PC 6300 Plus, which is not IBM PC/AT- or PC/XT-compatible. Previously, XENIX System V was available only for



Dual plans to introduce *its Chaparral multiprocessor microcomputer series at UniForum. The high-end configuration, Chaparral IV, includes a 16-MHz MC68020, MC68851 memory-management unit and MC68881 floating-point coprocessor.*

PC/ATs, PC/XTs and compatibles. XENIX System V, developed by Microsoft Corp. and introduced in September 1985, is licensed and verified by AT&T Co.

As for hardware, many of the noteworthy products at UniForum will be recently introduced 32-bit microcomputers. For example, Cromemco Inc., Mountain View, Calif., plans to introduce and demonstrate the System 432 series of supermicrocomputers, which is based on a 16-MHz version of Motorola's 32-bit MC68020. The company also plans to announce a CPU option for its previous high-end family, the System 400 series.

Also making its debut at UniForum will be the four-member Chaparral family of VMEbus-based systems from Dual Systems Corp., Berkeley, Calif. The company expects the entry-level system, Chaparral I, to include the VMPU-32 multiprocessor board with 1M byte of memory, a 16-MHz MC68020 microprocessor and an MC68851 memory-management unit. The high-end configuration, Chaparral IV, adds the MC68881 floating-point coprocessor along with the MC68020 and MC68851. All four systems will include DualPlus+, Dual's implementation of UNIX System V, Release 2.0, Version 2. Dual expects starting prices to range from $19,000 for the Chaparral I to $33,000 for the Chaparral IV.

Also demonstrating a product introduced this month will be Plexus Computers Inc., San Jose, Calif. Its P/75 multiuser UNIX-based microcomputer incorporates a 12.5-MHz MC68020 job processor, Plexus' single-board Advanced Communications Processor, an expansion chassis that permits as much as 6.5G bytes of disk storage and as much as 16M bytes of main memory, and Plexus' Common Circuits Board. Intended for database-intensive applications in Fortune 2,000 corporations, government agencies and medium-sized businesses, the P/75 supports as many as 80 users.

Other noteworthy products scheduled for exhibition at UniForum include:

- A series of intelligent, asynchronous multiplexers, introduced in October by Systech Corp., San Diego. The multiplexers, comprising host adapters and remote cluster controllers, work with Multibus I-, Multibus II- and VMEbus-based microcomputers.
- The UniPlex II integrated office-automation package from UniPress Software, Edison, N.J. UniPlex II incorporates word-processing, spreadsheet and relational database functions; menus; and screen-builder and printer-spooler components. Prices range from $895 for one to two users to $9,995 for 65 or more users.
- UNIX versions of the MicroTrak project-management tool and its graphics companion product, PlotTrak, from SofTrak Systems, Salt Lake City.
- The expanded Ten/Plus user environment from Interactive Systems Corp. Ten/Plus provides a consistent interface for computer users. It aims at organizations seeking a standard, easy-to-use environment that can run on different UNIX systems and on various classes of computing equipment: personal computers, multiuser microcomputers, minicomputers and mainframes. □

Interest Quotient (Circle One)
High 477 Medium 478 Low 479

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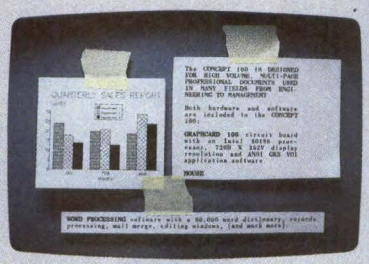

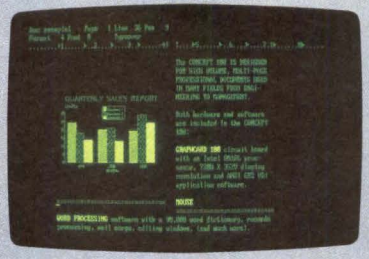

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CIRCLE NO. 68 ON INQUIRY CARD

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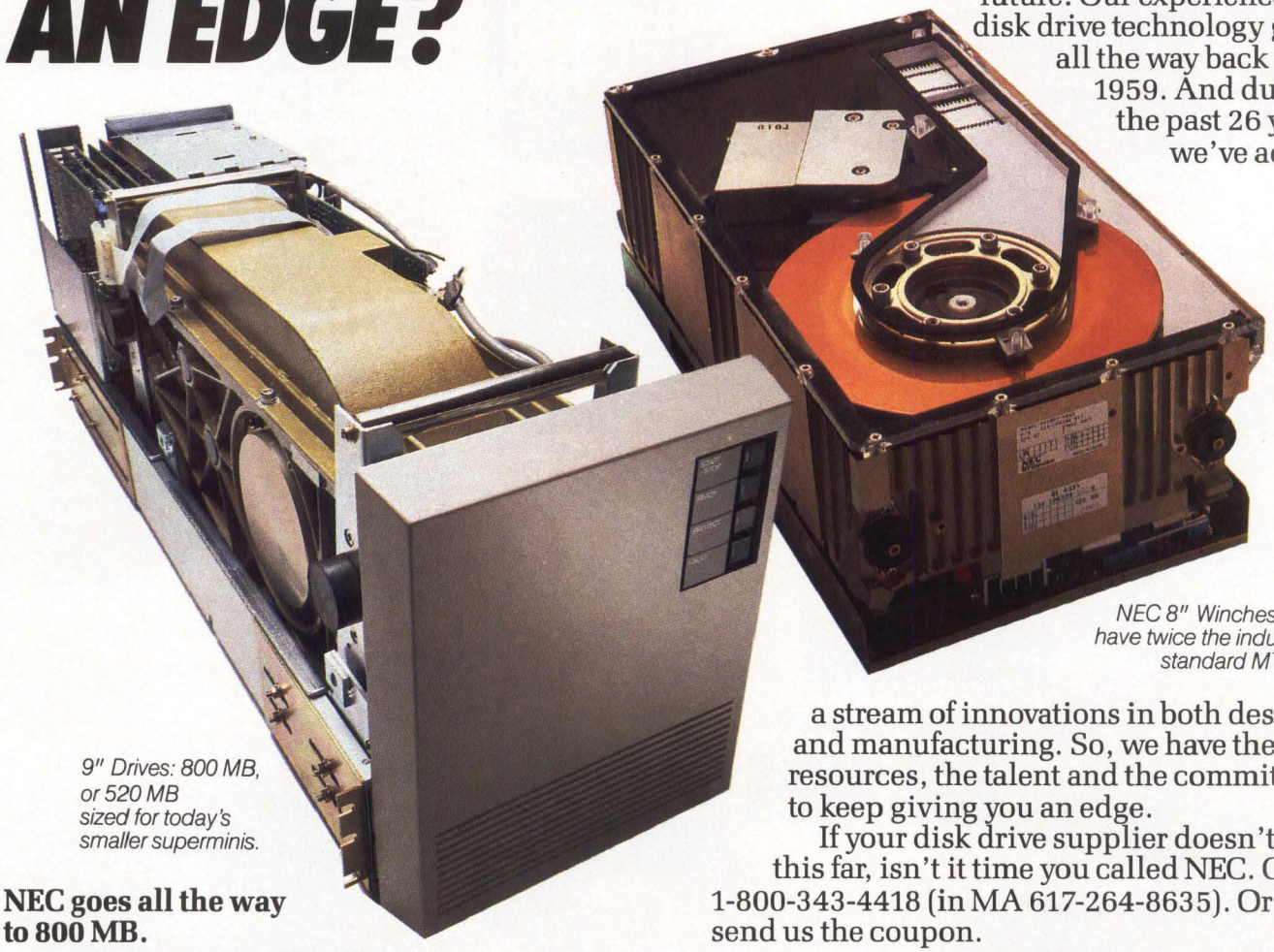

9" Drives: 800 MB, or 520 MB sized for today's smaller superminis.

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CIRCLE NO. 69 ON INQUIRY CARD

NEW PRODUCTS

SYSTEMS

Megan Nields, Assistant Editor

DESKTOP MICROCOMPUTER OFFERS RANGE OF CHOICES

- 80286 CPU
- 640-by-400-pixel resolution
- IBM PC/AT-compatible

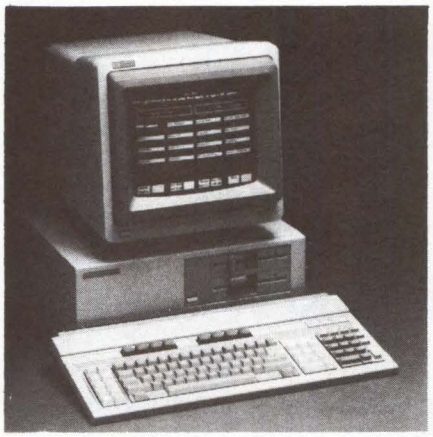
Hardware- and software-compatible with the IBM Corp. PC/AT, the Hewlett-Packard Co. Vectra personal computer is 30 percent faster, smaller and lighter than the PC/AT, according to company officials. Targeted for the office environment, the system uses the 8-MHz Intel Corp. 80286 microprocessor and the MS-DOS 3.1 operating system.

The monochrome and color monitors provide 8-by-16 alphanumeric character resolution with a full-display resolution of 640 by 400 pixels, more than twice that of the PC/AT. The color monitor displays 16 colors; the monochrome, 16 shades of gray. HP's Multimode Video Adapter supports 320-by-200-pixel and 640-by-200-pixel, IBM-compatible modes, plus the proprietary 640-by-400-pixel resolution, in both text and graphics applications. A Multimode Color Adapter supports 640-by-400-pixel resolution on the color monitor.

An enhanced graphics adapter, compatible with IBM's 640-by-350-pixel resolution Enhanced-Graphics Adapter, supports the proprietary high-resolution color and all IBM-compatible modes. This high-resolution board facilitates higher speed, bit-mapped graphics for environment managers such as Microsoft Corp. Windows and vertical applications.

The keyboard provides separate numeric and cursor pads, 18 programmable function keys and light-emitting diode indicators for the scroll, caps and number-lock positions.

The system is available in three configurations. Model 25 comes with 256K bytes of RAM and one 360K-byte, 5¼-inch flexible disk drive. Model 35 includes 256K bytes of RAM and a 1.2M-byte, flexible disk drive. Model 45 also comes with a 1.2M-byte, flexible disk drive but stores 640K bytes of RAM. Seven expansion slots are provided; RAM can be expanded to 640K bytes without using any of the slots. With memory cards, the system is expandable to 3.64M bytes.



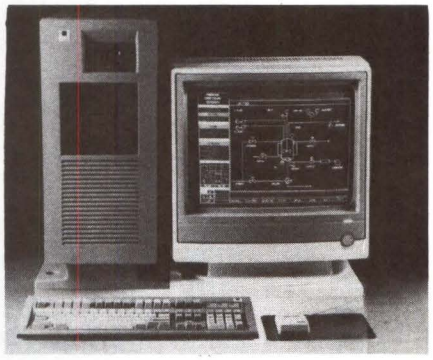
HP's Vectra personal computer *is IBM PC/AT-compatible and offers high-resolution text and graphics on its color and monochrome monitors.*

Up to two half-height flexible disk drives and one half-height rigid disk drive can be stacked inside the processor unit. The rigid disk drives offer either 20M or 40M bytes. A 5¼-inch, 360K-byte or 5¼-inch, 1.2M-byte disk drive allow the system to run IBM PC-compatible software. A dual, 3½-inch, 710K-byte flexible disk permits data exchange with HP's Touchscreen Personal Computer or any proprietary portable computer. A quarter-inch tape backup system with 60M bytes of storage can be attached to the system.

Communications capabilities are facilitated by the proprietary OfficeShare local area network. Together with Microsoft Windows, the LAN connects Vectra to the Touchscreen and to the IBM PC, PC/XT and PC/AT. The LAN also interconnects the system to the HP 3000, HP 1000 and HP 9000 scientific computer families.

Prices begin at $3,195, which is 20 percent less than the IBM PC/AT. **Hewlett-Packard Co.,** 3000 Hanover St., Palo Alto, Calif. 94304, (415) 857-1501.

Circle 300



Micros employ XENIX OS

- 80286 CPU
- 80287 coprocessor
- 1M- to 2M-byte RAM

Based on the 8-MHz 80286 microprocessor, the single-CPU model 286/310 AP series supports flexible and rigid disk and streaming-tape drives. All configurations include the 80287 numeric coprocessor; a 320K-byte, 5¼-inch, flexible disk drive; support for a 60M-byte, half-inch, streaming-tape cartridge drive; and a 40M- or 140M-byte, Winchester disk drive. With the optional 311 peripheral expansion subsystem, the AP series handles 420M bytes of rigid disk storage. The systems come with 1M or 2M bytes

of RAM and from two to 18 serial I/O channels. FORTRAN, COBOL, C and PL/M programming and utility packages for the XENIX operating system are included. $11,200, eight-user system with 40M-byte Winchester disk drive. **Intel Corp.,** 2402 W. Beardsley Road, Phoenix, Ariz. 85027, (602) 869-3825.

Circle 301

Workstations combine DEC, IBM environments

- 3M-byte memory
- 2M-byte graphic memory
- 19-inch monitor

Operating in both DEC and IBM environments, the 6500 family of standalone workstations consists of four configurations. Models 6580 and 6585 provide IBM 5080 emulation and DEC MicroVAX and 2-D and 3-D color graphics capabilities. Models 6500 and 6505 offer 2-D and 3-D graphics but operate only in the DEC environment. All workstations employ the MicroVMS operating system and allow the concurrent operation of Tektronix 4100 windows, four simultaneous DEC VT200 windows and the DEC MicroVMS console window. In addition, models 6580 and 6585 provide a proprietary 6080/IBM 5080 window. An entry-level system comes with the proprietary Ocean graphics engine; the MicroVAX II with 3M bytes of memory and hardware floating point; eight RS232 lines; dual, 800K-byte flexible disks; 105M-byte, 5¼-inch, fixed Winchester disk drive; Ethernet interface; four bit-plane, double-buffered pixel memory; 1M byte of graphics memory; a 19-inch, 60-Hz, noninterlaced, color monitor and keyboard. $49,500, model 6500; $54,500, model 6505; $66,500, model 6580; $71,500, model 6585. **Adage Inc.,** 1 Fortune Drive, Billerica, Mass. 01821, (617) 667-7070.

Circle 302

System suits process control

- 48 I/O channels
- Historical database
- 20M-byte drive

Automating continuous, batch and sequential processes, the Icon/1000 distributed control system configures complete process-control strategies on screen without conventional language programming. The system combines a plant-floor controller and a workstation. The workstation, based on the IBM model 7531/2 industrial computer, serves as a CAD/CAE graphics workstation for configuring process-control strategy; as an operator display for the plant floor; and as an information-management system for process data analysis. The workstation employs a 16/32-bit Intel 80286 CPU and a 20M-byte fixed disk. The controller combines a Motorola MC68010-based supermicrocomputer running a real-time, multitasking operating system with a universal signal interface. It supports up to 48 I/O channels. $56,000. **Data Acquisition Systems Inc.,** 349 Congress St., Boston, Mass. 02210-1222, (617) 423-7691.

Circle 303

High-Performance Ethernet TCP/IP for PDP-11/RSX™

Complete, low cost connectivity with most systems.

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The entire PDP/RSX package is only $4,495, including the EXOS 203 intelligent Ethernet/IEEE 802.3 controller for Q-bus, EXOS 8030 TCP/IP software, EXOS 1100 transceiver and cables. And the entire PDP/RSX package for UNIBUS is only $5,395.

Interested in high-performance connectivity? If so, look into Excelan's similar packages for DEC VAXes, UNIX supermicros, MicroVAX IIs, IBM PCs, XTs and ATs.

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Eight-inch drives use SMD/CMD interface

- 83M to 165.9M bytes
- 20-msec access time
- 9,000 bpi

The models MK-182FB, MK-184FB and MK-186FB 8-inch, Winchester disk drives use the SMD or CMD interface and hold 83M, 116.1M and 165.9M bytes of unformatted data. Each drive contains a shock-mounted frame and a sealed head disk assembly. Average access time for all drives is 20 msec; track-to-track access time, 5 msec. Data transfer rate is 9.6M bps. Each drive provides 20,160 bytes per track with 823 cylinders per drive. Track density is 900 tpi; bit density, 9,000 bpi. The drives' spindles are directly driven by a brushless, DC motor. MTBF is 20,000 hours. $2,395 (Q500), MK182FB; $2,495 (Q500), MK184FB; $2,795 (Q500), MK186FB. **Toshiba America Inc.,** Disk Products Division, Suite 103, 3910 Freedom Circle, Santa Clara, Calif. 95054, (408) 727-3939. **Circle 304**

Tape drive stores 138M bytes

- 25, 50, 100 ips
- 160 ips, rewind
- 160K bytes per second

A half-inch, streaming magnetic tape drive with a 7,400-hour MTBF, the DMT 2510 backs up Winchester disks or acts as secondary storage in data-processing systems. Storage capacity is 138M bytes at a 3,200-bpi density; 46M bytes at 1,600 bpi; and 92M bytes at 3,200 bpi. Tape speed is selectable at 25 or 100 ips at 1,600 bpi and 50 ips at 3,200 bpi. Rewind speed is 160 ips. Providing automatic tape loading and threading and power-on diagnostics, the drive transfers data at 160K bytes per second at 100 ips and 40K bytes per second at 25 ips. A Pertec formatted interface is standard. The drive employs a 6,000-gate, CMOS gate array in the control circuits and hybrid ICs to achieve reliability. $4,379. **Anritsu America Inc.,** 128 Bauer Drive, Oakland, N.J. 07436, (201) 337-1111. **Circle 305**

Winchester drives withstand extremes

- 3½-inch
- 20M-byte storage
- 35,000-hour MTBF

A series of two 3½-inch, Winchester disk drives, the Titan drives provide error-free storage of data under temperature extremes, shock and vibration. Both models, the 3525 and the 3265, store 20M bytes and have a 0.014-inch vibration displacement at from 5 Hz to 46 Hz and 1.5G acceleration from 46 Hz to 500 Hz. When not in operation, the drives withstand a 0.293-inch vibration displacement from 5 Hz to 20 Hz and 10G acceleration from 20 Hz to 500 Hz. The model 3525 runs under a temperature range of 5 C to 55 C and

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shock characteristics of 6G, peak operating mode and 40G, non-operating mode. The model 3265 operates under temperatures ranging from 0 C to 65 C and under shock characteristics of 6G, peak operating mode, and 60G, non-operating mode. Proprietary head lifters protect heads and media. The MTBF for both drives is 35,000 hours. Incorporating two disks, four heads and an ST412/506 interface, the drives transfer data at 5M bps. Track-to-track access time is 15 msec; average access time is 68 msec. Maximum access time is 150 msec. $430. **LaPine Technology Corp.,** 182 Topaz St., Milpitas, Calif. 95035, (408) 262-7077.

Circle 306

Disk drive suits Apple's Macintosh

- 20M bytes
- Manager utility
- Security utility

An internal, 20M-byte, rigid disk drive, the HyperDrive stores up to 50 Apple Macintosh flexible disks. The drive includes four disk-management utility programs. Permitting more efficient organization of disks, the manager utility divides the rigid disk into 32 file drawers (each appearing as a separate icon on the Macintosh screen) and assigns a password to each file drawer. The security utility protects files by scrambling their contents using encryption techniques. The third utility, disk backup, allows data to be transferred from the rigid disk to flexible disks. The print spooler utility frees the Macintosh for other operations while documents are being printed. $2,795. **General Computer Co.,** 215 First St., Cambridge, Mass. 02142, (617) 492-5500.

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Maxtor

CIRCLE NO. 73 ON INQUIRY CARD

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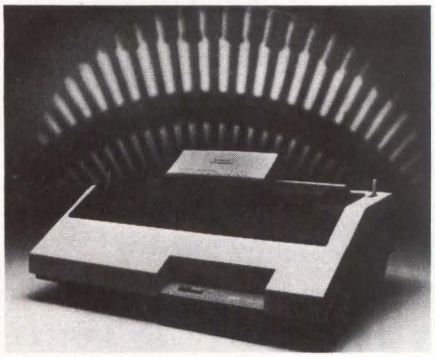
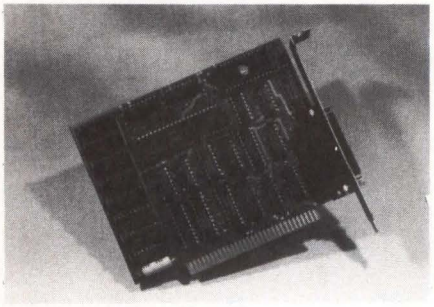
Daisywheel printer runs at 55 cps

- 4,000-hour MBTF
- Word processing
- 255 printwheels

Claimed to be 25 percent to 35 percent faster than its Diablo model 630 predecessor, the model 635 Diablo daisywheel printer runs at 55 cps, maximum speed, and 40 cps, Shannon text speed. Model 635 weighs 30 pounds, compared to 60 pounds for the 630. Noise level is 56 dBa. Accommodating correspondence, word-processing and personal computing applications, the unit achieves an MTBF of 4,000 hours. Features include semiautomatic paper loading, drop-in printwheel and dual-bin sheet feeder. The printer offers 255 different printwheels, providing 10, 12 and 15 proportional space pitch, as well as character sets for 15 languages. Word-processing functions include boldface type, underline, subscripts and superscripts and shadow printing. $1,485. **Xerox Corp.**, Xerox Square 006, Rochester, N.Y. 14644, (716) 423-5078.

Circle 308





Printer buffer suits IBM PC/AT

- 64K to 256K bytes
- 5¼-inch width
- Speeds transfers

This internal printer buffer for the IBM PC, PC/XT and PC/AT reduces the waiting time for a computer to transfer data to the printer. The 5¼-inch, short card unit combines the IBM parallel printer adapter with a buffer memory of 64K to 256K bytes. Included with the buffer is a series of utility programs that permit the erasing of buffer memory or the exchanging of printer adapters. The programs run at the DOS prompt. $155, 64K-byte version; $180, 256K-byte version. **Ditron Corp.** 4026 W. St. John, Phoenix, Ariz. 85308, (602) 938-3165.

Circle 309

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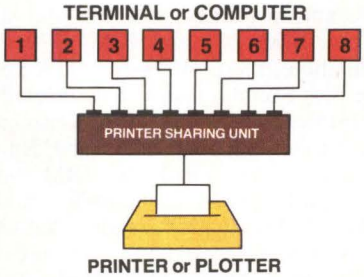

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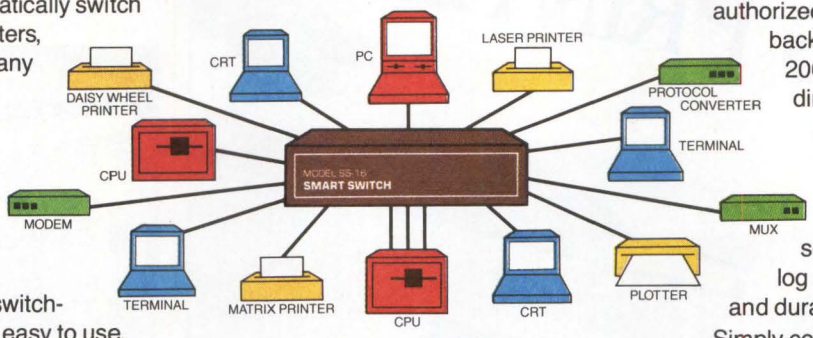
AFFORDABLE RS232 NETWORKING

Create your own local network with our Any-port to Any-port Smart Switches. Available in either 8 or 16 port versions, the Smart Switch is ideal for computer port expansion, computer sharing, engineering work clusters and much more.

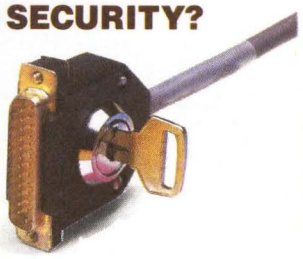
Each port has its own spooling buffer. So any baud rate can communicate with any other baud rate and parity anywhere in the system.



A special supervisory port lets you monitor activity on any other port, connect ports together, broadcast messages or designate the supervisory power to other ports.

The Smart Switch is easy to use. User friendly commands allow you to select ports, disconnect and display port activity. A push button defines each port for either DCE or DTE. So if you need an intelligent, affordable way to link your RS232 system, you're ready for the Smart Switch.

CONCERNED ABOUT DATA SECURITY?



Prevent unauthorized access to your computer system. Our Dial-back Security Unit prevents outsiders from peeking at, destroying or tampering with your data. Only users entering authorized passwords and dial-back numbers stored in the 200 number battery backed directory will be allowed access.

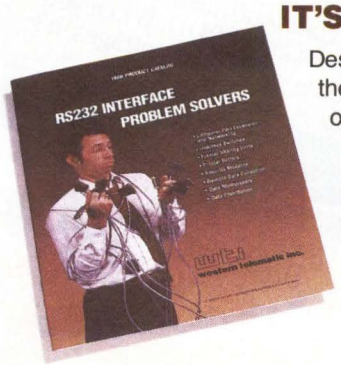
An auxiliary command port is used to set-up the directory and security levels as well as log each password attempt and duration of each call.

Simply connect the DSU between your computer and modem and feel secure about who's using your data.

QUALITY PRODUCTS

Every WTI product is designed and manufactured with quality and reliability as a major requirement. We're so confident you'll like our products that we offer a 30 day return policy. Compare our features, quality, customer support and prices with any other manufacturer and you'll know why WTI is a recognized leader in the Data Communications industry.

IT'S ALL IN THE BOOK...IT'S FREE



Descriptions, diagrams, specifications and prices for the above products, plus many more, are in our colorful new catalog. It's your cost saving connection ...just ask for it!

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western telematic inc.

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CIRCLE NO. 75 ON INQUIRY CARD

Printer handles high-volume output

- Daisywheel
- 35 cps
- 3K-byte buffer

A 136-column, daisywheel printer accommodating high-volume-output applications, the model DX-35 prints 35 cps at 10 cpi. Using a snap-in, 96-petal Diablo plastic printwheel, the unit runs word-processing software with automatic underlining, bold, subscript, superscript, bold shadowing and doublestrike features. The printer offers variable character pitches of 10, 12 and 15 cpi, plus proportional spacing mode. Features include friction paper feed, a 3K-byte print buffer and a Diablo all-purpose interface (RS232C, IEEE-488 and parallel). $899. **Epson America Inc.,** Computer Products Division, 2780 Lomita Blvd., Torrance, Calif. 90505, (213) 539-9140.

Circle 310

RIP OFF THIS PRINTER.

Stop wasting forms.
Get the new Datasouth 180DD–the high performance printer for true-to-form printing. It's fast, it's rugged, it's sophisticated and it prints legibly through six-part forms with ½ inch tear-off capability.
This makes the DS 180DD the ideal printer for hotels, motels, airlines, travel agencies–for any job that requires quality multipart form printing on demand.
Call your nearest Datasouth distributor today and ask about the new DS 180DD. When you consider all the money-saving advantages, it's really quite a steal.

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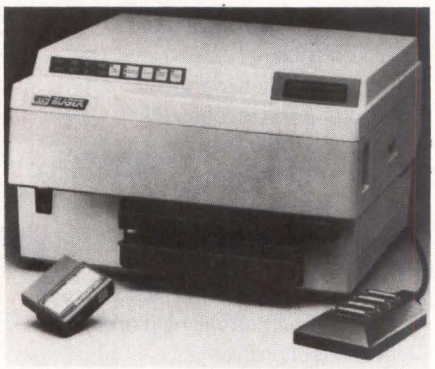
CIRCLE NO. 76 ON INQUIRY CARD



Laser printer connects to five hosts

- Eight fonts
- IBM PC-compatible
- 8 ppm

Printing at a resolution of 300 dpi, the Blaser laser printer offers eight font families in 128 styles online to boldface, compress, expand, reduce or rotate typefaces and to print superscripts and subscripts. IBM PC- and IBM 3270 PC-compatible, the unit operates at 8 ppm. Five host computers can be connected to the printer to generate text and graphics. The printer supports IBM and Epson bit-mapped graphics, the IBM print screen utility in text and graphics modes and the IBM extended graphics character set. It prints legal, letter, A4 and B5 paper. In communication mode, baud rate is 50 to 19.2K bps. Print modes include compressed and double width. $2,995. **GTC Technologies Inc.,** 216 W. Florence Ave., Inglewood, Calif. 90301, (213) 673-8422.

Circle 311

Presenting the Falco 500.

The spectacular productivity machine.

You're looking at a model that's about to reshape your image of a computer terminal.

Sure, it's got eye-catching looks. But more than that, it combines some of the most dazzling specs you've ever seen.

The kind that can make your operators—and your system—more effective than ever.

Screen

- 14" Flat-profile CRT with exceptionally high resolution.
- Crystal-clear soft white, green or amber display.
- Multiple screen sizes up to 38 lines by 132 columns.
- Real-time clock/calendar.

Keyboard

- 108-key, fully re-configurable keyboard.
- Designed for efficient data entry/retrieval.
- Styled for operator comfort.

Software

- Up to 6 windows for multi-tasking environments.
- Extra pages of local text storage.
- Compatible with industry-standard VDT protocols.
- Down-loadable character sets.

Enclosure

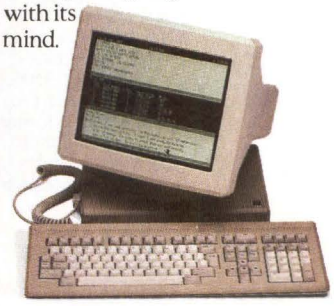
- Soft color tone, elegantly styled.
- Engineered for cool operation.
- Uses minimal desk space.

Communications

- Selectable RS232C/RS422 bi-directional ports.
- True 8-bit data capability.
- Baud rates up to 38.4 Kbps.

To screen test one of our attractive new models, call your local distributor today. Or contact Falco Data Products, 1294 Hammerwood Avenue, Sunnyvale, California 94089. (408) 745-7123. Toll-free **(800) 835-8765.**

The Falco 500. We think you're going to admire its body. But we know you're going to fall in love with its mind.



FALCO 500

CIRCLE NO. 77 ON INQUIRY CARD

Terminal provides color graphics

- 1,024 by 1,024 pixels
- 16 programmable keys
- 19 inches, 16 colors

Displaying 16 colors on a 19-inch screen, the CT1024 color graphics desktop terminal achieves 1,024-by-1,024 and 512-by-512-bit-map images. Operating in a 30-Hz interlaced or a 60-Hz non-interlaced refresh mode, the intelligent unit has 16 programmable function keys; supports non-destructive zoom, pan, blink and graphics primitives; and furnishes RGB output. The Tektronix-compatible terminal offers variable character sizes and a 512K-byte display memory. Features include scaled and clipped windows, cover overlay for text and messages and ADM 3A emulation. $8,495. **Chromatics Inc.,** 2558 Mountain Industrial Blvd., Tucker, Ga. 30084, (404) 493-7000. **Circle 312**

Terminal offers compact keyboard

- RS232C compatible
- 53-key keyboard
- 19.2K-baud rate

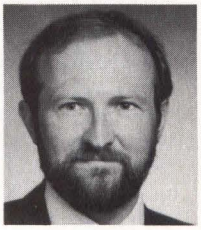
The TransTerm 6 is an RS232C-compatible portable data terminal generating an 80-character two line display with a 5-by-7-dot matrix. The keyboard contains 53 keys with raised graphics and an audible key-click for tactile feedback. One out of three operating modes is setup-selectable, allowing teletype-compatible operation, block-send mode or polled multidropped operation of up to 255 units. Selectable features include a 110K-byte to 19.2K-byte baud rate, parity, half/full duplex, auto line wrap, auto new line, auto key repeat, and X-on/X-off protocol. $349. **Computerwise Inc.,** 302 N. Winchester, Olathe, Kan. 66062, (913) 829-0600. **Circle 313**

Touch-screen monitor displays color

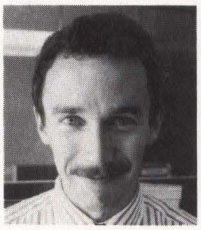
- IBM PC-compatible
- 13-inch screen
- 0.31-dot-pitch resolution

Providing a touch entry alternative for OEMs, system integrators and value-added resellers, the color CYCLOPS Touch-Screen Monitor displays a resolution of 0.31 to 0.63 dot pitch. The IBM PC-compatible unit comes with TTL or analog output and a horizontal 15.75-kHz and vertical 60-Hz scan frequency. It operates as a CRT display without the cabinet, or as a fully cabinet-enclosed monitor. Features include a 13-inch screen and a 2,000-character display area. $540. **ITW Entrex,** 6615 W. Irving Park Road, Chicago, Ill. 60634, (312) 282-9440. **Circle 314**

Concurrent™ PC DOS Works For These People



"PhoneXpress™, our voice messaging product, needs the powerful multi-tasking environment that Concurrent PC DOS offers. Also, our programmers love it, they can be compiling in one window and switch into an editor which increases productivity."
Dennis King
Executive Vice President, Founder
Applied Voice Technology



"The file manager is great. It's a step above the old DOS system. You don't have to remember commands and you don't have to read the manual."
John Martinson
Engineer
Pacific Gas Transmission

"Concurrent PC DOS gives us the capability to attach additional terminals for a more productive office. It has a true multi-user capacity. We can now meet deadlines."
Richard Vananda
Principal
Patrick Sullivan Associates, Architects

"I couldn't live without the product. Time is money and the ability to switch consoles and run more than one program has been a great time saver."
Joe Capp
Project Engineer
Union Carbide

"We have created a menu driven system that is totally transparent to our customers. By utilizing the menu system and 4 consoles concurrently we are able to fully utilize Concurrent PC DOS"
Subbash Chadha
MIS Director
Secoin Inc.

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Quality And Innovative Technology Can Work Together.

As a competitive OEM manufacturer, you demand even higher standards of quality and innovative technology from your equipment suppliers.

Newbury Data can meet that demand with a range of 5¼" and 3½" disk drives that provide unmatched storage capacity.

Closed loop voice coil technology guarantees fast access times, whilst all drives are fitted with industry standard interfaces: either ST 506/412 or the new Enhanced Small Device Interface (ESDI).

And all backed by the kind of service and support you'd expect from Newbury Data, Europe's leading peripherals manufacturer.

So if you're rethinking of disk drives, remember we've been providing 'hi-tech' solutions to 'hi-tech' problems for nearly 30 years.

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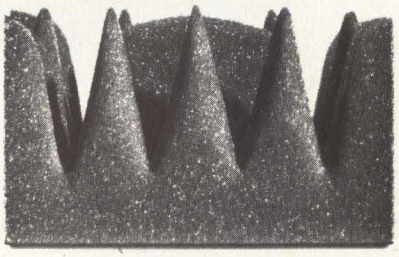
Len Kehoe, 20, Vernon Street, Norwood, Massachusetts 02062. Telephone: 617 551 0280

CIRCLE NO. 79 ON INQUIRY CARD

A pointed attack on noise.

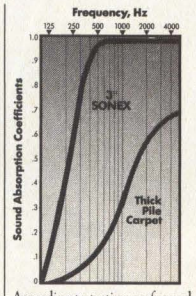


SONEX

SONEX acoustic foam wages a two-front war on equipment noise.

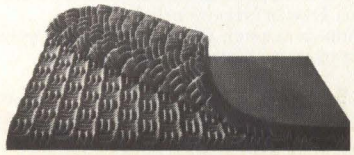
First, the patented SONEX wedge traps, deflects, and scatters noise. The wedge's depth and angle carry noise waves down into the lowest point of each anechoic foam valley. Most of it doesn't have the energy to come back up.

Then the foam itself converts sound energy to silent kinetic energy. Sound literally gets lost within the open cell pores of this special foam. What the wedge doesn't dissipate, the acoustic foam converts to silence. Together this two-pronged attack kills industrial noise every time. Call or write for complete technical specifications, acoustic charts, and independent test results: 3800 Washington Ave. North, Minneapolis, MN 55412. (612) 521-3555.

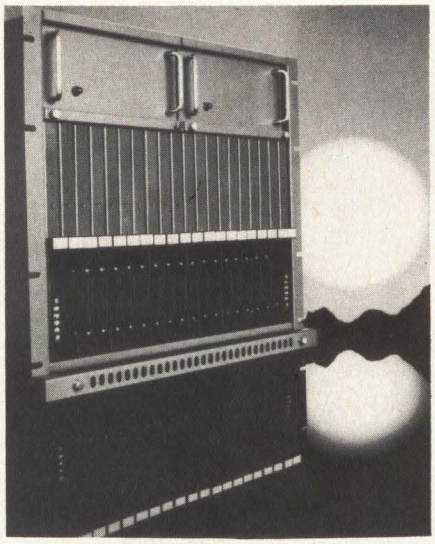


According to testing performed in strict accordance with ASTM C423-77 procedures, at 500 Hz 3" SONEX has a weighted noise reduction coefficient (NRC) of almost 0.98, while thick carpeting is 0.15.

illbruck



CIRCLE NO. 80 ON INQUIRY CARD



Modem operates in two modes

- Bell 212A-compatible
- Local, remote test
- Call-progress reporting

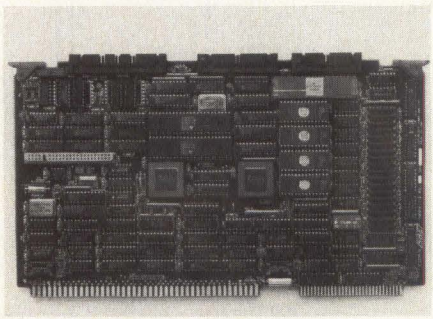
Running in both asynchronous and synchronous modes, the auto-dial, auto-answer 2400 Plus modem uses the IBM PC/AT command set. Achieving 2,400 bps, the modem is compatible with the Hayes Smartmodem 1200, the Bell 212A standard at 1,200 and 300 baud and with the V.22bis standard at 1,200 and 2,400 baud. The unit runs software for 1,200-baud modems. It automatically detects the speed of the remote modem and adjusts its own speed to match in both originate and answer modes. A frequently called number can be stored in non-volatile memory. Features include local and remote test modes, call-progress reporting, lease-line operation and fully programmable, synchronous operation. Four synchronous dialing modes are standard: dial with data terminal ready, dial when switch pressed, switch from async to sync and manual dial. $695. **Ven-Tel Inc.,** 2342 Walsh Ave., Santa Clara, Calif. 95051, (408) 727-5721.

Circle 315

Board communicates at 3M bps

- Multibus-compatible
- four-channel DMA controller
- 128K, 512K bytes RAM

Communicating at 3M bps, the COM II Multibus-compatible single board computer runs with no wait states at 10 MHz using the 68000 or 68010 microprocessor. The board employs a four-channel DMA controller to provide full-duplex operation on both serial ports. It supports X.25, SNA, SDLC, HDLC and bisynch protocols and can be be run in asynchronous, byte synchronous or bit synchronous modes. The device works with RS232C, RS422 or TTL drivers and receivers for both channels. Other features are 128K or 512K bytes of dual ported, hardware-refreshed RAM; parity; sockets for up to 256K bytes of EPROM on-board and a 16-bit iSBX connector for I/O expansion. $1,295. **SBE Inc.,** 2400 Bisso Lane, Concord, Calif. 94520, (800) 221-6458.



Circle 316

Modem features speed adjustment

- Bell 103, 212A
- auto-dial/auto-answer
- 300 to 9,600 bps

Operating asynchronously at 300, 1,200 or 9,600 bps in full-duplex mode or synchronously at 1,200, 4,800, 7,200 or 9,600 in half-duplex mode, the 9600VP Bell 103-, 212A-compatible modem provides error control and data compression. The unit uses a CCITT modulation technique and offers auto-dial/auto-answer, front-panel dialing and diagnostics and software configurable options. Automatic speed fall-back and fall-forward adjusts the data rate for variations in line quality; call statistics provide operation and performance data. Automatic speed conversion allows data reception at a speed different from that of the communication link or the receiving terminal. $1,495. **Racal-Vadic,** 1525 McCarthy Blvd., Milpitas, Calif. 95035, (408) 946-2227.

Circle 317

THE MODEM YOUR EQUIPMENT NEEDS. WHETHER IT'S INTELLIGENT, DUMB, OR JUST INSECURE.

Introducing the all-purpose NEC N2420/30.

It's the only 2400bps full-duplex modem that gives you all these choices: Async Auto Dial, Sync Auto Dial, Security Call Back, and Error Control.

Which means that now you can get just the right modem, whatever the personality of your equipment.

For instance: if your terminals are smart, you can choose our Hayes-compatible mode. (It's included in our Async Auto Dial option.)

If your terminals are dumb, you can make life easier with our NEC Logon mode. (Also a part of our Async Auto Dial.)

And if you use a synchronous terminal for either SDLC or BSC dial-up, you can finally have auto dial with it, too—a combination found only in our Sync Auto Dial option.

What's more, if you want to keep the hackers out of your communications network, you can pick our Security Call Back option, complete with 96 user passwords and telephone numbers.

With the N2420/30, you also get MNP Error Control for all your asynchronous data. (That includes security, an area where no other modem offers Error Control.)

Which makes a total of 4 different applications. All from a single, self-diagnosing modem.

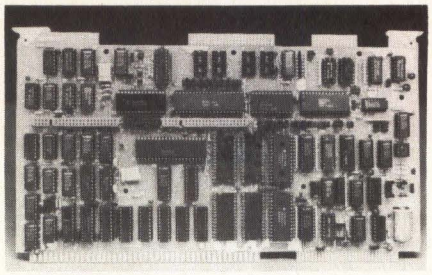
For more information on the N2420/30 and its remarkable options, call 1-800-538-8166. (In California, 1-800-672-3309.) Or write NEC America, Inc., Data Communications Products Division, 110 Rio Robles, San Jose, California 95134.

Get in touch with us today. You'll be making a smart move. And a secure one.

NEC

C&C Computers and Communications

CIRCLE NO. 81 ON INQUIRY CARD



SBC draws just 250 mA

- 80C88 CPU
- 24 parallel I/O lines
- Three counter/timers

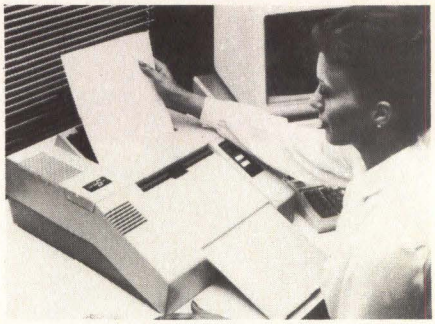
A CMOS Multibus CPU card offering compatibility with Intel's iSBC 88/25, the CBC 88C/25 requires only 5 percent of the Intel board's operating current. Power needs are 250 mA maximum at 5V. Employing an 80C88 CPU operating at 5 or 8 MHz, the board contains 16K bytes of CMOS static RAM and sockets for up to 64K bytes of JEDEC-compatible EPROM, expandable to 128K bytes. Features include 24 programmable parallel I/O lines; three programmable, 16-bit counter/timers; a programmable, serial interface; two SBX-compatible connectors; and an on-board Lithium battery for over four years of continuous RAM data retention. The board comes in two versions: 0 to 70 degrees Celsius and minus 40 to 85 degrees Celsius. $1,095. **Diversified Technology Inc.,** P.O. Box 748, Ridgeland, Miss. 39158, (601) 856-4121.

Circle 318

Desktop scanners enter text, graphics

- 30-second page scan
- stores scanned imaged
- 120 pages per hour

The models PCS 230 and PCS 240 optical page readers enter text and graphics into IBM PCs and compatibles.



Reading about 120 pages per hour, typical applications include word processing, data communications, document distribution, electronic mail, database and electronic filing. In word-processing applications, both models convert documents into a format compatible with WordStar, MultiMate and Microsoft Word. Model PCS 230 scans a page in 30 seconds. In addition to standard fixed-pitch font recognition, it automatically handles right-justified and proportional spacing and special symbols. Model PCS 240 enters graphics as well as text in the form of bit-mapped images. At 12 seconds per page in imaging mode, it scans graphics from small to full-page size, displays and stores the scanned image, manipulates the image, annotates it with comments or legends and produces composite text and graphics documents. Video resolution is 200, 150 or 100 dpi. $5,695, PCS 230; $5,995, PCS 240. **CompuScan Inc.,** 81 Two Bridges Road, Fairfield, N.J. 07006, (201) 575-0500.

Circle 319

Processor works with IBM PC, PC/AT

- Z80H CPU
- 128K-byte memory
- Two serial ports

A Z80-based, 8-MHz coprocessor board for the IBM PC, PC/AT, AT&T model 6300 and other PC-compatible systems, the Turboslave-PC stores 128K bytes of RAM with parity. Used as a background processor for communications, print spooling or data encryption, the board is supported by the proprietary TurboDOS multiuser operating system. Features include two serial ports, port-mapped FIFO for master-slave communications, diagnostics, monitor EPROM and the proprietary SLR Z80 assembler. $495. **Earth Computers,** Box 8067, Fountain Valley, Calif. 92728, (714) 964-5784.

Circle 320

Think of a Viking workstation as another way to add value.

If you're not integrating ergonomic support furniture in your system, you may be missing an easy way to increase margins and add even more value. Users don't like shopping around to complete the system any more than you do. Try buying a good workstation in your area sometime. It's tough, and it sometimes opens the door to competition and criticism.

We think a lot of users care about the system environment, and well-designed support furniture can make your system more comfortable. And therefore more useful and productive.

Call us on our toll-free line. Everyone wins: users get good furniture at no more cost; you increase margins; and we win through economy of scale, even if the scale is just a few units a month.

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IEEE-488

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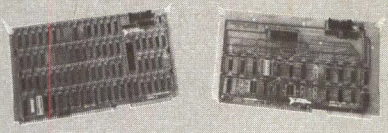

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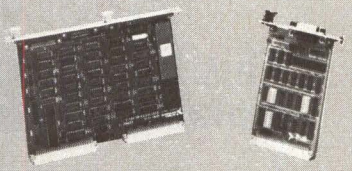

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ADVERTISERS INDEX

Adaptec Inc. 80-81
Alloy Computer Products 99
AMF Logic Sciences 33
Ampro 78
BASF E2-E3
Charles River Data Systems 36
CIE Systems 16
Cipher Data Products 40-41
Clearpoint E4
Concept Technologies 119
CXI 10
Datapoint 25
Dataproducts 105
Dataram D9
Datasouth Computer Corp. 128
Delta Airlines 123
Digital Equipment Corp. D4
Digital Research 130
EMC 50
Emulex Corp. 5
Equinox Systems 19
Excelan 122
Facit 22
Falco Data Products 129
Fujitsu America Inc. Storage Division 13
GP Technologies, Inc. 126
General Power Systems 28
Gould Inc., Computer Systems Div. 72
Human Design Systems Inc. (HDS) D3
Illbruck/USA 132
Information Builders Inc. 53
Infotron Systems Corp. 1
Intel Corp. 48-49
Interface Group 26
JDL 116
Keytronics 137
Lear Siegler Inc. 9
Lexidata Corp. D8
Masscomp 71
Matrox Electronic Systems Ltd. 20
Maxtor Corp. 125
MDB Systems Inc. 109
Micom Sales Div. 56-57
Microdesign International 95
Microware 12
Multi-Tech 75
National Instruments 135
NCR Corp. 90-91
NEC Peripherals 106, 120, 133
Newbury Data 27, 131
Omnicomp Graphics Corp. 87
Oregon Software 82
Philips T&M E1
Precision Visual 39
Quality Micro Systems 96
Qume 88
Radio Shack (Tandy Corp.) C3
RDS-Relational Database Systems C2
Santa Cruz Operations 79
S & H Computer D12
Seiko Instruments USA 76
Sharp IED 35
Shape Magnetronics Inc. 124
Silicon Systems 114
Simpact Assoc. Inc. 110
Tatung 43
TEAC Corp. 34
TEC, Inc. 4
Technology Forum 8
TeleVideo Terminals 45, 46-47, 61-66
Texprint D6
Toshiba 58-59
Uniforum 60
Unify Corp. 6-7
Universal Data Systems Inc. C4
U.S. Design Corp. D7
Versatec Inc. (a Xerox Co.) 14-15
Viking Acoustical 134
Visual Technology Inc. 113
Western Digital 100-101
Western Telematic Inc. 127
Wyse Technology 68

See P. 136 for Classified Advertisers

See P. 142 for Career Opportunity Advertisers

See P. 140-142 for Mini-Micro Marketplace

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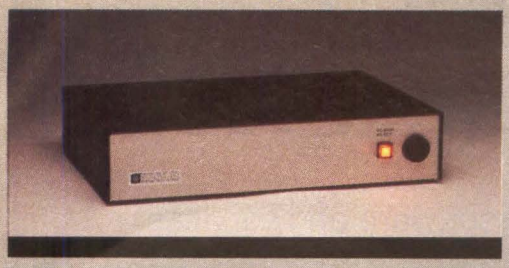

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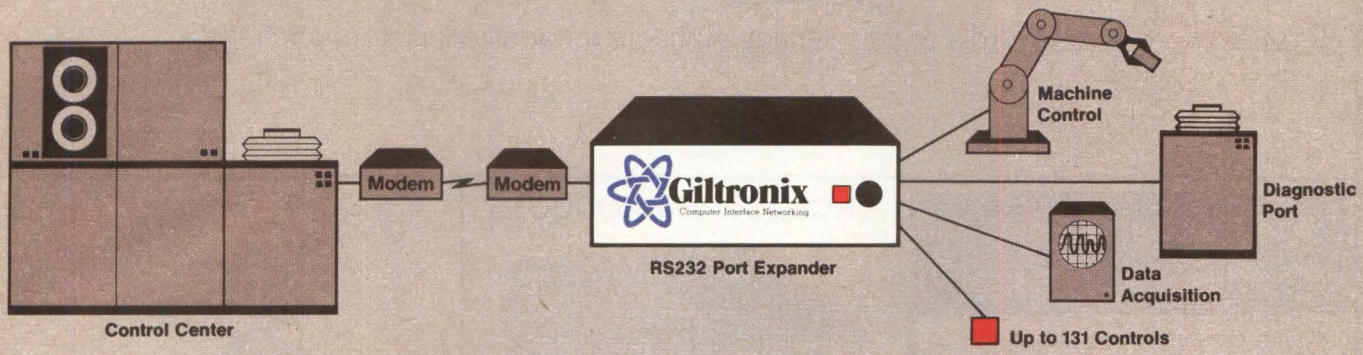

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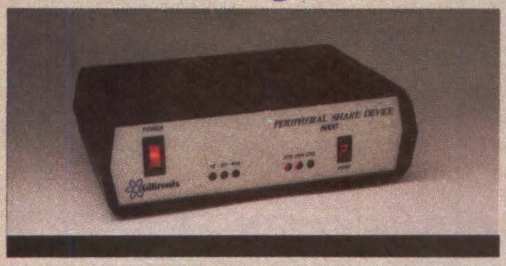

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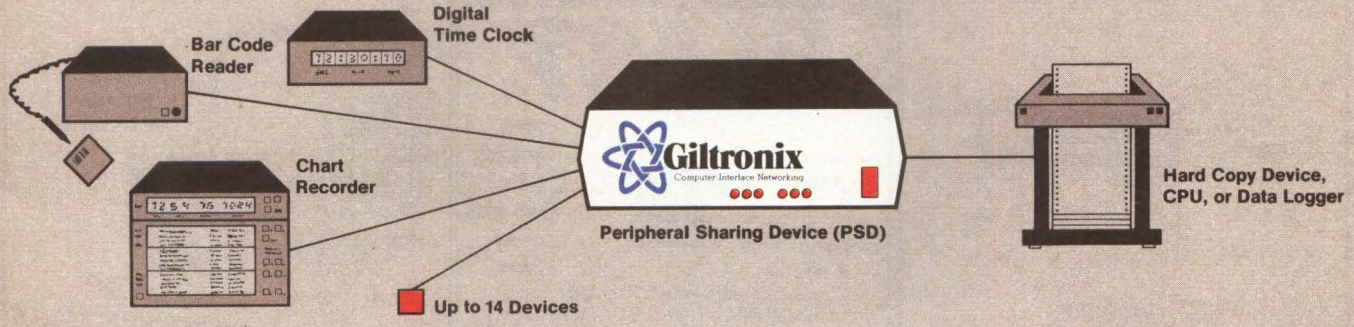

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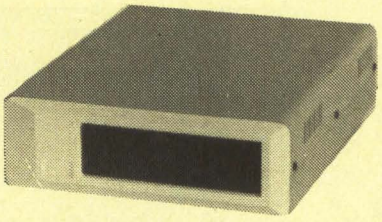

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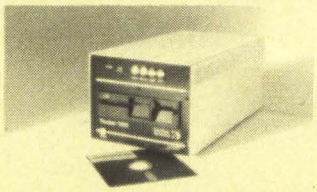

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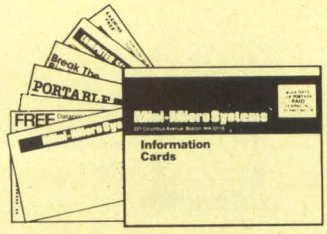

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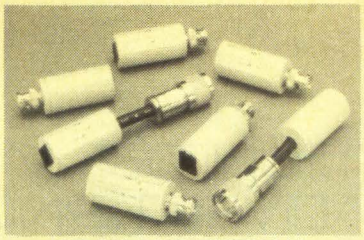

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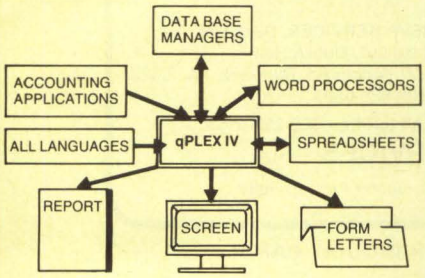

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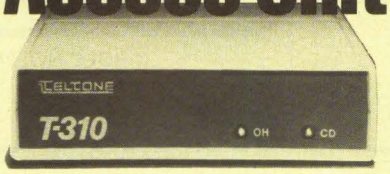

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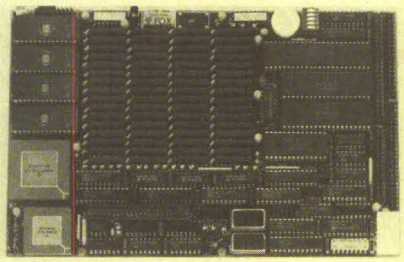

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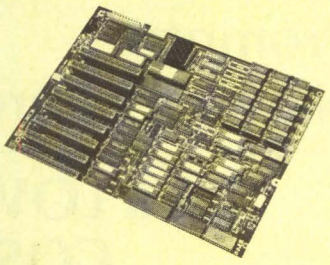

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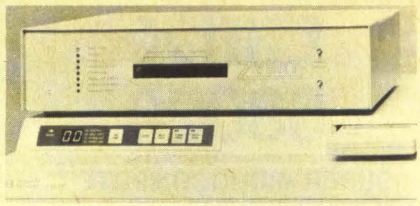

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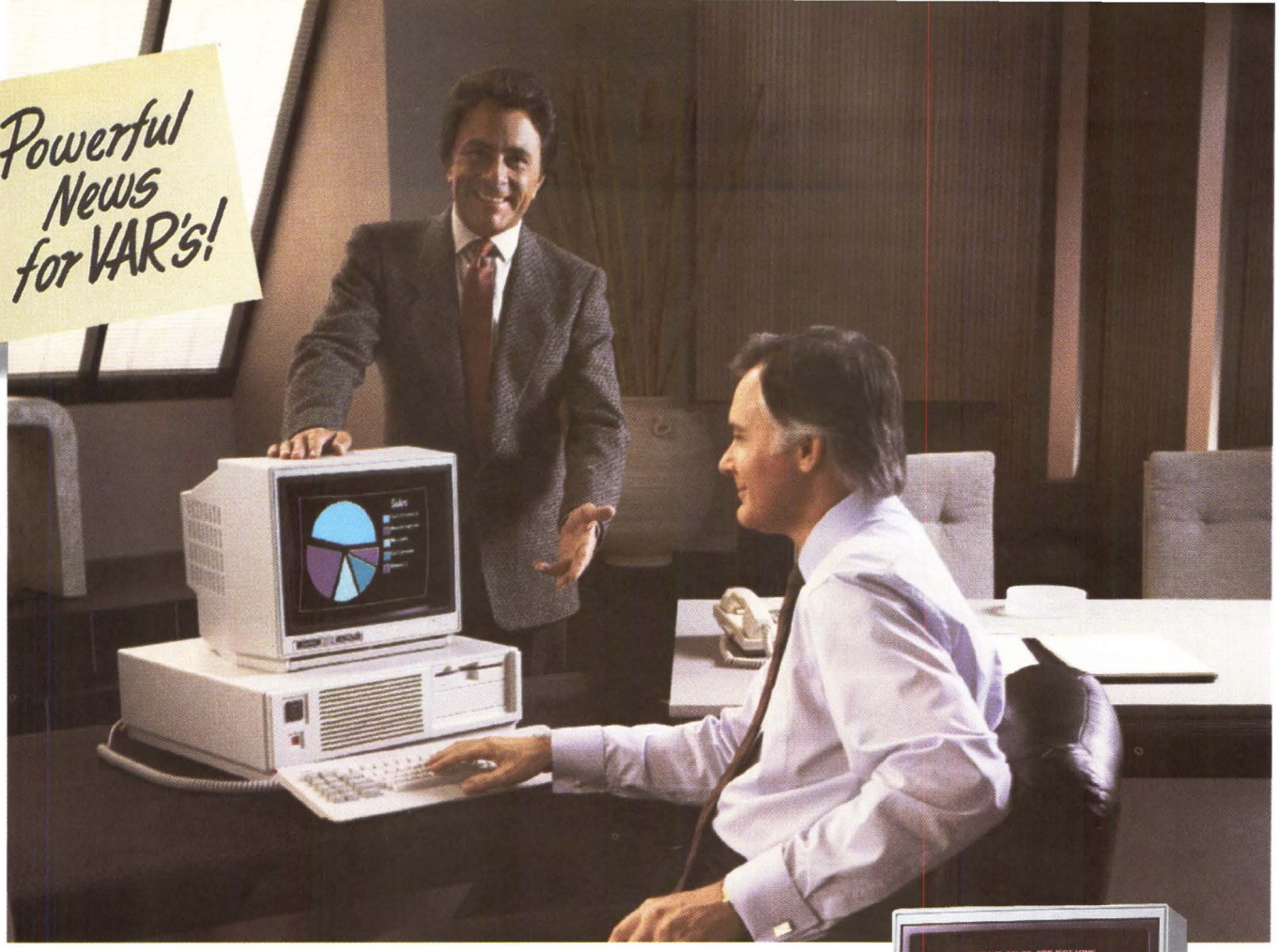

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Introducing the Tandy 3000, the affordable alternative to the IBM® PC/AT. When coupled with your total system solution, the Tandy 3000 provides the power your customers need, whether in a network or multiuser environment.

The Tandy 3000 supports the MS-DOS 3.1 operating system and is compatible with programs for the PC/AT and PC/XT. The XENIX 5.0 operating system will also be available for system solutions requiring multitasking applications. Plus, the Tandy 3000 can be configured with other MS-DOS computers, using our ViaNet local area network.

The Tandy 3000 features an 8-MHz 80286 cpu, 512K RAM (expandable to 640K on the main board and 12 Meg under XENIX), a high-capacity floppy drive, ten expansion slots and up to 40 megabytes of internal hard-disk storage.

Our VAR program features a flexible discount schedule, one-contract coverage for all Tandy Computer Products, and national hardware service and support. There's even a "turnkey" leasing program available exclusively to Tandy VAR's. Team up with Tandy.

Send more details concerning the Tandy 3000 and VAR program

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CIRCLE NO. 85 ON INQUIRY CARD

THINK SYNC!

For micro-to-mainframe or micro-to-micro bisync communications

New **Sync-Up**™ modems from UDS now bring synchronous communication capability to your IBM or IBM-compatible microcomputers. These units are ideal for bisync applications requiring automatic dialing.

Other features include auto-answer, automatic pulse/tone dialing selection, blind dialing, call progress detection and built-in diagnostic tests.

After initial set-up, options are keyboard selectable.

CHOICE OF SPEED

Sync-Up modems are available in two models: 201C for half-duplex 2400 bps and 208B for 4800 bps half-duplex communication via the dial-up telephone network. 4800 bps version is strappable to the 208A configuration, which delivers full-duplex capability on four-wire dedicated lines.

CHOICE OF SOFTWARE

To enhance the performance of **Sync-Up** modems, UDS offers two custom software packages — **Sync-Up** "Dial" and **Sync-Up** "BSC." "Dial" exercises complete control of the device until connection with the remote modem is achieved; control is then shifted to the RS-232C interface. "BSC" is the ideal package for micro-to-mainframe or micro-to-micro communication, since it fully emulates either a 2780/3780 or a 3270 terminal.

For full details and quantity prices on the **Sync-Up** hardware/software packages, contact UDS today. Universal Data Systems, 5000 Bradford Drive, Huntsville, AL 35805. Telephone 205/837-8100; Telex 752602 UDS HTV.

QUANTITY ONE PRICES	201C	208A/B
With "Dial" Software	$685	$1200
With "BSC" Software	$895	$1410
Without Software	$625	$1140

Universal Data Systems

MOTOROLA INC.
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UDS modems are offered nationally by leading distributors. Call the nearest UDS office for distributor listings in your area.

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