

Mini-Micro Systems

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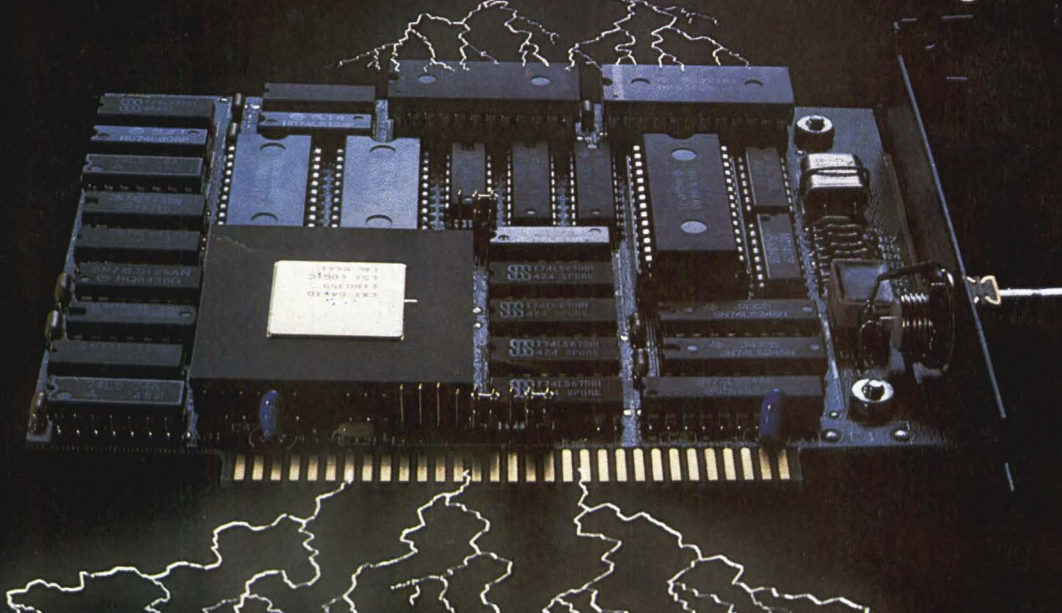
MAY 1985

**Micro-to-mainframe links
open windows
to host data**



**Office automation looks
to system integrators**

**Business software
goes vertical**



```

D--HOST1
----- SPF-MVS PRIMARY OPTION MENU -----
SELECT OPTION ==>
0  SPF PARMS  - SPECIFY TERMINAL AND SPF PARAMETERS
1  BROWSE    - DISPLAY SOURCE DATA OR OUTPUT LISTINGS
2  EDIT      - CRE A--PC
3  UTILITIES - PER
4  FOREGROUND - COM
5  BACKGROUND - COM
6  COMMAND   - ENT
7  SUPPORT   - TES
8  DMS/OS    - PER
9  FILE-AID  - DAT
X  SDSF      - SPO
   TUTORIAL  - DIS
   EXIT      - TER
PRESS END KEY TO TERM
  
```

	...Jan...	...Feb...	...Mar...	...Apr...
101,250	105,300	106,000	108,350	
65,200				
15,450				
96,700				
155,450				

```

USERID - TC0234
TIME - 15:49
TERMINAL - 3278
B--NOTEPAD1
Wednesday Schedule
9:30 Mtg with PK, RJ, DD, GU, TL
10:15 Appt with Charles M., Jim A.
11:30 C--NOTEPAD2
Corporate Sales Forecast
  
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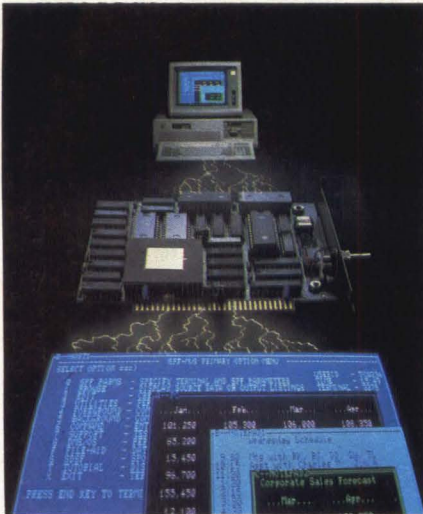
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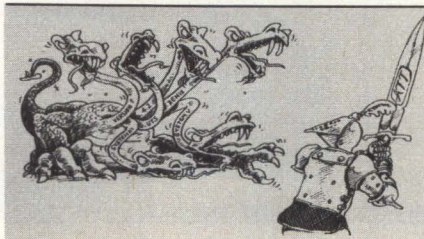
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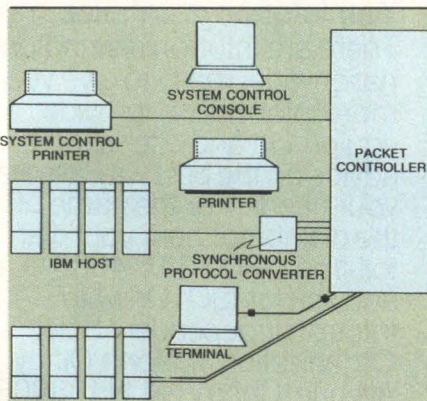
CIRCLE NO. 2 ON INQUIRY CARD



p. 113 Micro-to-mainframe links come into their own. Art direction and design by TFB Public Relations. Courtesy of CXI.



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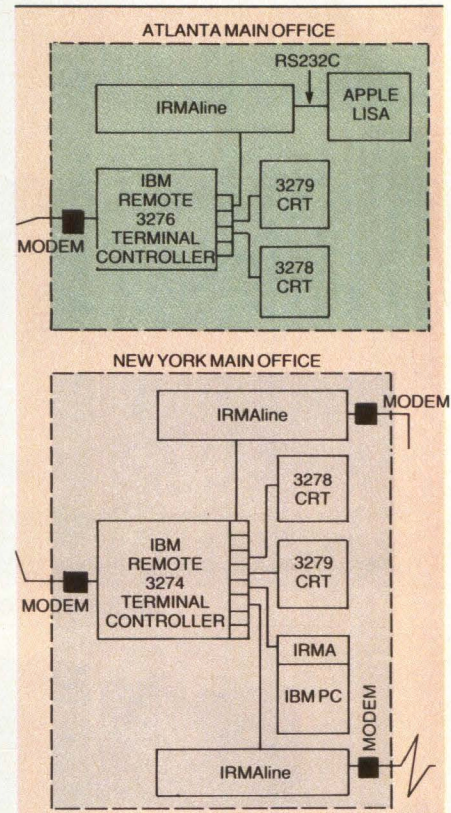
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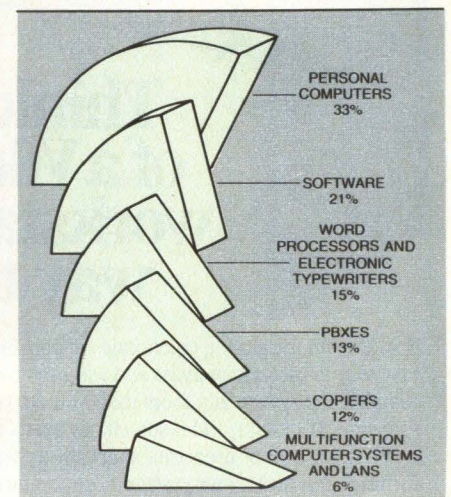
Nova-compatible RISC computer solves horsepower-hungry application problems such as office automation, real-time graphics and process control.

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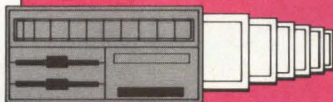
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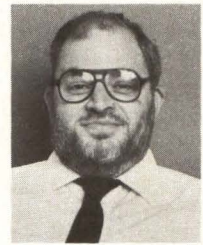
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EDITORIAL

OFFICE AUTOMATION IS YOUR HEADACHE



What you can say about office automation today is that it's as elusive as ever. You can say this, too: When it's finally defined and corralled and put to work in a real, honest-to-God office, it will be system integrators who will have put it there.

Right now, office automation is a mess. There are pilot projects all over the place, but few truly automated offices. There also are vendors all over the place, touting powerful hardware (personal computers with 2M bytes of RAM), communication devices and software of remarkable capability. Yet no vendor has the complete system, or even one close to it.

The only people who can make any sense of all this wonderful imperfection and bring its benefits to an office—while avoiding most of the pitfalls—are system integrators. Putting together all the pieces of the automated office will be a principal job of system integrators for the next decade.

It'll be a headache, too, because office automation is extremely people-intensive. The hardware and software are almost incidental. Canada spent \$14.5 million (about \$11 million U.S.) in the past four years, and the main thing government officials learned was that office automation is people-intensive.

Canada set up a series of office-automation pilot projects with Canadian vendors in government agencies. Evaluations of the projects have just begun, but here are some of the findings:

At first, people are going to fight the system. "Exaggerate whatever user resistance you expect by a factor of 10," says Mary Meloshe at the Department of Communication. "What you must do is consult people to death,"—meaning a lot of handholding.

After that, people will hang onto their keyboards with a death grip. "Pilot projects won't go away," says Mike Magar of Environment Canada, which manages the country's public parks. "We'd like to shut down some of our early projects, but the people won't let us." That shows acceptance

by workers, of course, but it can be a headache for a manager.

Training can be a tricky exercise in pop psychology. At the Department of National Defense, the vendor, Comterm Inc., Pointe Claire, Quebec, gave the users a week's training for the first installation and established a telephone hot line for questions. The approach was almost a total failure. Hardly anybody used the hot line. "People don't like to admit they don't know something," suggests Jens Laursen, a vice president at Comterm.

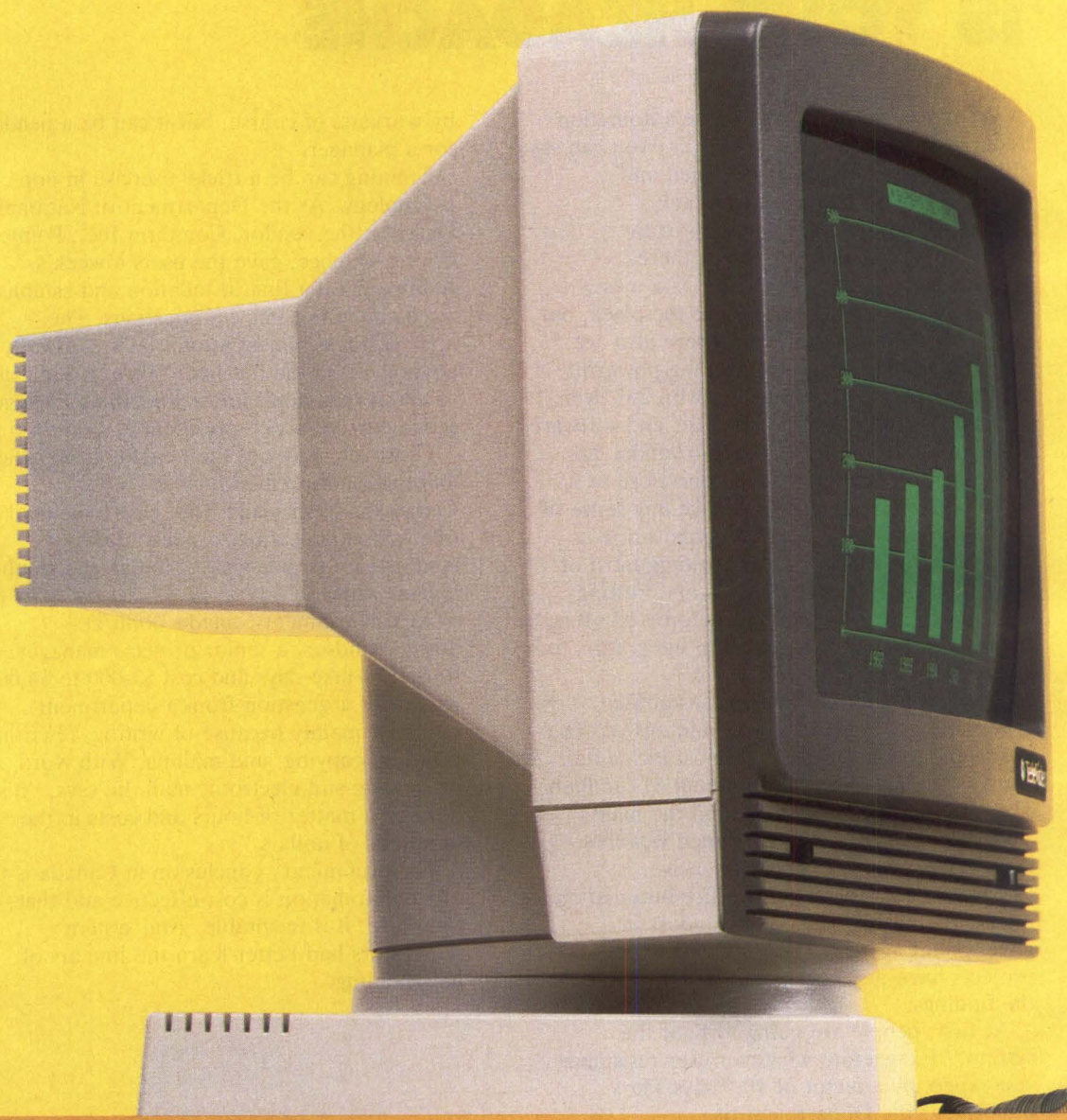
However, many of the benefits from office automation described by the Canadians—especially from electronic mail and other communications aspects of the system—are so persuasive that all the troubles appear worth it.

At Environment Canada, John D. Smith-Windsor, a senior projects manager, says it used to take days and cost \$3,000 to \$4,000 to answer a question from a department minister, mainly because of writing, rewriting, printing, copying and mailing. With word processing and electronic mail, he says, "it's done in a matter of hours and costs in the hundreds of dollars."

The preliminary conclusion in Canada is that office automation is cost-effective and that, therefore, it is inevitable. And system integrators had better learn the fine art of handholding.

A handwritten signature in black ink that reads "James F. Donohue". The signature is written in a cursive, flowing style.

James F. Donohue
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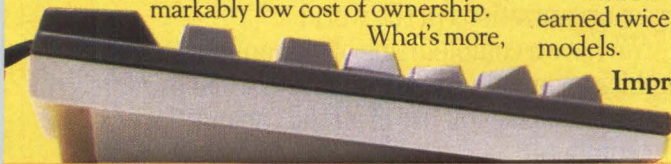
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BREAKPOINTS

PHOENIX COPROCESSOR BOARD MAKES NON-IBM PROCESSORS PC-COMPATIBLE

Already supplying system software to most major manufacturers of IBM Corp. PC-compatible computers, Phoenix Software Associates Ltd., Norwood, Mass., plans this month to extend its product line to include coprocessor board designs. The company will sell PC-AT-compatibility packages consisting of a ROM basic input/output system; GW BASIC and MS-DOS integration software; PC-DOS utilities; and choices of coprocessor-board, video-board and motherboard designs. Packages will range in price from \$700,000 for designs with an Intel Corp. host processor to about \$1 million for designs using other processors, such as Motorola Inc.'s MC68000, National Semiconductor Corp.'s 16016/32032 or Western Electric Co.'s 32000. A retail version of one 80286-based board, due in July, is called Pfaster286. The \$2,395 add-in board includes 1M byte of RAM, 16K bytes of EPROM and an optional 80287 math coprocessor. Although not designed for PC-AT compatibility, Pfaster286 reportedly triples the speed of an IBM PC or PC/XT.—*L. Valigra*

McDONNELL DOUGLAS TO BUY BRITISH CAD VENDOR

McDonnell Douglas Corp., St. Louis, appears ready to strengthen its position in the computer-aided design, application-software market with the acquisition of Applied Research of Cambridge Ltd. (ARC), England. In response to industry reports to that effect, ARC marketing manager Robert Ingram notes the already-close relationship between the two companies—McDonnell Douglas has been selling ARC's products in the United States for four years. These include ARC's top product, General Drafting System (GDS), a 2-D package that can be adapted for numerous engineering and architectural-design applications. GDS sells for over \$20,000 and runs on Digital Equipment Corp.'s VAX and Prime Computer Inc.'s superminicomputers. Ingram estimates that there are 250 GDS installations worldwide, including 60 in the United States. ARC's revenues came to about \$8 million in 1984 and are expected to reach \$12 million this year.—*K. Jones*

CONTROLLER INCREASES LASER PRINTER PRICE/PERFORMANCE RATIO

A new single-board raster image processor is said to increase the price/performance ratio of laser printers in the 8- to 20-page-per-minute (ppm) range. The Motorola Inc. MC68000-based Pixxon 300/SBC controller is scheduled to be introduced this month by Electronic Machine Corp., Los Angeles. Priced as low as \$550 per unit in OEM quantities, the 300/SBC is said to make it more cost-effective for OEMs to buy controllers and print engines separately. Using a proprietary rasterization technique, the controller allows laser printers to perform at their optimum speeds, the company says. For example, a 12-ppm laser printer with a 300/SBC controller reportedly prints at 12 ppm even during overlay operations such

BREAKPOINTS

as background shading. The board, designed for printers from Canon U.S.A. Inc., Ricoh Corp. and others, includes 384K bytes of RAM, up to 128K bytes of ROM for font storage, an RS232C port and a Centronics-like parallel port. It emulates Diablo Systems Inc. and Epson America Inc. printers.—*D. Bright*

SOFTWARE EMULATES IBM'S SNA, DIA PROTOCOLS

Communications Solutions Inc., San Jose, Calif., next month should introduce two software products to help system manufacturers connect their wares to IBM Corp. office networks. Access/SNA emulates IBM's advanced program-to-program communication protocol, which connects host-based applications to distributed workstation applications over IBM's Systems Network Architecture. Access/DIA makes workstations compatible with IBM's Document Interchange Architecture. This provides for document distribution and retrieval and library searches.—*D. Bright*

PROPOSED EUROPEAN NETWORK MAY CREATE NEW MARKETS

A major market for high-speed terminals and workstations capable of transmitting and receiving graphics and text at several megabits per second could emerge within the next 10 years in Western Europe as the result of a proposed Pan-European, broadband, public-switched, telecommunications network. So predicts Bernard Herdan, manager of communications and systems at market consultant company Mackintosh International Ltd., Luton, England. The proposed network, called Integrated Broadband Communications (IBC), would provide channels of several megabits per second capacity on low-cost, dial-up lines—the capacity currently available only on expensive leased lines, explains Herdan. The Brussels, Belgium-based Information Technology Task Force of the European Commission is trying to get the project started. The commission manages cooperative ventures within the European Economic Community.—*K. Jones*

CELLULAR PHONES CARRY DATA IN BELL ATLANTIC TEST

Starting this month, Bell Atlantic Mobile Systems (BAMS), Basking Ridge, N.J., will conduct a three-month test in the Baltimore-Washington market of the feasibility of using the company's cellular telephone system to carry computer data. BAMS, the cellular subsidiary of the Bell Atlantic regional holding company, will provide some 50 customers with cellular telephones, laptop computers supplied by Data General Corp. and Hewlett-Packard Co. and a new 300-bit-per-second modem, the CTS1620, developed by Bell Laboratories.—*S. Shaw*

SENATE BILL PROPOSED TO EXAMINE COMPUTER IMPACT

Legislation sponsored by Sens. Sam Nunn, D-Ga., and Frank Lautenberg, D-N.J., has been introduced into the U.S. Senate to commission a two-year study on the impact of computer systems and telecommunications advances

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BREAKPOINTS

on American society. Bill S.786, The Information Age Commission Act of 1985, would establish a 23-member panel representing industry, academia, labor and government. The panel would review and report on such issues as the steps needed to maintain U.S. leadership in these high-technology industries and development of the resources necessary to increase the technology's social benefits. The bill has received the support of the Association of Data Processing Service Organizations and other trade groups.—*S. Shaw*

TECH FILES: A QUICK LOOK AT INDUSTRY DEVELOPMENTS

RANDOM DISK FILES: Aspen Peripherals Inc., Longmont, Colo., is readying an IBM Corp. 3480-like, ½-inch, cartridge tape drive for showing at this month's Comdex show in Atlanta. According to program director George Rickenberg, the Aspen drive will operate exactly like the IBM drive at the tape head, using 18 parallel tracks and the new IBM cartridge. But, he says, the tape path and electronics will differ. Aspen is planning to use the IPI2 intelligent peripherals interface and is looking for controller manufacturers to support the drive.—*C. Warren*

PRINTER FILES: Hewlett-Packard Co., Palo Alto, Calif., has developed software that makes Apple Computer Inc.'s Macintosh personal computer compatible with HP's ThinkJet ink-jet and LaserJet laser printers. Called Jetstart and Laserstart, the programs are device drivers that replace the Apple Imagewriter dot-matrix printer driver in Macintosh application programs. HP says Jetstart and Laserstart will produce text and graphics from most application software that follows Macintosh printing standards. That includes Apple's MacPaint, MacWrite and MacProject and Microsoft Corp.'s Multiplan, Word and BASIC. The non-impact printers provide low-cost alternatives for Macintosh users, HP says. Priced at \$45 and \$95, respectively, and including Macintosh cabling, Jetstart and Laserstart should be available now. HP has also introduced the ThinkJet with an RS232C interface, as well as its original interfaces, for \$495.—*D. Bright*

SOFTWARE FILES: Start-up software company Server Technology Inc., Sunnyvale, Calif., has developed the Easylink office network for IBM Corp. PCs and compatibles. The product adds background communications to the PC and uses the serial ports to build limited area networks that operate at 9,600 baud. Like local area networks, Easylink permits transferring of files, sharing of peripherals and electronic mail communications. The company also plans to ship a 10-port add-on serial board by the third quarter.—*C. Warren*


BREAKPOINTS

NOTES FROM OVERSEAS: IBM Corp.'s proprietary communications standards are coming under increasing industry attack in the United Kingdom. The latest assault is from the **British Microcomputer Manufacturers' Group (BMMG)** in its proposal to set up a public, non-profit company to create an alternative standard. The proposed company, to be called BMMG Development Enterprises, will be 75 percent owned by the BMMG, with the remaining equity divided among local companies opting to participate. Britain's leading computer makers, ICL Plc. and ACT Plc., are said to be negotiating for shares. The government may also provide \$1 million in funding. BMMG's technical proposals for prototype communications support Open Systems Interconnection (OSI) protocols.—*M. O'Gara*

UNIX Europe Ltd. of London, the joint venture of AT&T Co. and Olivetti SpA charged with promoting and supporting UNIX in Europe, has replaced managing director Vanni Papi with long-time Olivetti veteran Alessandro Osnaghi, a systems software specialist. Papi was at UNIX Europe only nine months. Osnaghi has designed several Olivetti operating systems, including the UNIX-like MOS used on the company's Z8000-based Linea Uno machines. Papi, who went to UNIX Europe from Digital Equipment Corp. Europe's large-account business, has moved to Acorn Computers Ltd., Olivetti's new home computer acquisition, as the Olivetti liaison.—*M. O'Gara*


Good news for European high-technology entrepreneurs may be in the wind. Heinz Nixdorf, founder of Nixdorf Computer AG and himself one of West Germany's most successful and highly respected entrepreneurs, is chairing the management committee of a new venture-capital fund. The fund will back start-ups and help existing companies needing money for expansion. Based in Berlin and called the **New Europe High Tech and Bio Tech Corp. for Innovation**, the fund so far has secured \$24 million from several large companies and banks. Meanwhile, West Germany's finance minister, Gerhard Stoltenberg, has drafted a bill that would provide venture-capital companies with generous tax concessions, while at the same time making them safe investment vehicles.—*M. O'Gara*

SHOW NOTES: The first **Comdex** show in Japan drew more than 40,000 independent sales organizations from Japan, Korea, Taiwan, Hong Kong, Singapore and even China, more than doubling the expectations of its Needham, Mass., sponsor, the Interface Group. More than 200 Asian companies, plus the Japanese subsidiaries of 30 U.S. companies, occupied 700 booths spread over 150,000 square feet in Tokyo's Harumi Exposition Center, making it twice the size of any previous first-time Comdex. The three-day show was held March 26 to 28. The show's success reportedly has the Interface Group already planning an Interface communications conference for Japan.—*A. Kaplan*



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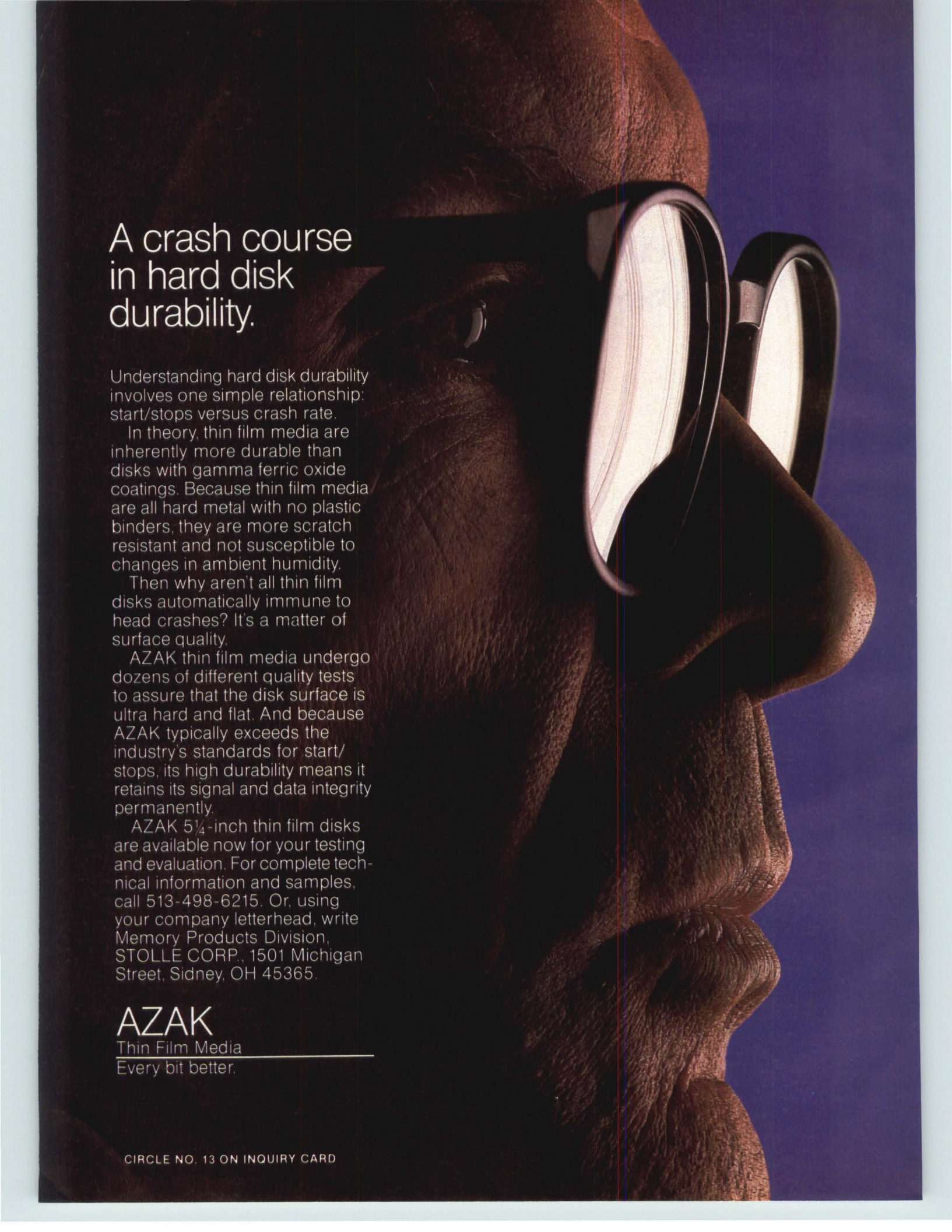
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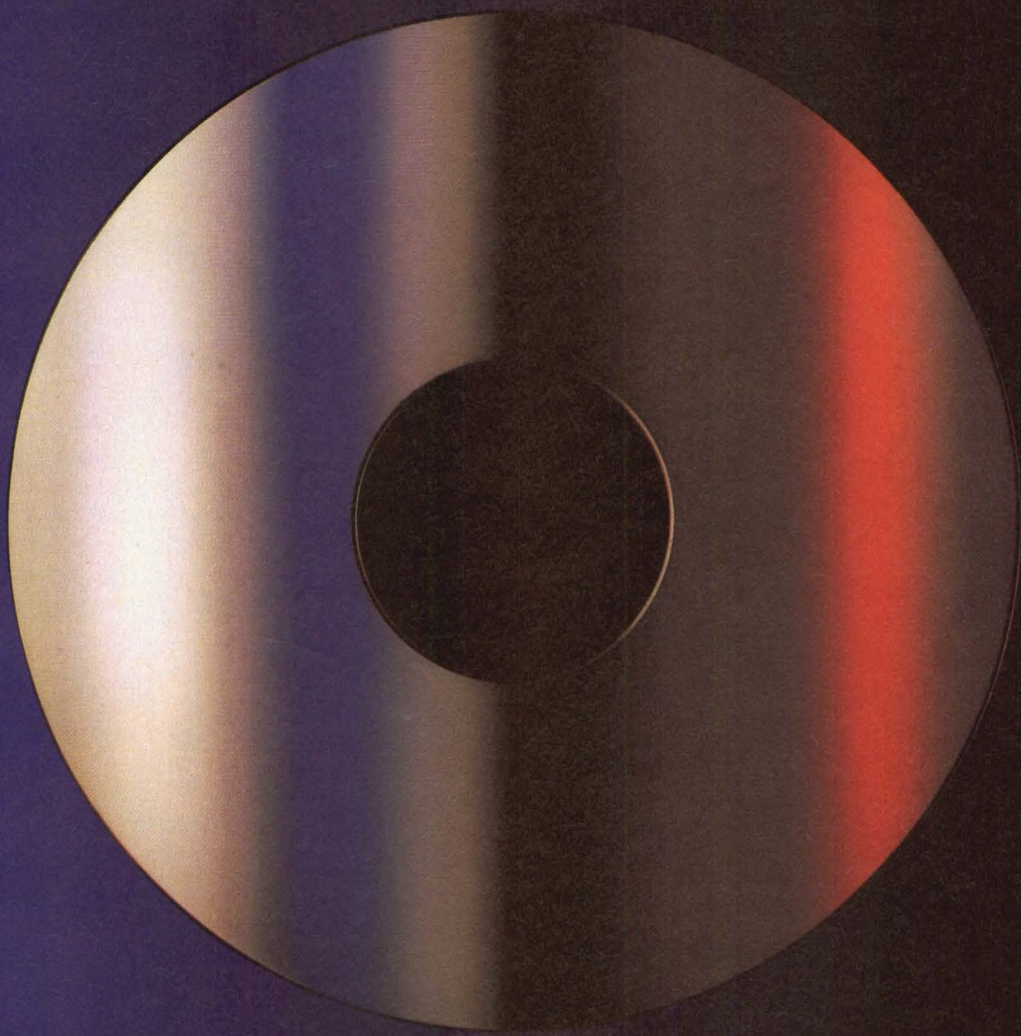
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MINI-MICRO WORLD

NEWS

Qume terminal sparks price war

David Bright, Assistant Editor

While manufacturers of high-end alphanumeric terminals must worry about competing against personal computers, the main issue at the low end remains price. As soon as Qume Corp., San Jose, Calif., recently introduced the industry's first smart terminal priced less than \$400, the QVT-101, Esprit Systems Inc., Melville, N.Y., quickly matched that by cutting the price of its smart ESP-6110 model by \$100, to \$395. The Qume and Esprit terminals boast 14-inch screens, ergonomic designs and various editing features.

Vendors and analysts expect the price war to continue. With low-end terminals, "you can't even distinguish between features," claims Eileen Goldman, a research analyst at International Data Corp. (IDC), Framingham, Mass. "Pricing is the No. 1 issue." Therefore, she says, other vendors must react to Qume's move. "They all want to be able to say, 'Our pricing is the best in the industry,'" she adds.

Qume's Keith Rapp, Terminals Division general manager, thinks his company's bold move will help it immensely. "Our strategy is to gain market share and become the No. 1 terminal supplier in the industry," he says. Rapp says Qume, an ITT Corp. subsidiary, has shipped over 100,000 terminals in the past year. Analysts agree that Wyse Technology, San Jose, Calif., is currently the leading independent terminal vendor. Wyse is shipping

COMPARING LOW-END TERMINALS		
	Qume QVT-101	Esprit ESP-6110
Screen	14-inch, tilt/swivel	14-inch, tilt/swivel
Display format	80 x 24	80 x 24
Programmable functions	16 (using 4 dedicated function keys and 4 arrow keys)	14 (using numerical keypad keys)
Pages of memory	1	1
Interfaces	RS232C, bidirectional RS232C; options: 20mA current loop, RS422	RS232C; options: bidirectional RS422 or bidirectional 20mA current loop
Baud rates	50-19,200	50-19,200
Block mode transfer	yes	yes
Emulations	Hazeltine 1500, Lear Siegler ADM-3A/5, TeleVideo 910	Hazeltine 1500, Lear Siegler ADM-3A, ADDS Viewpoint
Price (\$)	395	395

more than 5,000 units per week, according to marketing vice president Larry Lummis.

Wyse stresses price/performance

Despite analyst Goldman's assertion that all terminals in this class are virtually alike, Lummis claims Wyse's success is built on price and performance, not pricing alone. For example, the \$599 WY-50 terminal (recently re-

duced from \$695), while more expensive than Qume's new terminal, provides a 132-column display and 32 programmable functions. The Qume QVT-101 displays 80 columns and has 16 programmable functions. Lummis says his company's prices will come down, but that "there will always be companies with lower prices than Wyse."

Gaining greater sophistication is also

NEWS

the strategy at another Qume competitor, Liberty Electronics USA, according to Ben Nourse, marketing director of the San Francisco company. Liberty's \$595 Freedom 110 terminal offers 20 programmable functions.

Although Nourse agrees with Lummis that Wyse and Liberty may not ever have the lowest prices, both expect their prices to become more competitive. Since Wyse owns the Taiwanese factory where its units are produced, the company has significant leverage in adjusting its prices to fit the market, Lummis says. "That gives us control over our own destiny," he adds. Nourse says Liberty will not lower the prices of its current line, but a "development priority" is to use the latest technology to reduce the price of new models.

How low can prices go without severely cutting into vendors' and distributors' profit margins? Some competitors suggest that the \$395 price already is suicidal. "We really wonder how [Qume] can make money on that thing," says Nourse. "It's going to be difficult for the other manufacturers to [reduce prices] and have it be anything but a money-losing proposition." Nourse cautions that the margins—normally 40 percent to 45 percent off list price—will continue to erode and threaten to squeeze some distributors out of the market.

None of the vendors will actually admit to giving smaller margins or allowing themselves lower profit, however. At Qume, Rapp says, manufacturing economies such as merging the power supply and logic board into one assembly allow for the low price of the QVT-101. But he adds that ITT's marketing influence is also a help.

Don't overlook overhead

Goldman at IDC agrees that the price war may hurt the vendors. She says that with overhead considerations like manufacturing, sales support and marketing, the profit margins are tightening. Therefore, she thinks the price cutting will have to bottom out at about \$300. "The vendors are feeling [the pressure]. Even if you've dropped the price of your unit, that doesn't

mean the user will go out and buy 10 instead of one," she notes, adding that with the reduced revenues come reduced profits.

Bob Sanekoff, director of the Display Terminals Industry Service at Da-

taquest Inc., a Cupertino, Calif., market research company, is amazed at the price reductions. "If you had asked me a year ago," he says, "I would have said we were going to stop at the \$500 range." □

Kaypro stamps a clone, bucking the IBM PC-AT

Kathy Chin

Contributing Correspondent

Kaypro Corp. was one of the last microcomputer companies to introduce an IBM Corp. PC-compatible computer. The introduction of the Kaypro 16 last November barely stirred the hard-nosed microcomputer industry. After all, more than 50 clones were already competing for shelf space, and few of them had a chance to be big sellers.

Now, Kaypro has announced its first IBM PC-AT clone at \$4,550—approximately \$1,250 less than a comparably configured IBM PC-AT. The Solana Beach, Calif., company believes that its new Kaypro 286i, code-named KAT for Kaypro AT, will offer buyers more for their money with more standard hardware features and bundled application software, which distinguishes it from IBM's product.

The "i" in the Kaypro 286i stands for "impressive, or improved over IBM," according to David Kay, Kaypro vice president of marketing and son of founder Andrew Kay.

Paring the costs

Like the IBM PC-AT, Kaypro's new 16-bit system is based on the Intel Corp. 80286 chip, a component that makes the machine operate at a clock speed of 6 MHz. The Kaypro chip, called the leadless chip carrier, is an older, pin-less version of the 80286. IBM worked with Intel to develop an 80286 pin-grid array, a more expensive chip with pins that plug directly into the computer board instead of a socket. Intel marketing spokesman Bhup-

inder Solujo claims the versions perform identically.

The Kaypro 286i comes with 512K bytes of RAM and two 1.2M-byte floppy disk drives. The computer is expandable to 640K bytes of on-board memory using 64K-bit dynamic RAM, says Kaypro senior engineer Howard Boyle. He adds that Kaypro is not using the piggyback memory chips that IBM uses.

Locks against tamperers

The 286i features a key lock so that users can prevent tampering with their files. The computer has a socket for an 80287 math coprocessor for high-speed computations, similar to that offered on the IBM PC-AT.

The Kaypro unit includes eight card slots, five of which are open to the user. Three of the slots are filled with a serial/parallel interface card, a floppy disk/hard disk controller and a color card. The color card was more expensive than Kaypro officials projected, so days before the introduction, the company raised the system's price to \$4,550 from \$3,995.

Kay says the price difference still makes the Kaypro 286i competitive with the PC-AT. At \$3,995, the base model PC-AT includes 256K bytes of memory (the 286i has 512K bytes), one 1.2M-byte floppy disk drive (Kaypro offers two) and eight slots, seven of which are available for add-on boards. One slot is used for the floppy disk controller.

No hard disk included

Unlike IBM, Kaypro is not offering a model with a 20M-byte hard disk

drive, a move that was purely a marketing decision. Kaypro customers won't need 20M bytes, maintains Spencer Leyton, Kaypro's new director of sales operations. "The jury is still out as to who wants the memory," he says. "We want to give our dealers flexibility. They can still sell it with hard disk drives from other vendors if they want to."

During the year of development, 15 Kaypro engineers produced prototypes with 20M-byte hard disks to ensure that software would run, says Boyle. Software operating on the prototypes ran without problems, he says.

The company was to begin building 400 286i's per month starting in March. The initial shipments were to be aimed at value-added resellers, says Kay. He believes that the model's modest price and features will attract a steady flow of interest. Some 300 VARs such as Publisher Supply Center and Bellarmine and Tractor Inc., sell Kaypro machines.

By summer, the company may produce as many as 2,000 units a month, "depending on the market," says Kay. The company is also in the midst of developing a 1,200-baud modem expected to sell for less than \$300 for the Kaypro 16 and the 286i.

Kaypro officials claim the Kaypro 286i runs all the software the IBM PC-AT runs. But that also means it can't run the software that the PC-AT cannot run, such as Ashton-Tate's Framework and dBase III products. To run, the 286i, like the PC-AT, requires Microsoft Corp.'s PC-DOS 3.0, an operating system sold separately. But a bevy of application software from MicroPro International Corp. comes with the hardware.

Following IBM closely

Kaypro's forceful move into IBM territory represents several firsts for the publicly traded company. Never before has it tracked Big Blue's steps so closely. For the first time, the company will offer a one-year warranty on the new 16-bit system, breaking from the 90-day guarantee on all its other products. Kay stresses that his company had no choice but to change its

Kaypro's 286i
IBM PC-compatible micro-computer offers more standard features than IBM's PC-AT, such as an extra floppy drive and more memory, but it lacks a hard disk option.



warranty since IBM started offering a one-year warranty. "We don't want them to offer more than we do," he says.

Kaypro, like IBM, will not offer a monitor as standard with its product. Instead, Kaypro will sell its new color monitor as an option for \$595.

The biggest shift in the Kaypro business blueprint is its recent move to sign up office-supply dealers, adding to its more than 1,000 independent dealers. More than 150 office-supply stores have agreed to sell Kaypro products, says Kay. Their main interest, however, has not been in the 286i, but in the Kaypro Business Pak, a system that includes an 8-bit computer, a printer and CP/M software.

Meanwhile, Kaypro is still struggling to recover from a disastrous inventory buildup that caused the 600-employee company to lose \$267,683 in fiscal year 1984—its first loss since it began selling microcomputers in 1981. In 1983, it boasted \$3 million in profits. Kaypro is fending off at least four lawsuits from stockholders who charge that the company misrepresented itself when it first

went public over a year ago. When Kaypro came out on the stock market, it introduced shares at \$10 each. Kaypro stock is now at \$2.25 per share.

Kay recently hired Leyton, who has had five years of management and microcomputer experience, to assist him in marketing. John Haehl, from Canon USA Inc., was hired last year as director of materials to keep an eye on inventory.

Market analyst Jan Lewis of Info-Corp in Cupertino, Calif., says that Kaypro is on target in shaping up the management team and introducing a PC-AT clone. "I'm disappointed that Kaypro didn't offer a hard disk option, but the idea of the AT clone is necessary in Kaypro's next step in their business strategy," she says.

A Kaypro decision not to chase the XENIX market is wise, according to Lewis. IBM has a broader base of users, which include engineers who would be interested in XENIX, she says. "But Kaypro is really a small-business-computer maker, and business users could care less about XENIX." □

Long-frustrated UNIX finding its market

Michael Tucker, Associate Editor

After years of false starts, the slow-maturing commercial UNIX market may finally be taking shape. Analysts suggest that 1985 is the year that UNIX stops being an issue and starts being an industry. AT&T Information Systems, the division of AT&T Co. responsible for UNIX's promotion and development, appears to be succeeding in making its System V version the industry standard. Several hardware and software vendors have announced new System V implementations—among them IBM Corp.—and the UNIX industry as a whole is expected to be worth more than \$2 billion this year.

The greatest stumbling block to UNIX's commercial success has been its division into several mutually incompatible factions. Now, says Brian Boyle, director of research for market researcher Novon Group, San Francisco, "The standards issue is coming to a close. People are saying, 'Yes, it's going to be [AT&T's] System V.'"

To put a few teeth in the standardization effort, ATTIS said it would work with UniSoft Corp., Berkeley, Calif., to develop a verification test software package to validate derivatives of UNIX System V.

A market matures

"This year, UNIX has done it," says Novon's Boyle. "In 1985, in terms of all units shipped from all vendors, UNIX will move as much iron as Data General Corp. That is, if you were to lump together all the machines running on UNIX shipped by all vendors this year, then UNIX is selling as many computers as a major corporation. It looks like this year it will bring in just over \$2 billion."

Part of that success reflects vendors' confidence that, led by ATTIS, UNIX has become a coherent industry, with coherent standards. In the first quarter of 1985, ATTIS confirmed agreements with Amdahl Corp., Sunnyvale, Calif.,

and Microsoft Corp., Bellevue, Wash., to make their respective UNIX products compatible with System V. Microsoft, working with the Santa Cruz Operation Inc., Santa Cruz, Calif., will develop a System V version of XENIX, to be called "XENIX.5," while Amdahl will make its mainframe product, UTS, equally compatible with System V-based software.

Will Big Blue meet Ma Bell?

Analysts called the Microsoft announcement "extremely important for the entire industry," saying that it means System V as XENIX.5 could play a role in bringing professionals' desktop computers into the integrated office.

"One possibility is that those folks are going after IBM in a big way," says Peter Marvit, senior analyst at Yates Ventures, Palo Alto, Calif. "Suppose that every time AT&T goes in to bid on a company's internal phone system it can also offer computing power as part of the package. So, the buyer could have a little [UNIX-based] computer on every desk instead of just a phone. It's a nice edge into the office automation market."

It's uncertain exactly what changes would have to be made to make XENIX compatible with System V. Some sources suggest that System V will have to be upgraded to match XENIX. In particular, they suggest, System V may soon incorporate XENIX's record- and file-locking.

IBM, for its part, announced a UNIX System V implementation in February. Called IX/370, the implementation will run with IBM's proprietary Virtual Machine (VM) operating system on IBM 3090 mainframes.

While smaller IBM machines, such as the IBM PC/XT, have run UNIX System III implementations, this is the first time Big Blue has offered System V. But analysts caution that the IX/370 implementation does not constitute an IBM endorsement of UNIX.

"In general, IBM wants UNIX to go away, and they're trying to contain it by supporting just as little of it as possible," notes Laura Stuart, director of small systems research at the Yankee Group, Boston. "Their strategy is bait and switch: You can have UNIX, but gradually it leads you into VM."

Other standards emerge

Outside of ATTIS, UNIX users' groups are beginning to settle on System V as the industry standard. In January, the standards committee of the UNIX trade association, /usr/group, announced that it would merge with the IEEE UNIX standards group, P1003. The combined committee will operate under the auspices of the IEEE and P1003 chairman Jim Isaak, who is also director of product marketing for Charles River Data Systems Inc., Framingham, Mass.

In effect, the union brings UNIX users and UNIX producers closer than they've been. The /usr/group standards committee announced the merger shortly after ATTIS had announced support for a UNIX System V interface standard that was very similar to parts of a /usr/group definition of UNIX published in 1984. P1003 will also base its efforts on the 1984 /usr/group definition.

Even the scientific and academic UNIX communities are accommodating the the System V standard. William N. Joy, "the father of Berkeley UNIX" and vice president of research and development for Sun Microsystems Inc., Mountain View, Calif., has called for an industry-wide research program to make Berkeley UNIX Version 4.2 fully compatible with System V.

Speaking at Uniforum, the /usr/group exhibition in Dallas this year, Joy invited software developers and UNIX experts to join with Sun in what he calls "the New project." The goal to create a "super UNIX," extended System V, would retain the extensions of 4.2 for scientific and engineering applications but would run System V's business-oriented application programs as well.

Uniforum attendees' reactions to the

Many-faceted UNIX seeks unity

UNIX has so many different incompatible versions that programmers call schizophrenia "the UNIX disease." Among its many manifestations are:

- Berkeley UNIX Version 4.2, also called UNIX 4.2. At first, AT&T Information Systems didn't consider UNIX a viable product. In the late 1960s, it made the operating system available to academic institutions for research at low or no cost. At the University of California at Berkeley, students and faculty quickly turned UNIX into a powerful application-development environment. Berkeley UNIX Version 4.2 has been a favorite of computer scientists ever since.

- XENIX. In some ways XENIX is to commercial applications what UNIX 4.2 is to scientific ones. A product of Microsoft Corp. and also available from the Santa Cruz Operation Inc., XENIX was designed specifically for the business world and microcomputers. In the early 1980s, many observers thought it would be IBM's UNIX. Now Microsoft seems to be growing closer to AT&T.

- UNIX Version 7 and System III. As ATTIS realized the market potential of UNIX, it quickly attempted to upgrade and promote it. Version 7 was the first to be marketed commercially, and until recently the majority of UNIX implementations, among them XENIX, were based on that version. In the early 1980s, ATTIS introduced System III as 7's upgraded successor.

- UTS. UNIX entered the mainframe world when Amdahl Corp. introduced UTS. In January, Amdahl entered into agreements with AT&T to make UTS compatible with AT&T's System V, and with Fujitsu Ltd., Tokyo, to jointly promote a "UTS/V."

- System V. ATTIS brought out System V in 1983 as the form of UNIX that it hopes to make the industry standard for commercial purposes. System V is still evolving. In 1984, as Release 2, it acquired many 4.2-like characteristics. Following agreements between ATTIS and Microsoft, analysts speculate, it will acquire XENIX-like characteristics as well—notably, improved security.

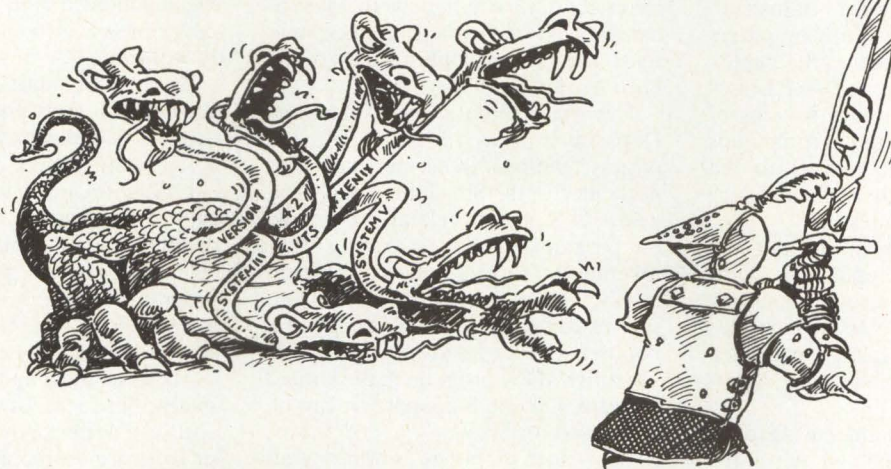


Illustration by Jon McIntosh

Hydra-headed UNIX has so far failed to become a commercial success, chiefly due to its division into mutually incompatible versions. Now, AT&T

may play crusader long enough to bring a united UNIX into the business world.

proposal ranged from calling it "the most exciting research effort in UNIX since the original Berkeley enhancements" to "a face-saving way of admitting the demise of 4.2."

ATTIS' official reaction to the proposal was favorable. "My overall sense was a positive one," says Mike

DeFassio, ATTIS' director of software system product management. "What I felt Joy was saying is that he and other developers see real benefits in building on a V core."

He adds that he doesn't see a new operating system as a rival to System V. "There will always be UNIX vari-

ants on the market with tools not available in System V. And there's nothing wrong with that. If there were no such extensions, it would mean UNIX technology had become static. In fact, if those extensions become popular, we have a mechanism to incorporate them into System V." □

HEARD ON THE HILL

Software industry faces threats from overseas

Stephen J. Shaw
Washington Editor

The U.S. software industry commands a dominant position in the world marketplace now, but it may be hard-pressed to maintain it into the 1990s. Intense competition from foreign suppliers, particularly the Japanese, and the growing problem of software piracy could sap the strength of U.S. software companies in their ability to compete worldwide.

Those are some of the conclusions reached by the U.S. Department of Commerce in a new study entitled, "A Competitive Assessment of the United States Software Industry." Prepared by the Office of Computers and Business Equipment, the report analyzes the strengths and weaknesses of the industry, examines sources of foreign competition and recommends a number of specific policies to the U.S. government to assist the industry in maintaining its leadership.

"From the standpoint of our nation's industrial strength, the U.S. software industry is virtually the only high-technology industry which has not seen its world leadership eroded by foreign competition," the report says.

Tim Miles, a Commerce Department analyst who helped write the report, comments: "Other countries, especially Japan, will make use of software-engineering tools and automated techniques. I'm confident that in the short-term the U.S. industry will be OK. Beyond 1990, however, there's a lot of uncertainty and many unknowns."

According to estimates compiled by the Commerce Department, the U.S. software industry captured 70 percent of the 1983 world market, valued at \$18 billion. U.S. software revenues were estimated to be 10 times larger in the early 1980s than those of either

France or Japan, its closest competitors. More than half of U.S. revenues come from packaged software. Foreign competitors get most of their revenues from custom software.

The world market for software is projected to grow 30 percent annually to an estimated total of \$55 billion in 1987. If U.S. companies can keep their competitive edge, they should have revenues of \$41 billion in 1987, or 75 percent of the world market.

The strength of the U.S. software industry is based on three factors: first, the long-term leadership of U.S. hardware manufacturers; second, the software industry's entrepreneurial character and willingness to take financial and technological risks; and third, the size and sophistication of the U.S. market.

The main threat, says Commerce Department analyst Miles, is software piracy, "rampant in certain countries, particularly in Singapore and Taiwan." U.S. vendors claim that unlawful program copying is cutting their revenues by several billion dollars annually. One case cited involves a Singapore company that sells a copy of a popular U.S. spreadsheet program. The price of the program in the United States is \$500; in Singapore, it can be purchased for \$7.50.

"This sort of piracy is widespread and is having a serious ripple effect on U.S. companies. It cuts deeply into sales revenues, which means less money for R&D, which degrades the United States' ability to remain competitive," Miles asserts.

Another threat to U.S. software leadership cited in the report is import restrictions imposed by many countries to protect and develop local software concerns. Such countries include Japan, Korea and Brazil. Cheaper labor costs in many countries could eventually erode the U.S. leadership.

The chief threat to U.S. software

companies will come from the Japanese. U.S. government analysts speculate that the Japanese will follow a strategy in software markets that parallels their successful equipment strategy: to develop standardized, low-cost products that are highly reliable. Both culturally and technically, the study says, the Japanese possess the means to challenge the U.S. software industry worldwide.

The Japanese have made significant gains in developing software-engineering tools. Nearly seven years ago, the Japanese government and major computer manufacturers began to invest heavily in automating software development. In contrast, the Commerce Department deems as "quite limited" the use of software tools by U.S. development companies.

The emphasis on the automation of software development indicates that the Japanese intend to turn software development into an applied science. In contrast, the report states, U.S. software companies consider programming a craft and believe the future of the industry lies in its creativity, rather than in automation.

U.S. software developers are typically characterized as creative and individualistic, but generally lacking discipline. In contrast, Japanese programmers are seen as more disciplined, group-oriented and more concerned with quality control.

These cultural and technical differences between U.S. and Japanese software writers may account for higher software-development productivity and fewer programming errors in Japan. The Commerce Department cites estimates that claim Japanese programmers generate an average of 2,000 lines of code per month, compared with 300 lines per month for U.S. program developers. And Japanese programmers reportedly experience one-tenth the error rate in their programs of U.S. programmers. This productivity and accuracy imbalance is offset by U.S. software project managers who are seen as able to supervise and lead software development teams more efficiently.

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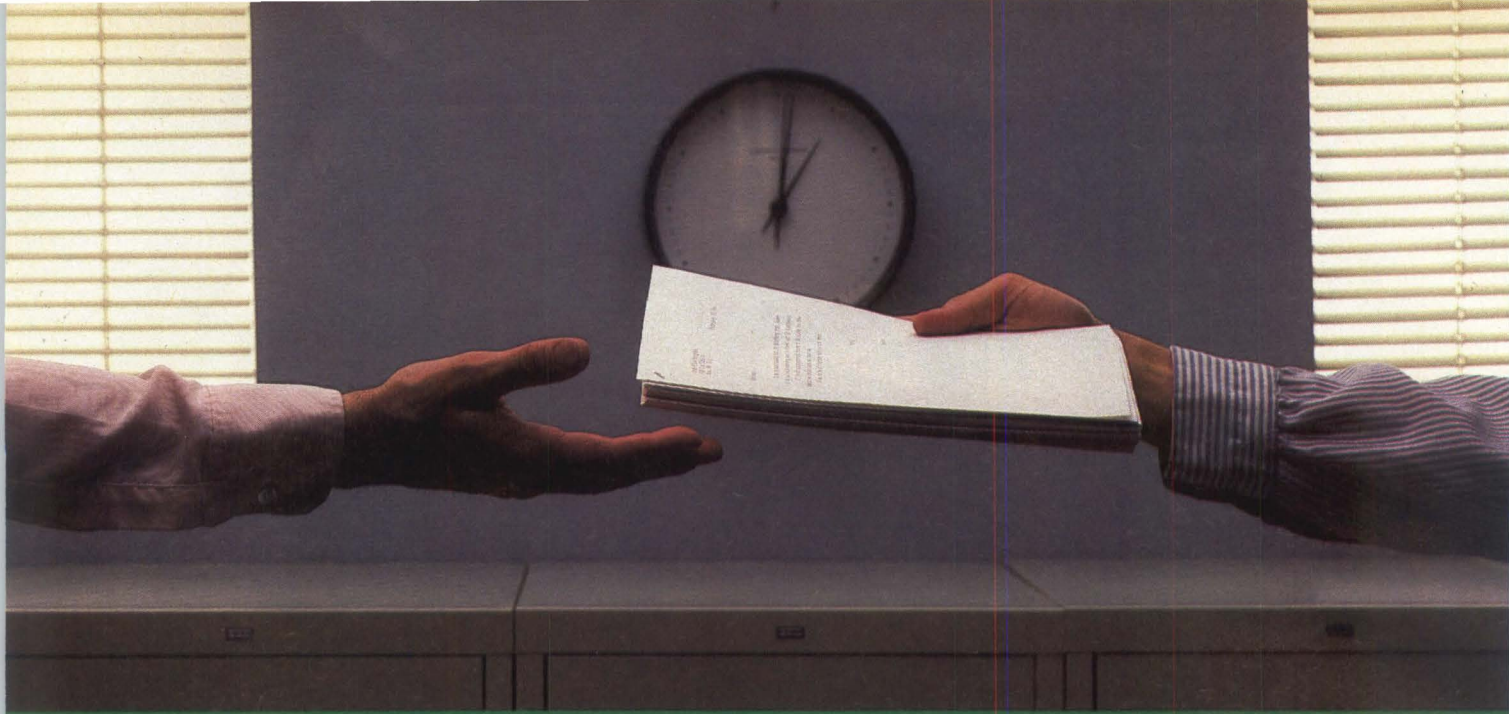
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MiniScribe banks on demand for 20M-byte, 3½-inch Winchester

Mike Seither

Associate Western Editor
and **Carl Warren**, Western Editor

To date, most activity in the 3½-inch Winchester disk drive market has centered around 10M-byte devices. But MiniScribe Corp. of Longmont, Colo., betting that the 20M-byte IBM Corp. PC-AT has set the storage standard for the next generation of desktop computers, has included a 20M-byte model in its new M8 line of 3½-inch Winchesters.

The M8 series due out this month consists of two drives. Model 8425 is a two-platter Winchester with 20M bytes of formatted storage. It will be priced under \$700 in quantities of 10,000, according to Robert Paul, MiniScribe product marketing manager. The one-platter model 8212 has 10M bytes of formatted capacity and will sell for under \$400 in similar quantities, Paul says.

Compared with the competition, MiniScribe is a latecomer to the 3½-inch Winchester game. Companies like LaPine Technology Inc. of San Jose, Calif., Microscience International Corp. of Mountain View, Calif., and Rodime Ltd. of Glenrothes, Scotland, have had 3½-inch models since last year. But all those drives—LaPine's Ranger 3522, Microscience's HH-312 and Rodime's RO-352, which is used in Compaq Computer Corp.'s Compaq Plus portable microcomputer—are 10M-byte devices.

Although MiniScribe introduced a 10M-byte drive to compete with low-capacity, 3½-inch models, the company's strategy is to sell higher capacity drives.

"We really don't expect to ship that many 10M-byte, 3½-inch drives," says MiniScribe's Paul. "The market is with 20M bytes simply because IBM has established that as the desired range [in its PC-AT]."

At least three other companies agree that 20M-byte devices will be used



MiniScribe's model 8425 3½-inch drive features 20M bytes of formatted capacity and a single-board ST412-compatible interface.

more frequently. Rodime, Microscience and Microcomputer Memories Inc. of Van Nuys, Calif., have developed such drives. When production will begin in earnest may largely depend on when demand materializes, says one marketing executive.

An IBM contract?

What products will impel the market for high-capacity drives is still a matter of speculation. Industry rumors say IBM intends to use a 20M-byte, 3½-inch Winchester in a new laptop portable that may be introduced this year. Another possibility is that the computer giant will use either 3½- or 5¼-inch disk drives in a replacement machine for the PC and the PC/XT.

Whether IBM intends to purchase 3½-inch drives from MiniScribe is not certain. Neither company is willing to discuss the matter. However, some analysts believe that MiniScribe is in a

good position to get an IBM contract, should one surface.

"I believe there is an arrangement for IBM to purchase [20M-byte, 3½-inch] MiniScribe drives," says James Porter, an industry consultant and president of Disk/Trend Inc. of Los Altos, Calif. "But it's not clear for what machine."

Porter says MiniScribe is the only 3½-inch disk-drive maker that has the manufacturing capacity to meet IBM's demand for 20M-byte, 3½-inch Winchesters. Earlier this year, says MiniScribe's Paul, the company had been building 1,000 of the drives per month, and production is expected to reach 10,000 per month by midyear. Another factor working in MiniScribe's favor is its prior dealings with IBM. MiniScribe is one of several manufacturers, including Seagate Technology of Scotts Valley, Calif., and International Memories Inc. of Cupertino, Calif., produc-

NEWS

ing 10M-byte, 5¼-inch hard disks for the IBM PC/XT.

Relies on proven designs

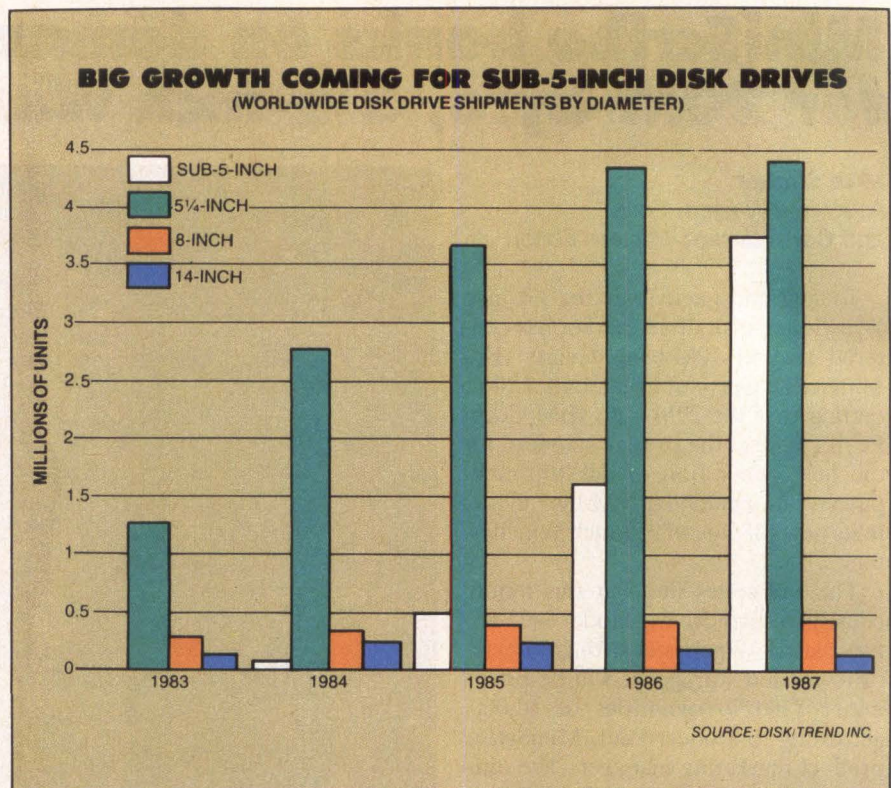
The M8 family of drives, although new, doesn't represent a technological breakthrough. Rather, MiniScribe has elected to rely on proven designs. Both drives, for example, use a single-board interface with VLSI to reduce power requirements to under 12W. By comparison, the company's half-height, 5¼-inch Winchester require between 14W and 17W. The M8 line also uses MiniScribe's rack-and-pinion linear-stepper actuator, which the company has used in other drives. And, to ensure compatibility with existing controllers, the new drives have been designed with the industry-standard ST412 interface in mind.

Since the drives are expected to be installed in small desktop computers and portables, MiniScribe has taken mounting and shock protection into consideration. Unlike similar 5¼-inch drives, MiniScribe's 3½-inch Winchesters can be mounted in any position—except upside down—and withstand up to 40Gs of shock when not running.

The introduction of the M8 Winchesters comes at a time of more talk about 3½-inch drives than actual demand. In 1984, shipments of 3½-inch hard disk drives totaled about 100,000 units, says Disk/Trend's Porter. By comparison, manufacturers shipped more than 2.5 million 5¼-inch Winchesters last year. But Porter and other analysts are optimistic about the prospects for the smaller drives. Porter forecasts about 500,000 3½-inch drives will be shipped this year and that shipments will climb to 1.6 million units in 1986.

Ray Freeman, a disk drive consultant in Santa Barbara, Calif., believes shipments of the 3½-inch drives will outnumber those of 5¼-inch devices before 1988. The reason? "It's impossible to stop down-sizing systems," Freeman says. "There is tremendous pressure for systems to be ever more compact and the disk drive is one of the biggest components."

Others seem to agree about the prospects for the smaller drives. In a



recent report, the Santa Clara Consulting Group said the sub-5-inch, rigid-drive market in the United States will have a 90 percent compound growth rate through 1989. That figure compares to a growth rate of 18 percent for 5¼-inch media during the same period, according to the company.

Pruning operations

MiniScribe, which posted a \$5.7 million loss in 1984 on revenues of \$123 million, in March terminated 450 workers at its Colorado facilities. The

company has moved its manufacturing operations to the Far East because of pressure from competitors. MiniScribe has established a printed-circuit board assembly plant in Hong Kong and final drive assembly, including the M8 line, is now taking place in Singapore.

"Ability to deliver" is one of the company's main concerns for the immediate future, says MiniScribe's Paul. If the analysts' predictions are correct and shipments of 3½-inch drives triple by next year, MiniScribe could be in a good position. □

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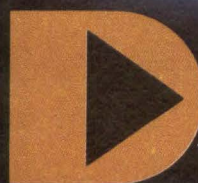
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CIRCLE NO. 17 ON INQUIRY CARD

Multiple-device subsystem links to most hosts

Carl Warren, Western Editor

Acknowledging the growing acceptance of the small computer systems interface (SCSI) bus design, Emulex Corp., Costa Mesa, Calif., has introduced Decathlon, the first packaged subsystem to employ a full SCSI implementation. The subsystem also is the first to improve system capabilities by accommodating three disk and tape peripherals. Up to now, such subsystems handled only two peripherals.

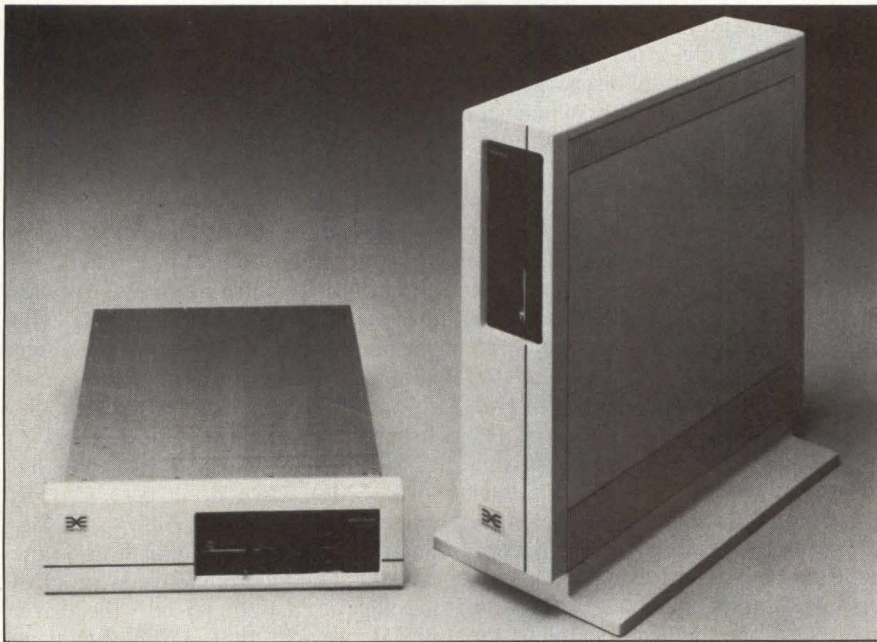
"This is a full SCSI implementation," says an industry observer, "not a hybrid of SASI. The advantage of full SCSI is that as your system grows and you need all the bells and whistles that SCSI offers—arbitration, disconnect/reconnect, copy—they're all there."

SASI stands for Shugart Associates systems interface, an intelligent interface bus design that preceded SCSI.

"Arbitration," "disconnect/reconnect" and "copy" are special SCSI command and bus arbitration functions, for which SASI has no comparable commands.

The Decathlon subsystem fits in a standard 19-inch rack or a tower enclosure. Its three peripherals can be a mix of 5¼-inch Winchester disk drives, ranging in capacity from 36M to 110M bytes, and a ¼-inch streaming cartridge drive. The Winchester disk drives use either the standard ST506 interface or the enhanced small disk interface (ESDI). As part of its package, Emulex provides the 60M-byte Cipher Data Products Inc. model 540, but streaming cartridge drives from other manufacturers can be used.

To provide maximum flexibility to system integrators, the Decathlon ties into the system host via four SCSI host adapters. These are the models UC03, UC13, IB01 and MB01.



The Decathlon fits either a rack-mount, 5½-inch-by-19-inch-by-23½-inch configuration or a 24½-inch-by-6-inch-by-30½-inch tower configuration. The packaged subsystem supports up to three high-capacity storage devices, including Winchester disk drives and ¼-inch streaming tape.

The model UC03 matches up to the Digital Equipment Corp. Q-bus and to the Micro PDP-11 bus; the model UC13 is for the DEC Unibus. Both adapters have provisions to emulate the DEC mass storage control protocol (MSCP), eliminating the need for changes to the operating system.

The model IB01 adapter for the IBM Corp. series of personal computers—PC/XT and PC-AT—provides full support for the PC-DOS 2.0 operating system and Digital Research Inc.'s CP/M-86 version 1.1.

The model MB01, designed for the IEEE 796 Multibus, provides software support for Microsoft Corp.'s XENIX operating system.

According to Ed May, Decathlon product specialist, the product's full implementation of SCSI "can be used or ignored, but they don't have to be added in later with new firmware."

Emulex provides a 10K-byte data buffer that May says lets the streaming tape operate at full efficiency in an off-line backup mode.

Controllers integrated

The 48-pound Decathlon incorporates a 138W power supply that can support the three peripherals and has integrated controllers for both the disk and tape.

The disk controllers, all Emulex products, are the Medalist, which provides SCSI to the 5¼-inch disks' ST506 interface, and the Champion, which provides SCSI to the ESDI.

The tape controller is the Emulex Titleist, which provides automatic read-after-write verification. It is available in three models: the MT01, which has the Cipher interface and uses the Quarter Inch Cartridge (QIC)-24 media format; the MT02, which provides interface compatibility to QIC-36-type drives like those offered by Archive Corp. and Wangtek Corp.; and the MT03, which supports Tandberg Data Corp.'s QIC-44-compatible drive.

Emulex's competition includes Qualogy Inc., San Jose, Calif., the maker of Cyclone, a two-peripheral subsystem.

Cyclone is specifically for DEC systems, which means it does not employ SCSI. A spokesman for Qualogy says

the company isn't keen on SCSI because the bus design tends to be slower than direct host-to-peripheral interfaces. Qualogy plans to offer the Cyclone system for DEC's MicroVAX mini-computer.

A Decathlon, with two Maxtor

Corp. 110M-byte, 5¼-inch Winchester and a 60M-byte Cipher ¼-inch streaming drive with integrated Medalist and Titleist controllers, is priced at \$15,425. A comparable Qualogy Cyclone with a 119.9M-byte Winchester and 16.25M-byte tape drive is priced at

\$12,295.

The Decathlon requires the SCSI adapters, which can be purchased from Emulex or built by the integrator. The Cyclone plugs into existing controllers with no modification of the hardware or software. □

5¼-inch Winchester poised to exceed 300M-byte storage

Carl Warren, Western Editor

Anticipating a demand from system integrators for more capacity in 5¼-inch Winchester disk drives, suppliers like Siemens Communications Systems Inc. and Maxtor Corp. are producing drives that can be pushed well above 300M bytes.

Siemens Memory Products Division, Westlake Village, Calif., recently introduced the MegaFile series of Winchester drives. Other producers besides Maxtor of San Jose, Calif., include Advanced Storage Technology Inc., San Jose, Calif., and Applied Information Memories, Milpitas, Calif.

Siemens' MegaFile has three models offering unformatted capacities ranging from 102M to 306M bytes. The 306M-byte drive's capacity can be extended to 450M bytes by increasing the tracks per inch (tpi) from the current 1,206 tpi to 1,650 tpi. The three MegaFile models are the Model 1100, with a 102M-byte capacity, for \$2,450; the Model 1200, with 204M bytes, for \$3,300; and the Model 1300, offering 306M bytes, for \$3,900.

Waiting for a market

Industry observers say Siemens has not gone to higher tpi yet because, so far, demand is not there. "It's anticipated," says one observer. "The market has not quite materialized. What Siemens and some of the others have done is position themselves to get into that market when it does materialize."

To get higher tpi, says Trevor D.

Constable, vice president of sales and marketing for Siemens, "requires the use of thin-film heads and media and better [servo-writing] methods."

Siemens is believed to be the first drive manufacturer to use both dedicated and embedded servo-writers in their drives—a technique designed to make more precise the positioning of the read/write head.

In addition, Siemens uses a proprietary spindle design that provides direct grounding of the platter stack. Many other drives use the spindle bearing as the grounding point. Direct grounding, explains Constable, eliminates bearing pitting caused by static discharge. Pitting, prevalent in many Winchester designs, increases spindle wear.

Brake time is 10 seconds

To avoid damage to the heads when the drive is shut off, Siemens uses a mechanical brake with a solenoid to physically stop the spindle. Most drives employ back electromechanical force (EMF) to pull the heads back and stop the spindle. Constable claims this typically takes up to 30 seconds and frequently causes the heads to land outside the safe zone. "We use the back EMF to pull the heads and, once in the safe zone, issue a spindle-stop command that brakes the drive in about 10 seconds," says Constable. He says the amount of time the heads spend on the media surface is directly related to the mean time between failures of the drive.

As areal density (tpi times bits per inch) increases to above 20M bits per

square inch in these super-high-capacity Winchester drives, suppliers strive for greater efficiency through increased data-transfer rates.

For starters, disk-drive makers say the 5M-bit-per-second (625K-byte-per-second) transfer rate of the standard ST506 interface no longer is fast enough. One way to get more speed is to design drives with the enhanced small disk interface (ESDI), used by Siemens, Maxtor and Advanced Storage, which supports transfer rates of 1.2M bytes per second.

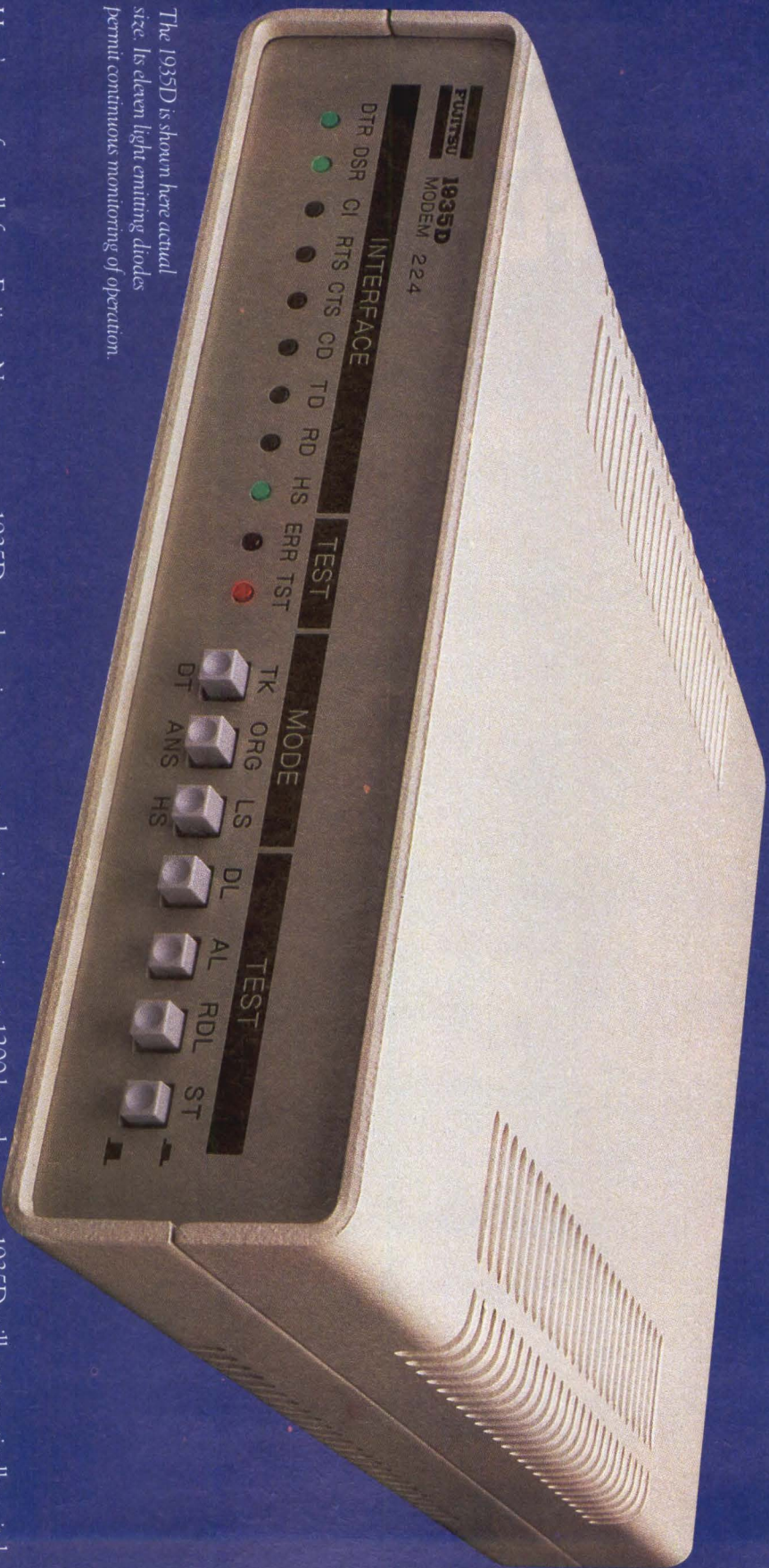
Other solutions to the speed issue include a scaled-down version of the standard storage module device (SMD) interface used by Applied Information Memories in its Dart series of drives. The SMD transfer rate also is 1.2M bytes per second.

The long-term solution may lie in the emerging intelligent peripheral interface (IPI), which promises 3M-byte-per-second data-transfer rates. The problem is that widespread implementation of IPI is at least three years away, according to I. Dal Allan, publisher of ENDL Inc.'s newsletter.

Siemens is happy it picked ESDI over SMD. "We don't feel SMD is applicable to small drives," says Siemens' Constable. "To match up to the systems being designed today, a lot of intelligence has to go into the drive. ESDI provides that. ESDI should be workable for the next couple of years."

Although the Siemens drives are sold by the company's California subsidiary, they are built by Siemens in Munich, West Germany. □

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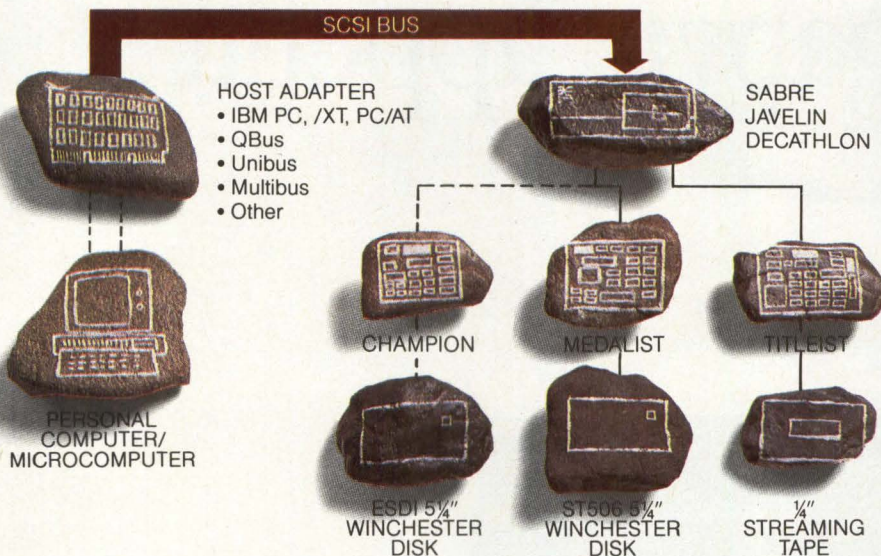


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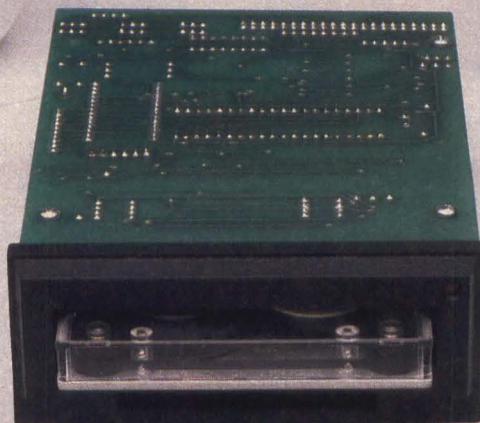
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MINI-MICRO WORLD

CORPORATE AND FINANCIAL

Apple vs. IBM: If you can't beat 'em, join 'em

David Bright, Assistant Editor

Has Apple Computer Inc. conceded victory to IBM Corp. in the office personal computer market? Apple, which had been pushing its Macintosh personal computer as a total alternative to the IBM PC, recently changed its strategy to one of coexistence with IBM. The new strategy was revealed with the announcement of Apple's Macintosh Office business environment. Among the new and forthcoming products announced for Macintosh Office are networking equipment for linking the resources of Macintoshes and IBM PCs.

This policy shift is not a major concession to Big Blue, say many analysts. "I don't think that Apple is giving in to IBM," comments Michele Preston, senior vice president at New York financial analysts L.F. Rothschild, Unterberg, Towbin. She says the planned IBM PC connection is a smart move because it broadens the Macintosh's appeal to large corporations.

War is over, says analyst

Strongly dissenting, however, is George Colony, president of Forrester Research, Cambridge, Mass. "It's over," he states. "IBM has won." The problem is that Apple is in the "dark ages" as far as communications is concerned, he says. What Apple should do, Colony says, is develop its own distributed, multiuser systems. "You can't grow office systems with workstations," he maintains.

Despite the controversy, first-year sales of the Macintosh reached approximately 250,000 units. "What sold it was the sizzle," observes Charles Pesko, president of market consultant

C. A. Pesko Associates, Marshfield, Mass. Pesko says the Macintosh's small size, graphics capability and ease of use made it an attractive alternative to the IBM PC.

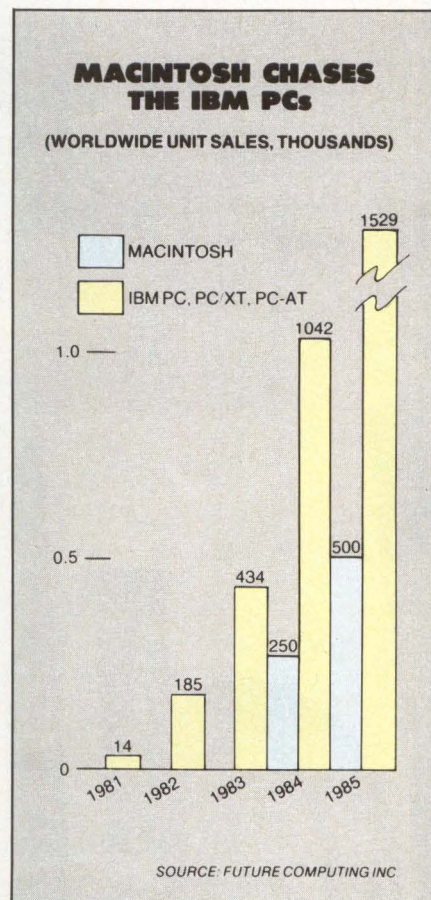
Now, in a stepped-up effort to further penetrate business markets, Apple is promoting the Macintosh as the core product of the Macintosh Office. Products announced with the Macintosh Office include the AppleTalk Personal Network for connecting 32 devices and the \$6,995 LaserWriter laser printer. Due later this year are file servers and the IBM PC-related products, some of which, like Sytek Inc.'s link between AppleTalk and IBM PC networks, are being developed by third parties.

With the new products, Macintoshes will be able to access data from IBM PCs, and IBM PCs will be able to tap into AppleTalk networks and share the LaserWriter. The LaserWriter has received high marks from analysts.

The IBM-related products won't be available until the second half of this year, however, so they will not be an immediate factor, notes analyst Preston.

Another analyst, Esther Dyson, president of EDventure Holdings Inc., New York, agrees that Apple's intention of coexisting with IBM is "realistic and sensible." But she also emphasizes the importance of AppleTalk, which distributes the resources of all the Macintosh products—computers, LaserWriters, file servers and disk servers.

A key to Apple's attempted drive into corporations is the IBM PC connection, according to Raymond Falls, an associate editor at Datapro Research Corp., Delran, N.J. That strate-



gy shows that Apple is "willing to cope" and should help Macintosh find its way into more corporations, he says.

But Colony at Forrester Research insists that Apple will have trouble reaching the larger corporations. His company's projections show Macintosh sales reaching 450,000 in 1985—50,000 fewer than predicted by Future Computing Inc., Dallas. Further, Colony says, only about 75,000 of those Macintoshes will go to Fortune 1,000 companies. □

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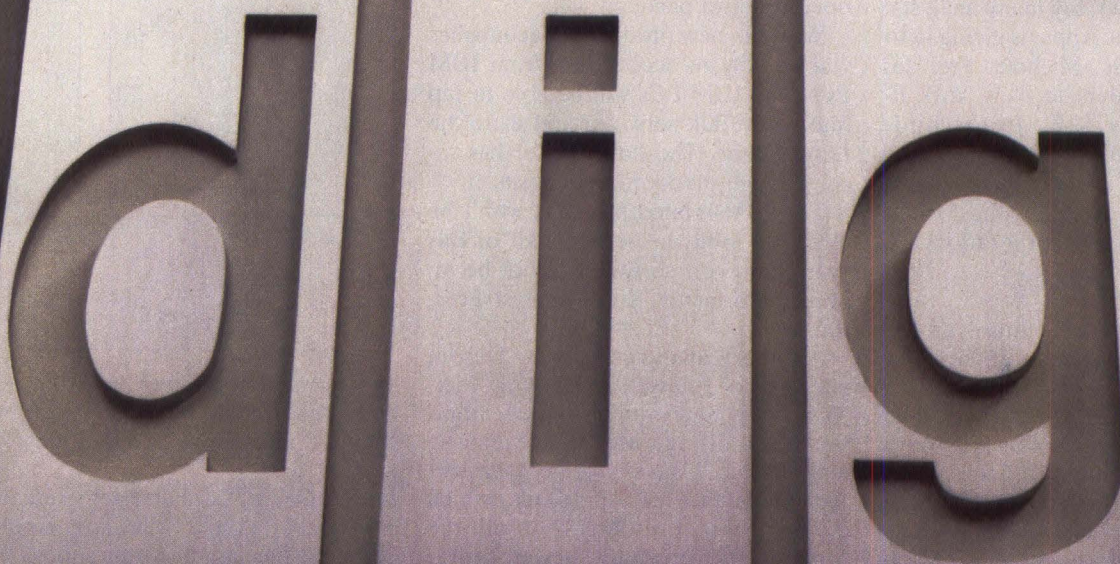
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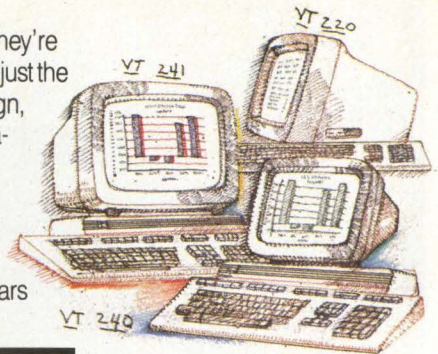
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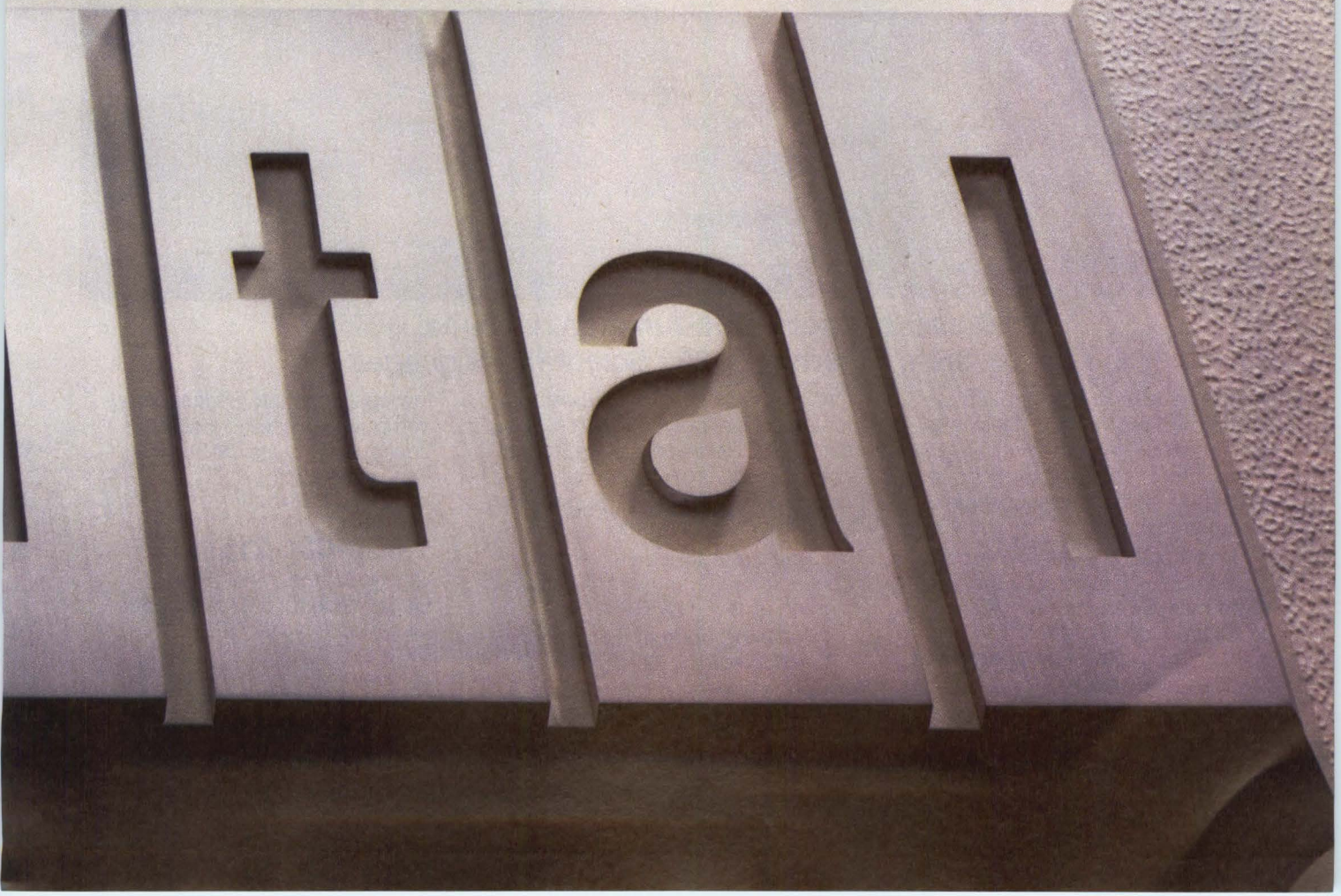


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MINI-MICRO SYSTEMS/May 1985

MINI-MICRO WORLD

INTERNATIONAL

Japanese pioneering in erasable optical disks

Denise Danks

London Correspondent

Japanese companies came late into the world disk drive market, and only with the 3½-inch floppy drive have they become a real force, analysts say. But some observers feel Japan could come close to monopolizing the next generation of devices—the erasable optical disk drive—partly because of the need in Japan to adequately handle complex ideograms.

Although Sony Corp. and Hitachi Ltd. are the only companies to have previewed products so far, a host of others are working on the technology including Fujitsu Ltd., Matsushita Electric Industrial Co., Sharp Corp. and Toshiba Corp.

Sony announced a 12-inch erasable drive last October and already claims to be shipping production units. Sony had intended to start volume production in the first quarter of this year, and Hitachi, which is using the same technology on a 5-inch platter with 550M bytes of storage on each side, claims to be close behind.

Matsushita aims to have production models of an 8-inch erasable drive with 700M bytes per side out this year. Other companies such as Toshiba Corp., Sharp and Pioneer Electric Corp. appear further behind. But in the United States, only 3M has discussed plans for erasable optical media.

A domestic need filled

Raymond Freeman Jr., of Santa Barbara, Calif., analyst company, Freeman Associates, thinks the Japanese are pursuing optical disk drives not just because of the potentially vast

world market, but also because they fulfill an important domestic linguistic need.

“The Japanese have long faced a data-storage problem associated with their language’s character set. Unlike English characters, these need a bit-mapped picture demanding very large amounts of disk capacity. This is just what optical technology offers,” says Freeman.

Erasable drives outside Japan

The effort going into erasable optical drives outside Japan seems to be much smaller in comparison.

The Optical Storage International joint venture company formed by NV Philips, Eindhoven, the Netherlands, and Control Data Corp., Minneapolis, is shipping a write-once drive and is developing an erasable version, but it does not expect to ship that drive before late 1986 or 1987.

Xerox Corp.’s Optitem division, which has now been spun off of Shugart Corp. as a separate operation, is working on optical disk technology, as is Alcatel-Thomson Gigadisc SA, La Boursidiere, France, and some U.S. start-ups.

But the company that has bet the most on optical disk systems, Storage Technology Corp., Louisville, Colo., has been in financial difficulties. Although its optical disk program is still operational, its staff has been slashed from 180 to 40.

IBM Corp. has privately shown a pair of non-erasable drives for use with personal computers, but its public stance is one of skepticism. At the Share European Association user conference in Switzerland last year, Daniel Leeson, head of marketing at IBM’s

General Products Division, said he regarded the technology as still experimental and thus unsuitable for serious applications.

In contrast, new computer systems announced in Japan routinely include optical disk drives. Japan has already amassed experience well in excess of that gained elsewhere.

Technologies vary

There are many competing versions of the currently favored optical disk technology.

Sony’s first units are based on a combination of laser and magnetic technology developed in conjunction with Kokusai Denshin Denwa, Tokyo, a Japanese telecommunications company.

Its 12-inch drive uses a laser to melt magnetic material on the surface of the disk and a coil underneath the disk to set the polarity of the melted spot. Once the spot cools, it retains its polarity until it is melted again.

Other approaches include “phase change” and “dye-in-polymer,” both of which are based on a medium with optical qualities that can be changed and detected by a laser.

The magneto-optical technology seems to have the most adherents, but companies currently are working on combinations of substrate, active layers and disk diameters.

Incompatibility to remain

This variety leads Freeman to think it is much too soon to say the Japanese will come to dominate the market. “The Japanese may well be the first to get products to the market, but they [the products] are likely to be incompatible. The market will not grow rap-

idly until a standard emerges," he says. Freeman feels this may allow non-Japanese companies to break into the market and even help to establish the standard if they get their timing right.

James Porter of Disk/Trend Inc., Palo Alto, Calif., a disk market analyst, thinks one product is already well-advanced as a possible standard in the United States. "Optical media is the

key to standardization, and 3M is perfecting the most advanced magneto-optical media yet developed. It has a much better signal-to-noise ratio than anything else so far made public, and it could well be adopted as a standard. The company says it could produce volume shipments of 5¼-inch, 500M-byte disks this year."

Moreover, both Freeman and Porter

are skeptical about the schedules the Japanese have announced for volume shipments. Porter comments, "I doubt we will see erasable drives appearing in real numbers within the next three or even four years. The Japanese still have a lot of work to do on reducing the access time of drives to the point where the performance would be acceptable to OEMs." □

Lower labor costs, taxes attract U.S. to Far East

Charles Hintermeister
Taiwan Correspondent

"Automate, emigrate or evaporate," is a phrase that over the last few years has been gaining currency among industrial-automation engineers in the United States. Rising production costs have convinced many U.S. computer product manufacturers that they must choose between the first two to fore-

stall the third.

"Emigrate," in this sense, means moving out of America and setting up manufacturing in Taiwan, Hong Kong or some other place where production-worker pay is low. However, the decision to automate existing U.S. operations or to manufacture overseas is not easy to make.

There are many advantages for U.S. companies that automate production

at home. First, companies that manufacture products in their own countries can rack up considerable savings by not having to ship finished products halfway around the world to domestic markets. And, in the fast-moving, competitive computer industry, a long transit time for a product can have a negative effect on the product's marketability.

Second, these companies avoid complex problems associated with finding a reliable OEM in the Far East and of making sure operations run smoothly.

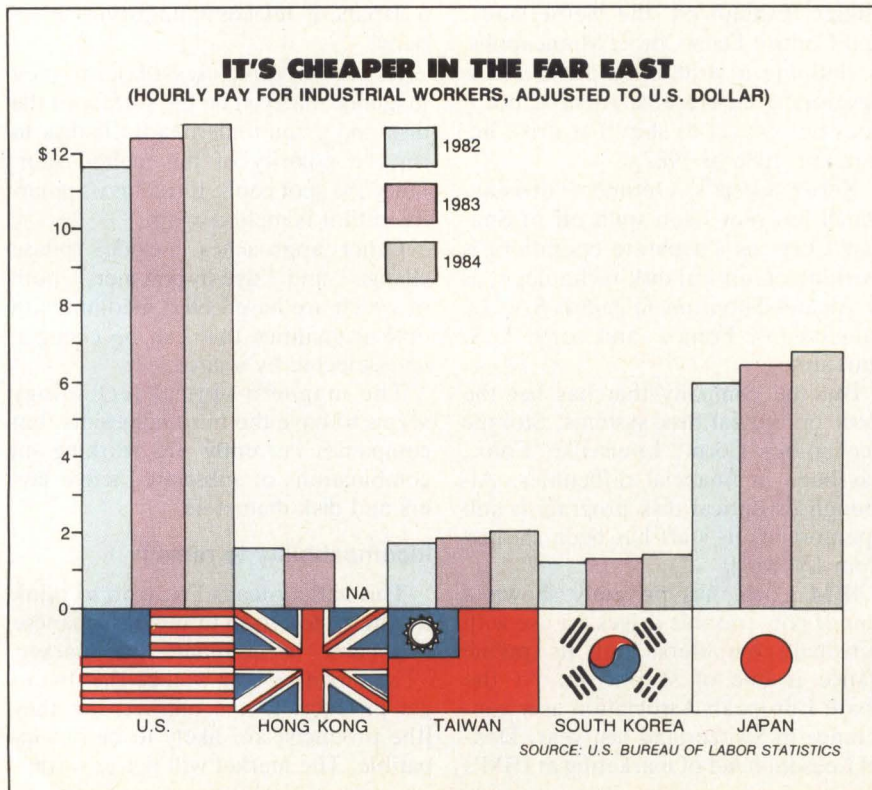
Third, in a period when unemployment is an ongoing problem in the United States, companies such as Apple Computer Inc. and Hewlett-Packard Co., which manufacture at home, derive significant public-relations benefits by providing jobs for U.S. workers.

An additional reason for not locating abroad, especially in the Far East, is that companies can reduce the possibility of their designs being counterfeited.

For those going abroad

Overseas manufacturing, particularly in the Far East, has long been a standard option for companies trying to escape high wages and corporate taxes. Some U.S. electronics companies that have transferred production to Taiwan have reportedly realized 30 percent savings on production costs, according to one industry consultant.

These are average rates for industrial workers. In some Far East countries, rates are substantially lower for electronics assembly workers.



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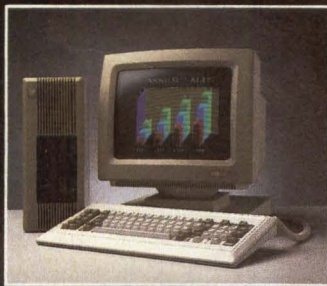
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CIRCLE NO. 23 ON INQUIRY CARD

A large percentage of mainstream computer peripherals sold in the United States, such as terminals, monitors and floppy disk drives, comes from manufacturers like South Korea's Daewoo or Taiwan's Tatung, or are produced in other foreign manufacturing facilities staffed with assembly line workers earning far less than their Western counterparts. IBM Corp., for example, last year manufactured over \$300 million worth of peripherals, components and subassemblies in Taiwan alone.

According to Paul Tittmann, head of consulting company Investec-Gemini Ltd., Taipei, Taiwan, which specializes in the transfer of electronics production to the Far East, labor rates in the region's four newly industrialized countries (Taiwan, South Korea, Hong Kong and Singapore) average \$1.50 per hour. Pay for workers on electronics assembly lines in Singapore and Hong Kong tends to be higher than in Taiwan, where the average is about \$1 per hour. South Korean electronics

assembly workers earn about 80 cents per hour.

The cost of labor all over Asia is rising steadily, however. Electronics industry wage levels in Taiwan have increased about 7 percent a year for the last several years.

Additionally, in high-end electronics products such as computer peripherals, labor represents as little as 10 percent of production cost, so the benefits of \$1-per-hour labor are small.

Nevertheless, rates are still low and "are very attractive for almost any electronics manufacturer," says Tittman. "But, as assembly labor is available elsewhere at even lower rates, there remains a need to find other reasons to justify electronics assembly in the Far East."

Many companies are finding that justification in lower component prices. "Clearly," says Tittman, "one of the important advantages Asia has to offer is lower material costs."

With the exception of integrated circuits, he says, basic materials and com-

ponents can be purchased in Asia at prices up to 30 percent lower than in the United States. "Such materials are generally of comparable quality to those produced in the advanced nations. The process [of buying them] simply takes a bit of patience and an experienced eye," Tittman says.

Taiwan and South Korea, Tittman points out, are already very competitive in a wide range of materials and electronic components. Hong Kong is becoming competitive, he says, with support from suppliers in China's Special Economic Zones, industrial areas that offer tax breaks to attract foreign investors.

Richard Kamman, an electronics industry consultant in Taipei, Taiwan, says some foreign companies manufacture components in the Far East and then assemble them in automated plants in their own countries. "One of my clients, who is producing a low-volume, high-value electronics product, has been very successful doing exactly this," he says. □

PACIFIC PERSPECTIVE

IBM's 5540 could boost Japan's micro sales

Ichiro Kakehashi
Tokyo Correspondent

Japan's microcomputer makers are more optimistic about sales prospects for the fiscal year, which began in April, after looking over last year's results. They showed a better-than-expected total of 1.2 million personal computer shipments in the fiscal year ending in March.

Preliminary figures from manufacturers indicate a strong holiday season helped avoid what, as late as last fall, promised to be a slump. Shipments in December reached 238,000 units, including 88,000 exports. But, despite overall optimism for the current year, manufacturers have taken to adding functional upgrades to low-end mod-

els to work off excess inventories in that market area.

Among the stimulants to this year's market are the more fully featured products such as the NEC Corp. PC-8801 Mark II and PC-9861 Mark II, the Oki Electric Industry Co. IF-800 model 60, the IBM Corp. JX, the Fujitsu Ltd. FM-16 β and the Hitachi Ltd. B16/EX. For the most part, the machines have more RAM and ROM but cost less than last year's models because they have simpler circuitry.

One of the market's strongest booster shots could be the February offering from IBM Japan Ltd., the wholly owned subsidiary of IBM, of the 16-bit 5540, a scaled-down version of the popular IBM 5550 office microcomputer. The 5540 is based on an

Intel Corp. 8086 microprocessor and has 16K bytes of ROM and 256K bytes of RAM, expandable to 640K bytes. Character ROM supports 7,190 Japanese Kanji ideograms, which is a more elaborate dictionary than most of those on more expensive competing machines.

The product is priced in Japan at ¥640,000 (about \$2,460) for a standard configuration with two 5¼-inch, 720K-byte, dual-sided, double-density, floppy disk drives and a 15-inch monochrome display. The display has a 24-by-24-dot character matrix and graphics output of 1,024 by 786 pixels driven by a 256K-byte video RAM. The 5540 runs the same software and will drive the same peripherals as the 5550.

Now, with the 5540, the 5550 and the low-end JX, IBM Japan has a product line with price points comparable to, rather than more expensive than, those of its American parent, a factor which could entice more Japanese buyers.

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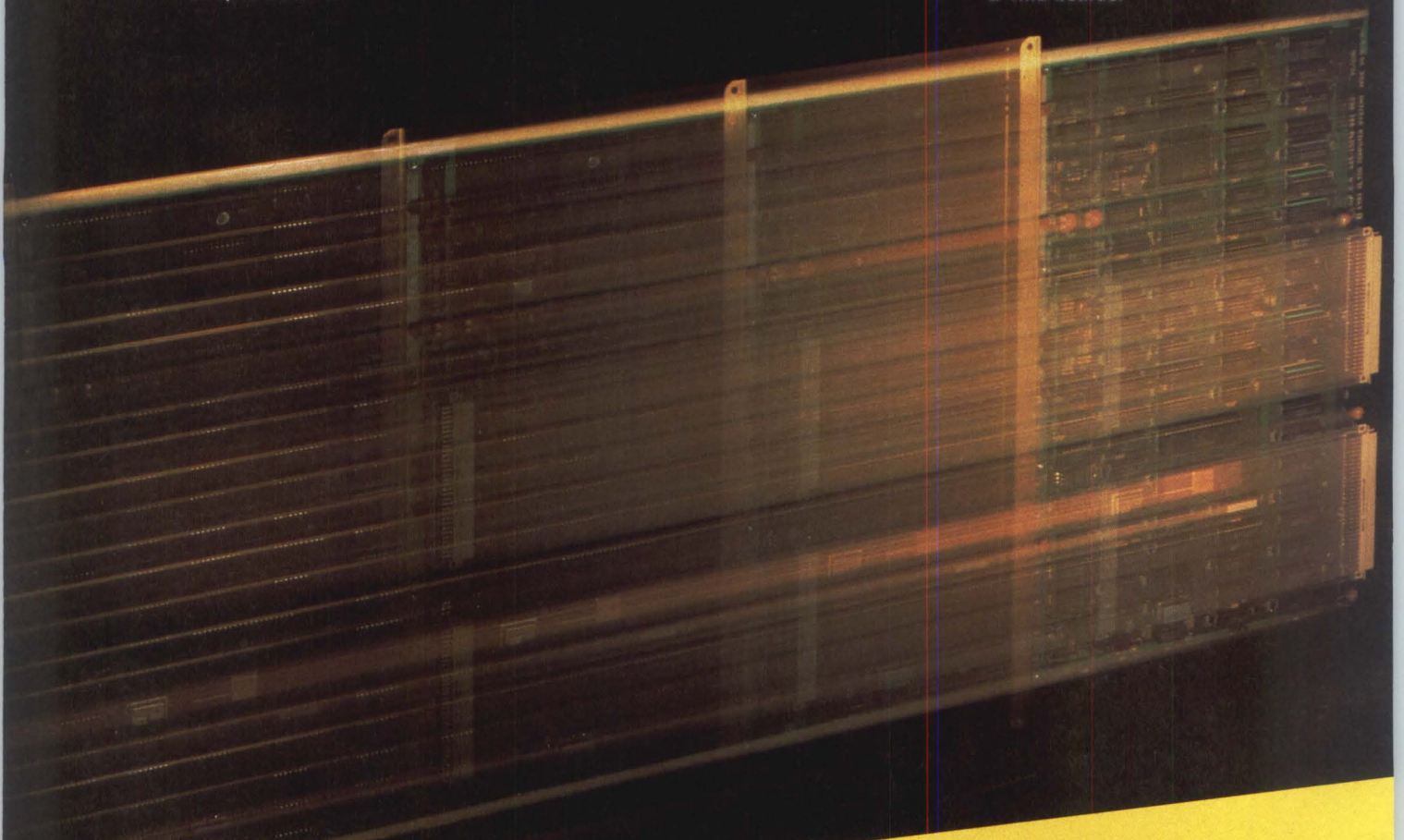
A clear leader in its price range — from \$7,000 for OEM quantities — the 3068 combines the 32-bit MC68020, multiple auxiliary processors, and a tuned version of UNIX™ System V. Use it as a stand-alone or a network node.

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INTERPRETER

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

VOICE/DATA TECHNOLOGY SPAWNS NEW PRODUCTS

Computer and communications companies join forces to address uncertain voice/data terminal market

Stephen J. Shaw, Washington Editor

A spate of product announcements, some rosy market predictions and a growing number of strategic corporate alliances are providing visible evidence that the marriage of computers and communications may finally be producing some legitimate offspring.

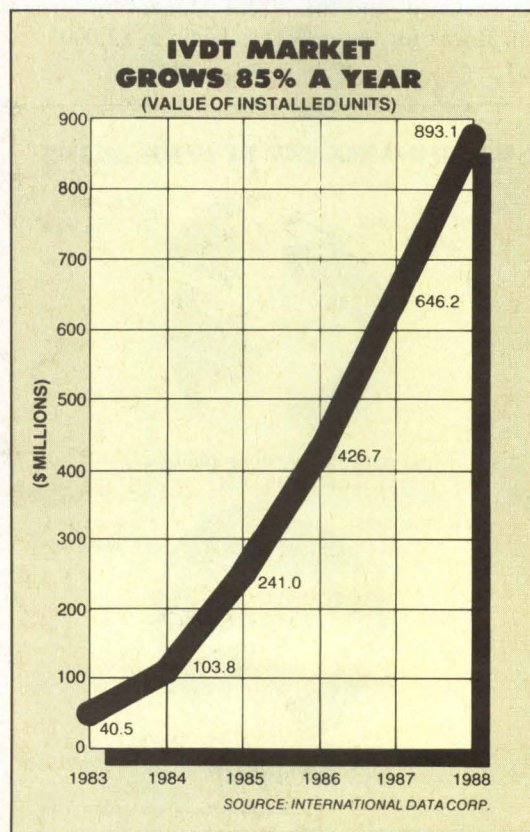
Integrated voice/data terminals (IVDTs) merge the processing power of microcomputers with advanced telephone features such as call management, calendars and directories. In theory, the blend of voice and data functions is a natural combination. In practice, however, IVDTs may prove less difficult to develop than to sell. The price tags on the new products are high and users have not flocked to earlier versions in large numbers.

To varying degrees, most of the major computer manufacturers are testing the IVDT waters through alliances with suppliers of advanced communications equipment. For communications companies, a link with computer suppliers provides additional marketing clout for sales of add-on equipment for networks. Computer manufacturers see technology-exchange agreements as a way to gain technical expertise in voice communications to develop their own IVDTs as the market eventually matures.

"It's a sensible approach for computer manufacturers to adopt," comments Ray Boggs, manager of the office equipment division of Venture Development Corp. (VDC), a Natick, Mass., market research company. "By forming alliances with communications companies, they can gain experience with voice technology."

At the high end of the IVDT market are products that combine in a single unit a fully programmable microcomputer and an enhanced telephone workstation. These devices allow the simultaneous transmission of voice and data over telephone lines. Typified by the Cedar worksta-

In practice, IVDTs may prove less difficult to develop than to sell.





"There's been no big demand for IVDTs in the past, but the new equipment is going to surprise users and stimulate demand," predicts Federico Faggin, president of Cygnet Technologies.

tion introduced in November 1984 by Rolm Corp., Santa Clara, Calif., and AT&T Information Systems' new PC 7300, expected to be introduced this year, these units carry a price of \$4,000 to \$6,000.

Another approach taken by recent start-up companies is to offer hardware/software packages that add voice- and data-communications features to microcomputers. These packages include Watson from Natural Microsystems Corp., Asher from Wilcom Inc. and Communications Co-System from Cygnet Technologies Inc. These packages may not offer the same level of functionality that equipment initially designed as an integrated device does, but, priced between \$800 and \$2,000, they offer current personal-computer users an attractive alternative to buying an entirely new IVDT workstation.

A third approach to the IVDT market is to develop terminals with some degree of local intelligence to function as workstations in a local voice/data network. Typified by Northern Telecom Inc.'s Displayphone, the first IVDT-type product, introduced three years ago, these units traditionally do not offer much local computing power. But they bring together limited voice and data functions. GTE Corp.'s Omni-Action Station, manufactured by Sydis Corp., is such a product. Others are the Davoxnet terminal from Davox Corp. and the AT&T Dimension terminal. Prices for these IVDTs begin at \$2,000.

From a small installed base of 23,000 units in 1983, the number of IVDTs almost doubled last year and is expected to jump this year to 170,000, according to International Data Corp. (IDC), a Framingham, Mass., research company. By 1988, the installed base of units is projected to swell to 883,530 units.

The value of IVDT shipments will grow from a paltry \$35.3 million in 1983 to \$246 million in 1988, despite an expected drop in the average per-unit price from \$1,752 to \$900, IDC reports.

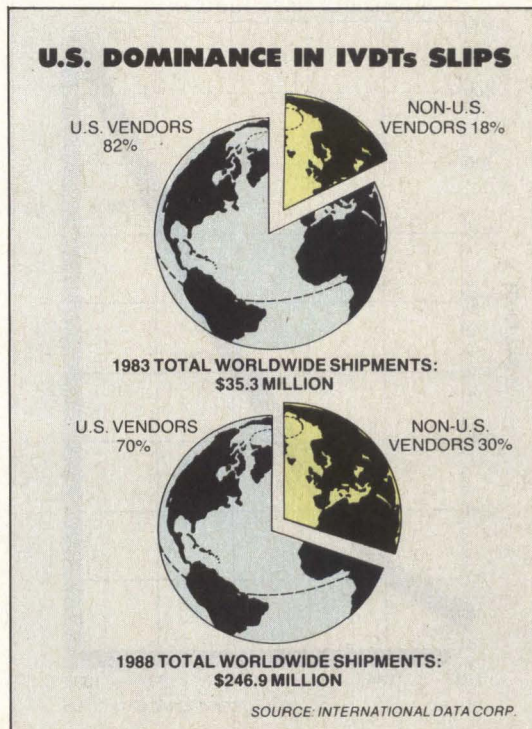
Computer companies find PBX allies

Eager to acquire expertise in voice communications, computer companies have been linking up with manufacturers of private branch exchanges. These digital switches serve as the hub of local telephone networks and provide a gateway to external telephone systems. By digitizing voice communications, advanced PBXes can multiplex the voice and data signals along the same telephone circuit wire. Since most office telephone networks use cheap and easily available twisted-pair telephone wire, the PBX as the network switch offers an economical alternative to local data networks, which uses more expensive coaxial cable.

The recent acquisition of Rolm by IBM Corp., followed quickly by the introduction of Rolm's PC-compatible Cedar terminal and Juniper add-on board, demonstrate that IBM intends to be a major force in this marketplace and clearly legitimize the IVDT market, says IDC communications analyst Charles R. Robbins. The IBM/Rolm venture, however, is only one of several computer/PBX alliances.

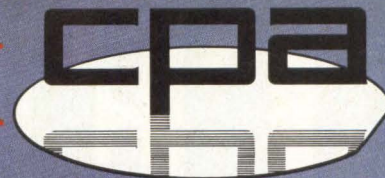
In mid-1984, Wang Laboratories Inc. bought a 15 percent share in PBX manufacturer InteCom Inc. The companies jointly developed a telephone workstation that emulates a Wang VS terminal or can be fitted with the Wang PC central processor and disk drives to provide full microcomputer functions. Data General Corp. has technology agreements with five PBX manufacturers to develop interface capability between DG's MV processors and the manufacturers' PBXes. AT&T Information Systems codeveloped the PC 7300 IVDT workstation with Convergent Technologies Inc., Santa Clara, Calif. The unit is expected out this year.

No single computer company has demonstrated sufficient voice and data expertise to implement fully featured generic IVDTs for all PBX environments. Many companies have allied themselves with PBX manufacturers to develop IVDTs that are proprietary to specific PBXes. For now, the computer vendors are content to let the PBX vendors handle the marketing and sales



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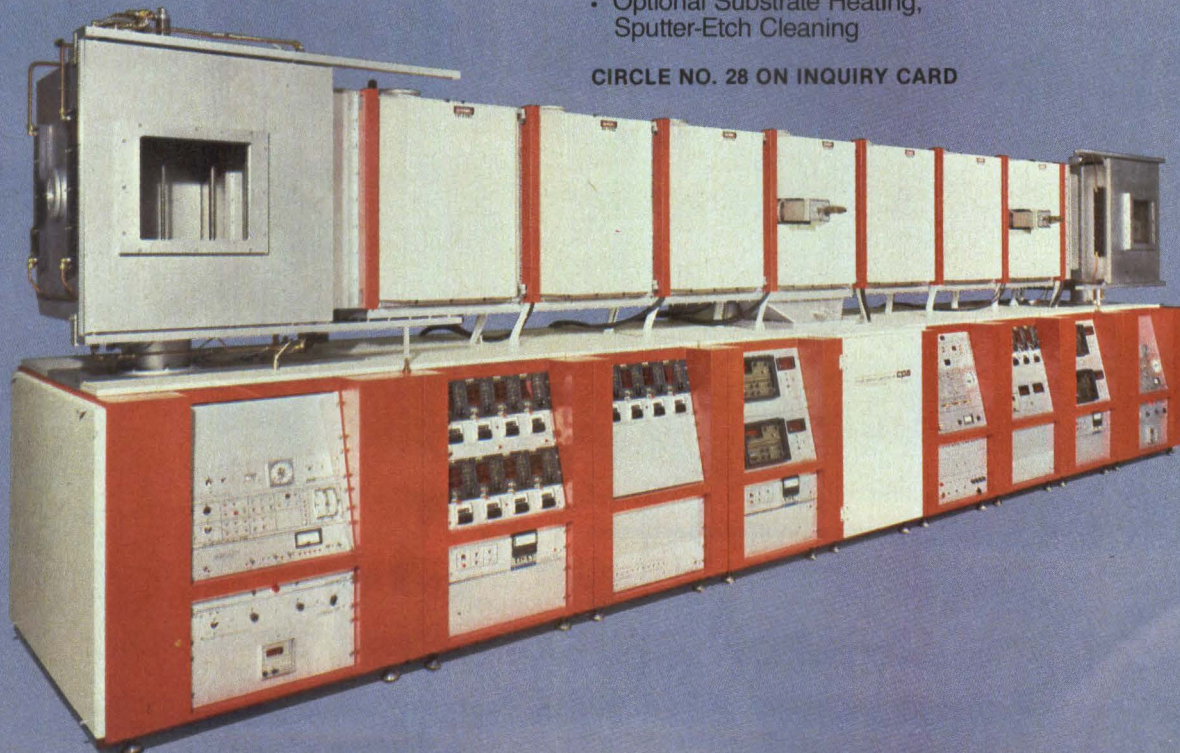


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of IVDTs. As the market becomes more lucrative, however, the computer companies are likely to use their newfound knowledge to offer products that directly compete with those of their current partners.

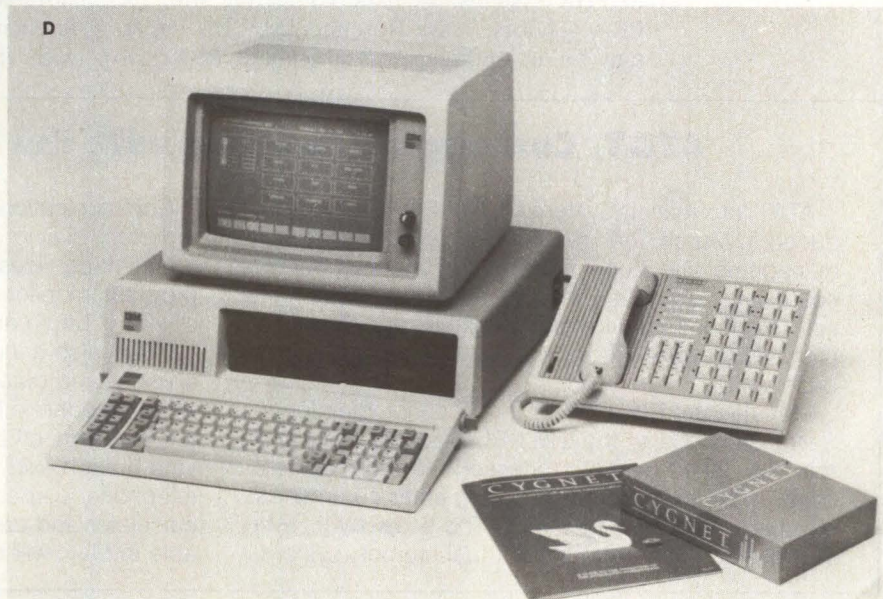
"Computer manufacturers are chicken," says VDC's Boggs. "They want to reduce their exposure, if the market doesn't take off, and minimize their capital development costs. But they know it's critical to get a wider view of telephone technology and systems."

Companies plot similar strategy

Wang is taking a four-step approach toward

developing IVDT products, with each succeeding step designed to broaden the marketability of equipment. With its new workstation developed with InteCom, Wang has met its first goal: to build an IVDT that is proprietary to the InteCom Integrated Business Exchange (IBX) switch, according to William Rosenberger, Wang IVDT product development director in Lowell, Mass. As part of its long-range communications plan, Wang intends to make arrangements with other PBX vendors to integrate value-added functions into its PBX-terminal systems. Next, Wang will develop physical interconnections between its voice-mail systems and

A variety of technical approaches to integrated voice/data terminals is typified by some recently introduced products: Rolm's Cedar terminal (A) offers an IBM-compatible microcomputer with integrated telephone features. Workstations from Davox (B) and a prototype IVDT (C) developed by Wang and InteCom Inc. provide terminal emulation features combined with enhanced voice functions. An add-on board and telephone handset (D) from Cygnet Technologies can turn an IBM PC into an IVDT.





"It's important for us to learn about PBXes and voice technology to generate generic voice/data products," says William Rosenberg, Wang IVDT product development director.

other office-automation equipment. The final step, Rosenberger says, will be to achieve the ability to interconnect Wang workstations generically, including IVDTs, with the widest possible range of PBXes via twisted-pair wire.

DG is interested in developing generic IVDT products that can run on a wide range of PBX-driven office-automation systems, says Frank Pinto, marketing director of DG's information systems division. Through technology-exchange and marketing agreements with five PBX companies, DG will ensure that its office-automation products can support and interface with the integrated voice/data-communications equipment.

Although computer manufacturers want to develop their own lines of generic IVDT products, PBX vendors are in the best position to capture the major portion of the IVDT market during the next several years, claims Boggs. Experienced in selling digital telephone systems, PBX manufacturers can insure IVDT integration with a user's data-processing operation and communications environment by marketing the PBX and IVDTs as a bundled system.

A recent VDC study indicates that PBX suppliers will increase their market share of IVDT terminals to 46.8 percent in 1987, up from 11.6 percent in 1983. Vendors of standalone IVDTs, on the other hand, should see their market share slip from 88.1 percent to 51.6 percent during the same time.

Analysts and industry executives agree that computer manufacturers will eventually market their own IVDTs. "When IVDT sales are made on the basis of terminals, rather than as add-ons to PBX systems, we'll be competing with the PBX vendors," says Rosenberger. "It's important for us at Wang to learn about PBXes to

generate our own generic products."

PBX vendor executives agree that they could eventually face a major competitive threat from computer companies. "I see a danger in these joint development agreements," says Teresa Felicetti, product manager at InteCom, Allen, Texas.

But Jeff Benson, marketing manager for the Displayphone group at Northern Telecom, Nashville, Tenn., says ensuring communications compatibility between desktop computers and PBXes outweighs any future competitive concerns. "It's much more important for us right now to have close working relationships with a number of computer manufacturers. Besides, these arrangements provide tacit acknowledgment by the computer industry that the PBX has emerged as the controller for the automated office."

An IVDT niche?

Questions remain as to whether the new generation of IVDTs represents an evolutionary step in office automation or simply a better solution to an undefined problem.

"Look, I have my PC on my desk next to the telephone. I really don't believe I need to have both in one box," comments Harry Newton, president of The Telecom Library, a telecommunications consulting company in New York.

"Users have not been crying for IVDTs," concedes Federico Faggin, president of Cygnnet, Sunnyvale, Calif. "The marketplace is, admittedly, embryonic."

IVDTs configured to take advantage of the advanced capabilities of PBX services such as store-and-forward messaging, auto-dialing, conferencing and call management can integrate with traditional personal computer functions.

AT&T, Convergent team up with the UNIX PC 7300

AT&T Information Systems' UNIX PC 7300, introduced in March, features sophisticated telephone-management and communications functions but does not, as was expected, incorporate a telephone handset. Telephone-management functions are accomplished by connecting a standard handset to the base unit.

Manufactured by Convergent Technologies Inc., Santa Clara, Calif., the UNIX PC incorporates a Motorola Inc. 68010 central processor, the UNIX System V operating system and a mouse to enter commands and perform screen functions. The 512K-byte RAM is organized into a 4M-byte virtual-memory system.

Communications services include directory dialing, repertory dialing and last-number redial. Call-management services include call timer, call history, call-progress monitoring and messaging. Prices for the UNIX PC begin at \$5,095.

ATTIS also announced the AT&T Personal Terminal, a voice- and data-communications terminal equipped with a telephone handset and a touch screen. The terminal runs off the company's System 75 or 85 private branch exchange and features a four-line digital telephone, a speaker phone, an auto-dialer, a built-in calculator and calendar programs. The terminal, available in May, will be priced at \$1,795.



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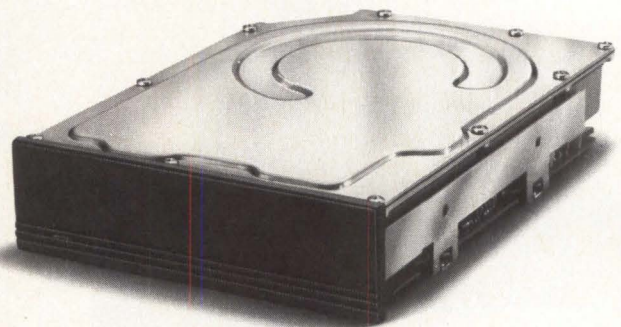
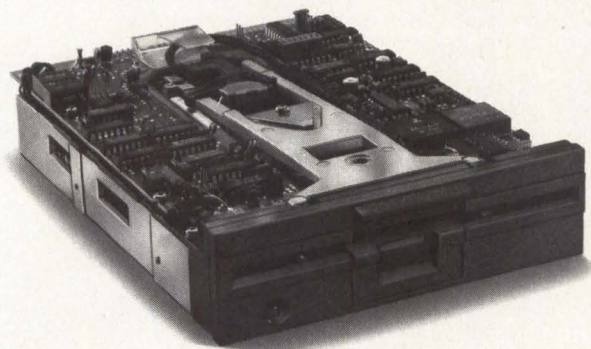
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IVDTs could save time in situations where a request for information is relayed by telephone. Instead of putting the phone down and going to a paper file or another computer terminal, a user could simply access the needed database from the same workstation.

But a lack of customer awareness concerning specific IVDT applications, the lack of clear-cut responsibility for purchase decisions and the existence of high prices could delay the widespread appearance of these devices. The dual nature of IVDTs is not easily understood by business professionals and potential customers who specialize in either voice or data technology, but rarely both applications. "IVDTs are neither fish nor fowl. That's going to create some confusion among potential customers," says VDC's Boggs.

Who signs the purchase order?

The dual nature of IVDTs is likely to confuse company purchasing departments, asserts VDC's Boggs. Who is responsible for making the decision for purchasing IVDTs, he asks: the

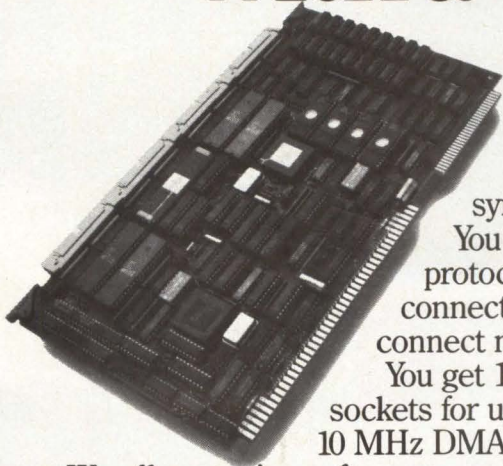
telecommunications department or the data-processing group? Some large corporations have named a vice president for management information systems, who is responsible for both areas. "Still, it's a thorny jurisdictional problem that will dog IVDT sales," Boggs predicts.

The increased sophistication of newer IVDT products could turn up the heat in a market where users have been lukewarm. Yet, IVDT vendors concede that potential customers may not be ready to buy if the only sales pitch is the convenience of a single box.

"We have a tough sales task facing us," admits John Flint, marketing manager at Davox, Billerica, Mass. "Not all customers will be able to apply equally integrated phone and data functions to their particular jobs. Vendors have to prove they offer something better than individual phone and data terminals." □

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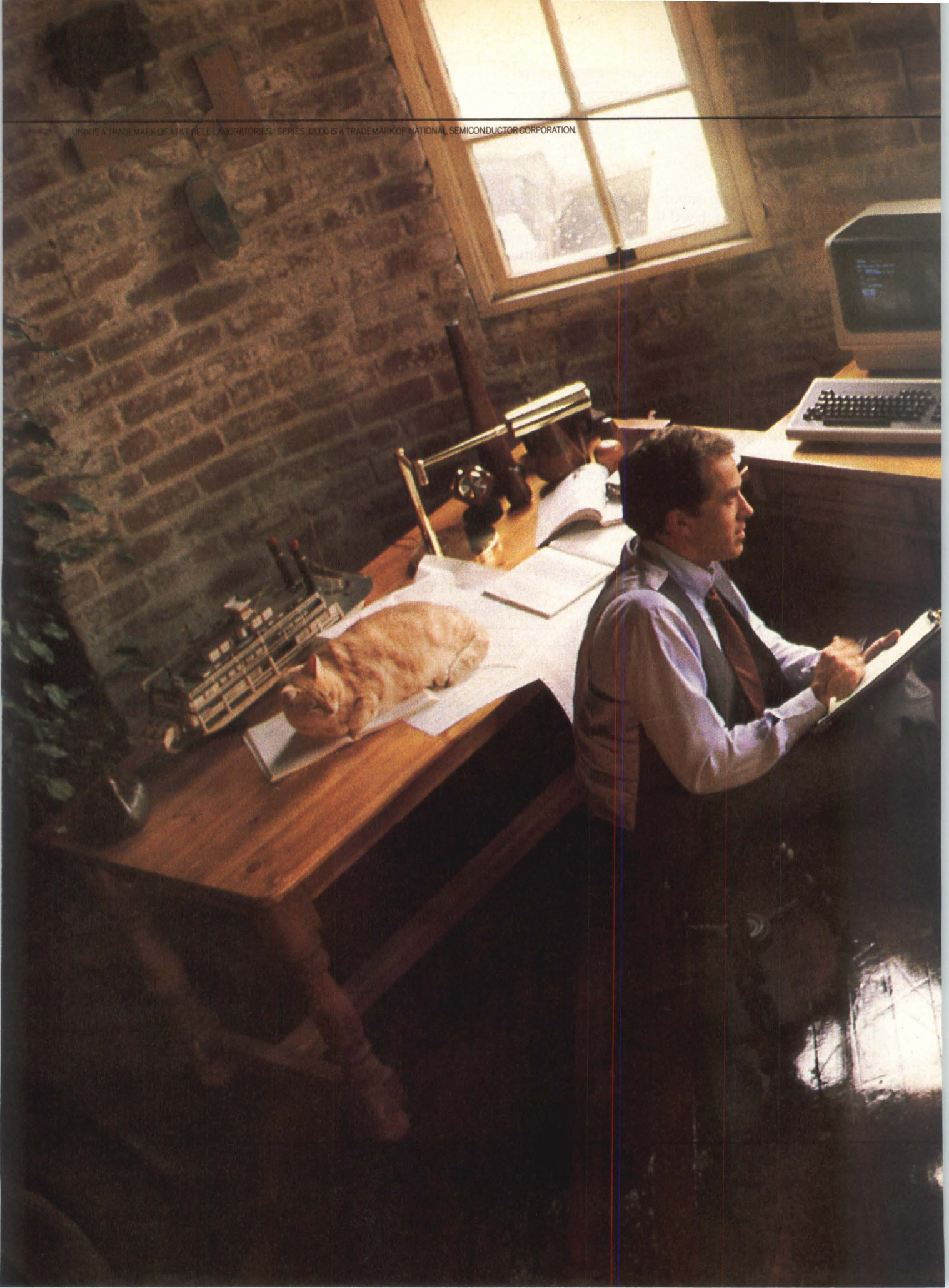
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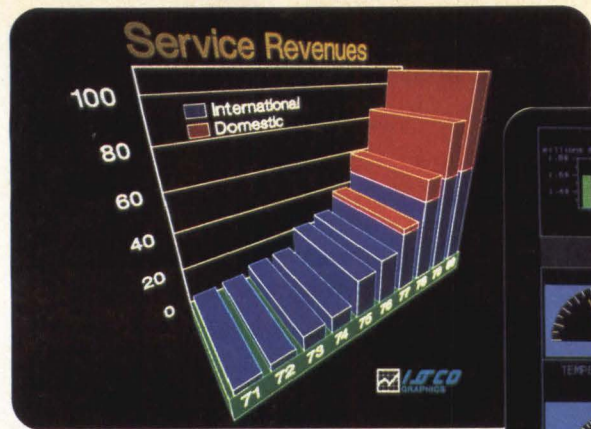
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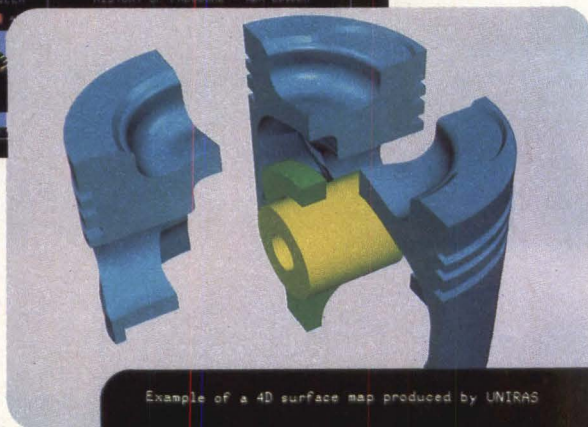
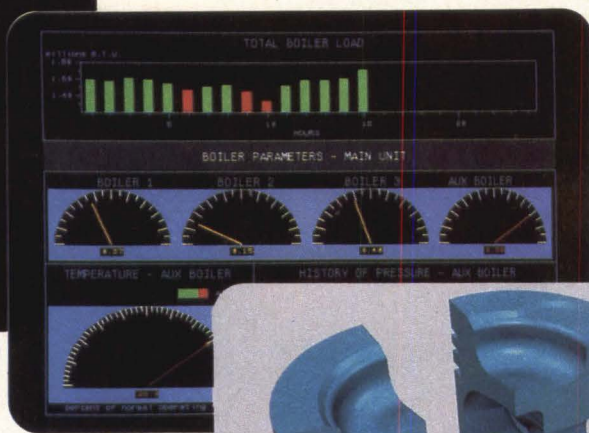
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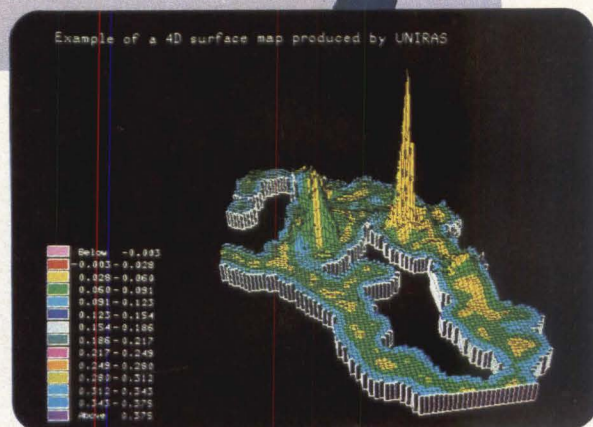
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CIRCLE NO. 34 ON INQUIRY CARD

INTERPRETER

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

AT&T GEARS UP FOR NEW MARKET

In 1985, AT&T's communications technology could provide the credibility it currently lacks in the office area

Lynn Haber, Associate Editor

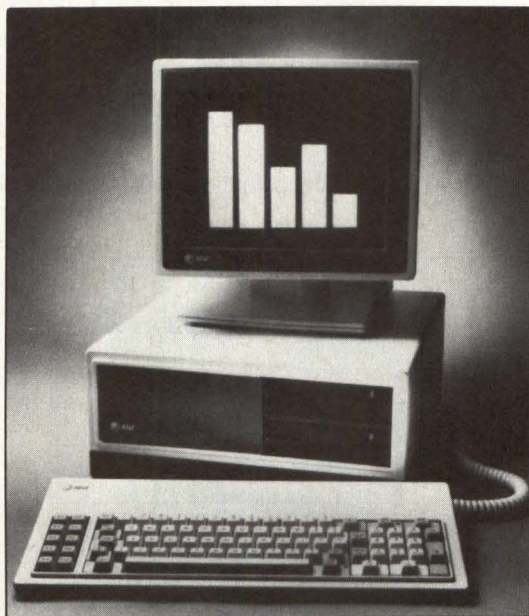
The key to AT&T Information Systems' success in the office computer market over the next couple of years will depend on how well it sells its strengths—communications and networking. ATTIS is the equipment marketing arm of AT&T Technologies Inc., the giant company's manufacturing and marketing division.

"What's making money for AT&T is their communications business," says Charles R. Robbins, former consultant with International Data Corp. (IDC), a Framingham, Mass., research and consulting company. "AT&T's strength is the PBX [private branch exchange] and their communications capability to wire the office with twisted pair and then to sell all the bits and pieces they want to sell."

According to IDC, in 1983, the year AT&T agreed to divestiture of its 22 regional telephone companies, it was the leader in the PBX market, claiming a 27 percent market share. Following AT&T were Northern Telecom Inc., 20 percent; Rolm Corp., 18 percent; NEC Telephone Inc., 8 percent; and an assortment of companies capturing the remaining 27 percent. And despite post-divestiture blues, corporate revenue for 1984 was reported at \$33.2 billion. IDC estimates that AT&T Communications (ATTCOMM), the long-distance-telephone supplier, is accountable for at least 60 percent of the total. Company earnings were \$1.38 billion for the same time period—less than the \$2.1 billion projected.

Mapping a strategy

Despite a slippery start, AT&T's office-system



Last June, ATTIS introduced the AT&T PC 6300 a 16-bit, 8086-based, MS-DOS, IBM-compatible machine.

strategy could take hold in 1985. While ATTIS emphasizes its grasp of telecommunications technology to get into the office-information field, it is working with outside business resources to broaden its software and hardware base. Also, it is promoting customer service and support, not just engineering and technology.

The year 1984 will be remembered as that in which ATTIS began reorganizing against its weaknesses. "There seems to be a general consensus regarding AT&T's position in the computer industry. It hasn't deteriorated enough for people to say [AT&T] won't be a force, but no one seems to be willing to say they've become a

force either," says Thomas R. Billadeau, vice president with the Gartner Group Inc., a research and consulting company in Cambridge, Mass.

"I think 1984 was a year to position ourselves in this business," says William McSweeney, vice president of marketing with ATTIS' computer systems division. "In 1985, the company will make a series of announcements regarding communications, new products and software."

At Uniforum, held in January in Dallas, AT&T announced a joint agreement with Microsoft Corp., Bellevue, Wash., to make future releases of Microsoft's XENIX software compatible with AT&T's UNIX System V. AT&T also announced endorsement of XENIX for AT&T's PC 6300, an MS-DOS-compatible machine.

Faces tough competition

In the computer marketplace, AT&T's biggest challenge is to penetrate a thick IBM Corp. customer base. According to IDC, IBM, the \$45 billion industry giant, captured 38 percent of the total computer market in 1983, a share five times that of its nearest competitor, Digital Equipment Corp. (DEC), which had 7.6 percent of the market.

Industry observers often see AT&T and IBM

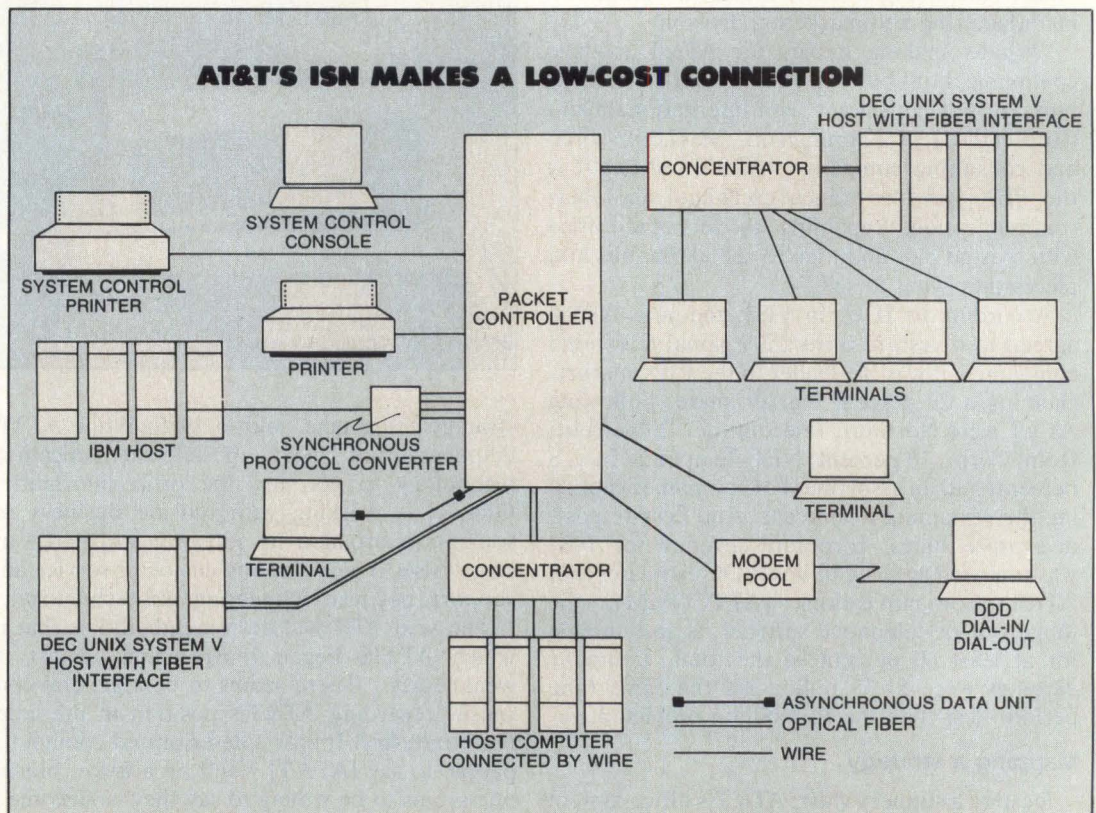
as pitted against each other in the battle for high-tech supremacy. But in many respects, the two companies are worlds apart. IBM is established in the communications marketplace as an information-processing company, while AT&T is well-entrenched in telecommunications transport and service. Also, in addition to IBM, other formidable competition for AT&T includes DEC, Data General Corp. and Hewlett-Packard Co.

According to Gartner's Billadeau, the question of competition for AT&T is two-sided: Which companies does AT&T see as the competition, and which companies in the industry view AT&T as a rival? "If you ask AT&T who their competition is, they'll probably say IBM," he explains. "But if you ask some major companies about AT&T, they'll all acknowledge AT&T as a competitor. Yet, these companies also agree that, when they go out to make a sale, they don't bump into AT&T."

Struggling with credibility gap

When AT&T agreed two years ago to divest itself of its telephone companies, the U.S. Justice Department freed the telecommunications company to enter the competitive high-tech marketplace. Life for AT&T Technologies began on

AT&T
Information Systems' network is based on a packet-switching architecture and centralized system management. It utilizes both copper twisted-pair and fiber-optic cable, offers a bandwidth of 8.64 bits per second and sells for \$400 to \$500 per connection.





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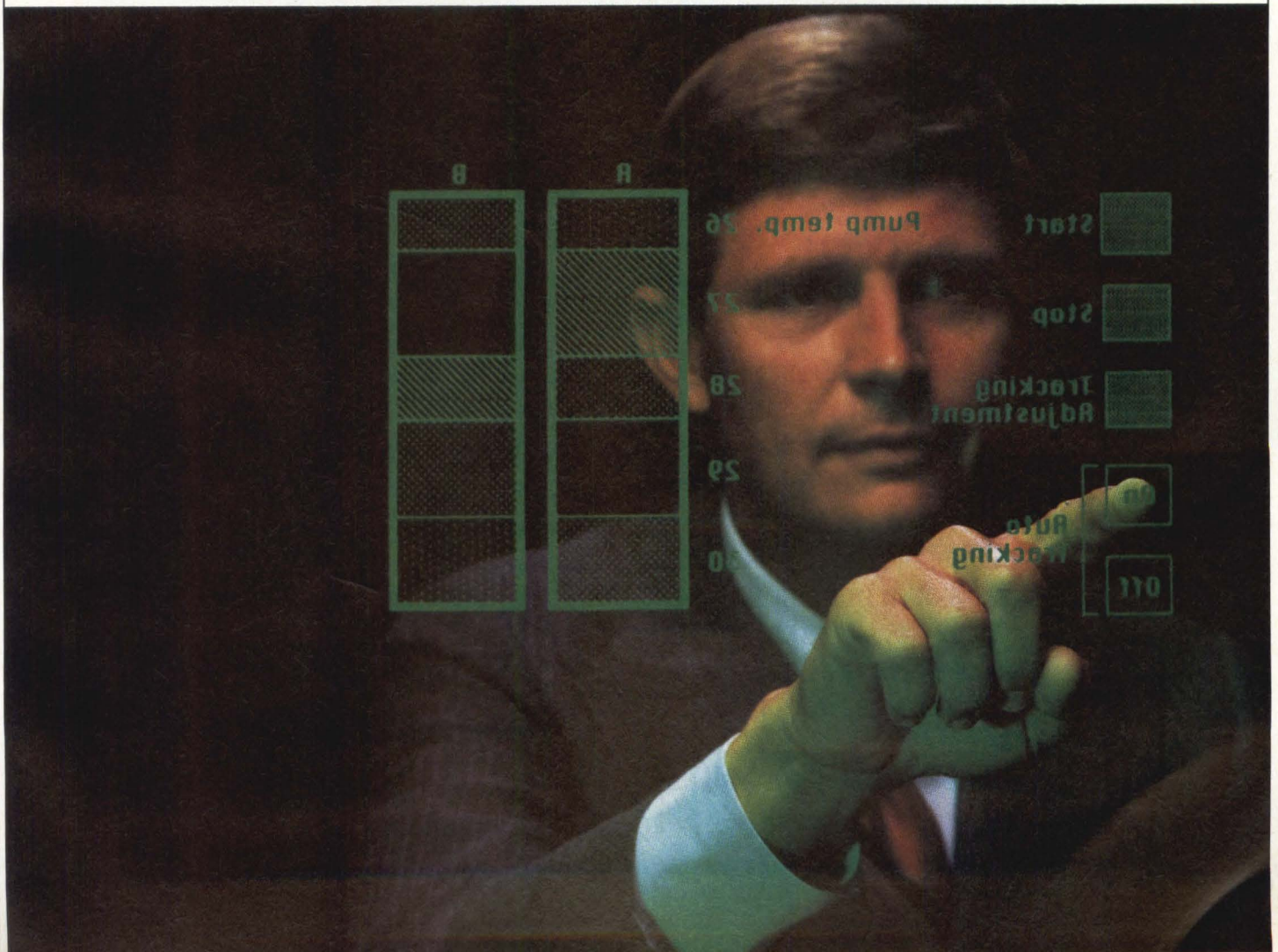
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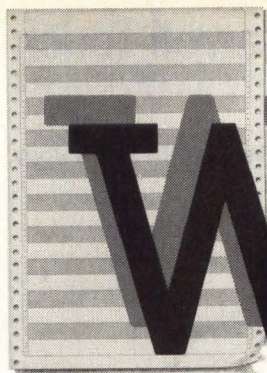
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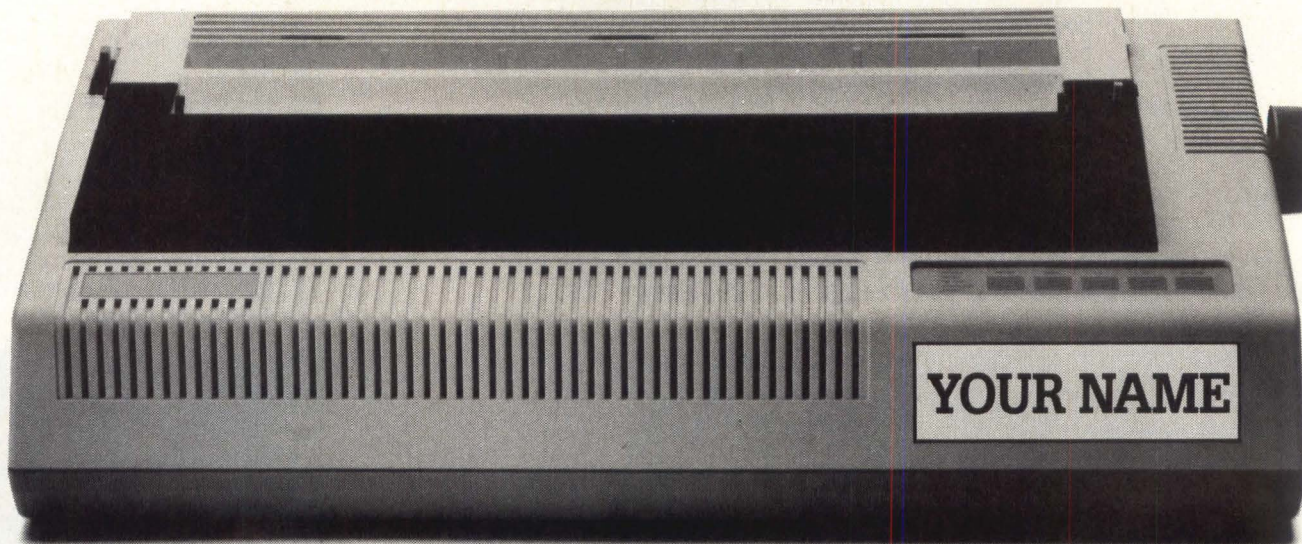
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Jan. 1, 1984.

On March 27, three months later, AT&T officially entered the general-purpose computer business. In the company's first product announcement were the UNIX-based 3B20 line of superminicomputers, including the 3B20A, 3B20S and 3B20D; two models of the mid-range 3B5 superminicomputer, the 3B5/100 and 3B5/200; the 3B2/300 microcomputer; 3BNet, the high-speed local area network (LAN); and PC Interface, which makes UNIX System V accessible by IBM and IBM-compatible personal computers.

But AT&T has yet to gain credibility as a computer vendor in the office environment where, according to IDC's Robbins, people think of Wang Laboratories Inc. for word processing, IBM for data processing and AT&T for telecommunications and equipment. "The problem is: How do you get AT&T into the office?" he asks.

Banks on networking

At the heart of AT&T's office automation strategy lies the Information System Network (ISN), a data-networking product for both local- and wide-area applications, scheduled to be

available this year.

ISN is reputed to be AT&T's challenge to IBM's token ring LAN, expected in approximately two years. ISN is based on twisted-pair technology that exists in most buildings today, whereas with IBM's Cabling System, the wiring must be installed.

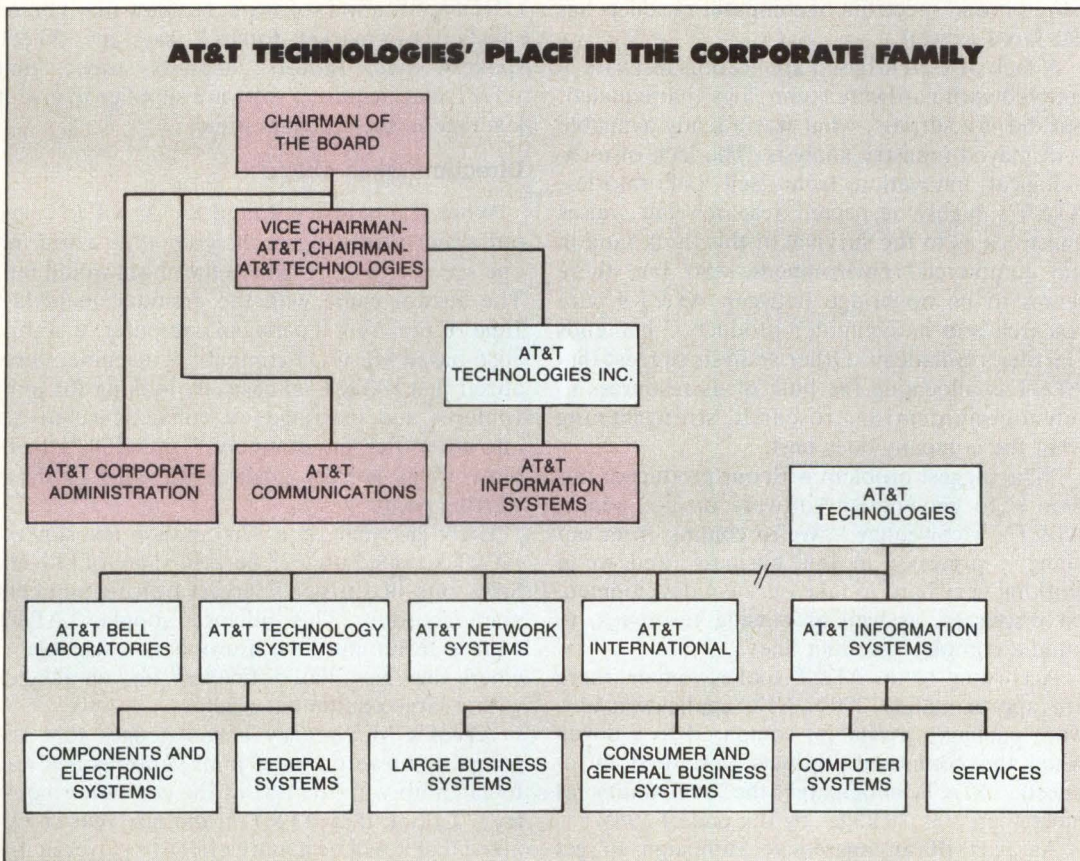
ISN is based on packet-switching architecture and centralized system management. The network utilizes both twisted-pair copper wires and optical fiber (to connect packet controllers) and offers a bandwidth of 8.64M bits per second (bps). ISN's topology, a hierarchical star with a centralized short bus, is formed by a packet controller, concentrators and data devices.

ISN is compatible with the company's improved System 85 PBX office manager/controller for transmissions around and out of an office. ISN off-loads the System 85, acting as an applications processor and enhancing the data-switching capabilities of the system.

According to IDC's Robbins, PBX vendors are excited about ISN because it is a low-cost connection scheme. AT&T says the cost per connection is \$400 to \$500, not including wiring.

Officials at the University of Pittsburg, site of one of a half dozen controlled ISN pilot intro-

'I think that AT&T in the last year recognized that it will be a more effective player in this market if it's willing to utilize outside resources.'



Anyone who expected fireworks from AT&T this past year was disappointed. While the company has revealed some of its intentions, it has not given away its game plan.

ductions, are very satisfied with the initial performance of the AT&T network. The multimillion-dollar "Campus of the Future" project will provide voice, data and video transmission over a fiber-optic-based network, which includes ISN compatibility for 450 terminals and personal computers and the System 85.

ATTIS is currently prohibited from entering joint marketing ventures with ATTCOMM, the regulated arm of AT&T, but AT&T is pressuring the Federal Communications Committee for deregulation. Meanwhile, ATTCOMM is busily beefing up voice- and data-network services, moving toward an end-to-end digital network. Some private-line AT&T offerings include the Dataphone Digital Service, Accunet Packet Service, Accunet T1.5 Service and Skynet 1.5 Service, for satellite networks.

Seeking alliances

Although AT&T's reputation as a telecommunications provider had diminished in the commercial limelight, ATTCOMM has since polished its image and is recouping respect in the telecommunications industry. "People are going back to AT&T," says Jeffery Kaplan, telecommunications consultant with IDC. Yet, the company's broad spectrum of computer products has not fared as well.

A lack of UNIX-based application software—coupled with hardware technology that equaled, but did not surpass, what was already available—dismayed industry analysts. The lack of technological innovation from Bell Laboratories, AT&T's highly respected research lab, raises questions as to the survival of this think tank in the commercial environment. "So far, there seems to be no bridge between AT&T's pure research and its computer products," contends Gartner's Billadeau. Other analysts suggest that AT&T is allocating the bulk of its resources to telecommunications research, strengthening what the company does best.

"The biggest problem with our product at this time is to get enough software on it," admits AT&T's McSweeney. "We're coming from not being a presence in this business, and we're working very hard to take our own developmental resources, as well as outside resources, to build a complete product line."

According to an AT&T spokeswoman, there are approximately 200 UNIX application-software packages available, compared to a dozen when the computer products were first introduced. AT&T anticipates the availability of more than 500 packages by the end of 1985.

As part of an aggressive campaign to get

Model	United States	International
3B20	1,500	30
3B5 100/200	600	200
3B20 Duplex	450	50
PC 6300	30,000	0
3B20/300	800	50
Total	33,350	330

Source: International Data Corp.

third-party software developers to write UNIX software, ATTIS announced an agreement in January 1984 with Digital Research Inc. (DRI), Pacific Grove, Calif., to build an application library for ATTIS' computer systems. A year later, AT&T abandoned the project, reportedly due to lack of venture capital needed to set up a separate company with DRI, and to the increased availability of other companies' UNIX application software. "Originally, our strategic objectives were to stimulate the availability of UNIX application software, but now that's being satisfied by market forces," says the AT&T spokeswoman. Industry analysts suspect that AT&T may acquire a software supplier to give it leverage in the software area.

Direction takes shape

While the industry waited for AT&T to carve out a niche for itself in the computer world, no one seemed to know where the chisel would fall. The answer came with the announcement last June of the AT&T personal computer, a 16-bit, 8086-based MS-DOS-compatible machine. "I realized that [AT&T is] basically looking for joint ventures and marriages of convenience to get into the office environment," says IDC's Robbins. "This is very positive for AT&T. It's a starting point."

Early last year, in a \$260 million investment, AT&T scooped up a 25 percent share of Olivetti SpA, one of Europe's largest office-equipment manufacturers. This alliance supplies AT&T with a ticket into the European marketplace, where they have had difficulties, and an alliance with a large equipment vendor.

AT&T's McSweeney acknowledges that the company's awareness of joint ventures is a way to catch up with the rest of the computer industry. "I think that AT&T in the last year recognized that it will be a more effective player in this

THE SHOCK ABSORBER

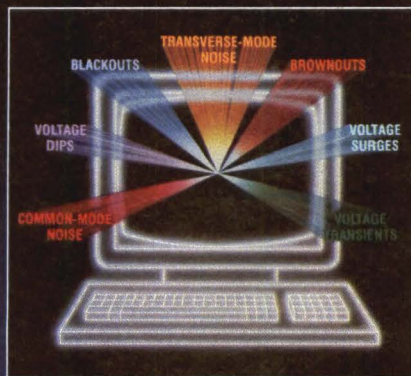


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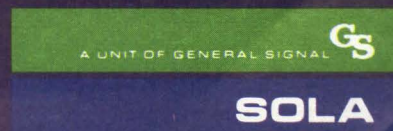
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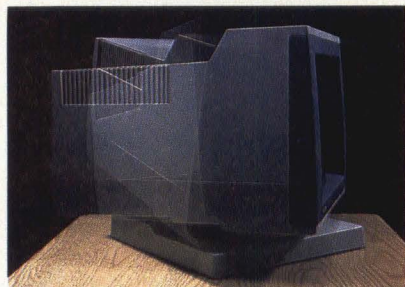


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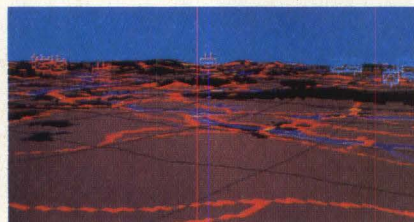
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Computer-driven command and control battle simulators are using Lexidata graphics systems to display 3-D terrain appreciation maps. (Courtesy of The Singer Company, Link Simulation Systems Division)



Students at the Royal College of Art in Kensington, England, use Lexidata's SOLIDVIEW to create designs such as these first-class passenger train seats.



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market if it's willing to utilize outside resources," he says.

AT&T is reportedly talking with mainframe vendors, such as Control Data Corp. and Amdahl Corp., about equipment agreements. AT&T's need to capture a share of the personal computer market has fueled speculation about the possibility of AT&T's acquiring a major microcomputer vendor.

Focuses on customers

When AT&T entered the commercial marketplace, the company faced two major obstacles. First, it had to overcome inexperience in dealing in a competitive environment; second, it had to disprove prevailing public opinion that, while it possessed the required technology, it had no idea what to do with it.

In a recent internal reorganization, AT&T aligned with its customers. Last September, AT&T announced a shift of key resources within its technologies sector into three new lines of business within ATTIS. The new units focus on specific business and resident customers that purchase or lease voice- and data-communications systems and products and AT&T's computer line.

The restructuring, under Charles Marshall, former chairman and chief executive officer of ATTIS, includes the integration of AT&T's Computer Systems division, Consumer Products division and the Teletype Co. At the time of the announcement, ATTIS' Marshall commented, "The move is good news for our customers and for us. It builds a much stronger bridge between the customer and our business, providing one easy point of contact for our products and systems."

The three new lines of business are called Large Business Systems, Consumer and General Business Systems, and Computer Systems. A single organization, Services, will meet installation, maintenance and service needs for all three lines.

"Here's where AT&T comes of age," says IDC's Robbins. "This reorganization is significant because what AT&T is saying is that the battle between marketing and engineering is over, and marketing won."

VAR program expands

AT&T is pursuing all channels of distribution, including direct, retail and value-added reseller. In the last year, the company reportedly signed up 50 resellers. VARs provide expertise that would otherwise take years for AT&T to acquire.

"We've done very well in ascribing a significant amount of the business to the VAR channel and establishing relationships to the point where we'll have a major impact in correcting what is generally perceived to be one of the few weaknesses of the UNIX-based strategy—lack of application packages," says Charles Redmond, general manager of AT&T's VAR program, which was initiated last spring under the Computer Systems Division. It aims at stimulating application-software development for UNIX System V and at serving vertical markets.

According to Redmond, VARs favor the 3B2 multiuser distributed system, which supports as many as 16 users. Vertical markets include brokerage, financial services, health care, accounting, advertising, public relations, engineering and scientific markets. The ultimate goal of the program, Redmond says, is to ground it as a solid distribution channel in which a user can get quality turnkey support and solutions.

AT&T's task formidable

Anyone expecting fireworks from AT&T this past year was disappointed. While the company has revealed some of its intentions, it has not given away its game plan.

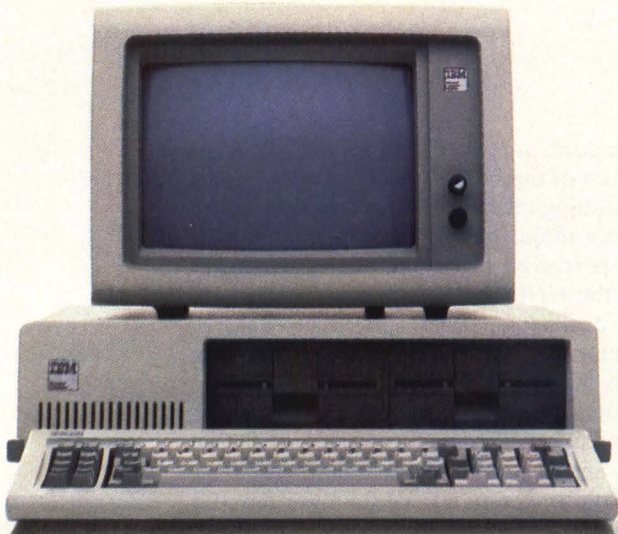
Vendor compatibility via communications and open-network architecture is AT&T's emphasis for the near future. "We don't intend to put IBM out of business," quips AT&T's McSweeney. "We're not going to make an effort to displace IBM's MVS operating system. We are going to make sure that our products link into the IBM world."

One of AT&T's strategies will be to sell to the IBM customer. That is why the company offers capabilities of IBM protocol conversion, have introduced an IBM-compatible product and are likely to support IBM's Systems Network Architecture (SNA).

Will the lion lie down with the lamb? "There's no reason that you won't see a lot of AT&T communications capability in an IBM shop, despite IBM's recent acquisition of Rolm," claims IDC's Robbins.

As far as life as a computer vendor goes, the jury is still out on AT&T. According to Gartner's Billadeau, AT&T has an outside limit of three to four years to prove itself a viable force in this area. But, he cautions, "While AT&T solidifies corporate strategy, the industry is not standing on the sidewalk watching the parade go by." □

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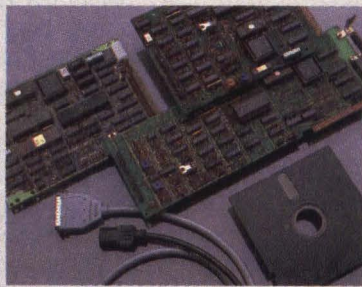
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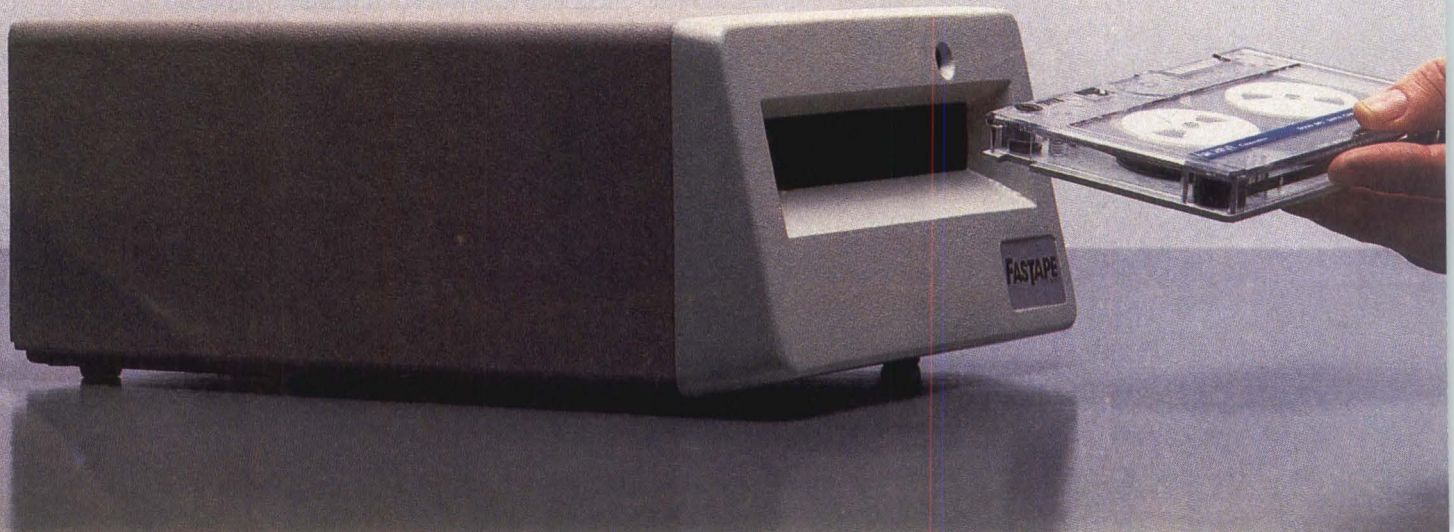
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MODULA-2 AIDS STRUCTURED PROGRAMMING

Thanks to modularity, Modula-2 may be a better choice than Pascal for programmers working on large projects

Giacomo Marini and Hugh McLarty
Logitech Inc.

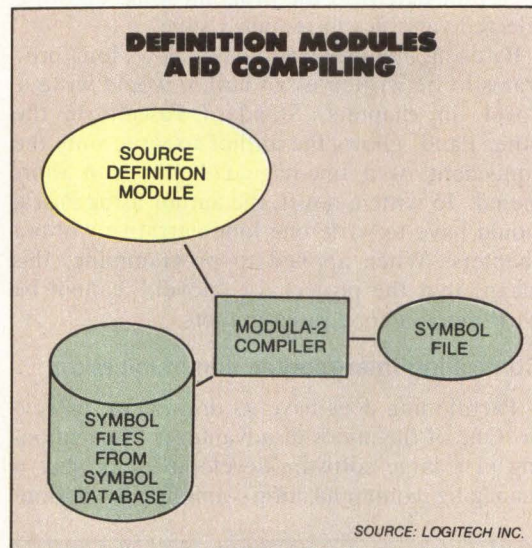
For professional software programmers, a structured programming language serves as a productivity tool. This tool, supported by editors and debuggers, can save hours of work in rewriting and in tracking errors in a program. One such tool is the Modula-2 programming language, an evolution of Pascal designed to remedy many of Pascal's shortcomings.

Modula-2 aids productivity and software development by allowing several programmers to work simultaneously on different parts, or modules, of a program. While Pascal handles I/O facilities better than Modula-2, it also partitions programs into "blocks," which do not provide as tight restrictions on interaction between sections as do modules. In addition, unlike modules, blocks cannot create variables whose values remain intact throughout a program.

Moreover, Modula-2 boasts a more streamlined, English-language-like syntax than does Pascal. Finally, a lack of standardization restricts Pascal. As a result, software developers must sometimes resort to the use of non-standard extensions of the language.

Modularity aids partitioning

Modula-2's primary advantage in multiple-programmer environments is its modularity—an important feature in large software-development projects. Such projects require the division of a program from among four or five to several thousand programmers for coding, debugging and maintenance. Because each programmer



A "definition module" acts as a source to the Modula-2 compiler to define the interface between a module and the external world. The symbol file contains the output of the compilation.

must design, code and test, the choice of a development language—and the success of the project—depends on the availability of programmers who know a particular language and on the ease of learning it. For this reason, Modula-2 benefits from its roots in Pascal. Designed as a language to teach structured programming, Pascal has a widespread impact as a teaching medium. Many educational institutions use Pascal to teach programming, and some now teach Modula-2 in addition to, or instead of, Pascal. Programmers who already know Pascal can typically learn Modula-2 in a few hours.

Modularity is also important because of the high amount of personnel turnover typical in

large software-development projects. Because these projects can take years to complete, programmers may join or leave a company, move to other departments or be reassigned to other tasks during the life of a single project.

Modules, as used in Modula-2, are well-defined units of a program that group related variables and the procedures to manipulate those variables. In block-structured languages, such as Pascal, all procedures and variables reside in a monolithic, closed block of code—called a “compilation unit”—which is the Pascal program.

Modules use an “information hiding” feature to impose tight restrictions on interaction between sections of a program. To access variables and procedures residing in another module, the referencing module “imports” those it requires from the other module, which, in turn, “exports” those elements. This technique “hides” irrelevant details of the program while allowing selected variables to remain visible.

By using modules, Modula-2 allows long programs to be written as an author would write a novel—in chapters. Standard Pascal, on the other hand, allows the author to write only the equivalent of a one-page column or a short memo. To write a novel, the author using Pascal would have to write one long narrative without chapters. When applied to programming, this means that the project, or “novel,” cannot be partitioned among programmers.

Controlling inter-module communication

Partitioning does have its drawbacks, however. One of the major disadvantages of partitioning in a large software-development project is managing communication—among the various

programmers assigned to each unit and among the modules themselves. Block-structured partitioning methods, as used in Pascal, ALGOL and PL/I, and “separately compiled” subroutines and functions, as used in FORTRAN and C, do not solve the major problems associated with partitioning. These problems are: keeping close control over the visibility of objects and enforcing consistent use of objects across separate modules, thus controlling changes that affect inter-module interfaces.

Modula-2 addresses these problems by using compilation units called “definition modules” and “implementation modules.” Definition modules, which define the interface between a module and the external world, contain declarations—statements that “declare” fixed information about a program—of exported objects. They also contain declarations of imported objects that are essential to the definition of the exported objects.

To control module interfaces, Modula-2 provides symbol files, which include the output of a definition module’s compilation. The symbol files contain an encoded representation of the definition module itself. A Modula-2 compiler uses an exporting definition module’s symbol files when compiling modules that import objects from it. The compiler performs inter-module consistency checks, based on the information contained in the symbol file. This means that, although Modula-2 supports separate compilation of different modules, it requires that compilation be based on the full information about the interfaces with other modules. As a result, compilation in Modula-2 is separate from, but not independent of, other compilations.

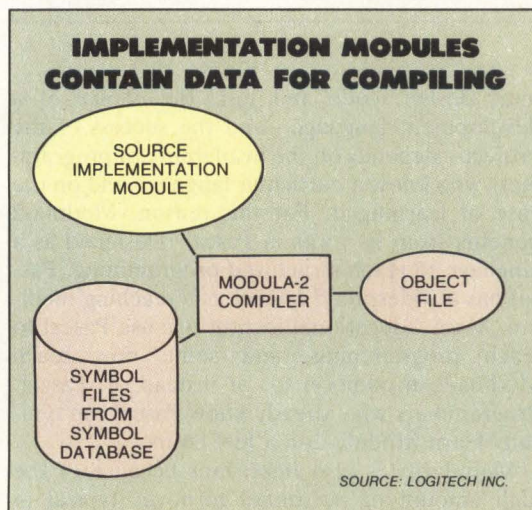
The other type of Modula-2 modules, implementation modules, contain the code and the data necessary to “implement” the definition module so that the external world can use it. The output of the compilation of an implementation module is contained in object files.

Strong typing is important

Some programmers do not like Modula-2’s strict control over the definition and use of module interfaces. However, most programmers appreciate the language’s use of required declarations, strong typing and readable syntax. Moreover, the use of linkers (utility programs combining two or more modules) or linker/loaders (linkers that, after linking, load the program into memory) can prevent most errors caused by inter-module inconsistencies before run-time.

An important feature of Modula-2 is the use of

Using an “implementation module” as a source, Modula-2 can implement the definition module’s data in a form that the external world can use.



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required declarations. Declarations facilitate programming because they have a global effect on a program. For example, they declare values associated with symbolically named constants, data types used and other fixed information. Because the information remains in effect throughout the program, using a language with required declarations can prevent errors from occurring. Once a value is declared, the programmer cannot make the mistake of using the same declaration for two different data elements. This feature enables the programmer to spot errors at compile time rather than run time.

Modula-2 also features strong typing. Typing so classifies data to which a given element belongs that it constrains the procedures that can be performed on that data. Modula-2, like Pascal, is extremely rigorous in enforcing types, thus helping to prevent programming mistakes.

In addition, Modula-2's English-language-like, readable syntax is helpful in large-scale software development. Other languages, such as C and APL, are known for terse syntax, which seems advantageous for individual programmers writing programs. However, on large projects, this terseness may result in programs that are difficult for other programmers to read and understand and thus may hinder programmers from being able to modify the program quickly. Moreover, Modula-2's syntax is a cleaner, more systematic version of Pascal, from which it evolved.

Coherence demands standardization

An important requirement for large software-development projects is standardization of their language. Modula-2 and Pascal share a common, academic, development environment and the

Glossary of Modula-2 terminology

- **Block:** the part of a block-structured program, such as Pascal, containing the specifications for the program, including a label declaration, a constant definition, a type definition, a variable declaration, a procedure part, a function part and a statement part.

- **Compilation unit:** a block of code or a module that comprises a software language.

- **Declaration:** a statement at the start of a computer program that has a global effect on that program. It "declares" fixed information that remains in effect throughout the program.

- **Definition module:** a module that defines the interface between the module and the external world. It contains declarations of the objects that the module exports to the other portions of the program and declarations of imported objects that are essential to the definition of exported objects.

- **Development tools:** aids to software documentation and development, including language compilers and debuggers.

- **Export/import:** the process that a module performs to access variables and procedures residing in another module. The referencing module imports those it requires from the other module, which, in turn, exports those elements.

- **Implementation module:** a module that contains the code and data necessary to provide an "implementation" of the corresponding definition module that the external world can use.

- **Information hiding:** a software-design concept that reduces interaction between sections of a program, thus reducing the likelihood of

difficult-to-trace errors, called "side effects."

- **Module:** a well-defined unit in a software program that groups related variables and procedures while hiding the irrelevant details of internal variables and procedures, allowing selected variables to retain their values throughout program execution.

- **Object file:** a file in a Modula-2 program containing the output of the compilation of an implementation module.

- **Partitioning:** the division of a software project into several reasonably small, self-contained units that can be allocated among several programmers.

- **"Side effects":** difficult-to-trace errors in a software program that occur when operations performed in one section of a program have an unintended effect on another section of the program.

- **Structured programming:** a disciplined approach to computer program development, coupling the use of a limited number of control structures with a modular approach to program development.

- **Symbol file:** a file used in Modula-2 that contains the output of a definition module's compilation and an encoded representation of the definition module itself.

- **Typing:** the classification of data to which a given element belongs, constraining the procedures that can be performed on that data. The classification documents the intended behavior of the type and communicates this behavior to designers and users of this type.

Modules, as used in Modula-2, are well-defined units of a program that group related variables and the procedures to manipulate those variables.

same designer—Nicklaus Wirth of the Eidgenössische Technische Hochschule (ETH), Zurich, Switzerland. However, unlike Modula-2, Pascal has been plagued by a lack of standards.

The reason for this lack of standardization is that Wirth intended Pascal as a language for systematically teaching programming by simplifying the real world. However, as the need for a structured-programming language made the use of Pascal more widespread than Wirth intended it to be, other developers introduced non-standard extensions at various times to cope with Pascal's limitations. The most necessary of these extensions was probably the development of a separate compilation facility—modules.

The need for modules resulted in the development of Modula-2 about 10 years after Pascal. The language includes all aspects of Pascal, extends them with the module concept and with multiprogramming and adds the important advantage of standardization. Standardization facilitates the porting of software to various machines, the ability to change development tools and the ability to evolve and maintain the software over time.

In the case of Modula-2, both the language definition and the use of its system library are standardized. After Modula-2 emerged, its developers tested it almost immediately in two implementations at the ETH, and the design was revised. After the initial revisions, several commercial implementations of Modula-2 produced feedback on the language design. Meetings held between the commercial implementors and the ETH group resulted in minor changes, which Wirth documents in the second edition of *Programming in Modula-2*. The ETH has recently published more changes, which will become part of the third edition of *Programming in Modula-2*. So far, the implementors have cooperated with the changes and have accepted Wirth's definition as the standard language.

A standard system library is also a key element in a language's success. In the case of Modula-2, most of the current implementations include a library that is a superset of, and compatible with, the library defined by the Zurich team. More recently, Modula-2 implementors have tried to start a Modula-2 Standard Library. A preliminary draft of the library exists, and the first implementations should appear next year.

Unlike Pascal, in which the standardization effort occurred too late in the language's development, the designers and implementors of Modula-2 are carefully controlling both the language and the library and are actively cooperat-

ing to set, maintain and enforce standardization.

Users of Modula-2 can now rely on wide industry support because compilers and interpreters for the language are available. Among those offering such products are Logitech Inc., Modula Corp., Tartan Laboratories and Volition Systems.

For example, Logitech's products include tools for the Intel Corp. 8086 family of processors under the MS-DOS, PC-DOS and CP/M-86 operating systems as well as the Digital Equipment Corp. VAX family under the VMS operating system. Logitech offers the development system for the 8086 family in a resident version running on the 8086 itself and on a cross-version hosted in a VAX/VMS environment. The company also plans to offer development tools for other processor families.

The Logitech tools also include an optional ROM package featuring an absolute linker that allows code to reside at fixed memory locations in ROM-based systems or in systems without operating systems. It also includes a version of the run-time system adapted for these (ROM-based and operating-system-less) systems.

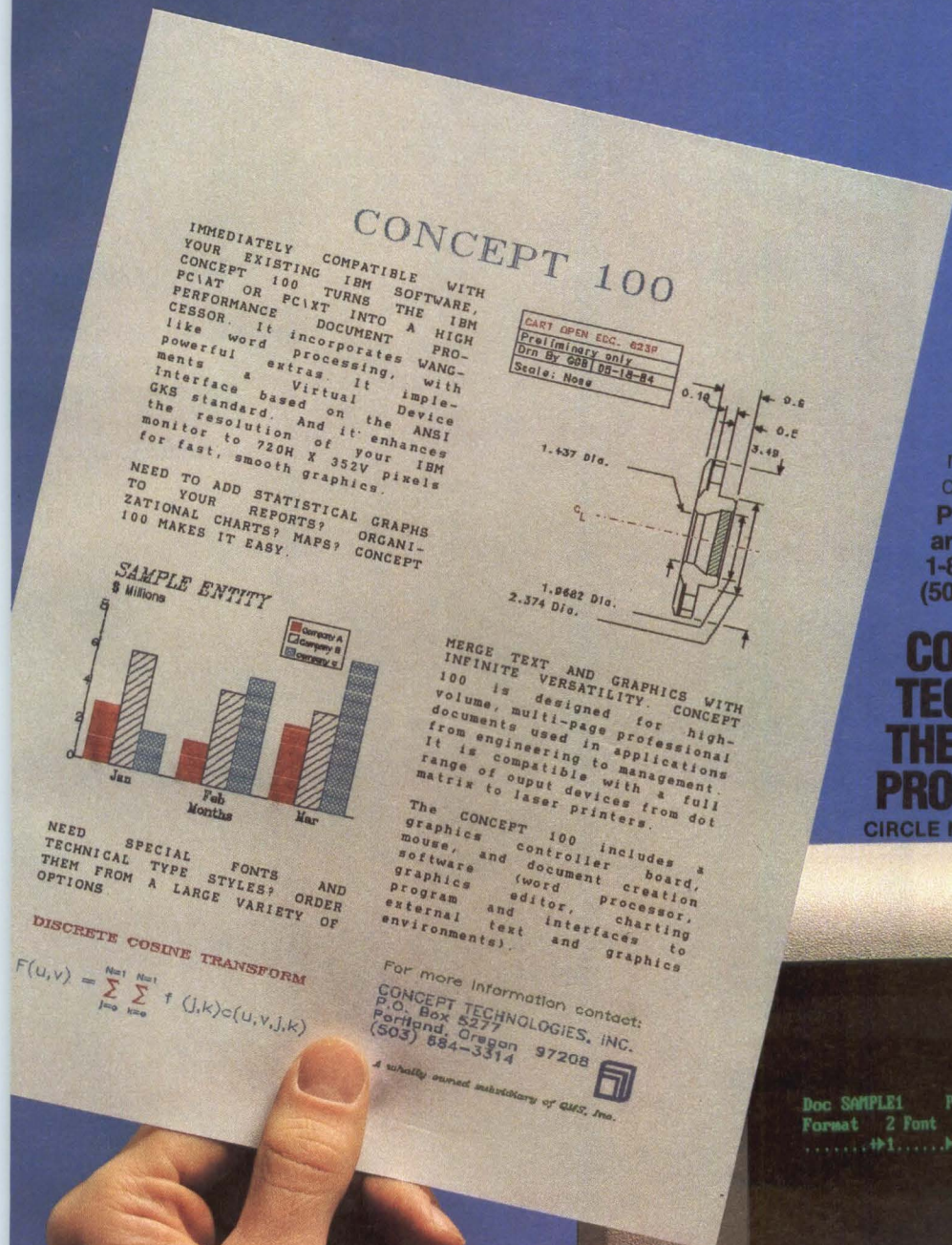
In addition, the company offers two debuggers for the 8086, one of which is included in the basic package. The basic debugger allows symbolic examination of memory dumps, while the optional run-time debugger allows symbolic dynamic debugging of Modula-2 programs, including overlays and multiple processes.

Furthermore, the ETH Zurich has made Modula-2 compilers available to universities and other educational institutions, and Modula-2 vendors often offer sales incentives to educational institutions and user groups.

Giacomo Marini is co-founder and vice president of software engineering at Logitech Inc., Redwood City, Calif., a developer and distributor of Modula-2 software-development systems. Before founding Logitech, Marini was president and software development manager of Logitech Srl, Ivrea, Italy. Marini holds a degree in computer science from the University of Pisa in Italy. **Hugh McLarty** is project manager at Logitech. His primary responsibilities include developing Modula-2 software and text and graphics editors.

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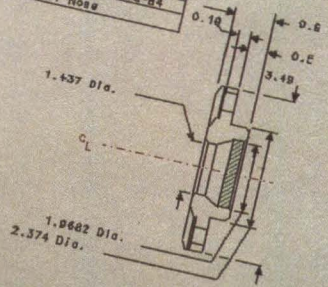
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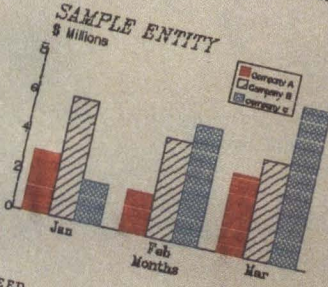
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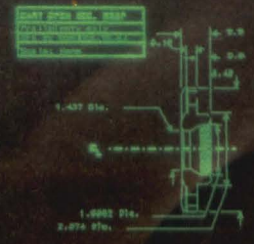
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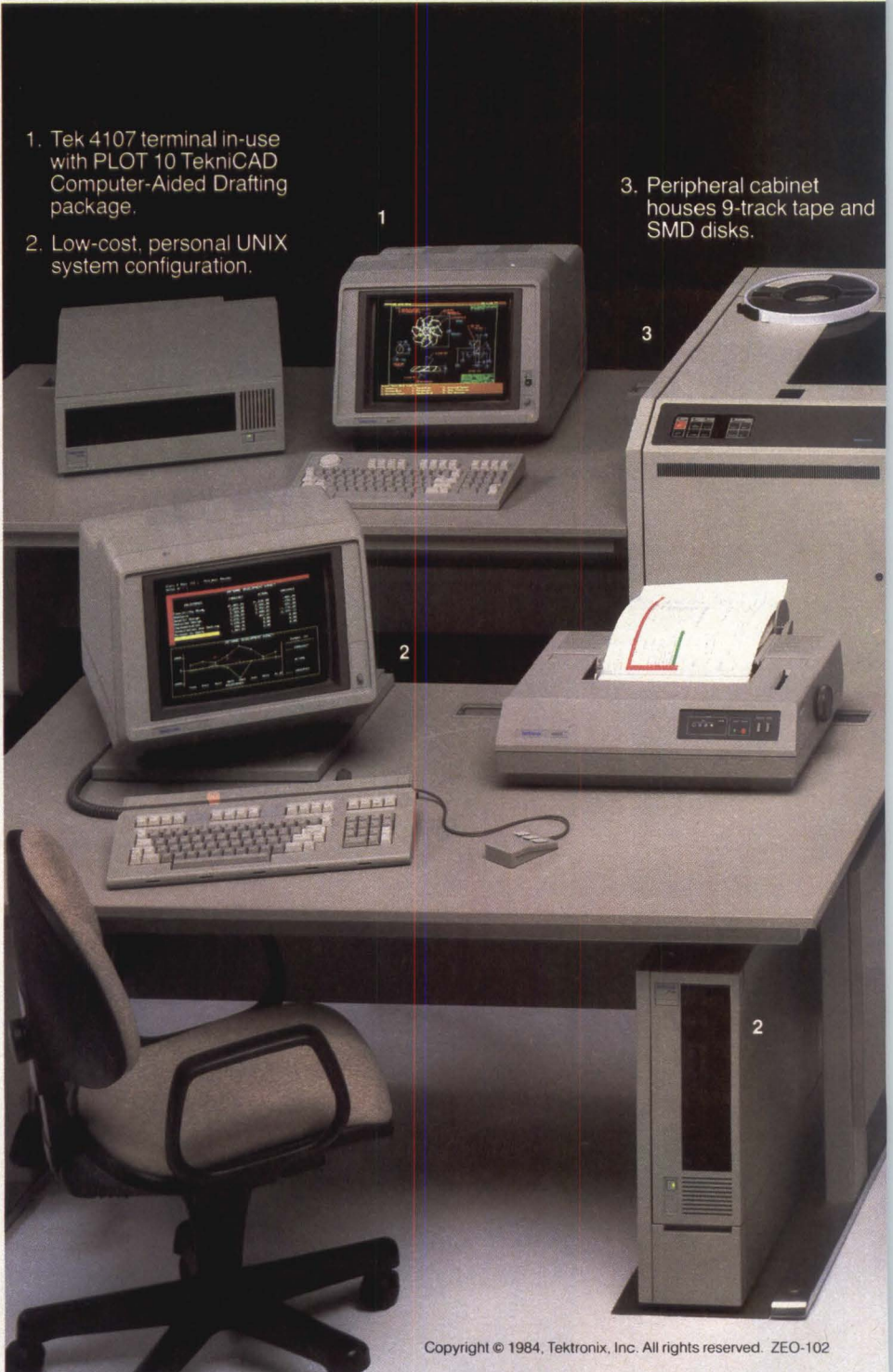
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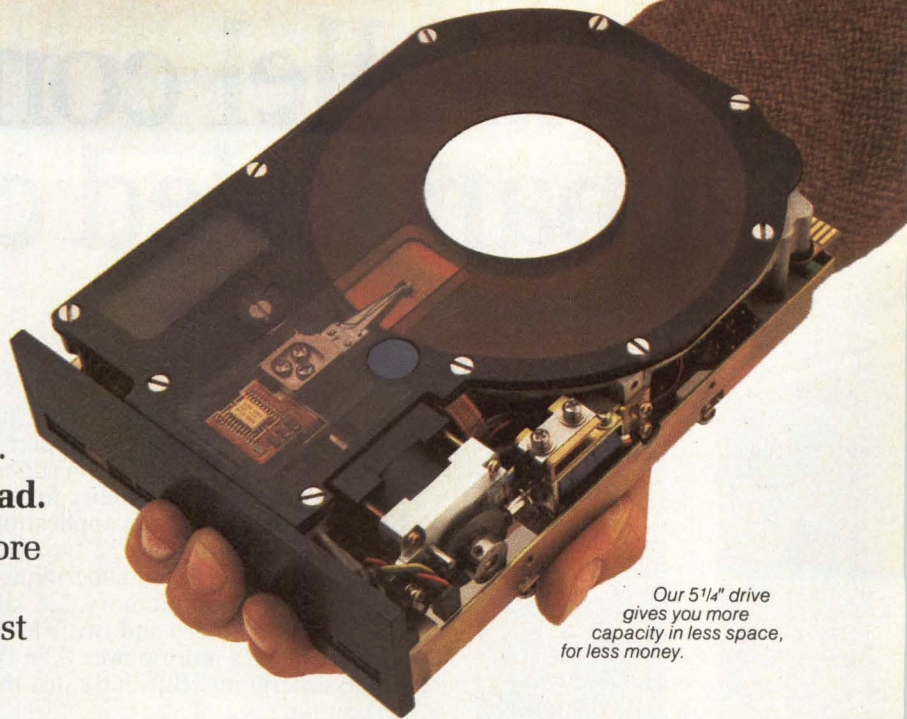
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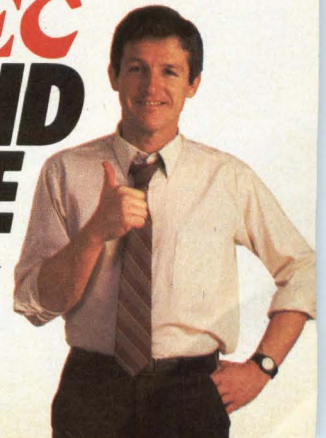
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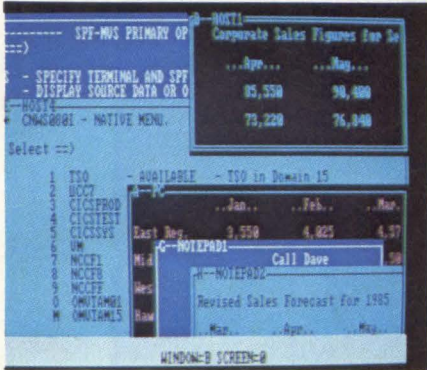
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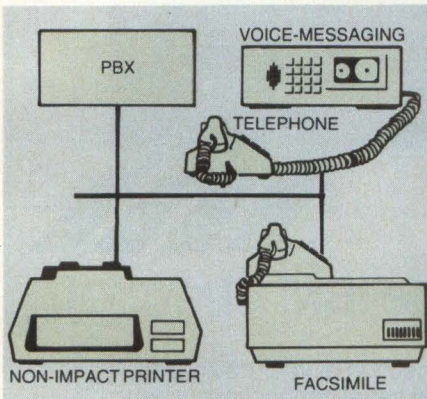
p. 113 . . . More sophisticated links

MICRO-TO-MAINFRAME CHOICES EXPAND 91

Personal computers are getting more and more powerful, but their usefulness is limited if they can't access the wealth of data in the corporate mainframe. One key to making this connection is the micro-to-mainframe link, which provides communications and file-transfer capabilities. Our survey of the broad range of available products concentrates on the IBM world, where the action is heaviest, and includes a comprehensive product table (p. 107).

MICRO/MAINFRAME LINK ALLOWS FIVE SESSIONS (Cover story) 113

Two of the more sophisticated micro-to-mainframe links to recently enter the market are CXI Inc.'s IBM 3278/79 and IBM 3270 PC emulators. The 3278/79 emulators are compatible with the popular Irma board from Digital Communications Associates Inc. and the 3270 PC emulator enables five host sessions to operate interactively on an IBM PC.



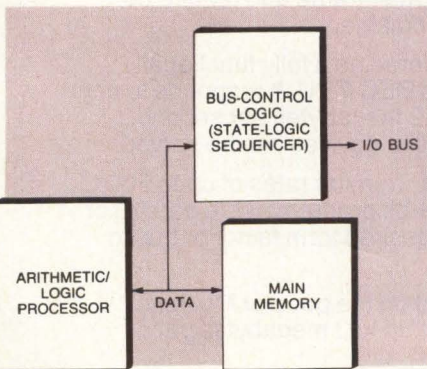
p. 137 . Confusion in the OA market

BUSINESS SOFTWARE GOES VERTICAL 127

Generalized business software solutions—such as the many spreadsheet and database management packages, as well as integrated packages like 1-2-3 and Framework—are getting all the attention, but for many users, generalized solutions aren't enough. Some users want specialized software targeted at vertical markets, and many system houses and software vendors are now reacting to this demand.

STRATEGY DEBATES CLOUD OFFICE AUTOMATION 137

Although IBM, DEC, DG and Wang seem to have cohesive plans for automating the office, confusion still exists in the OA market because of the plethora of products available and the number of technical issues that still need to be resolved.



p. 147 New mini solutions

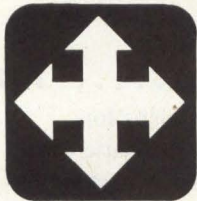
SIMPLE SYSTEM APPROACH INCREASES THROUGHPUT 147

There is evidence that traditional minicomputer architectures have reached a ceiling, and that new approaches are needed if minis are going to challenge mainframes while staving off competition from superminis. Some manufacturers think the answer is more horsepower, but sometimes a simple approach is best. One example is Integrated Digital Products Corp.'s Nova-compatible Whetstone series of RISC computers.

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MICRO-TO-MAINFRAME CHOICES EXPAND

A wide variety of links to IBM machines eases integrating personal computers with diverse mainframe applications, operating systems and databases

Jesse Victor, Associate Editor

Microcomputer-to-mainframe links are proliferating almost as fast as the microcomputers they are designed to serve. The increased availability of, and expanding market for, connections to IBM Corp. mainframe computers gives system integrators greater leeway than ever before in implementing communications and file-transfer facilities. The products are not restricted as to type or tied to a particular mainframe operating system, application or database. And they include sophisticated security features and file-handling capabilities in order to protect sensitive mainframe data while meeting the needs of complex corporate networks. As links evolve in the direction of complete PC-to-mainframe integration, connections are being made to a variety of local area networks and linked computers running the UNIX operating system.

Micro-to mainframe links are defined by their organizational, hardware/software and operational aspects. Standalone personal computers in corporate environments have obvious limitations. Although they provide a wealth of computer power on managers' desks, corporate data in the organization's mainframe computer remains out of reach. A manager projecting division sales growth, for example, although able to instantly update spreadsheet projections, must go to the management-information-system/data-processing (MIS/DP) department for necessary data and enter it manually into a desktop com-



Emulating IBM's 3276 terminal controllers and 3278 display stations, Techland Systems' BlueLynx 3270 SNA/SDLC micro-to-mainframe link gives IBM PCs and compatibles access to remote mainframe databases. The Data Reader utility formats downloaded files for 1-2-3 and other PC application packages.

puter. However, the mainframe database administrator does not want indiscriminate access by all personal computer users in the company to all

MICRO-TO-MAINFRAME LINKS

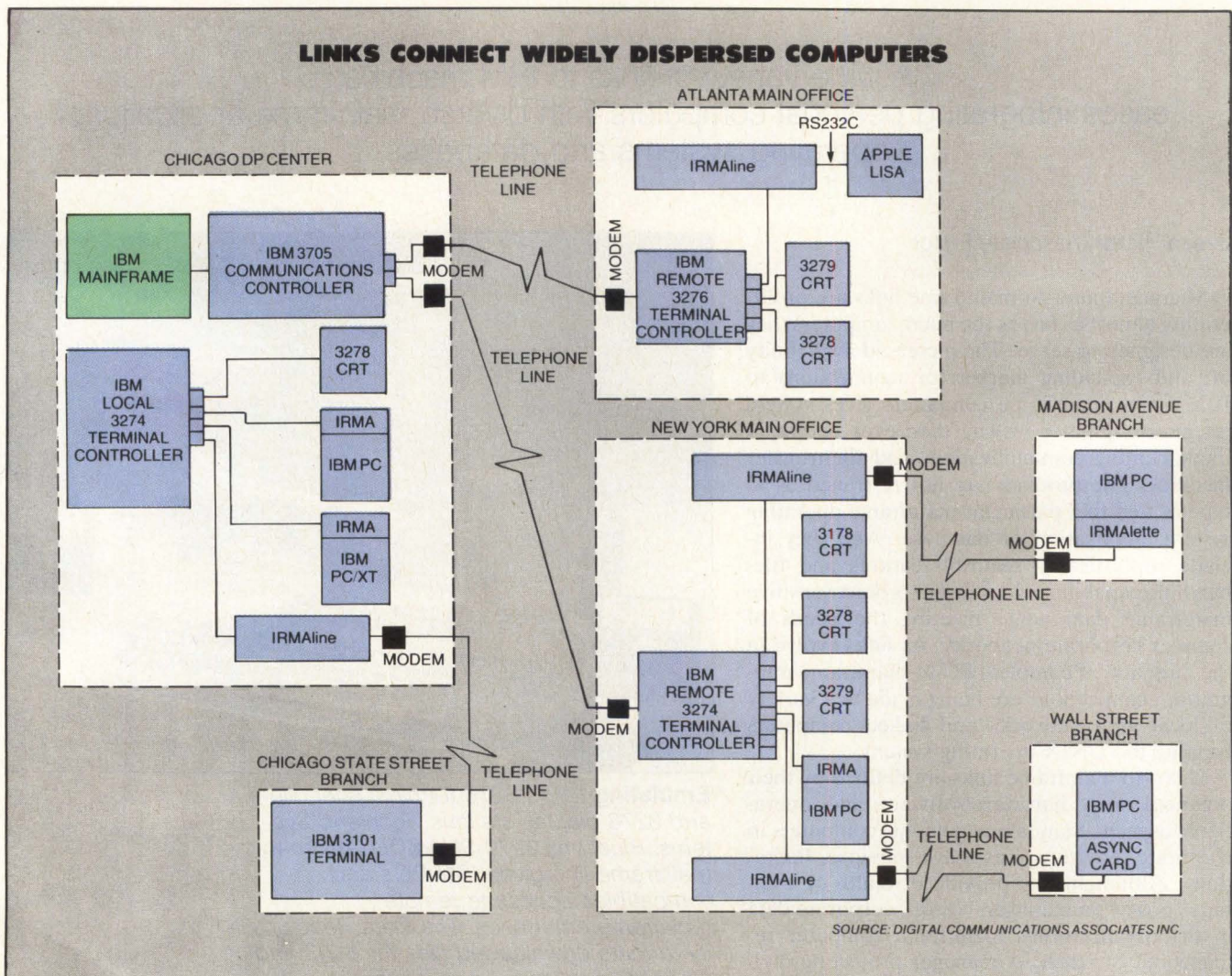
information in the mainframe.

In terms of hardware and software, at the most basic level, linking microcomputers to mainframes means tying into the IBM systems network architecture (SNA) environment—either directly with coaxial links or remotely through a modem using a communications/terminal-emulation board. The board makes the computer appear to the mainframe as a standard IBM 3270, 3278 or 3279 (color) terminal, 3270 PC or other familiar peripheral. With either connection, a database query program must extract data from the mainframe database for the file-transfer program, which loads the data into the designated file on the microcomputer. A protocol-conversion/data-transfer program puts it into a form the microcomputer's application

package can manipulate.

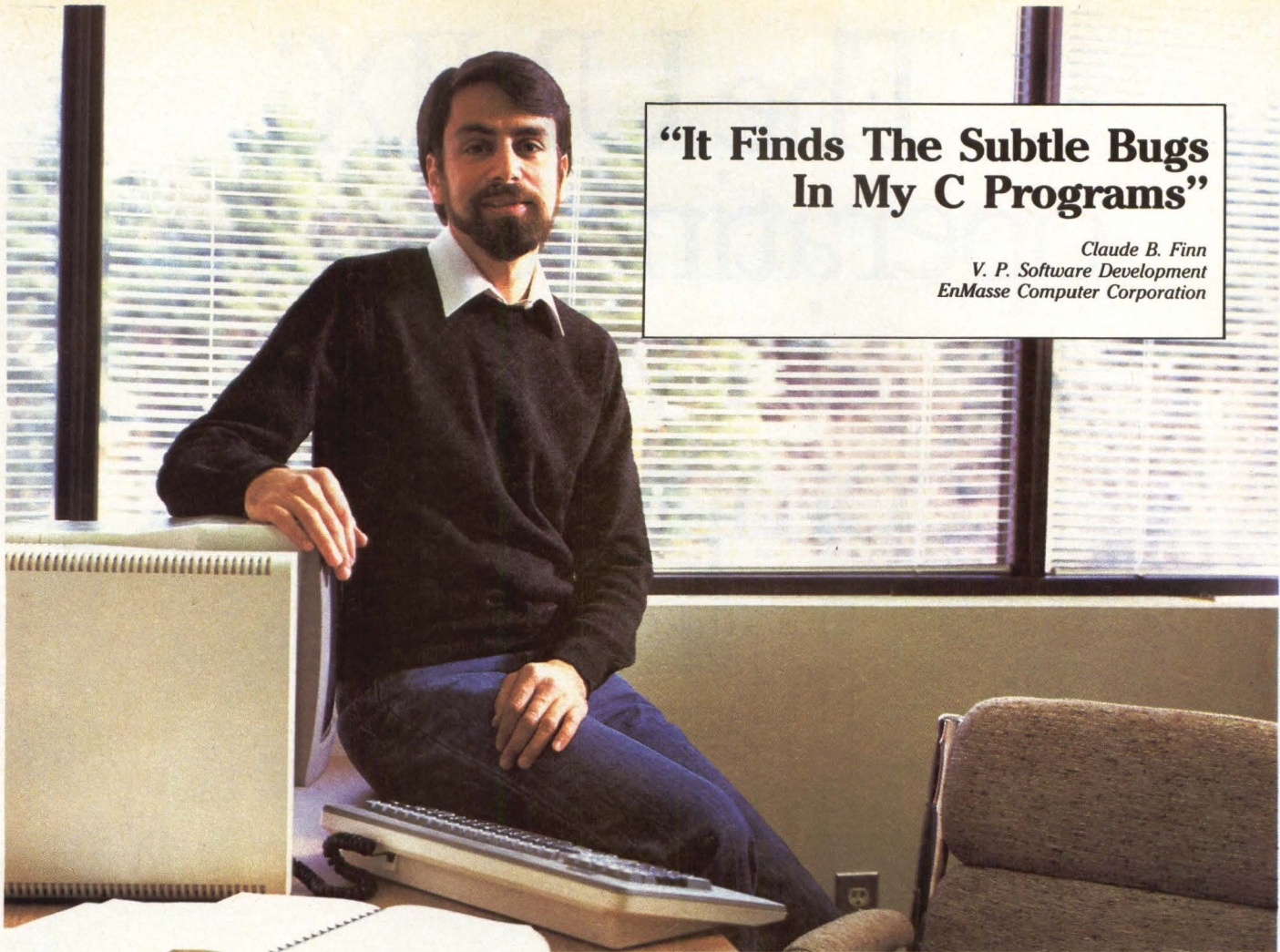
Functionally, micro-to-mainframe links build upward from basic terminal connections using communications boards or modems with little or no file-handling capability. Using these products may require some knowledge of mainframe data-access procedures, and they may require system integrators to write additional software to make the data accessible to the PC-based spreadsheet or word-processing application package.

Higher level products are designed to extract only the fields or records required from the mainframe file or from several files simultaneously—preventing the downloading of whole (and usually very large) mainframe files—and automatically reformat and load data into PC application programs. Basic security procedures



Multiple micro-to-mainframe links speed communications and file transmission to and from an IBM mainframe in a geographically dispersed data network. DCA's Irma board and software connect IBM PCs to

terminal controllers. IrmaLine implements links to remote terminals, PCs with Irmalette or other asynchronous communications cards, or non-IBM computers using RS232C connections.



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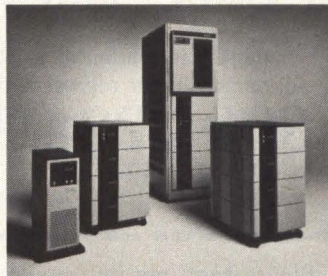
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MICRO-TO-MAINFRAME LINKS

can limit access to mainframe data.

More integrated micro-to-mainframe links implement sophisticated file-handling, data-security and data-integrity procedures for large numbers of personal computer users, and usually require a costly mainframe-resident software component in addition to a package for each connected PC.

The most popular basic communications/emulator link, the Irma board from Digital Communications Associates Inc., (DCA) Norcross, Ga., provides IBM PCs, PC/XTs or PC-ATs with direct high-speed access to IBM mainframes through IBM 3274, 3276 and Integral Terminal controllers in both SNA and binary synchronous (BSC) environments. IBM 3278 and 3279 terminal emulation accommodates features such as light pens, asynchronous character input and extended screen attributes. Two file-transfer utilities work with mainframe IBM virtual machine/conversational monitoring system (VM/CMS) and multiple virtual storage/time-sharing option (MVS/TSO) operating systems and can transfer binary data, e.g., from spreadsheet programs, between connected PCs, using the mainframe as an intermediate storage facility. CMS and TSO file transfers run under the mainframe's XEDIT and EDIT editors, respectively.

Basic links have advantages

Irma has by far the largest installed base—more than 90 percent of the links in use—of any micro-to-mainframe product, and users are not rushing to buy the more expensive, integrated micro-to-mainframe links for several reasons, says DCA product manager for Irma, Steve Kangas.

“Integrated links can start at \$25,000 to \$30,000 and go to \$150,000 or more,” compared to a few thousand dollars for a basic emulator product. “The market is application-driven. If you don't have a driving need for an integrated link, you will go slow in purchasing it,” Kangas asserts.

In addition to lower cost, another strong factor in favor of an Irma-type product, Kangas points out, is the broad popularity of IBM 3270 terminals. “You have a lot of terminal users who are converting to personal computers,” he notes. “They are familiar with dealing with the mainframe in this manner. They just want to have the local processing power of the personal computer.”

This type of user, Kangas argues, goes on-line to the host computer mainly to view data and not pull it into the PC for processing. “They may be doing file transfers only 30 percent of the time,” Kangas emphasizes.

DCA also offers a “much more powerful” file-transfer package, Irmalink DBX/CICS, for mainframes running IBM's CICS (customer information control system) under DOS/VSE, MVS or OS/VS1 and microcomputers running MS- or PC-DOS 2.0 or higher. It furnishes a multilevel security system, controlling access by specific users to groups of files and fields within files and the capability of accessing selected records within a file.

Diversity characterizes 3270 emulation

Micro-to-mainframe links from Avatar Technologies Inc., CXI Inc., Forte Data Systems Inc. and Techland Systems Inc. illustrate the diversity of products within the 3270-emulation environment.

As with most IBM 3278-terminal-emulation products, the Avatar PA1000 Turbo connects to the IBM mainframe through IBM 3274 or 3276 cluster controllers, providing several computers remote access though modems and telephone lines to text and binary files in CICS, CMS and TSO application environments. Macro Language allows system integrators to customize the

Data-handling capabilities of micro-to-mainframe links increase as the products evolve from basic communications cards (terminal connections) through 3270 emulator devices (simple data transfer) to more fully integrated links (file-distribution management).

Type of link	Advantages	Limitations
Terminal connections		
PC emulates 3270 terminal Modems and communications boards are required	PC can make a physical connection to mainframe and view data	PC acts as a dumb terminal can only view data; no downloading or uploading PC capabilities not available during emulation
Simple data transfer		
Mainframe files are transferred in bulk to PC	data from mainframe computer is available for PC users	customized programming required on mainframe customized programming required on PC no data selectivity entire file transferred processing often slow and inefficient
Selective data access		
Data is extracted from files, transferred to PC and reformatted to popular PC software	only needed information is downloaded information is made usable to PC software PC data may be uploaded to mainframe no programming is required	no communications with other PCs access typically limited to only one file at a time processing often slow and inefficient
File-distribution management		
Distributes information and programs between PCs Selective data access Accesses many files simultaneously	PCs can communicate with each other extracts information from many files at once and transfers the combined data down to the PC	some links may not be able to access specific vendor applications or databases

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Integrated links provide advantages in terms of file-handling control and flexibility, ease of use and security features.

package to specific applications. For example, one macro command can allow a user to locate specific mainframe-based data, compare it with other information, update one or both data sets, should they meet certain conditions, and simultaneously print out the results.

CXI's 3278/79 Plus PC coaxial interface board and its software's windowing capability allows a personal computer user to simultaneously view a host session, a PC-DOS session and two note pads. It supports data-compression- and direct-memory-access-assisted file transfer to and from TSO or CMS host systems. The 3278/79 Plus PC modem board attaches through a synchronous modem to an IBM 3705/25 communications controller and supports SNA/SDLC (synchronous data-link control) networking capability, permitting remote PC access to mainframe data without a 3274 controller.

Links for all reasons

Also supporting concurrent windows (four sessions with different hosts, one DOS session and note pad), the 3270PC Emulator/Adapter from Forte Data Systems allows system integrators to modify standard 3278 and 3279 terminal keyboard definitions, switch displayed colors and use non-standard monitor equipment. It uses one IBM PC, PC/XT or PC-AT expansion slot and is soft-loaded from disk.

For remote communications with IBM mainframe computers, Techland's BlueLynx 3270 SNA/SDLC emulation package supports five concurrent mainframe sessions. For example, a configuration could be two 3278 terminals, one 3278 logical terminal for uploading to the host and two 3287 printers for uploading or downloading data. A "hot key" permits users to toggle back and forth between DOS and emulation modes.

Micro-to-mainframe links from InfoCenter Software Inc. and Linkware Corp. offer connections to a wider range of personal computers and mainframe databases than many 3270-emulation products.

Linkware's mainframe-resident Information Server (L:IS) and personal-computer-based PC Connection support the upload and download of text and data files, protocol conversion and file reformatting for IBM and IBM-compatible PCs and Digital Equipment Corp. Rainbow or Lee Data Corp. personal computers running MS-DOS, PC-DOS or CP/M-86. Users can store and exchange data through a "virtual disk" area or "user library" on the mainframe; access to the host's central file area is controlled by authorization procedures.

Error-detection-correction capability notifies

the personal computer of incomplete file transfers and automatically retransmits the data. Audit-trail capability tracks file transfers in both directions. VM and MVS versions are available.

Another micro-to-mainframe link supporting a virtual disk concept is Forte's EComNet. Working with the company's PJ 3278/3279 Emulator/Adapters, it creates a MIS-defined mainframe storage area of as much as 32M bytes for each user. Virtual "floppy disks" allow personal computer users to share data. Authorized access to other mainframe files is implemented by using the DOS COPY command on the PC.

System integrators who do not want to be tied to a particular mainframe database might consider InfoCenter's iLINK micro-to-mainframe link. Functioning with RAMIS, FOCUS, SAS, ADRS II, APLDI-II and FPS, it transforms mainframe data files into data-interchange formats (DIF) or comma-separated values (CSV) formats for widely used PC spreadsheet and database packages.

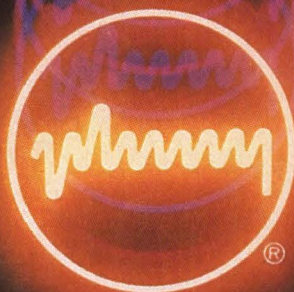
iLINK can also crossload data between mainframe databases and personal computers. For example, data from a RAMIS database could be graphed using ADRS2BG or moved from APLDI into a SAS database for statistical analysis. The link works with any communications/file-transfer package and mainframe running under VM/CMS or MVS/TSO.

Both the InfoCenter and Linkware products, like many of the more integrated micro-to-mainframe links, reformat mainframe-based data directly for 1-2-3. Not to be outdone, Lotus plans to enter the micro-to-mainframe arena this summer with an add-in product for its Symphony software developed with DCA. Connecting to IBM 3270 systems and System/34, 36 and 38 minicomputers, it will permit high-speed synchronous file transfers between the host and PCs, PC/XTs and PC-ATs. Lotus is also aggressively developing links between its integrated software and LANs, according to president Jim Manzi.

Move up to full integration

The full functionality of integrated micro-to-mainframe links provides advantages over more limited file-transfer/emulator approaches in terms of file-handling control and flexibility and security features.

For example, Cullinet Software Inc.'s mainframe-based Information Database (IDB), used in conjunction with the Goldengate integrated package and Information Link on personal computers, supports a sophisticated multilevel security system, controlling access to data by specific users, groups of users and types of data. "Pass-



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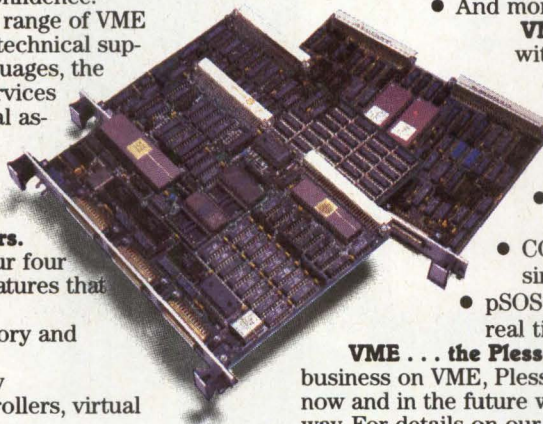
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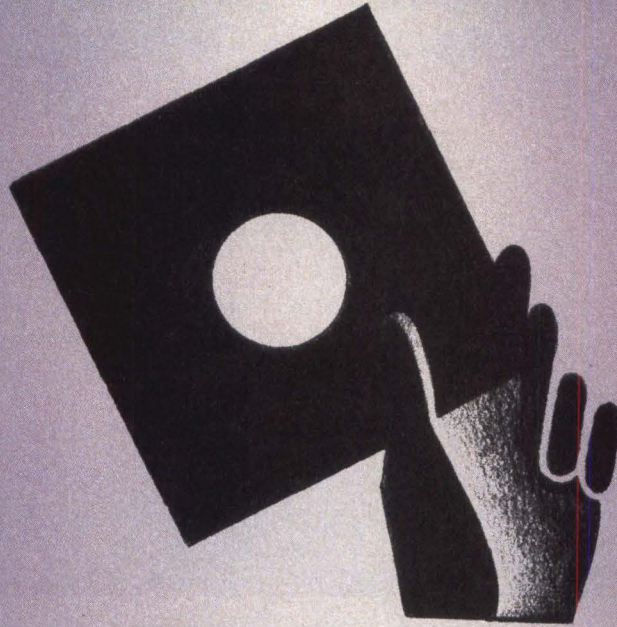


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MICRO-TO-MAINFRAME LINKS

keys," a function granting permission to access and/or modify data, permits the database administrator to define the relationship among users in the organization and the information they are allowed access to.

"Views" can grant direct access to data in integrated-database-management-system/relational (IDMS/R) production databases, stored "objects" (units of information) in the IDB or combined data from several sources, including information from tape files and outside databases.

IDB, essentially a mainframe "staging area" for information accessible to personal computer users, can be updated through the company's IDMS/R automatic system facility (ASF) or Culprit programs. IDB works with Cullinet's IDMS/R or VSAM and other mainframe databases and DOS, VM and MVS operating systems.

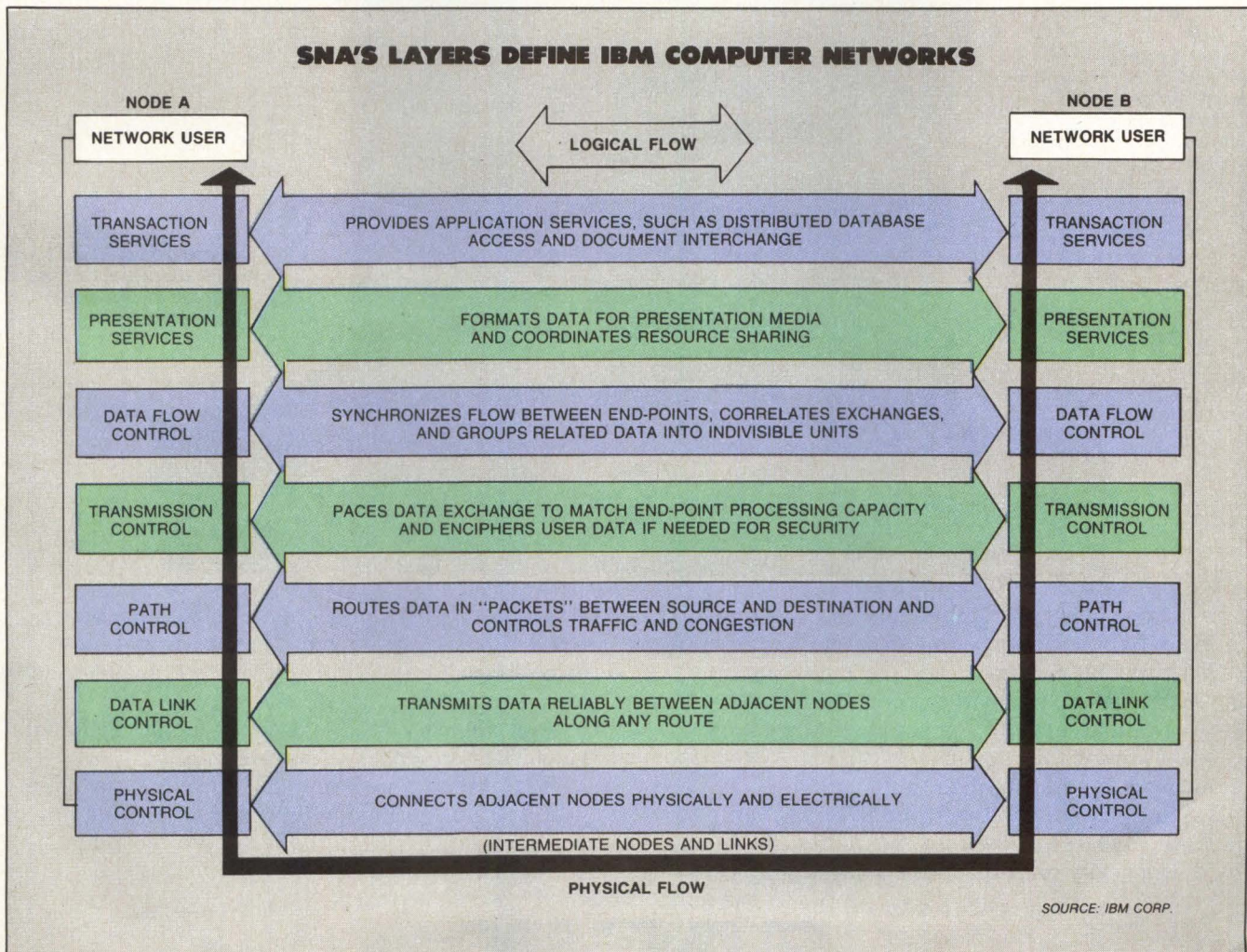
Slated for beta testing by the year-end, Cullinet's Universal Link translates data obtained

from the company's mainframe-based information center management system (ICMS) and other sources into 1-2-3, DIF or ASCII formats for microcomputers running PC-DOS. The hard disk version offers enhanced IDB functions, including electronic mail. Links with departmental minicomputers are under development. Cullinet's Symphony Link add-in, developed with Lotus, downloads and uploads data between the ICMS and the integrated package.

Carleton Corp.'s, CQS-Infotek combines the fourth-generation-language-based CQS-Infotec information-retrieval and report-writing tool with CQS-Communications software and CQS-Dialogue Manager. CQS-Infotec permits direct access to mainframe databases and allows system integrators to tailor database-extract requests to specific user applications. An English command language eases access through the menu-driven data dictionary for personal computer users to the mainframe staging-area file server.

Database administrators can assign security

SNA governs communications (from Node A to Node B, for example) among mainframes, communications controllers, terminals and other devices in an IBM network. Micro-to-mainframe links using the SDLC protocol must deal with the specifications prescribed by the SNA layers.



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MICRO-TO-MAINFRAME LINKS

levels to control access to specific files or records. The system runs on all mainframe IBM OS operating systems and VM environments. It works with most mainframe databases and IBM PCs, DEC Rainbow and DECmate II, and Lee Data computers.

Omnalink, from On-Line Software International Inc. provides electronic-mail capabilities to 3270-emulating devices in addition to the flexible file-handling capabilities and security features expected of an integrated micro-to-mainframe link. For IBM CICS systems, Electronic Mail option assigns "mailboxes" and passwords to users, permits files and reports to be sent automatically to certain users, assigns priority levels to communications and tracks the status of each message sent. Document Exchange ties Wang Laboratories Inc. VS or office-information system (OIS) word-processing systems to the network.

Content Address Method (CAM) data-retrieval system on the Advanced-Function mainframe package collects data from mainframe files based on the content of the data required.

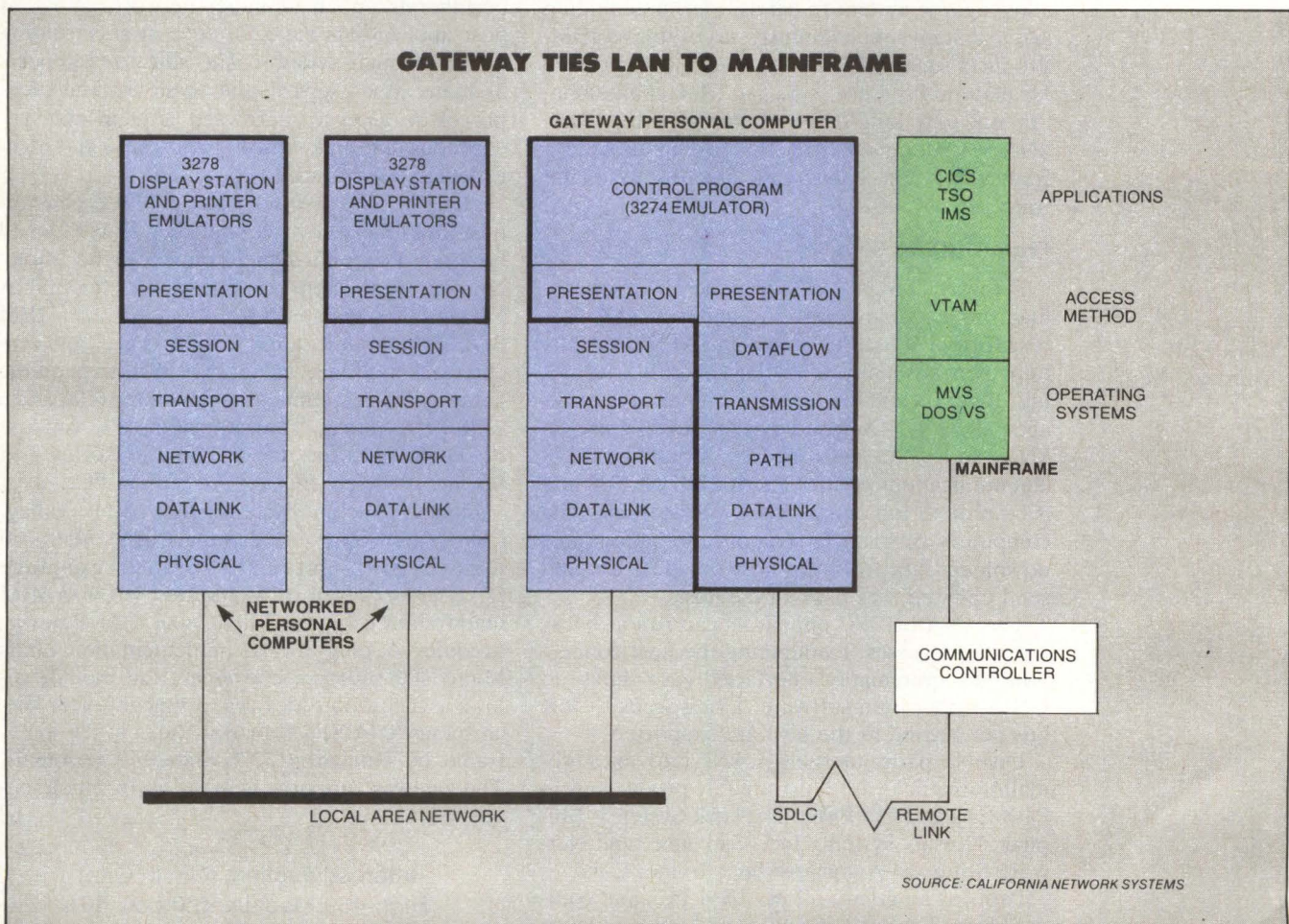
As a result, "the computer does not have to search through every record for the data," comments On-Line president Jack Berdy. "When you have a couple of million-byte files [on the mainframe], the user does not want a couple of million bytes but only the information he needs." Multiple file access allows users to simultaneously extract data from several files.

Links connect to LANs, UNIX

Micro-to-mainframe links are not ends in themselves but a means of facilitating information transfer between an organization's computer users. Because separate departments in a large organization might have microcomputers connected by LANs or microcomputers running UNIX tied to another microcomputer acting as a file server or to a supermicrocomputer, micro-to-mainframe links are beginning to include gateways to LANs and linked microcomputers running UNIX.

IBM's recent announcement of its Interactive Executive for System/370 (IX/370) mainframes typifies this trend. Based on UNIX System V

Personal computers joined in a LAN can access mainframe applications, such as CICS, through gateway packages, which provide IBM 3278-terminal and 3274-cluster-controller emulation.



'SNA was designed from the first to provide a framework for connecting micros to mainframes.'

and running as a guest under VM/SP, it replaces UNIX System-III-based VM/IX mainframe software. VM/IX and PC/IX PC software (also System III-based) have a similar user interface, suggesting a path for micro-to-mainframe communications through UNIX. PC/IX and IX/370 may offer the same possibilities, emphasizes Laura Stuart, director of small systems research at the Yankee Group, Boston.

"IBM went to a great deal of trouble to ensure that IX/370 has a similar interface to PC/IX. For some users, IX/370 could fit into a micro-to-mainframe strategy, primarily in a less-than-total, non-business IBM environment," Stuart suggests. "For example, going from UNIX on a technical workstation to a departmental local processor." Stuart expects IBM eventually to replace PC/IX with its own multiuser implementation of the IX/370 family.

IBM's plans in this area may be indicated by one of IX/370's extensions to UNIX System V—the Connect facility—developed by Interactive Systems Corp. It permits concurrent work on two IX systems, such as PC/IX and IX/370, by allowing one system to act as a terminal and an active system simultaneously, according to IBM. Products such as IBM's PC Network SNA 3270 Emulation Program, says an IBM spokesman, "fit into our long-range master plan for SNA. SNA was designed from the first to provide a framework for connecting micros to mainframes."

From UNIX to SNA

Pathway Design Inc.'s approach to micro-to-mainframe communications under UNIX System III and V focuses on its UniPATH products. Supporting as many as 32 "logical units," including IBM PCs and intelligent terminals, the packages allow UNIX-based systems to operate on SNA and BSC networks by emulating 3270 communications controllers or 3770 or 2780 and 3780 remote job entry (RJE) workstations. The computers can run host application programs, download data from the host for local use and send updated files back to the host.

The SNA or BSC emulators can run as background processes, maintaining the host connection. Programmatic interfaces ease links to UNIX application software. Line speeds to 56K bits per second to the host are supported.

Diverse paths to tying LANs into micro-to-mainframe links are illustrated by products from Pathway, and California Network Systems, Milpitas, Corvus Systems Inc., San Jose, and Network Software Associates Inc., Irvine, Calif.

Pathway's netPath allows IBM PCs and compatibles in LANs to download and upload files to

IBM mainframes under SNA and BSC protocols using Novell Inc.'s NetWare operating system software and Pathway's Communications Adapter installed in the gateway PC. The system supports as many as 32 concurrent sessions per gateway, and multiple gateways can be implemented.

California Network Systems offers OEM and end-user versions of its SNA Gateway software, comprising a 3274 cluster controller emulator and communications card for the gateway IBM PC and compatibles, plus 3278 terminal and 3287 printer emulators for connected PCs. It also supports as many as 32 concurrent SNA sessions.

The OEM product functions with any LAN that supports IBM network adapter basic input/output system (NETBIOS), MS/NET and CCITT X.215 session layer facilities. The IBM PC network product works with IBM's PC LAN and has all the features of the OEM version.

Gateway supports electronic mail

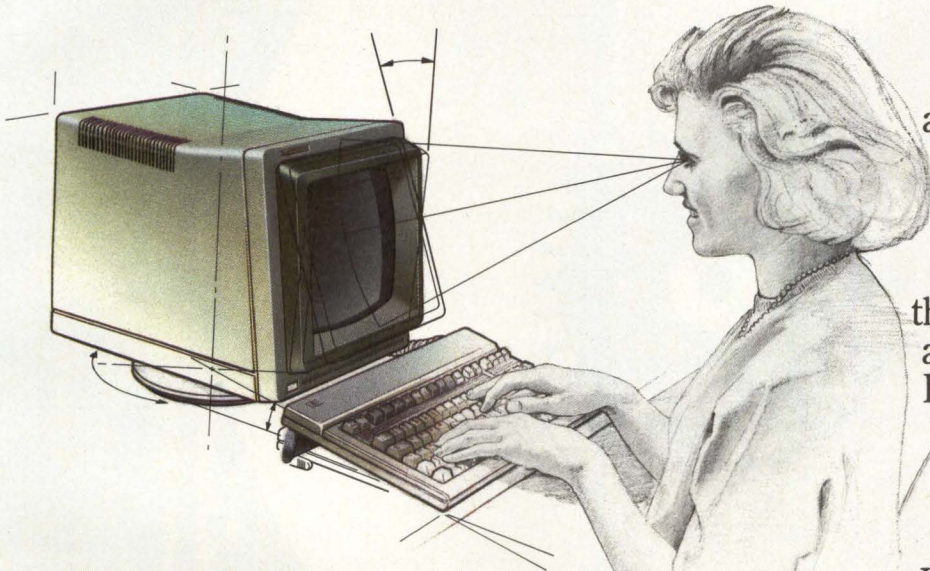
The SNA Gateway from Corvus Systems allows IBM or Corvus Concept computers and peripherals on an Omninet network access to host applications via 3270 emulation, including electronic-mail systems. The software supports as many as 64 logical unit sessions. The dual-processor gateway hardware implements synchronous data-link control plus RS232 and higher level SNA access.

High-speed (4,800-bps), direct SDLC communications and file transfer between IBM PCs and between PCs and a mainframe can be implemented using Network Software's AdaptSNA PCcom and AdaptSNA 3270 software, IBM SDLC Communications Adapter Cards and synchronous modems. AdaptSNA 3270 runs on the gateway PC and emulates a 3274 controller and a 3278/79 terminal. The controlling PC can use PC-DOS functions to change directories and rename or delete files on the remote PCs.

Finally, Micom Systems Inc., Simi Valley, Calif., offers a means of connecting its Micro600 Data private automatic branch exchange (PABX) employed in its Instanet LAN to IBM mainframes using the Micro7400i IBM Gateway Module. A plug-in-card implementation of its Micro7400 protocol converter, the module allows asynchronous devices to function over synchronous SNA/SDLC or BSC links to the mainframe by emulating 3278 and 3279 terminals. The gateway supports as many as 16 simultaneous users. □

Interest Quotient (Circle One)
High 459 Medium 460 Low 461

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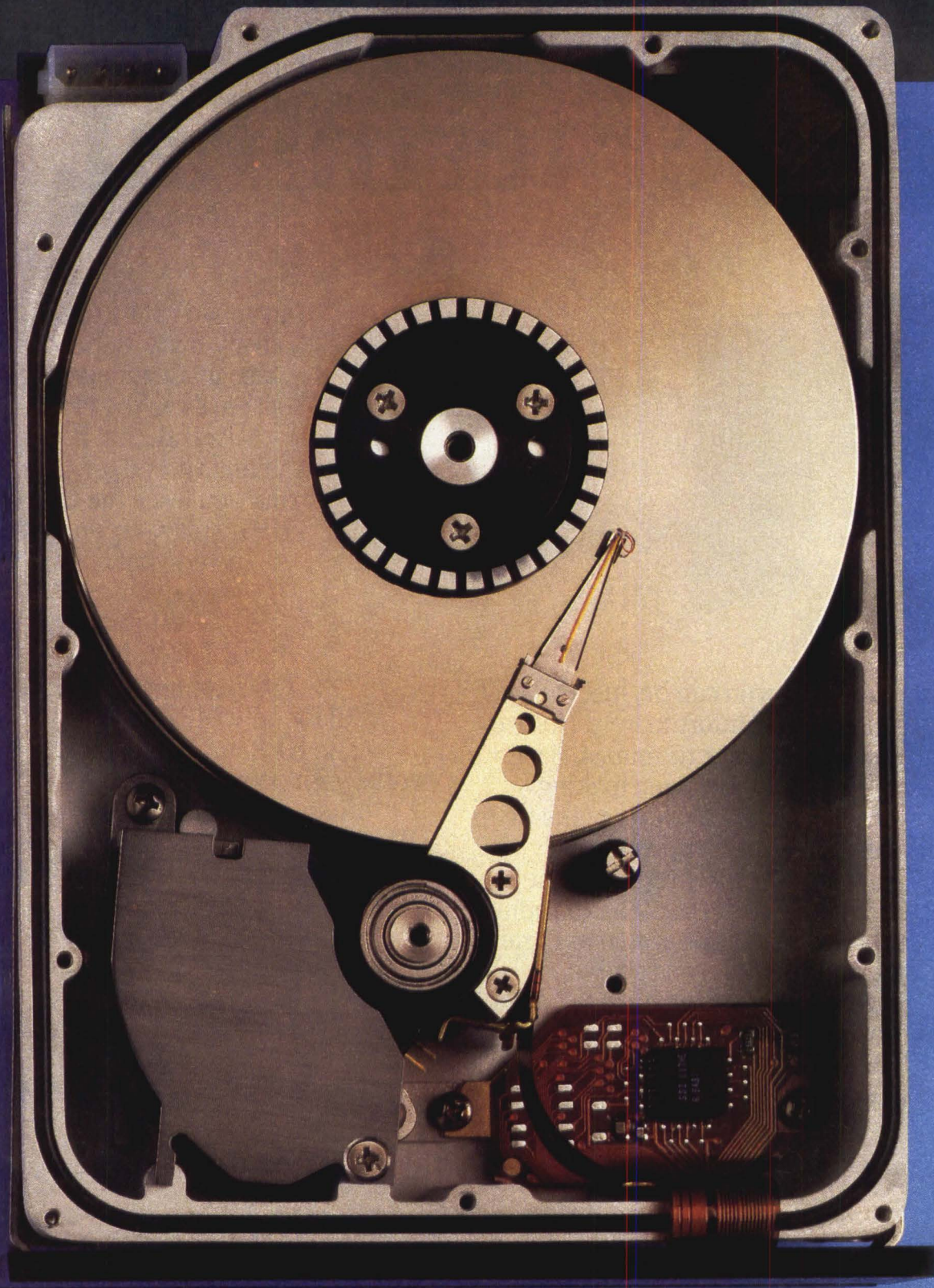
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REPRESENTATIVE MICRO-TO-IBM MAINFRAME LINKS

Product/Company	Microcomputers supported						File transfer				Security features	Mainframe component	Mainframe operating systems	Cost (\$)	
	IBM PCs	Compatibles	DEC Rainbow	DEC DECmate II	Lee Data	Wang	Whole files	Selective	SNA	BSC				Upload	Microcomputer
ADR/PC DATACOM	•						•	•	•	•	•	•	DOS, OS, MVS	495	12,000–13,500
ADR/PC/PTE	•						•	•	•	•	•	•	DOS, OS, MVS	Undetermined	Undetermined
Applied Data Research Inc. Rte. 206 and Orchard Road Princeton, N.J. 08540 Circle 386															
PA1000 Turbo	•	•					•	•	•	•	•	•	DOS, OS, MVS, VM	1,395 for first; 200 additional	500
PA100 Turbo	•	•					•	•	•	•	•	•	DOS, OS, MVS, VM	1195	500
Avatar Technologies Inc. 99 South St. Hopkinton, Mass. 01748 Circle 387															
CQS-INFOLINK	•	•	•	•	•		•	•	•	•	•	•	OS, VM	350	48,000–53,000 with 10 PC hookups
Carleton Corp. 245 First St. Cambridge, Mass. 02142 Circle 388															
3278/79 PLUS	•	•					•	•	•	•			VM/CMS, VMS/TSO	1,145	
3270 PC	•	•					•	•	•	•			VM/CMS, VMS/TSO	1,595	
CXI Inc. 3606 W. Bayshore Road Palo Alto, Calif. 94303 Circle 390															
GOLDENGATE	•	•					•	•	•	•	•	•	DOS, MVS, VM	1,195	75,000 for IDMS/R installations
Universal Link	•	•					•	•	•	•	•	•	DOS, MVS, VM, OS	300	150,000
Cullinet Software Inc. 400 Blue Hill Drive Westwood, Mass. 02090 Circle 389															
IRMA	•						•	•	•	•			VM/CMS, MVS/TSO	1,195	
IRMAlink DBX/CICS	•	•					•	•	•	•	•	•	DOS/VSE, MVS, OS/VS1	9,995 (DOS version)	
Digital Communications Associates Inc. 303 Technology Park Norcross, Ga. 30092 Circle 391															
EComNet	•	•					•			•	•	•	MVS, MVS/SP, VM		30,000
3270PC Emulator/Adapter	•	•					•			•			MVS, MVS/SP, VM	495	
Forte Data Systems 2205 Fortune Drive San Jose, Calif. 95131 Circle 392															

REPRESENTATIVE MICRO-TO-IBM MAINFRAME LINKS

Product/Company	Microcomputers supported						File transfer			Security features	Mainframe component	Mainframe operating systems	Cost (\$)		
	IBM PCs	Compatibles	DEC Rainbow	DEC DECmate II	Lee Data	Wang	Whole files	Selective	SNA				BSC	Upload	Microcomputer
PC Network 3270 Emulation Program IBM Corp. P.O. Box 1328 Boca Raton, Fla. 33432 Circle 393	●						●	●	●		●		all 30XX, 43XX	375	
Minicom IDEAcomm 3278 IDEA Associates Inc. 35 Dunham Road Billerica, Mass. 01821 Circle 394	●	●					●	●	●	●	●		VM/CMS, TSO	895 with one package	
ILINK InfoCenter Software 171 Main St. New Paltz, N.Y. 12561 Circle 395	●	●					●	●	●	●	●	●	MVS, MVS/TSO, VM/CMS	450	MVS: 17,500; VM: 14,000 with product bridge to one database
SNA/BSC Exchange File Exchange Intelligent Technologies International Corp. 151 University Ave. Palo Alto, Calif. 94301 Circle 396	●	●					●	●	●	●	●		DOS, OS	895 for SNA/RJE; 695-795 for BSC	CICS: 2,000; CMS: 400; TSO: 400
Information Server, PC Connection Linkware Corp. 77 Rumford Ave. Waltham, Mass. 02154 Circle 397	●	●	●	●	●	●	●	●	●	●	●	●	MVS, VM/CMS		40,000
OMNILINK On-Line Software International Inc. Fort Lee Executive Park Fort Lee, N.J. 07024 Circle 398	●	●					●	●	●	●	●	●	DOS, OS	350	12,000 entry level; 25,000 advanced function
pcPATH Pathway Design Inc. 177 Worcester St. Wellesley, Mass. 02181 Circle 399	●	●					●	●	●	●	●		all	890	
VDAM Phaser Systems Inc. 353 Sacramento St. San Francisco, Calif. 94111 Circle 400	●	●					●	●	●	●	●	●	MVS, MVS/TSO	500	4,950 with 5 nodes
Bluelynx 3270 SNA/SDLC Techland Systems Inc. 22 Waterside Plaza New York, N.Y. 10010 Circle 401	●	●					●	●	●	●	●		DOS, OS, MVS, VSE	945 with 3270 keyboard; 795 without	

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UNIFY CORPORATION

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RELATIONAL DATA BASE MANAGEMENT SYSTEM

RELATIONAL DATA BASE MANAGEMENT SYSTEM REFERENCE MANUAL

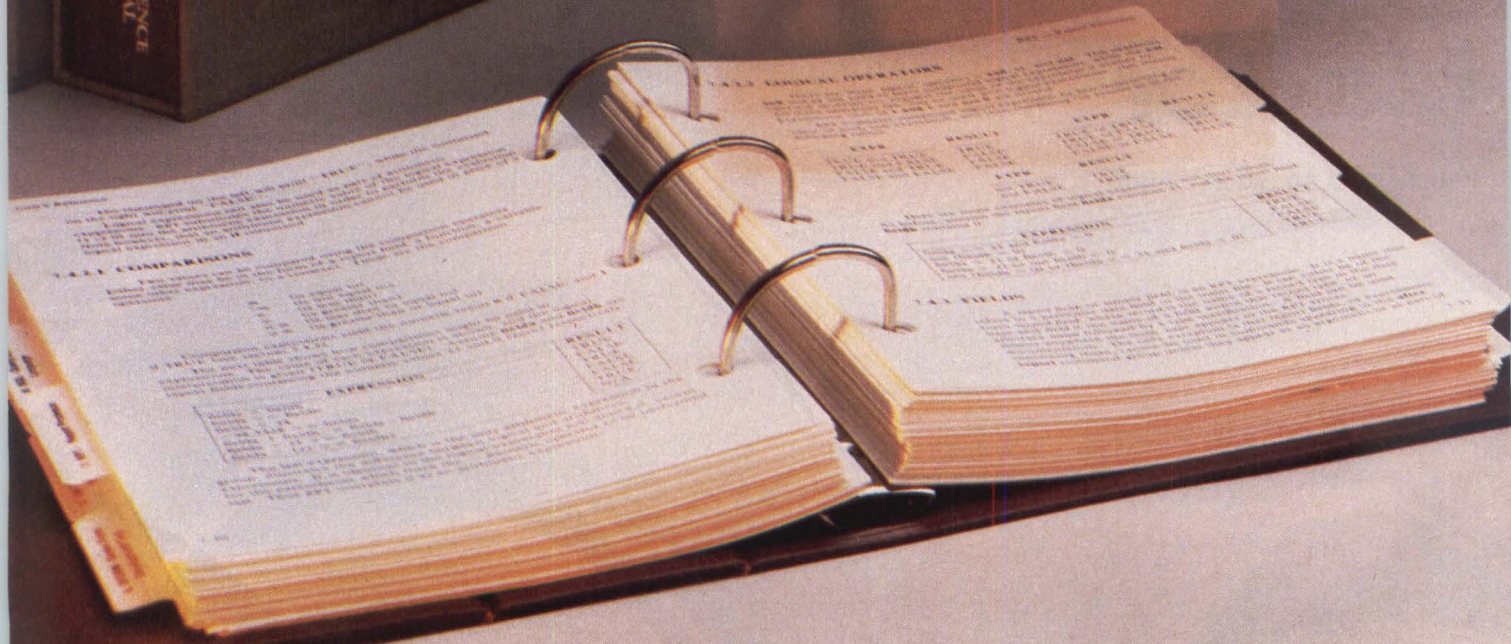
```
[sysmenu]
1. Schema Maintenance
2. Schema Listing
3. Create Data Base
4. SFORN Menu
5. ENTER Screen Registration
6. SQL - Query/DML Language
7. SQL Screen Registration
8. Listing Processor
SELECTION: █
```

```
UNIFY SYSTEM
17 SEP 1984 - 10:01
System Menu
9. Data Base Test Driver
10. MENUH Screen Menu
11. MENUH Report Menu
12. Reconfigure Data Base
13. Write Data Base Backup
14. Read Data Base Backup
15. Data Base Maintenance Menu
```

```
[student] UNIFY SYSTEM
[INQUIRE] 25 Aug 1985 - 18:45
Student Registration Form
Invoice Number: 458
Last Name: Gordon First Name: Richard
Company: Silicon Design Labs
: 5558 Industrial Hwy
: Basking Ridge NJ 07890
: (201) 555-5400
Student's phone number (if different): (201) 555-5421
Class code (samey): CP8905 Subject: C Programming
Class fee: 995.00 Class date: 9/1/85
Deposit date: 8/15/85 Deposit amount ($): 100.00
Payment date: 8/25/85 Payment amount ($): 895.00
```

```
[student] UNIFY SYSTEM
[INQUIRE] 25 Aug 1985 - 18:45
Student Registration Form
Current: 1
REPORT TO: SCREEN PRINT FILE FILENAME
1. Student Registration Listing (x) ( ) (x)--listing
2. Student Billing ( ) ( )
3. Billing Summary ( )
```

REPORT #: 1



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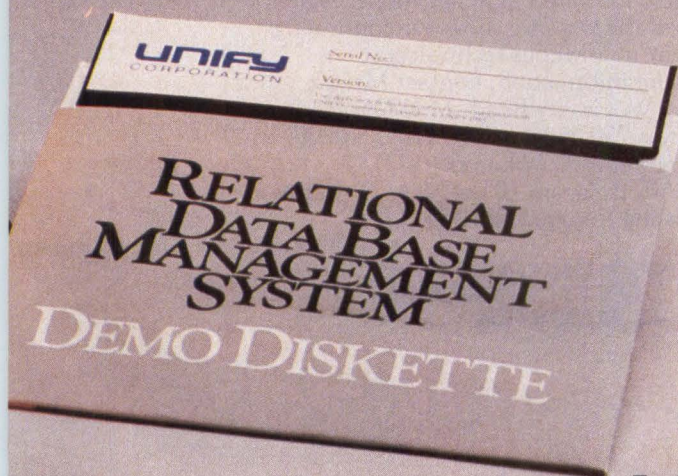
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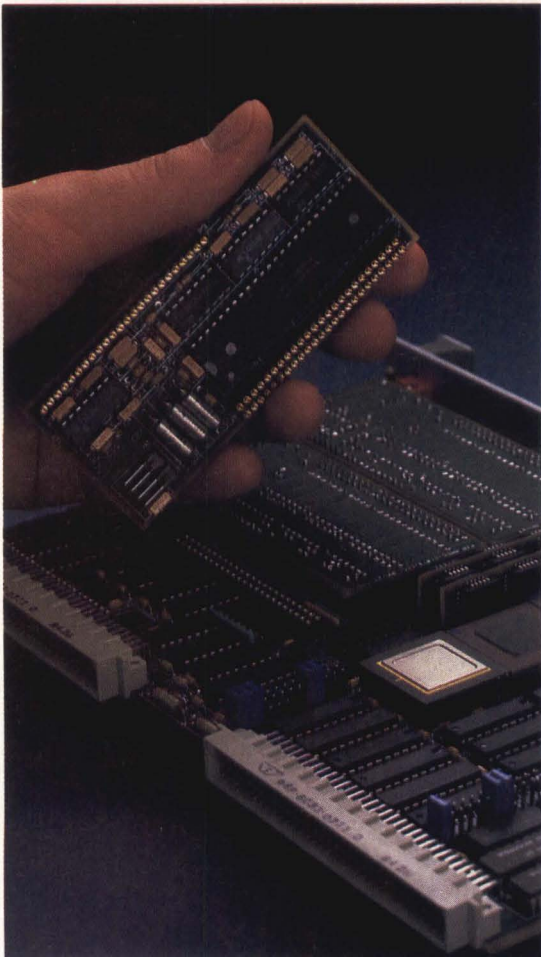
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CIRCLE NO. 56 ON INQUIRY CARD

MICRO/MAINFRAME LINK ALLOWS FIVE SESSIONS

IBM 3278/79 and 3270 PC emulators provide
windowing of host and PC sessions
and remote or local connection

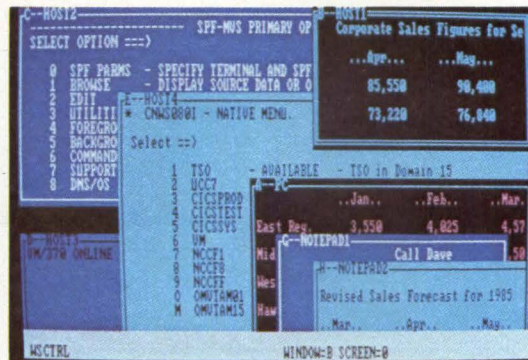
Charles Morel, CXI Inc.

Microcomputer-to-mainframe links came into being within only the last five years, but their impact on the corporate world is already evident. CXI Inc., Palo Alto, Calif., has found that over 80 percent of potential IBM PC users have expressed a desire to be part of a network. As new products emerge to satisfy these demands—and as the thirst for data expands with the ability to process it—corporations are looking to the mainframe to fill the data gap.

The microcomputer fits integrally into this trend. It now seems that in most organizations microcomputers are among the resources dispensed, controlled and applied by management information services (MIS) departments. The essentially decentralized microcomputer can be integrated with the mainframe, a centralized resource, by being integrated into the data-processing system through the corporate data-communications network.

The most common corporate data-communications networks are IBM Corp. 3270 family networks. The 3270 series of terminals communicate with IBM mainframes. The mainstay of the 3270 network is the IBM 3274 cluster controller (or equivalent). One 3274 can control up to 32 terminals and printers.

IBM 3270s and compatibles are dumb, non-programmable input/output devices. But using a microcomputer as a 3270-type link to the mainframe adds intelligence. The resulting system offers the stability and support base of an estab-



The 3270 PC Connection emulator provides windowing capabilities and five concurrent host sessions. The IBM 3270 PC allows four concurrent sessions.

lished terminal infrastructure with the flexibility and power of a programmable device providing local computing and storage resources. The benefit to the end user is access to centralized corporate data, both interactively and automatically, through a microcomputer program. This offers the potential of putting the resources of both the microcomputer and the mainframe at the disposal of the end user, adding departmental autonomy while retaining central control.

To connect a mainframe to a microcomputer that's emulating a 3270-type device requires both hardware and software in the microcomputer as well as software in the host computer. The hardware needed is some type of communications mechanism, which can be as simple as a 1,200-baud RS232 interface or as complex as a 2.34M-bit-per-second IBM Category A coaxial interface.

The software for 3270 terminal emulation can

be equally diverse. Generally these emulators can be described as a three-layer system which includes data-link control, high-level protocol control and presentation services. (The three-layer system is used in an effort to simplify, not as a counter to IBM's Format and Protocol Language (FAPL) or any International Standards Organization standards.) The data-link control provides the software connection with the hardware communications interface. The high-level protocol control processes the protocols necessary in the 3270 network environment. The presentation services interface with the end user through the keyboard display, printer and application-program interface.

Ordinarily, the number and location of users determine the network topology and define the type of 3270 connection. Although number and location of users is ultimately more important than price in choosing a remote vs. local coaxial connection, remote connections are three to five times more expensive than coaxial, mainly because of the cost of communications equipment and telephone charges.

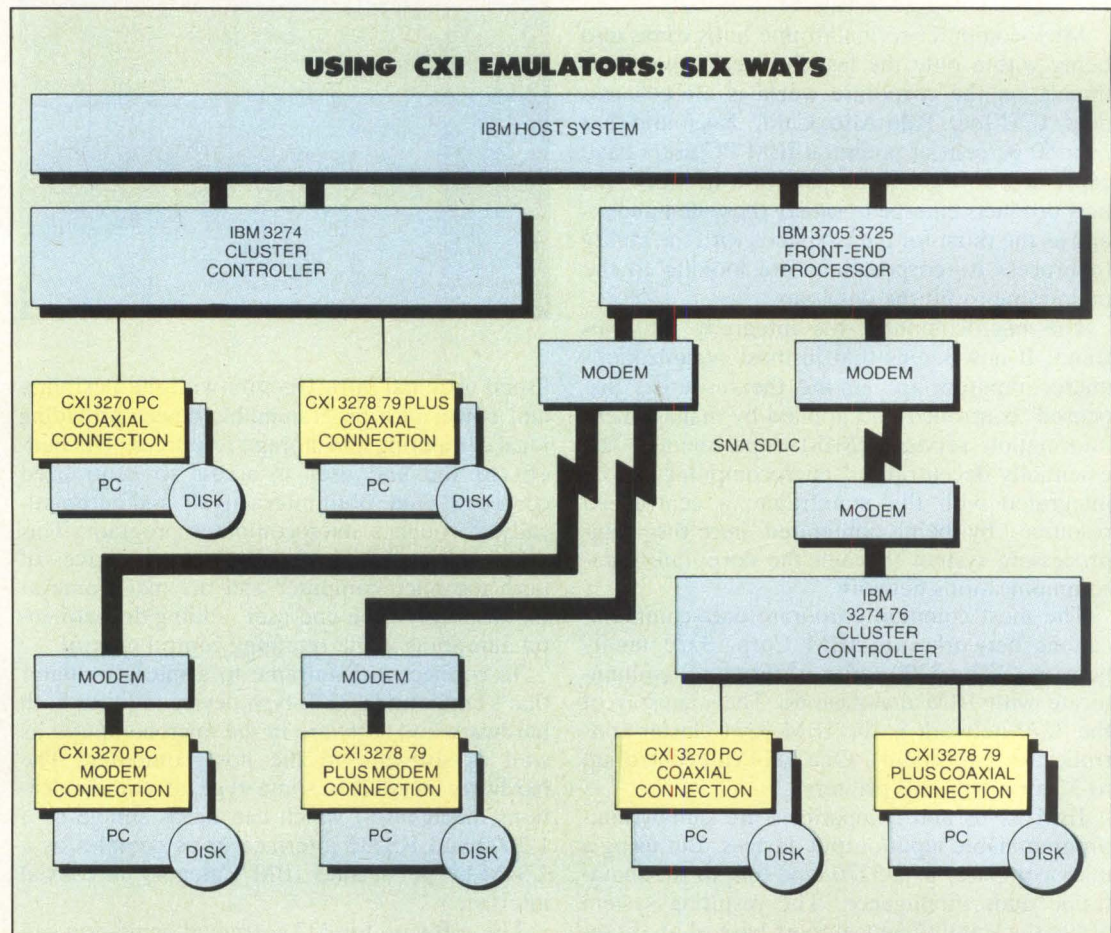
Prior to the advent of micro-to-mainframe

connections, mainframe application software was written under the assumption that 3270 devices would be non-programmable and interactive (as opposed to batch) terminals. Now, 3270 emulators can provide basic terminal emulation as well as programmatic interfaces, thus facilitating more sophisticated applications.

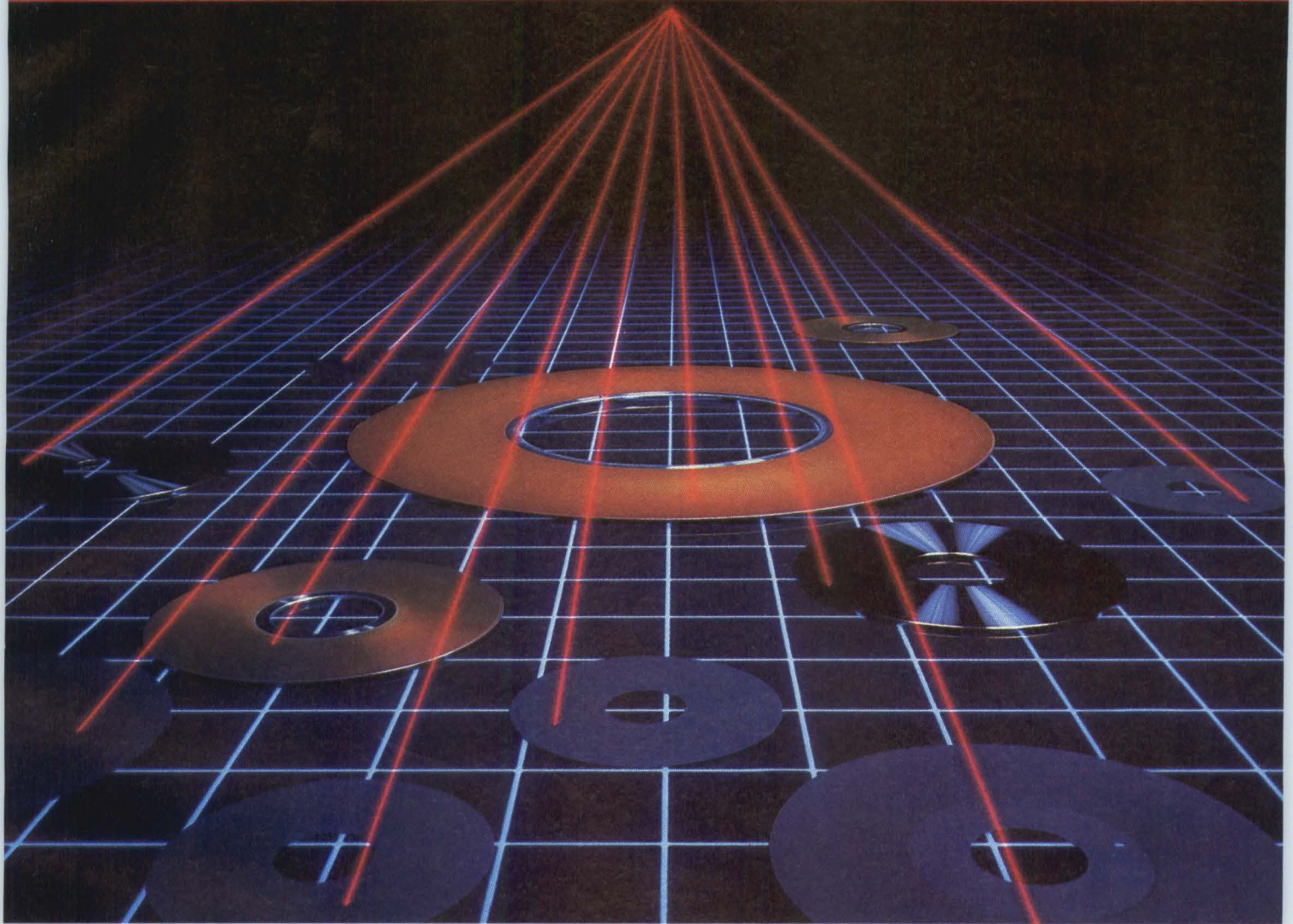
Today, there is a wide range of mainframe software that takes into account the possibility of intelligent, programmable microcomputers at the other end of links. This software provides file-transfer capability that can blend the microcomputer resources with the host resources. These mainframe data-extraction and file-transfer packages provide a wide range of capabilities but can be difficult to control because the separate security features that usually must be added create installation, training and maintenance problems.

To upload and download mainframe data, there must be some physical connection between the mainframe and the microcomputer along with the software. Two examples of such a connection for the IBM PC include 3278/79 Plus from CXI and the Irma board from Digital

Coaxial and remote emulation products enable IBM PCs, XTs, ATs and compatibles to access and process information from IBM mainframes, combining the intelligence of microcomputers with the storage and speed of the host.



Introducing high speed laser-based detection of micro-size surface flaws.

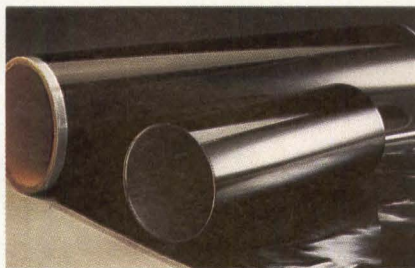


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Typical disk defect map.

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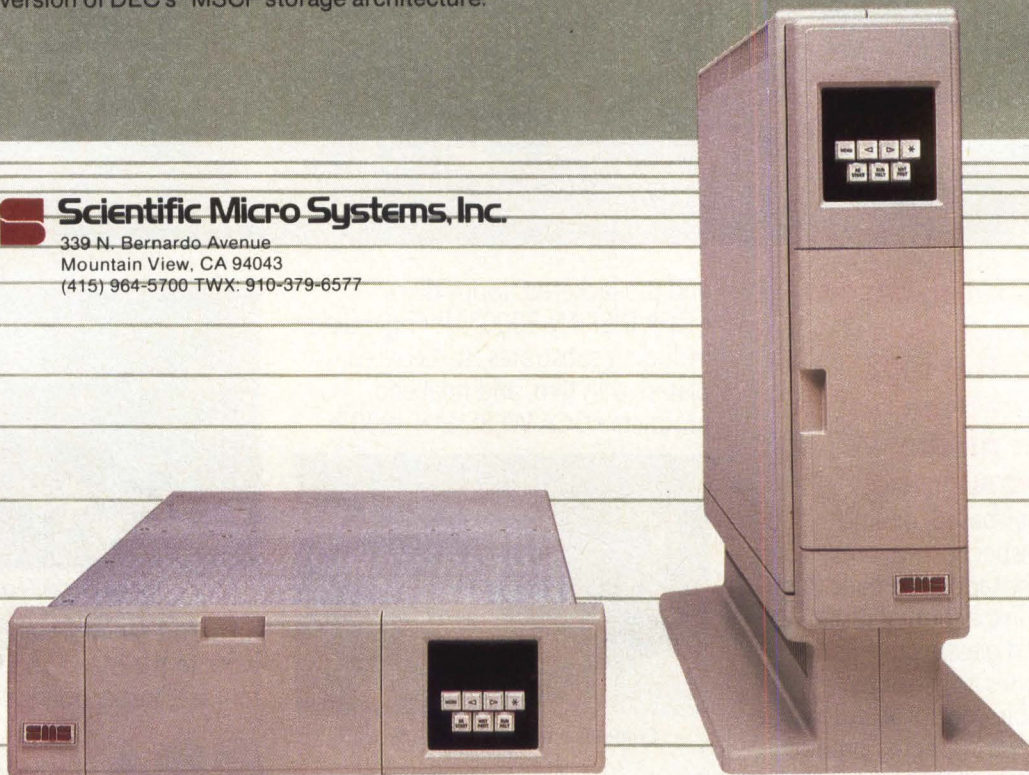
The SMS Model 40 is really a family of products, available in over 150 different configurations—today—with more to come in the near future.

If these are the answers to the questions you are asking, please contact us immediately for more information.



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CIRCLE NO. 58 ON INQUIRY CARD

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Communications Associates Inc. (DCA), which has the largest installed base. Irma is a 13-inch PC-compatible board, while the 3278/79 Plus is a 5-inch board that fits into the short slots of an IBM PC.

How to link a PC to the host

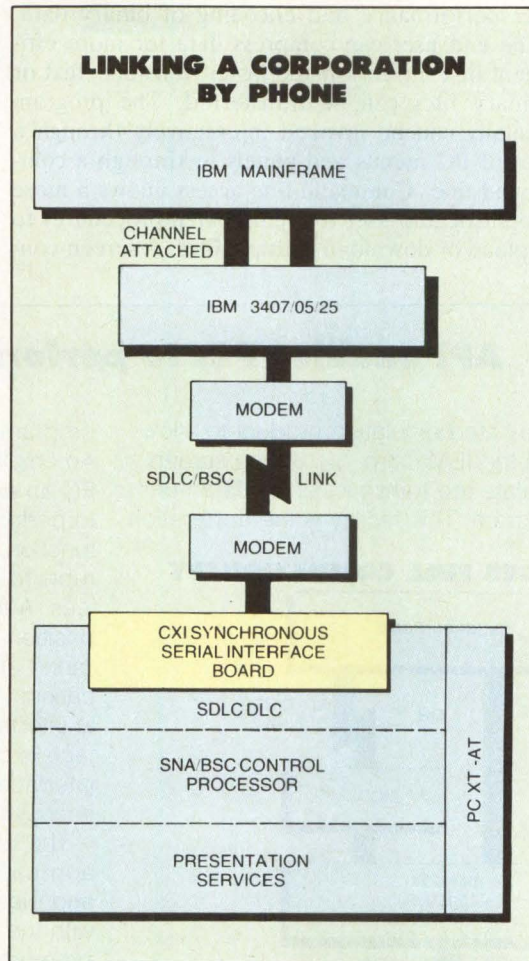
There are many methods of linking a micro-computer to a mainframe and many levels of performance in communications products. A basic network consists of PCs emulating 3270-type devices. The major types of emulators are: an asynchronous terminal emulator; a protocol converter; an IBM Systems Network Architecture (SNA) 3274 emulator; emulators of IBM 3278 or 3279 CRT terminals; and an emulation package based on the IBM 3270 PC.

A coaxially connected 3270-type emulator is perhaps the most common type of product. Like all advanced emulation packages, it includes software, an add-in board and coaxial cable. To configure a coaxial interface to a PC emulating a 3270-type terminal, the following hardware components are required: a high-speed processor resident on the interface board to control the protocol interchanges with the 3274, a transmitter/receiver section to connect the coaxial cable, a device buffer to contain the screen or display image necessary to the protocol operations and an access mechanism between the PC and the interface board.

The simplest linkage technique is start/stop terminal emulation by the PC, which requires connection to a front-end processor and the use of modems with switched lines. This is a relatively slow method of asynchronous terminal emulation.

Another common method connects a PC to the front-end processor via a protocol converter that emulates a remote 3274 cluster controller. The protocol used on these devices can be a binary synchronous or an SNA/Synchronous Data Link Control (SNA/SDLC). Most terminal emulation products link into SNA because this IBM architecture dominates in the corporate world. Older connection methods, such as protocol conversion, are a less desirable option today because of the availability of faster, multifeatured communications products.

In emulating a 3274 cluster controller, the proximity of the microcomputers to the 3274, along with the number of connections, should be considered. Sites with a concentration of users, for instance, call for a communications controller and coaxial interface from the microcomputer to the cluster controller. In sites where only a few connections are required and the mainframe is located elsewhere, remote 3274 emulators,



CXI's synchronous serial interface board emulates a 3274 cluster controller, using modems to allow communications between the host and microcomputer.

which run aboard the microcomputers themselves, are practical. Here, these cluster-controller emulators connect to the mainframe over dedicated or switched communications lines through modems.

Two software layers needed

The 3278 and 3279 are the most commonly emulated and frequently used of the IBM dumb terminals for accessing mainframe applications. Emulating the 3278 and 3279 requires only two software layers: the link-level protocol control and presentation services. The link-level protocol control manages the communication between the interface board via the direct-memory-access (DMA) or I/O ports. The presentation services provide interfaces to the keyboard-display, and map terminal-device buffer codes and keystroke-scan codes into analogous codes in the PC.

One of the chief user benefits of 3278 and 3279 emulation is file transfer, which requires programs in both the PC and mainframe. File transfer uses data compression to enhance trans-

fer performance and encoding of binary data. The end user can compress data for more efficient link utilization and faster transfers. Text or binary files can be transferred. The program usually can be invoked interactively through a set of PC menus and panels or through a command line. Command-line access allows a more sophisticated user to create batch procedures to upload or download multiple files. A screen-con-

trol-application-program interface allows PC programs to perform file transfer. The interface uses software interrupts to invoke function calls to the presentation services.

At issue for busy users is the speed of the 3278/79 emulator. Before mainframe data can appear on the PC screen, the data must be sent to the PC's memory. Transfer speed is limited to how many bytes can be funneled into the PC's

API enables PCs to perform file transfer

It takes a sophisticated emulation product to allow the user to bypass the IBM Corp. 3270-type screen format and manipulate the transmission of data from an application program. This facility is the application

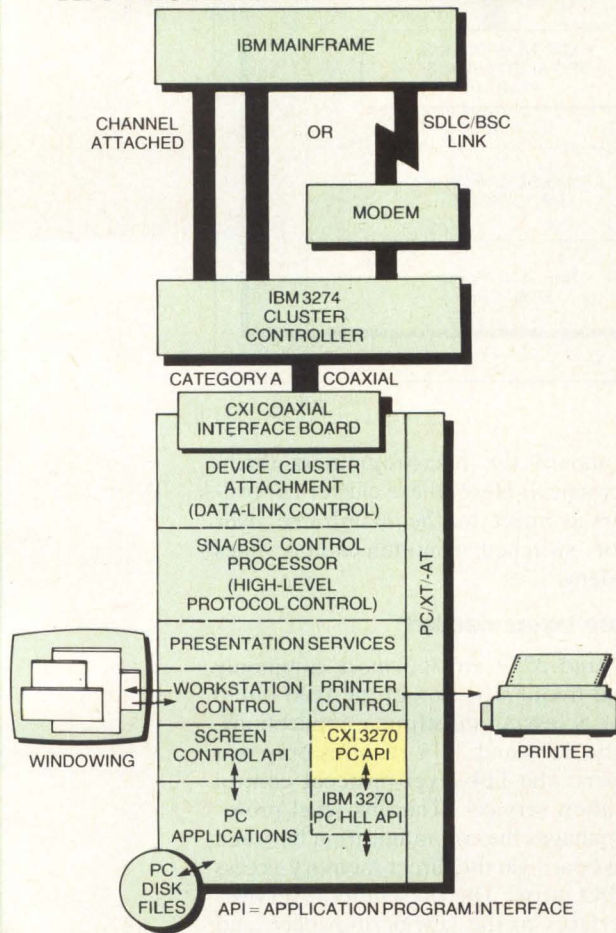
program interface (API), or programmatic interface. An emulator without an API renders an intelligent IBM PC an expensive dumb terminal. A PC needs an API to perform file transfer, an increasingly important function. CXI Inc.'s screen API uses software interrupts to invoke function calls to the presentation services. A few examples of these calls are "read cursor position," "get character from screen buffer" and "send character." CXI also offers a Digital Communications Associates Inc.-compatible Irma programmatic interface on its 3278 emulation products. This interface is controlled through the processor on the CXI interface board. With this interface, a CXI user can access any application program that Irma can.

The IBM 3270 PC API provides an interface for PC applications to read and write host session screens and messages (see figure). The interface is supplied with the current release of the IBM 3270 PC control program. Data on ordinary host session screens can be read and written by the PC applications. Messages can be sent and received by using 3270-structured fields. To support message-oriented transfers using structured fields, it is necessary that the application at the PC and mainframe be implemented with this support. Structured fields allow the transmission of binary data without encoding.

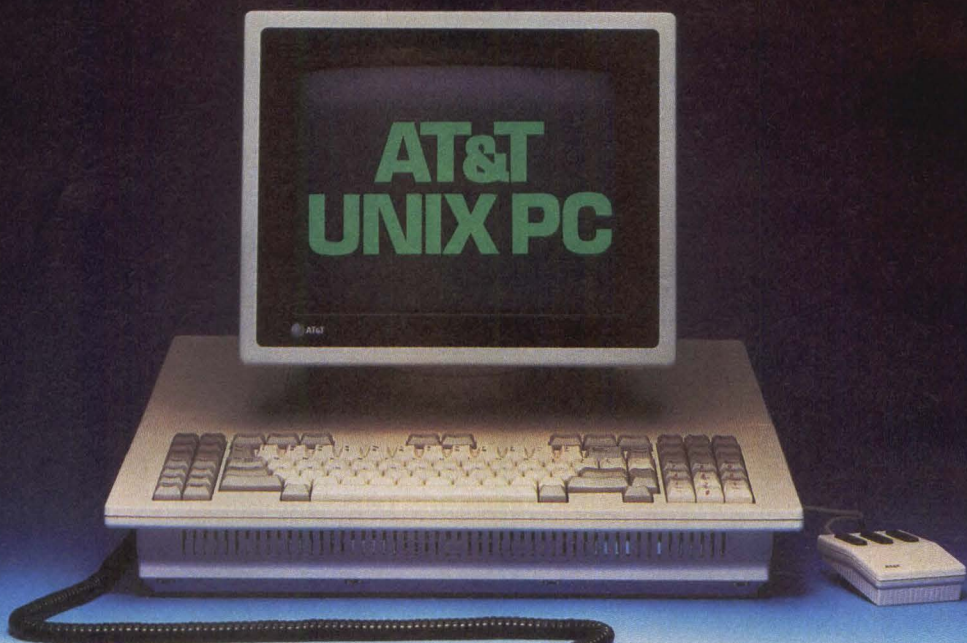
The IBM 3270 PC API is a prerequisite to the IBM PC high-level language application program interface (HLLAPI). The IBM 3270 PC HLLAPI is a software interface for applications written in IBM PC BASIC, COBOL and Pascal. These are connected through IBM-supplied language interface modules (LIMs). Function calls from a LIM to the HLLAPI are made using software interrupts, as are service requests from the HLLAPI to the API. Support for other compilers can be accomplished by the implementation of an appropriate LIM.

The CXI 3270 PC emulator's API is, functionally, service-request and return-parameter compatible with the IBM 3270 PC API. Thus, PC application programs that run on the IBM 3270 PC using control program API can run on products using the CXI 3270 PC emulator's API.

API PROVIDES FULL COMPATIBILITY



The application program interface in the CXI 3270 PC-emulation package allows PC application programs that run on IBM 3270 PCs to run on CXI-enhanced PCs.



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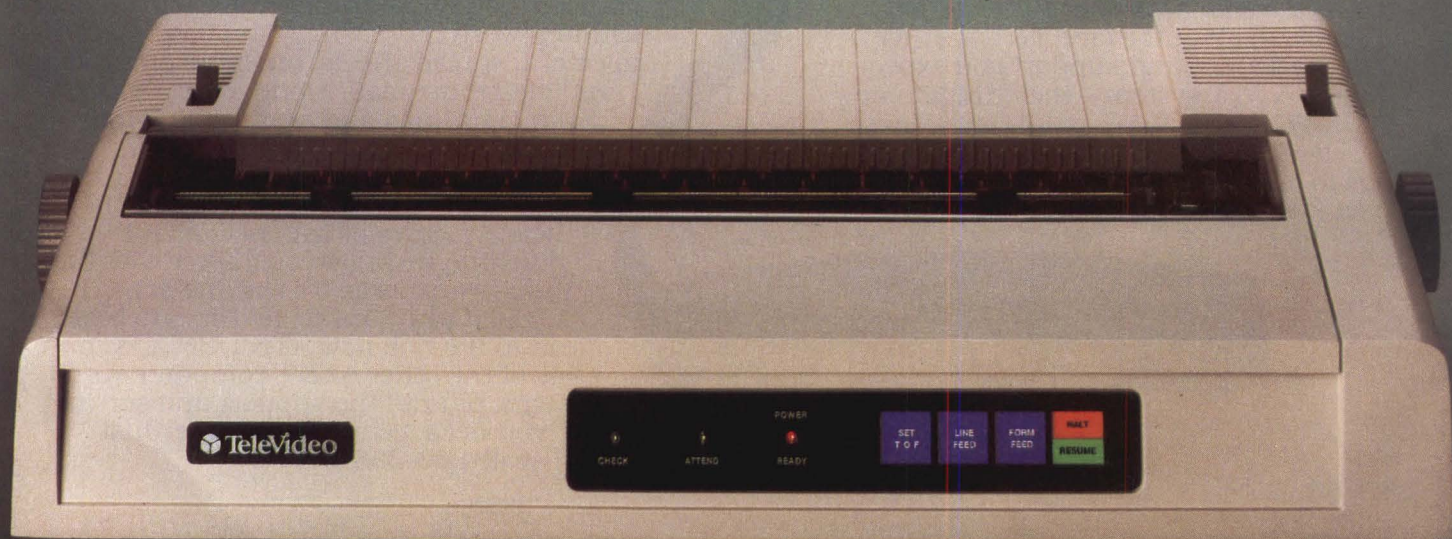
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RAM at one time. Most emulation products transfer data through the I/O bus, one byte at a time. However, CXI emulation products use DMA, thereby sending a continuous stream of data into RAM.

Manufacturers of 3278/79 emulators include CXI, DCA, AST Research Inc., Irvine, Calif., Forte Inc., Santa Clara, Calif., and Tecmar Inc., Cleveland. Most mainframe file-transfer software developers have incorporated support for DCA's Irma boards in their programs because Irma was one of the first 3278 and 3279 emulators. Mainframe file-transfer software written for Irma can also be used on CXI's 3278/79 products with CXI's Irma-compatibility feature.

CXI uses a nanoprocessor design: a proprietary, bit-slice CPU implemented in a custom CMOS gate array. The nanoprocessor runs as fast as 36 MHz and uses a transmitter/receiver communicating with the cluster controller to build the screen image in the device buffer.

The program controlling the processor resides in RAM on the CXI coaxial interface board, which measures only 5 by 4 inches because of the unique gate-array design. The board fits into the short slots of the PC. Other manufacturers use Signetics Corp. 8X305 processors and supporting components, which require a 13-inch board.

The CXI 3278/79 Plus is the only emulator of the IBM 3278 and 3279 terminals to offer windowing capability. The Plus product can concurrently window a single 3278 or 3279 keyboard/display/host session, up to two note pads and a PC session. The CXI 3278/79 Plus runs on any IBM or compatible microcomputer, including the PC-AT. CXI also offers a standard 3278/79 emulator without windowing capability.

Calling on multiple host sessions

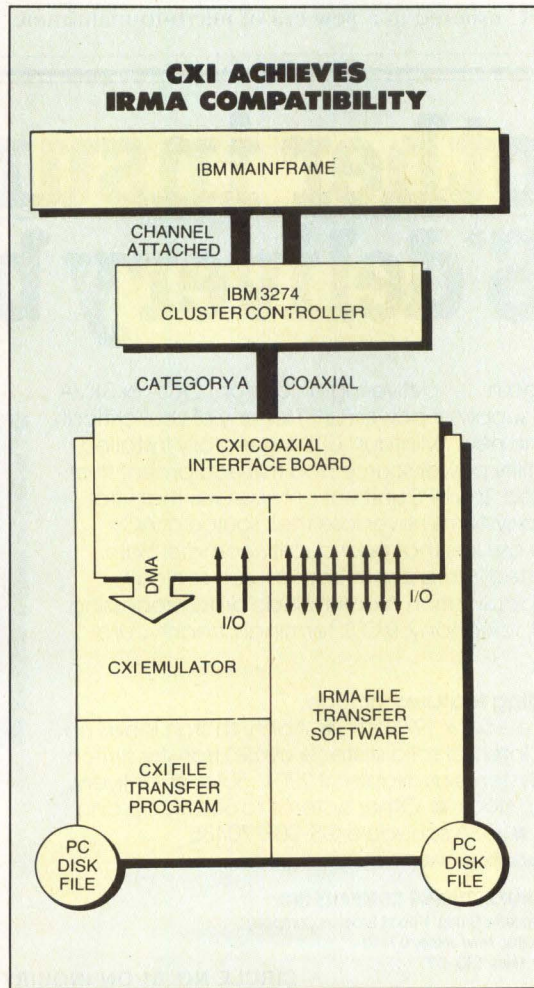
There are many corporate data-processing needs that can be filled with a 3278/79 emulator. The ideal situation for such a product includes light use of host resources, no printer requirements and limited file transfers, such as for users doing accounting functions, order entry or inquiry/retrieval. A solution for users with more intensive data-processing needs is a system with the ability to support multiple host sessions, such as that provided in the IBM 3270 PC or CXI's 3270 PC emulation product.

On the IBM 3270 PC, the presentation to the end user's screen is through a windowed display. The user interacts with one session at a time through these windows. Each window is delineated by a border and mnemonic label. At any time, the current window is represented as the one that is uppermost on the screen. Using CXI's 3270 PC emulator adds an extra host session to

the four available with IBM's product. The five host sessions can be configured as PC-attached printers rather than simply as interactive terminal sessions viewed through windows.

CXI's 3270 PC emulator is architecturally similar to IBM's product in most ways. However, CXI differs from IBM in several important areas. Besides providing an extra host session and the ability to attach to a host-addressable printer, CXI's emulation package is available in both coaxial and remote versions that provide similar features. The IBM 3270 PC has no remote capabilities, nor does it offer international-keyboard mapping as does the CXI product.

The coaxial version of CXI's 3270 PC emulator provides the functionality of IBM's 3270 PC in distributed-function-terminal (DFT) mode as well as control-unit-terminal (CUT) mode. The screen-window presentation is managed through workstation-control (WSC) mode. Through keyboard interaction in WSC mode, the end user can define up to 10 screens. Each screen definition can have any combination of sessions/note



The CXI 3278/79 Plus emulator's compatibility with DCA's Irma emulation board enables PCs to run PC and mainframe applications designed to work with the Irma board, including Irma file-transfer software.

pads, window sizes, relative order, foreground/background colors and other functions. Note pads provide the user with a presentation space in which data from various sources can be combined and edited using ordinary mainframe keystrokes such as delete and insert. Any of these definitions can be saved on disk and restored later.

CXI's 3270 PC emulator is a solution for users who own PCs and want the additional features of the IBM 3270 PC. Those users who do not yet own PCs but want to create a micro-to-mainframe network performing multiple host sessions will pay about the same for an IBM 3270 PC as for CXI's emulation package plus an IBM or compatible microcomputer. But there is much more software available for standard IBM PC products than for the IBM 3270 PC. Another advantage of purchasing a PC and an emulation package is flexibility. The PC can be used in standalone mode or upgraded to a 3270 PC by adding the coaxial board and software as needs change.

IBM's introduction two years ago of the 3270 PC ushered in a new era of micro-to-mainframe

communications. Its features will increasingly become the norm in the future. Indeed, it is highly likely that IBM will stop producing dumb terminals altogether because intelligent microcomputers connected to the host can cost only slightly more than a dumb terminal yet can offer much more. Multiple host sessions—the key feature of the 3270 PC—are a cost-effective way of making full use of corporate computer resources. Interacting concurrently with several keyboard/display sessions has the effect of integrating host applications on the user's PC monitor. □

Charles Morel is chairman and chief executive officer of CXI Inc., Palo Alto, Calif. Before founding CXI in 1982, he was a technical consultant in systems network architectures.

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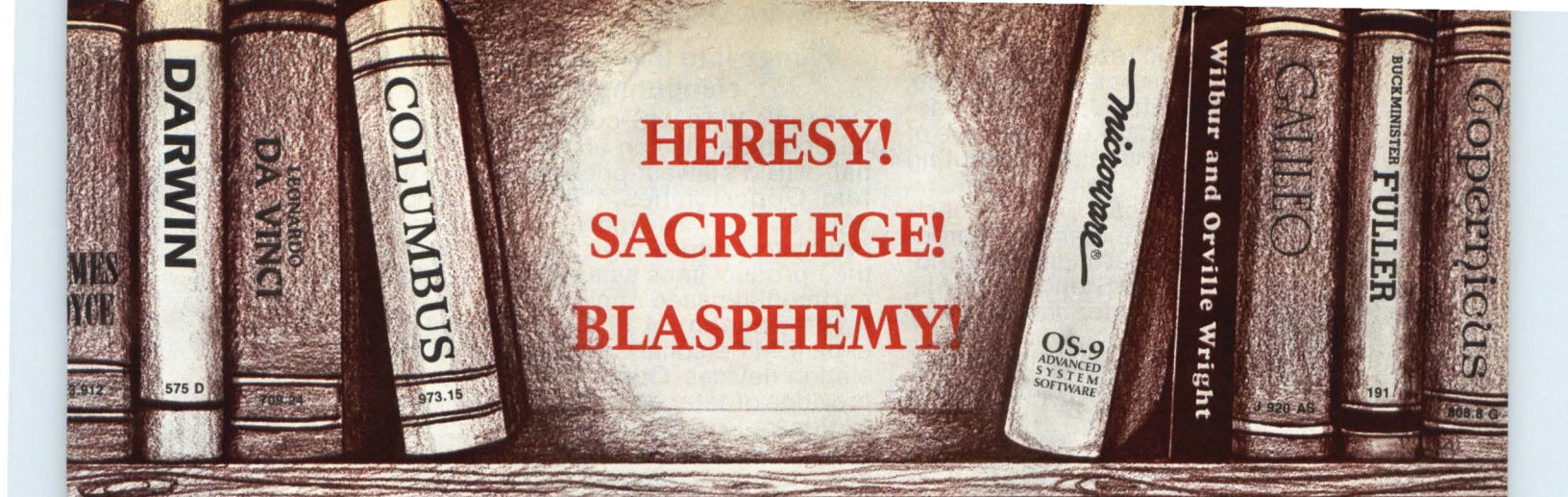
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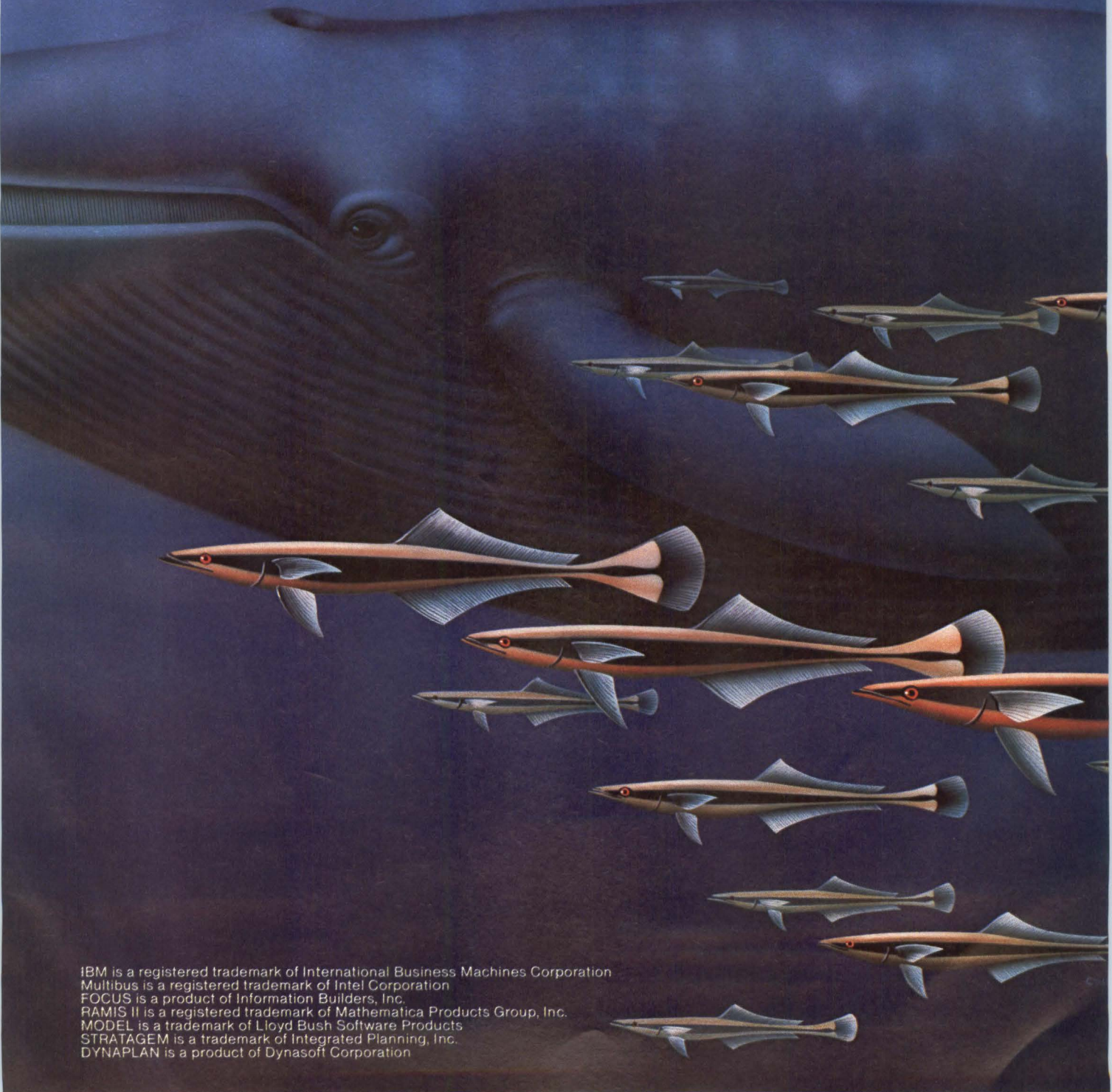
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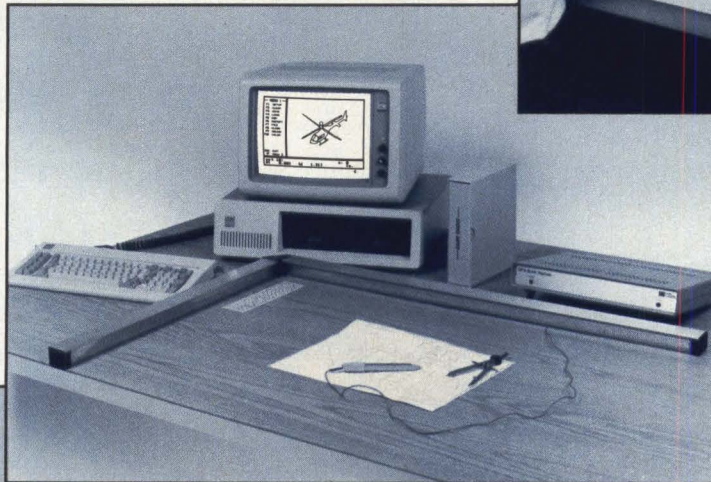
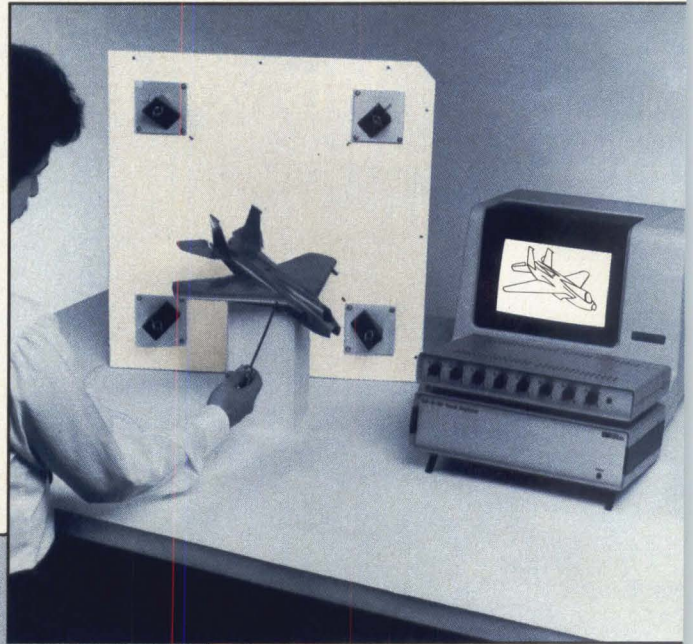
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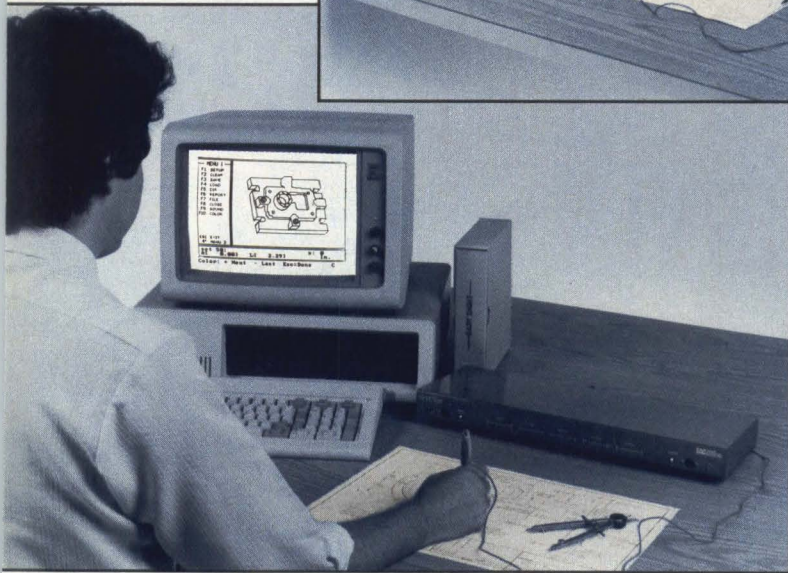
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BUSINESS SOFTWARE GOES VERTICAL

The latest in business software is specialized packages that look beyond generalized solutions

Carl Warren, Western Editor

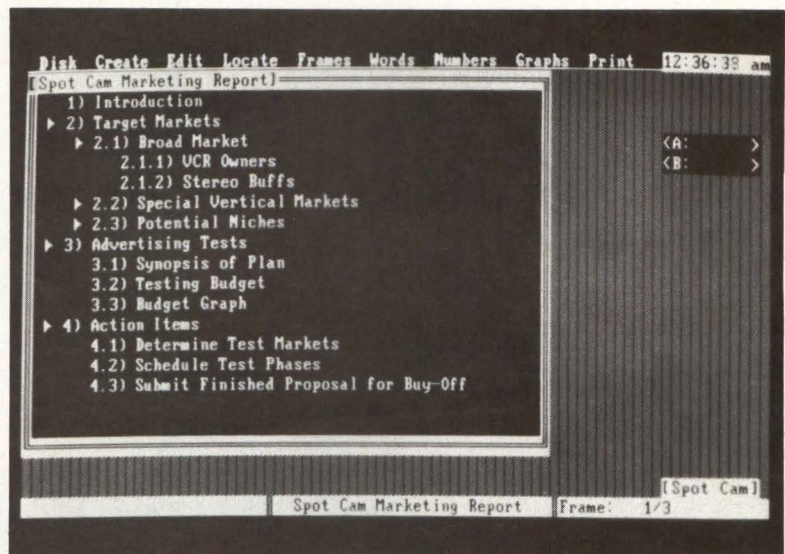
Despite a growing number of sophisticated generalized business packages for microcomputers and minicomputers, the latest trend appears to be specialty software for vertical markets.

Such software isn't limited to the usual spreadsheets, database managers, word processors, integrated solutions and general business packages. Innovative value-added distributors and value-added resellers are tackling specific vertical-market problems with a mix of hardware and software solutions. In addition, more emphasis is being put on the appearance of reports and presentation data, which requires more sophisticated solutions to match vertical-market needs.

Even though manufacturers of generalized business packages promise users a total solution, many VARs disagree. "Generalized business packages are just that," says Jack Petty, president of FoxMeyer-TBL Corp., Southlake, Texas. According to Petty, generalized business packages have too many shortcomings to meet most needs. Petty's company has developed a hardware and software solution for the pharmaceutical market.

FoxMeyer-TBL's Model 686 is a Motorola Inc. 68010-based board designed for the Multibus or VMEbus with non-standard software. The company does support Bell Laboratories' UNIX System V for development purposes, but for business operations it provides its own multiuser/multitasking operating system, called TBX.

Gordon Martin, FoxMeyer-TBL's vice president of engineering, explains that TBX is optimized for the system environment and the associated application language, TBL. "We



Ashton-Tate's Framework integrated software package uses an outline structure to develop application requirements. The integrated Fred programming language is then used, in much the same manner as spreadsheet formulas, to create the necessary application code.

understand what the hardware is supposed to do and how the applications are supposed to work. Most off-the-shelf operating systems and applications don't work well in our environments," says Martin. Consequently, FoxMeyer-TBL's vertical-market packages are written in TBL. Besides serving the pharmaceutical market, TBL provides applications aimed at veterinary medi-

Due to the shift toward vertical markets, retailers are starting to feel the pressure in decreasing sales of generalized packages.

cine and retail management.

FoxMeyer-TBL is only one of a growing number of companies reaching out to the vertical market. Another, Bluebird Systems Inc., Carlsbad, Calif., is also taking the vertical approach, but with a slightly different twist. Rather than build both the hardware and software, Bluebird is an IBM Corp. value-added dealer, adding value with software. "What we do," says company president Hal Tilbury, "is to take an IBM PC-AT and create a multiuser system that matches a customer's specific requirements."

The fledgling company, now in its third year, is just starting to enjoy the fruits of its labors, having done about \$4 million in sales in 1984. "When we began in 1982, we took the expected retail approach with an 8-bit machine using our own operating system, SuperDOS, and our version of Data General [Corp.'s] Business BASIC. The problem was, it was a CP/M world and retailers couldn't be made to realize that they had a ready library of business applications written for Data General machines," explains Tilbury.

The emergence of the IBM PC, however, opened up opportunities for Bluebird. Once SuperDOS was ported to the PC environment along with Business BASIC, the company began looking at vertical-market applications, as well as providing a standard offering of easily tailored applications. For example, Bluebird has standard accounts packages for receivable/payable, general ledger, payroll and inventory management and material requirements planning (MRP).

Bluebird has also created application and sys-

tem solutions for car-rental agencies and junkyards. One company using the Bluebird system is Hollander Publishing Co. of Minneapolis. Hollander specializes in providing a computerized cross-reference book of interchangeable parts for automobile salvage yards. Hollander originally developed their reference series on a DG Eclipse minicomputer system. Because Bluebird's Business BASIC is similar to DG's Business BASIC, moving the databases and applications to the IBM PC-AT was easy. "The key," says Bluebird's Tilbury, "is the SuperDOS operating system. It provides all the necessary file locking and handling that specialized database systems such as Hollander's require."

Retailers recognize shift

Due to the shift toward vertical markets, retailers are starting to feel the pressure in decreasing sales of generalized packages. "Retailers are still reporting strong sales of hardware but a drop-off in software," comments Mike Witter, publisher of *Computer Retailing* magazine, Atlanta. According to Witter, there are about 2,500 computer retailers, of which 1,000 are addressing vertical markets. "How many have a consistent plan is hard to say. Probably about a third," says Witter. He contends that the independents—not the large chains—tend to address vertical markets. "It's about the only way [the independents] have to compete," he says.

Besides Witter, numerous industry observers see a decrease in general business software sales. On the other hand, there has been a growing trend toward add-on applications for existing products. Examples include products from

Fred provides powerful development language

With a clear indication that developers are seeking better ways to add value to the systems they are selling, software providers such as Ashton-Tate are making efforts to provide products that can be tailored to specific applications.

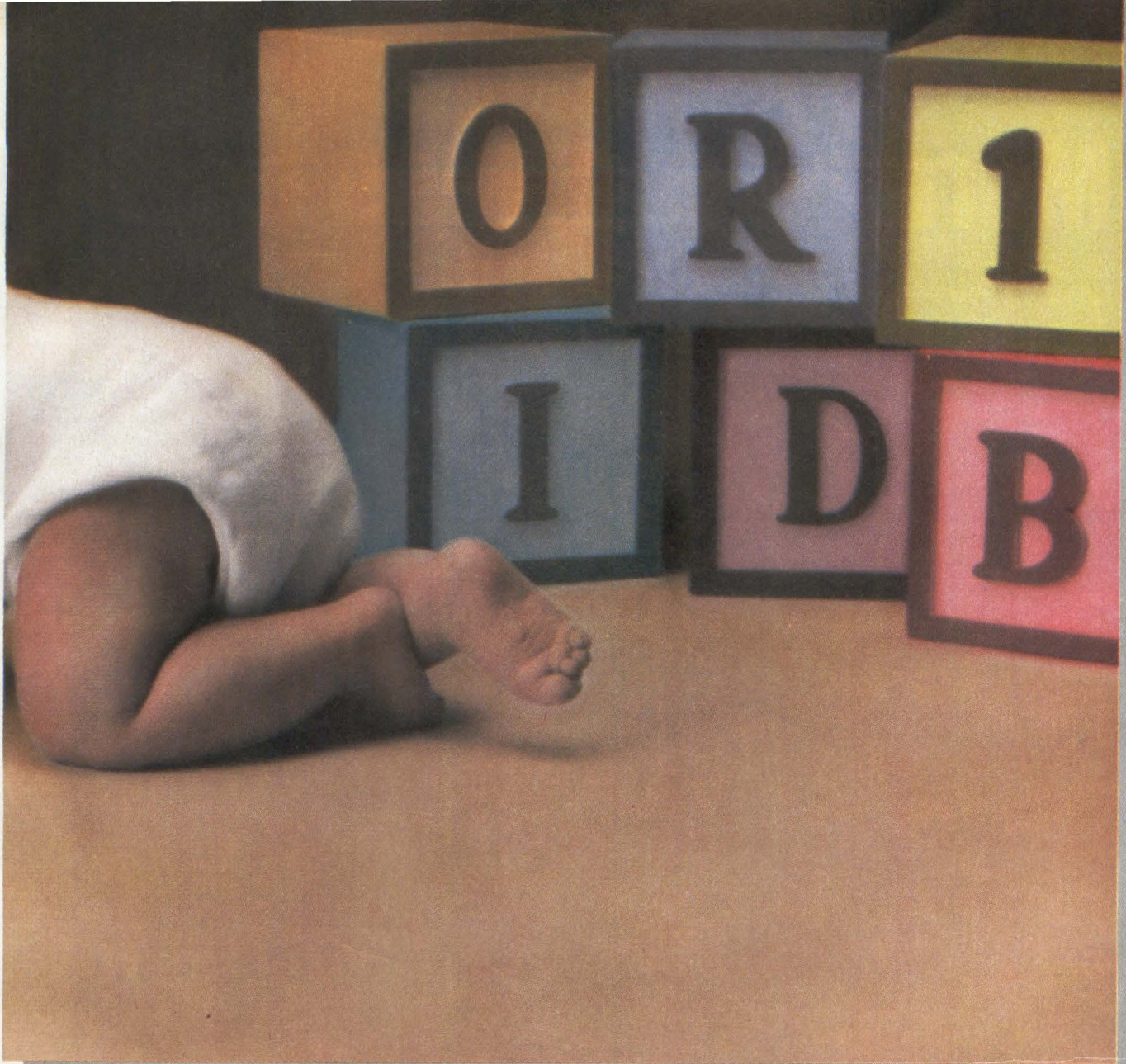
Ashton-Tate's integrated software package, Framework, falls into this category. The product is based on an outline metaphor and combines word processing, database management, spreadsheet functions, graphing and communications abilities, surrounded by a graphics-oriented window manager. However, developers and end users aren't limited to the structures provided by the package.


To meet the needs of value-added resellers, Framework also provides a powerful development language called Fred, which allows the creation of diverse applications. "The developer doesn't have to worry

about the user interface. We've provided that. Fred lets them develop the applications that they want," says Rob Lewis, Framework product manager.

Interestingly, Fred's syntax for entering formulas is much like what users of spreadsheets expect. In the creation of a Fred program, the developer first makes an outline of the program structure using the outlining feature of Framework. Then, each section of the outline, which is a separate frame, becomes the Fred code segment for the application.

Moreover, a screen-builder function allows the developer to arrange input fields into the desirable format. "Basically, Framework is similar to dBase II and III," says Lewis. "Both products allow developers to create specific applications. We merely supply the tools, and, in the case of Framework, the user environment."



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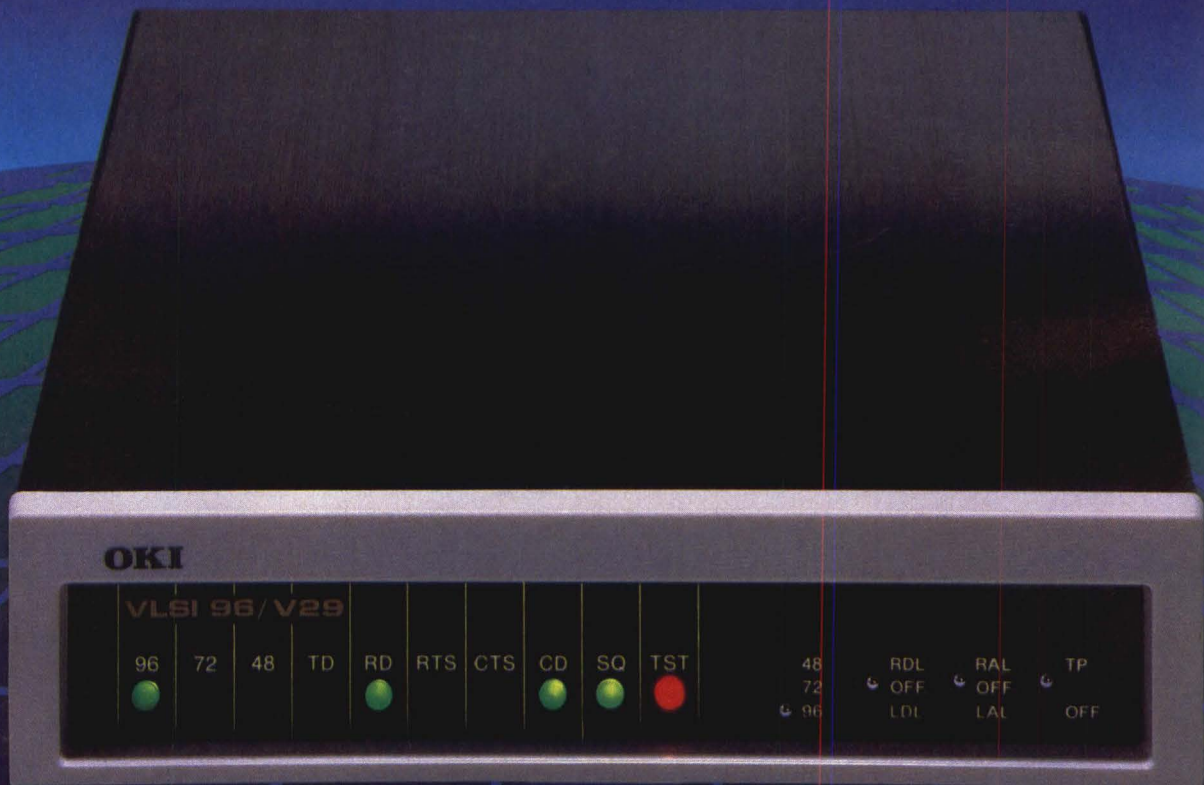
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'Developers are starting to recognize the hard-copy device as being part of the total system environment.'

OptionWare Inc. (formerly DSS Development) and GNP Development Corp. Both companies have developed sophisticated vertical applications around Lotus Development Corp.'s 1-2-3.

OptionWare's business applications (also called OptionWare) use 1-2-3 as the base operating environment. By using an OptionWare-developed language based on Lotus' macro commands, applications can be tailored to just about any environment.

Similarly, GNP's CPA+ is a fully integrated, menu-driven software program that simultaneously ties into accounts receivable/payable, general ledger and payroll. Like OptionWare, GNP uses the Lotus macro commands to create the necessary functions in the applications.

Although both the OptionWare and GNP products can be classified as generic, they can also be tailored to specific environments. But *Computer Retailing's* Witter says that companies like Lotus are going to have to go to the vertical market themselves. "It's a painful process, since it takes time to understand the business you want to address," says Witter.

Many software companies are already heeding Witter's words. Ashton-Tate, for example, has already benefited from the number of applications written in its dBase II and III. According to a company spokesman, more than 3,000 applications have been written for those powerful database managers. "We're already starting to see a similar trend for Framework, our integrated product," he claims (see "Fred provides powerful development language," Page 128).

But rather than let the market stall out, Ashton-Tate is developing a variety of applications as well. Similarly, Sorcim/IUS Micro Software, a division of Computer Associates International Inc., San Jose, Calif., has developed a full range of generic, yet vertical, packages. These packages, which include standard business packages, are designed to be integrated under the Easy/Plus windowing system, and can be tailored by VARs to match customer needs.

Start-ups jump on bandwagon

Start-up company Inspiration Systems Inc. is taking an integrated/non-integrated approach to providing its UNIX-based Prevail package as a base for VARs to build upon. "We do provide database management, word processing and so forth, but we don't lock the user in. The base is a strong development language that allows the creation of vertical packages," claims Dennis M. Moyles, chairman and chief executive officer. He insists that UNIX VARs can use Prevail as the development environment. The user interface serves as the shell. Using Prevail as a foundation

for creating applications eliminates the complexities of the operating system, he says.

Some VARs still like to build from scratch. Companies like FoxMeyer-TBL and Bluebird are betting that a substantial market exists for the do-it-yourselfer in the business world. Hence, products such as FoxMeyer-TBL's application language and operating system and Bluebird's Business BASIC seem to many VARs to be ideal solutions.

Roll your own

Other developers are also taking advantage of a variety of existing tools. Query Computing Services Inc., Redondo Beach, Calif., gravitates to the tools that best solve the problem at hand. Among the tools favored by Query are dBase II and III and compiled BASIC, FORTRAN and C languages, as well as assembly languages. "We have yet to find a single tool that meets all our needs," says Query president Steve Bostwick. "One day, we're building a point-of-sale cash register; the next, a real-time, event-monitoring system. Thus, each of our applications requires an in-depth understanding of the actual operation of the customer's needs. That's what vertical software is all about," insists Bostwick.

Moreover, Borland International, Scotts Valley, Calif., is finding strong interest by developers in Turbo Pascal for vertical-market packages. Thus, the company has developed a set of Pascal tools that ease development tasks. In a similar manner, software writers are finding that using C language is becoming easier.

Additionally, companies like Ryan-McFarland Corp. are experiencing strong sales of COBOL due to the growing trend toward vertical applications. The commercial operating system (COS) is growing in numbers as well. COS is an optimized operating system for COBOL and, as such, simplifies application design. The number of COBOL applications is growing, and Ryan-McFarland can list more than 200 companies offering vertical-market packages for the business language.

Another company that is willing to take a chance on the vertical market is The Mega Group Inc., Irvine, Calif. This company offers mainframe software designed to work with microcomputer-based files. Specifically, their Megacalc spreadsheet, which runs on mainframe-sized computers, is similar to Lotus' 1-2-3. Due to the computing power available on Megacalc, large spreadsheets and multiple spreadsheets can be created and linked.

Although Megacalc may be looked on as just another way of doing a spreadsheet, Alan V. Cameron, Mega Group's chairman and chief

Not all the action in vertical business software is in the basic application.

executive officer says it's really the link to information bases. He adds that their intention was partly to make Megacalc flexible enough to address a variety of market needs. "We're in the business of environment translation. Therefore, we allow data created in one environment [i.e., Lotus 1-2-3 on a microcomputer] to be moved to a larger mainframe environment," says Cameron.

Cameron insists that this opens new opportunities to VARs that create vertical-market applications. "Since information is the key element, we provided the connective tissue to large pieces of information." Notably, the Megacalc product isn't limited to just spreadsheets but allows the connection of several diverse types of information. For example, information can be extracted from the database, placed in the spreadsheet and returned, using the Structured Query Language developed by IBM. Moreover, the data can be converted to graphs and even included in word-processed documents. "Connecting data is an important element, especially for vertical markets," claims Cameron.

Output goes vertical

Not all the action in vertical business software

is in the basic application. Businesses are attaching more and more importance to the quality of hard-copy output. Additionally, the growing availability of low-cost (under \$10,000) laser printers is making it easier to achieve high-quality results.

For example, Visual Engineering Corp., San Jose, Calif., and Imagen Corp., Santa Clara, Calif., have been working closely to develop better output for business reports. Visual Engineering's Prochart software is designed to produce tailorable, presentation-quality business charts. "The problem was that there was really no acceptable hard-copy method of reproducing the graphs," explains William B. Elmore, president of Visual Engineering. However, Imagen, which produces a 12-page-per-minute laser printer, says it has developed the necessary software to provide typeset-quality hard copy in concert with the Visual products.

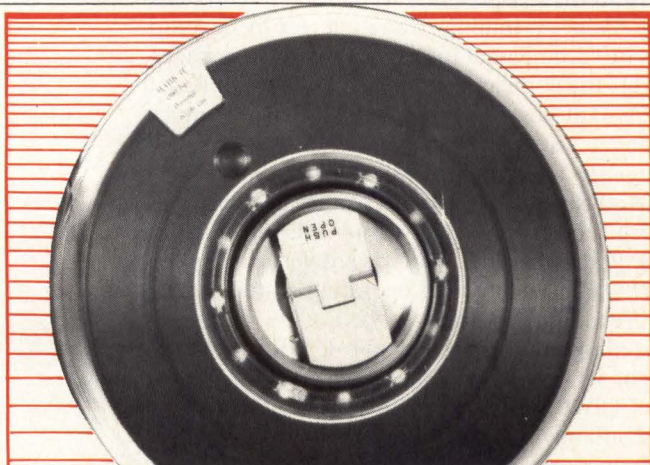
Michael Cohn, director of Imagen's support services, says quality hard copy is becoming critical and is being pushed by people doing vertical-market software. "It has always appeared in the past that the hard-copy output was the last thing anyone thought about. Now we're finding that a lot of VARs are looking for quality output first and building the rest of the solution around it."

Charles M. Geschke, executive vice president for Adobe Systems Inc., Palo Alto, Calif., maker of PostScript typesetting software for laser printers, agrees. He notes that, due to the diverse and vertical nature of many new applications, most developers want more control over the final output. "Developers are starting to recognize the hard-copy device as being part of the total system environment. They want to control it, and they want the tools that let them control it to match their specific needs," says Geschke. Thus, Adobe provides developers with software to manage the laser-printer environment.

Market size unclear

No one has a real handle on what the market size is for vertical applications. "Right now you can speculate all you want," says *Computer Retailing's* Witter. He contends that vertical applications are a gray area because a lot of the research work on the market is being done by independent consultants.

Although market size is unclear, many observers agree that the heyday for general-purpose software is over. □



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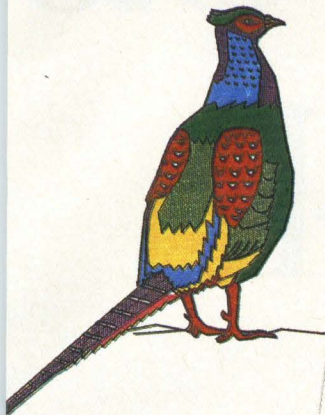
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Fig. 2

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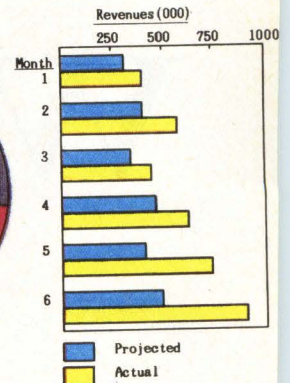
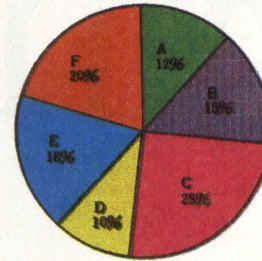
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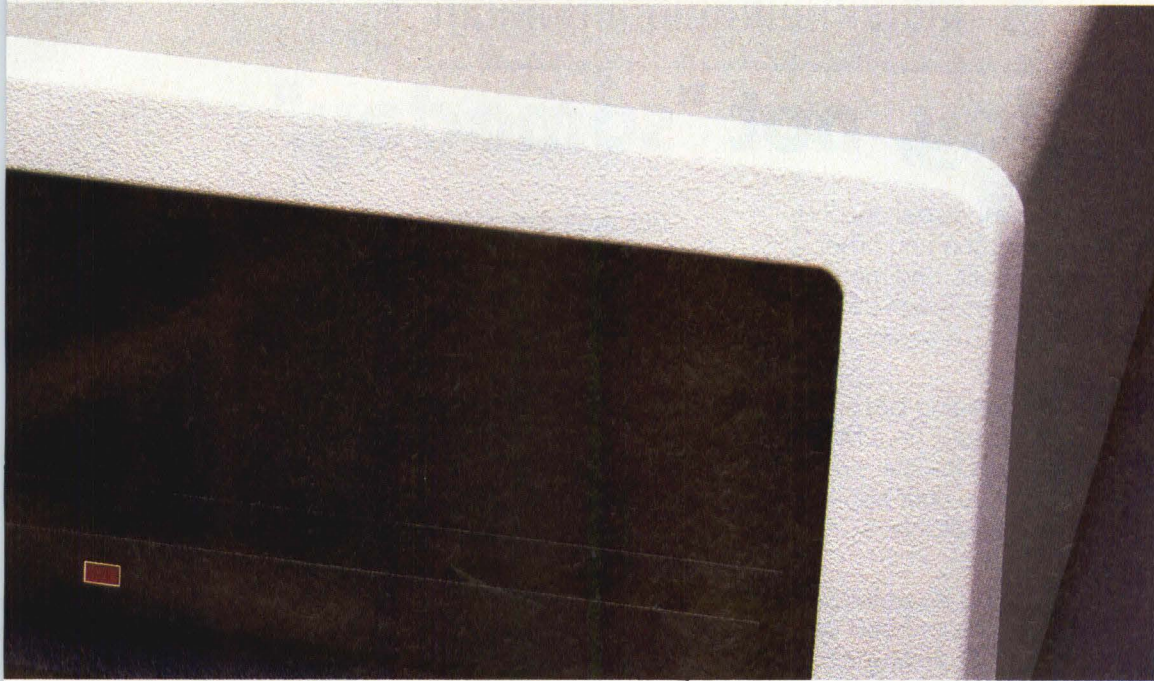
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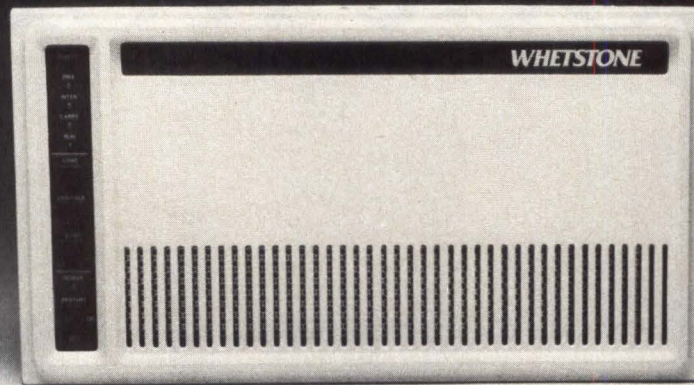
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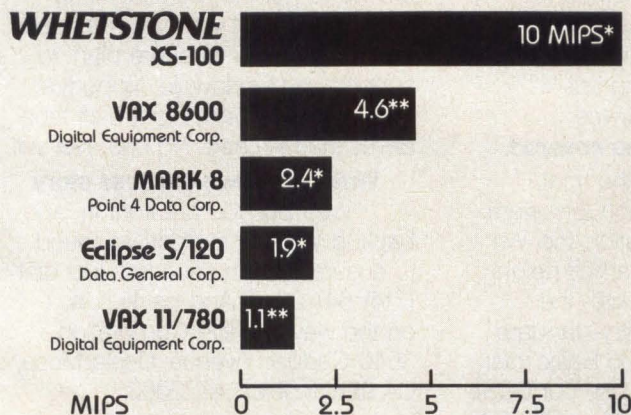
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STRATEGY DEBATES CLOUD OFFICE AUTOMATION

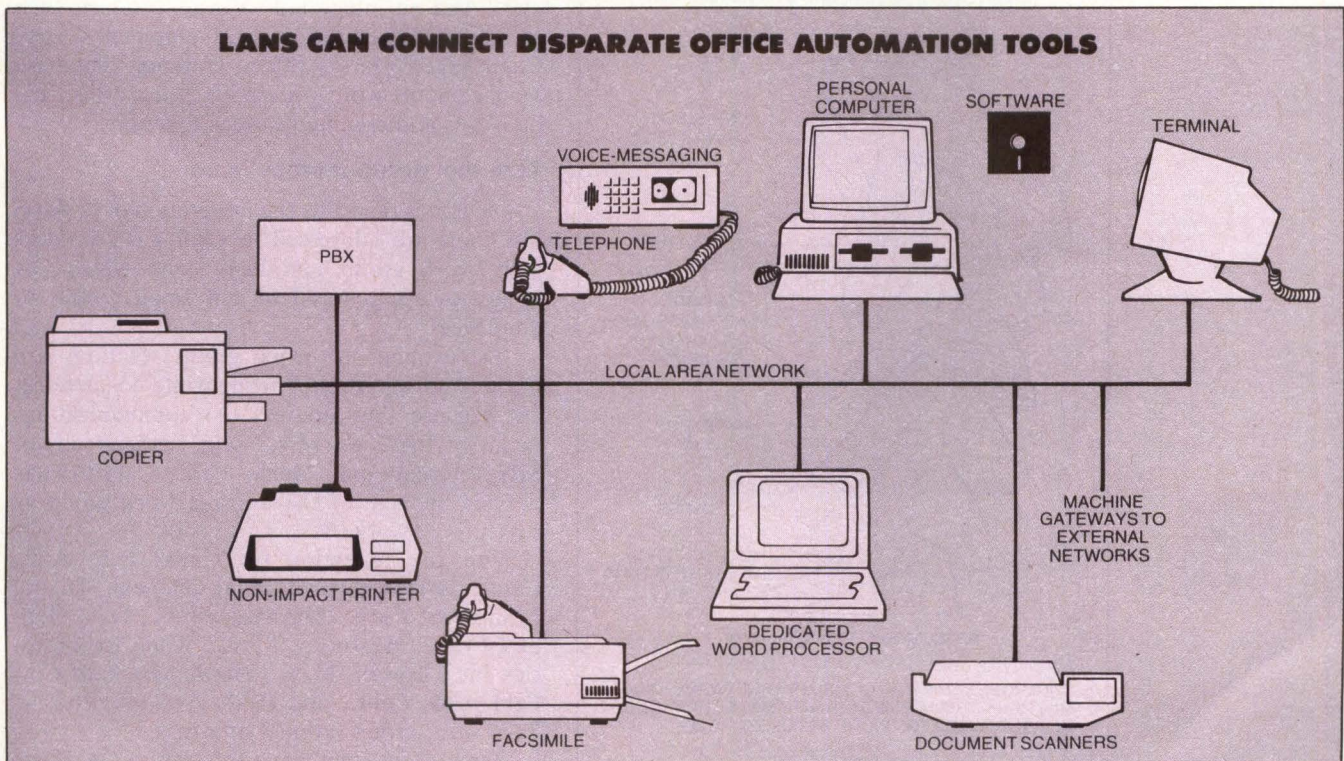
As IBM, DEC, DG and Wang solidify plans, continued controversy centers on multivendor environments, standards and work groups

Jerry Borrell
Senior Western Editor

Spurring developments in office automation (OA) is a shift in the labor force from blue- to white-collar workers. Jack Walsh of Visual Technology Inc., New York, points out that 1983 was

the first year that capital equipment expenditures on office workers equaled those spent on factory workers.

Office workers insist that their present equipment—typewriters, word processors, copiers, phones and facsimile machines—be retained. At the same time, they want new tools that promise



While office workers demand the latest tools of the trade—including PBXes, voice messaging and document scanners—they want to retain familiar printer, copiers, and facsimile machines.

The integration of the telephone and the computer spawned a number of software developments in integrated voice-data products.

higher productivity: personal computers, smart telephones, electronic mail and messaging services, local area networks and high-quality desktop peripherals.

The flurry of OA expenditures has meant in part that corporate data-processing departments have less control over automating offices. Even in large corporations with central OA policies, the sophistication and distinctive purposes of new equipment dictate that separate management-information systems, telecommunications and other administrative areas be run as specific segments within OA. Christine Hughes, vice president of the Gartner Group Inc., Stamford, Conn., contends that the greatest problem in automating the office today results from fractionalized decision-making within organizations.

Today's OA planner needs to consider integrated telecommunications, such as private branch exchanges (PBXes), broadband networks and telephone-based products; central data processing and storage; office support and

training; integration of new technologies, such as on-demand publishing; and interfacing and compatibility. Recently introduced products, therefore, are a mixed blessing to the OA planner who has to juggle all of these factors.

The explosion of products at all levels compounds the difficulties of users and vendors alike. Four product areas in particular—computing, integrated voice-data, support and integrated software—prompt observers to predict that integrated office systems are well on their way to widespread use. Vendors respond to any apprehension about the surfeit of offerings by making “integration” of these components their latest catch phrase.

The integration of the telephone and the computer, for example, spawned a number of software developments in integrated voice-data products (MMS *Communications Digest*, Feb. 15, Page 99). One such product, Watson, from Natural Microsystems, Framingham, Mass., adds voice- and data-communications capabilities to the IBM Corp. PC, along with a long list of telephone-management functions. Another product, the Desktop Organizer, from Warner Software Inc., New York, allows the PC to manage functions ordinarily handled separately: It serves as client index, file, note pad, calculator, word processor, auto-dialer and scheduler. And an integrated software product, such as Symphony, from Lotus Development Corp., Cambridge, Mass., offers graphics, database management, word processing, spreadsheet capabilities and communications functions.

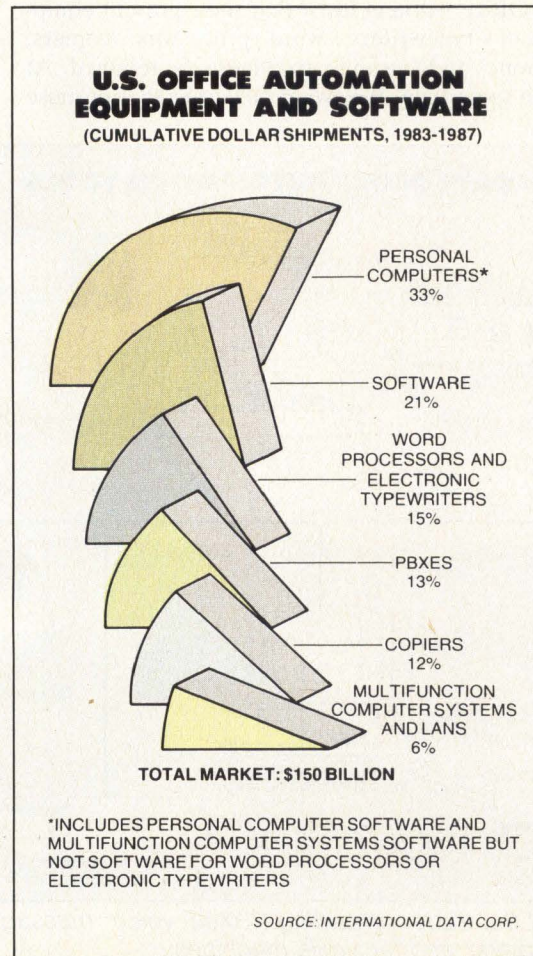
Take the 'group-therapy' cure

The issues raised by the integration of desktop OA tools are addressed in what most vendors call “work group” products, with which OA strategies are tailored to suit small groups of employees.

“Department or work group solutions are more important in supporting white-collar workers because they address the communications needs of these workers,” says Linda Bruns of SRI International, Menlo Park, Calif. Bruns defines the size of the average work group as seven to 30 workers.

With the exception of Xerox, Palo Alto, Calif., the major players in the OA field—Digital Equipment Corp., Maynard, Mass., Data General Corp., Westboro, Mass., Wang Laboratories Inc., Lowell, Mass., Hewlett-Packard Co., Palo Alto, Calif., and IBM, Armonk, N.Y.—have work-group product offerings.

Wang offers a multistep solution to OA needs—a range of products that provides software, networking, peripherals, microcomputers,



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switching systems, and support. Similarly, Henry Ancona, DEC's product group manager for office and information systems, says that DEC's approach targets five key areas: word processing, electronic mail, business application software, multifunction office systems and emerging technologies. DEC labels this approach "All-in-1."

Along that line, DG calls its product offering the Comprehensive Electronic Office (CEO). Wendy Ruess, manager of market development for DG's Information Systems Division, explains that "CEO integrates the software capabilities for a total office environment—from administrative to application needs—with the computer offerings of the company." Ruess declares that no other company can claim the breadth of CEO's utilities on systems ranging from portables to superminicomputers.

HP has reorganized its OA planning staff into four groups to support its "Personal Productivity Center" approach to OA. Tom Hill, market manager of office systems, remarks, "The company's advantage is in its installed base of 17,000 3000 Series minicomputers."

Although few companies openly discuss their plans for integrating office products, HP has formulated an OA philosophy that addresses integration strategy. The company claims to seek a "unified systems architecture" that enables users from manufacturing, office and engineering departments to share data and resources. The implication is that corporate-wide computer, communications, applications and automation needs be solved by a central source.

Workstations proliferate

Although the office workstation has been long thought an OA panacea, it so far has been a greater success as a marketing idea than as a realized product. During the late 1970s, companies promoted products that did little more than combine communications equipment and computers on a desktop. The products were not successful, primarily because of their high cost and large size.

But now Advanced Resources Development, (ARD), a Medfield, Mass., market research concern, reports a lucrative market for workstations. ARD cites 1983 shipments of 200,000 workstation units for support staff alone. However, ARD researchers predict that future growth lies in the "executive workstation" market, in which annual sales are expected to reach about 750,000 units by 1989. Market research company International Resource Development Inc. (IRD), Norwalk, Conn., predicts that 85 percent of the 600,000 potential executive-work-

station users will own such a workstation by 1994. IRD's figures are based on users among chief executive officers, their staffs, and line executives and managers.

Research company Venture Development Corp., Wellesley, Mass., in the recently published "U.S. Executive Workstation Market Report," qualifies its enthusiasm for the workstation market: "The true executive workstation evolves into a voice-data terminal, used to access information including corporate data, on-line data files, electronic and voice mail, and other functions crucial to executive decision-making."

Communications: the new Babel

As products for OA have grown in complexity and power, so has the need for these products to communicate. From 1983 to 1984, OA-related communications products have risen to prominence with the primary focus on integrated voice and data, LANs and switching systems. Louise Herdon Wells, research analyst for Dataquest Inc., San Jose, Calif., says the need to share resources, files and applications and the desire for electronic mail have pushed along communications products.

However, two technical barriers to better communications remain: the inability to transfer files between computers and a lack of standards, which continues because no single vendor has sufficient OA-market share to provide overall direction.

Currently, LANs offer a solution to office communications. However, Charles Newton, of the Newton-Evans Research Co., Elliot City, Md., suggests in his company's report, "Computer, Communications and Office Automation Industries," that LANs will not suit large corporations in the long run because of the complexity of companies' communications needs.

Officially, of course, standards exist. The International Standards Organization's (ISO) Open Systems Interconnection (OSI) model provides the framework on which communications products are often built, but to date "even IBM with Systems Network Architecture [SNA] does not address all of the types of functionality available," comments Tim Caffrey, director of strategies at International Data Corp. (IDC), Framingham, Mass. The market for communications devices should be open to suppliers that can work with the growing base of IBM PCs, he says.

The 'paper chase' ensues

The inability of OA systems to exchange text represents one of OA's most vexing compatibility problems. And, again, as the products from

Two technical barriers to better communications remain: the inability to transfer files between computers and a lack of standards.

The market for communications devices should be open to suppliers that can work with the growing base of IBM PCs.

different vendors proliferate, so do the problems associated with the products' inability to share documents.

The years 1983 and 1984 saw a growing attempt to reduce such problems through the development of a common communications protocol for documents. IDC's Caffrey remarks, "There is a growing effort to standardize the way in which documents are stored and transmitted to provide a common way of exchanging documents in the office."

At present, there are three competing standards. IBM has proposed the document-interchange architecture/document-content architecture (DIA/DCA). The U.S. Navy, the Department of Commerce, and the National Bureau of Standards tout the Document Interchange Format, which is supported by Xerox and Datapoint Corp., Austin, Texas. Finally, the X.400 standard has been proposed in the Comité Consultatif Internationale pour Téléphone et Télégraphique. Caffrey thinks IBM's standard may gain acceptance due to IBM's large

installed base, although previous IBM standards, such as the SNA, for instance, have met resistance both in Europe and in the United States.

Wang's director of strategic planning, Peter McElroy, feels that OA depends upon the ability of communications networks to become as transparent and as easily used as today's telephone system. This may be difficult in a deregulated communications environment in which industry develops its own standards.

Overall, businesses want tools that will improve the day-to-day work flow. Although eager to serve this need, system integrators must also provide systems that will fit into a complex environment of communications, computers and information storage products. User demands for more features per product exacerbate the integrators' difficulties. □

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 particular law violated.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1.1	1.3	1.5	1.7	1.7	1.8	1.9	2.2	2.2	2.1	2.4	21.9	
1.8	1.8	1.8	1.1	1.1	1.3	1.1	1.3	1.3	1.3	1.3	14.8	
6.7	6.3	6.7	6.2	6.3	6.4	6.7	6.8	6.3	6.4	6.2	6.1	71.1
6.3	6.6	6.2	6.8	6.1	6.3	6.9	6.9	6.8	6.9	6.6	6.8	187.8

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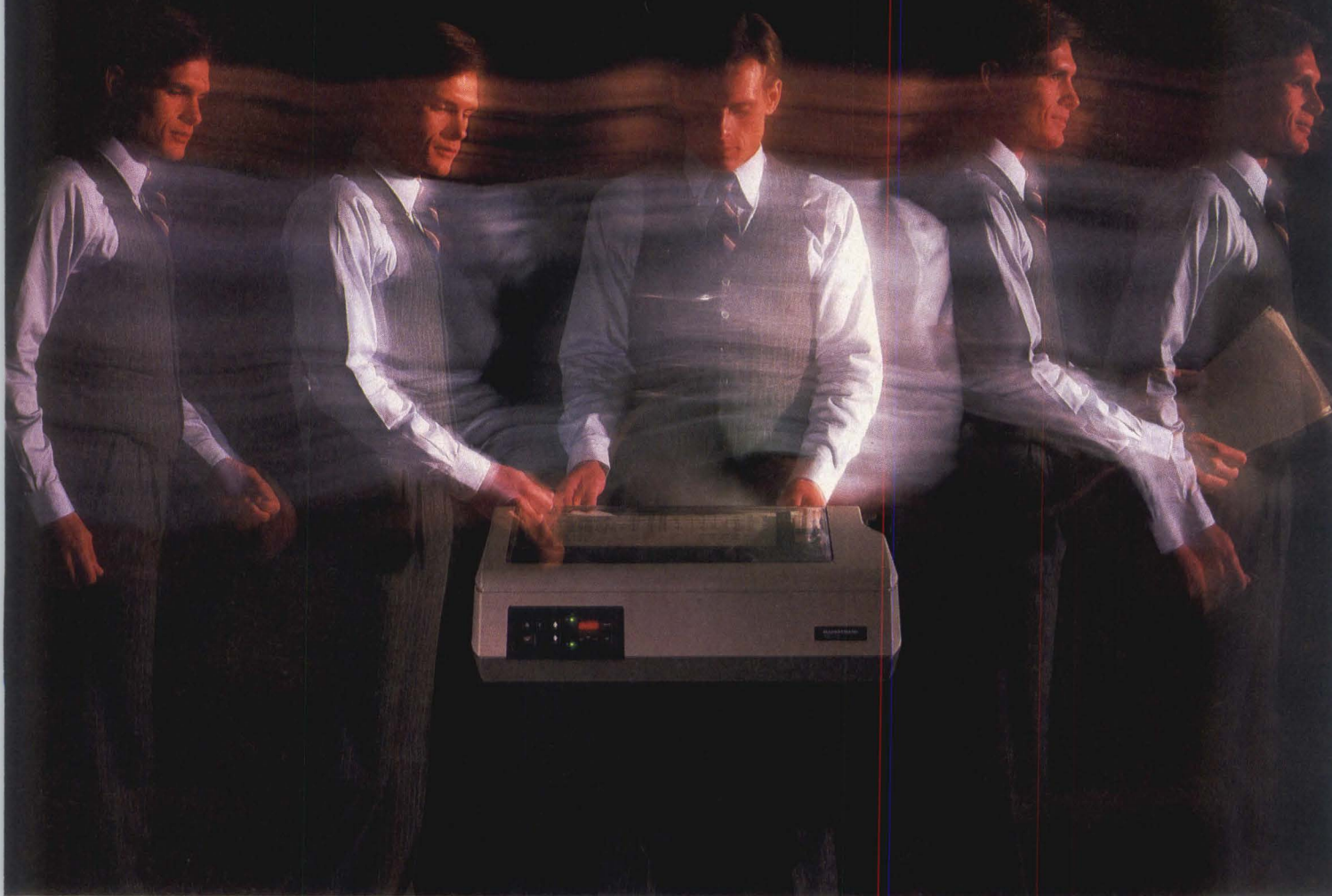
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such as office automation, real-time graphics and process control

Patrick Goodrich
Integrated Digital Products Corp.

Minicomputer systems that serve a growing organization of users must be re-evaluated constantly in terms of throughput—the speed at which computers process input and produce data. As the number of computer ports increase, so, too, must the complexity of the computer's software. Typically, as the system grows, users and OEMs face the discouraging realization that the processor is overloaded and the performance is degraded.

Because increased work loads contribute to slower throughput, CPU problems appear as horsepower problems; the traditional approach to increasing CPU speed has been “the more horsepower the better.”

Many current minicomputer systems are based on architectures that were developed during the 1960s. There have, of course, been many developments since then—including extended instruction sets and expanded memory space with mapping—but there is growing evidence that traditional minicomputer architectures are “topping out.” Modest or even nominal increases in the throughput of high-performance minicomputers have been attained only through disproportionate cost increases.

Simpler is faster

While the tendency of most processor designs has been toward increased complexity as a means of achieving better throughput, experimental reduced-instruction-set computers



The Nova-compatible Whetstone processor hits speeds of 10 MIPS with an architecture that has a notably low memory-cycle time and a large instruction buffer.

(RISCs) have been recently built. RISCs demonstrate the possibility of significantly better throughput through simplified architectures.

Traditional minicomputer architectures emphasize the power of the instruction set. The reasoning behind this approach is obvious: Finely delineated instructions do more than simplified, basic instructions do. So, complex instruction sets, implemented in microcode, should increase throughput.

The trouble with that reasoning, however, is clear. Such microcode-programmed architectures severely hamper main-memory control: Several microcoded instructions are required to perform a single memory cycle. And, with microcycle speeds constrained by the time it takes to access the PROM, the machine, typically, can access memory only as fast as 2 million

times per second. As a result, a microprogrammed CPU is tied to the use of slower dynamic RAMs because it cannot efficiently use faster memories associated with static RAMs.

Furthermore, the processor must compete for direct-memory access (DMA), if not actually control all transfers. Because the I/O bus is under the control of the microprogram, heavy periods of I/O tie up the CPU for a significant amount of time with data transfers, thus suspending instruction execution.

Large multiuser systems avoid the speed constraints of disk access by providing large memory capacity. But, in a microprogrammed machine, because instructions are executed out of the large main memory, this memory must be distributed across several printed-circuit boards. This distribution contributes to bus delays, which degrade memory-cycle time, thereby reducing the speed of instruction execution.

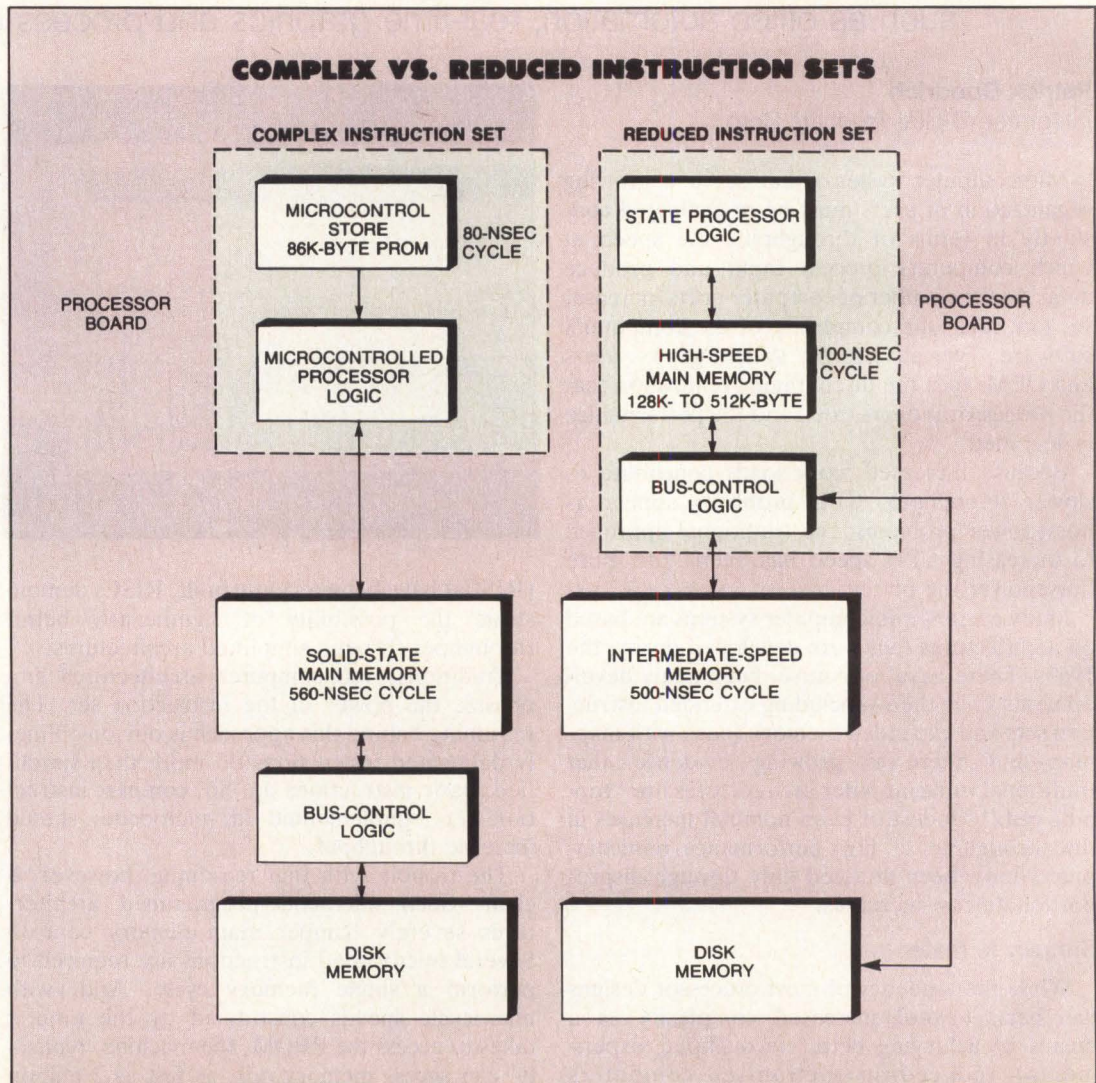
In a RISC machine, the architectural emphasis differs. Although the power of each instruction is smaller, these simpler instructions reduce architectural complexity. When balanced properly, other architectural elements provide significantly higher speed.

Instruction set provides DG tie-in

Integrated Digital Products Corp., Anaheim, Calif., has implemented a simplified Nova instruction set in its Whetstone series of minicomputers. Whetstone XS-100, first made available in mid-1984, is currently the fastest CPU in the line. Its 100-nsec instruction speed and 200-nsec DMA transfer time derive from a unique hardware implementation of the Nova instruction set in a triply overlapped, pipelined architecture designed to maximize use of memory bandwidth.

The small Nova instruction set—18 basic instructions with four addressing modes—makes

Conventional architectures with complex instruction sets, in contrast to RISC computers, rely upon microprogramming. Each approach uses bus-control logic, but with complex instruction sets the bus-control logic interrupts instruction execution during I/O data transfer. In contrast, RISC executes instructions and I/O transfers in parallel.



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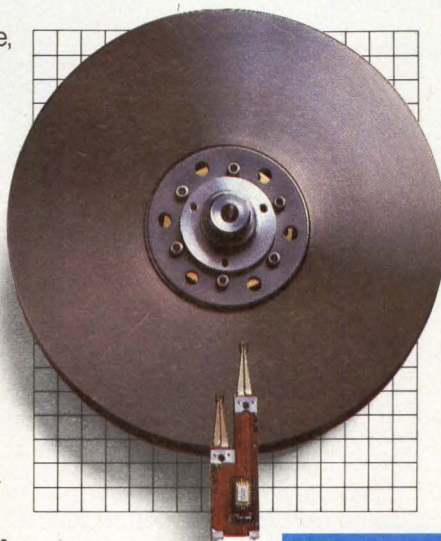
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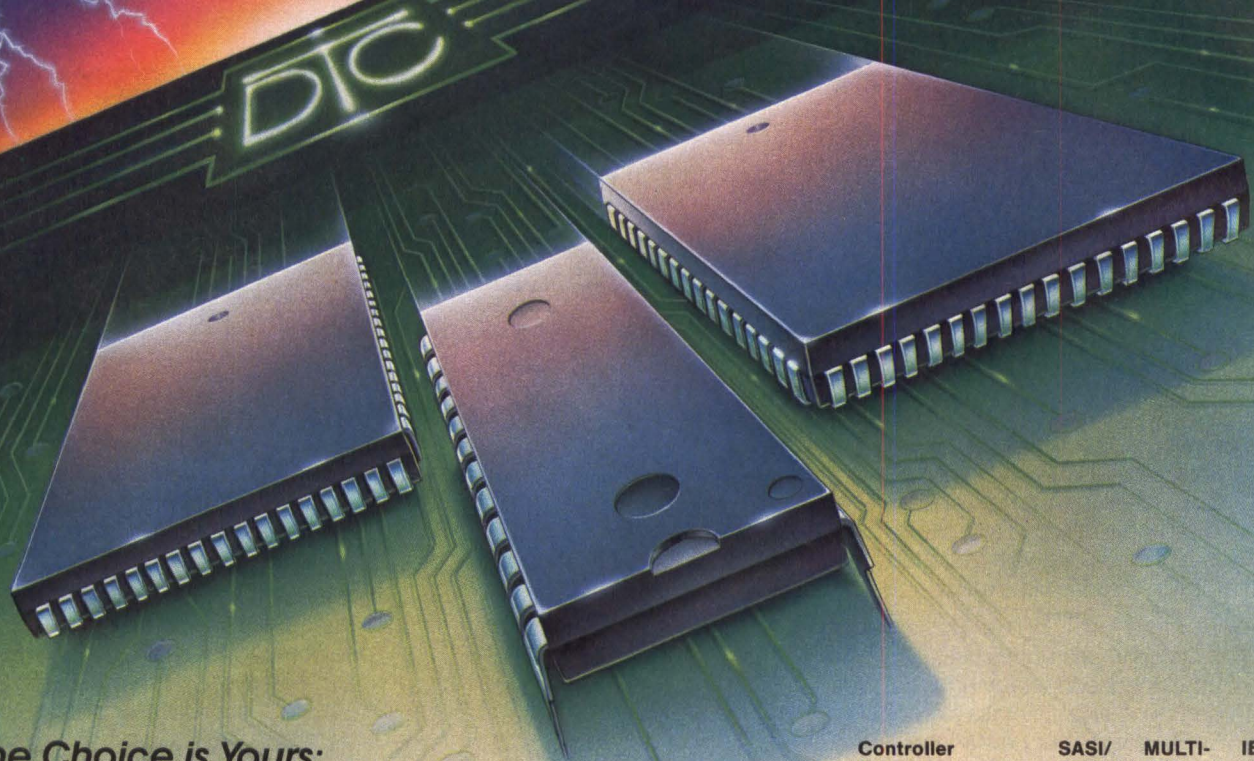
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Specifications	C2075	C2120	C2476
Storage capacity, fixed disks	53.5 megabytes	87.8 megabytes	475.9 megabytes
Storage capacity, removable cartridge	26.7 megabytes	35.1 megabytes	—
Positioning time, average	32 milliseconds	32 milliseconds	15 milliseconds
Interface	SMD/LMD	SMD/LMD	ESMD
Transfer rate	1209 kilobytes/sec	1209 kilobytes/sec	1859 kilobytes/sec
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possible a simple state-machine implementation. The Nova instruction set provides two important benefits: compatibility with a large group of existing hardware and software (the Data General Corp. and compatible worlds) and logic simplicity, which improves performance.

State logic controls sequencing and data paths in a processor, using only simple registers and combinatorial logic. In contrast, a microprogrammed machine uses a microprogram counter and ROMs to sequence and control the processor. Therefore, the state logic of RISCs is significantly faster.

The Whetstone machines combine the Nova instruction set with high-speed emitter-coupled logic (ECL), large-scale integration and closely coupled memory to provide instruction execution of 10 million instructions per second (MIPS), a speed once achieved only by so-called supercomputers.

Whetstone's instruction-execution speed translates into a throughput improvement three to eight times that of microprogrammed machines. For example, disk-intensive processing, typical in office-automation environments, benefits from much-reduced competition for memory access.

Execution speed blazes

In any computer architecture, there are two keys to throughput: computational speed and data control, usually described as memory-cycle time and memory management, respectively.

Computational speed is a function of the limitations that are imposed upon electronic impulses by three types of delays: logic delays, bus delays and memory-access time. Obviously, if any of these delays can be shortened, throughput will increase.

The logical simplicity of the Nova instruction set allows implementation of silicon-based logic that is physically close to the high-speed main memory. That minimizes logic delays and eliminates bus delays. The speed gained through the use of silicon logic more than overcomes the delays caused by an increased number of instruction fetches.

The high-speed ECL used in the Whetstone helps to maximize the use of memory bandwidth by minimizing the amount of time that logic components consume within a memory cycle.

LSI components enhance the ECL speed while reducing many of the "penalties" usually associated with ECL. Because signals travel on the chip rather than across a printed-circuit board, logic delays are reduced, thereby substantially lessening overall cycle times. LSI also minimizes component count, power consump-

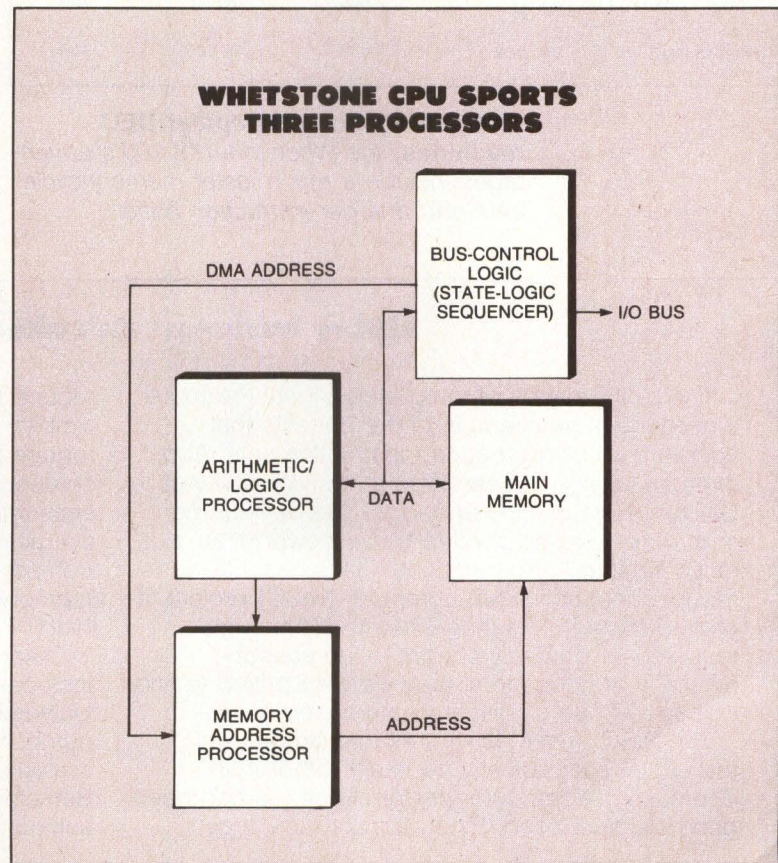
tion, heat generation and board space. These reductions increase reliability and make additional board space available for memory directly adjacent to the processor.

By contrast, conventional architectures require so much logic that memories must be located away from the processor on separate boards. Because bus delays between boards can easily triple memory-access time, even the speed attained through the use of fast memory chips is largely wasted in a conventionally microprogrammed architecture.

Closely coupled memory permits the memory to be processor-driven, which allows the processor to run at its full speed. The processor is responsible for keeping memory as active as possible to maximize memory bandwidth.

Instead of utilizing conventional dynamic RAMs for main memory, Whetstone uses as much as 512K bytes of high-speed static RAM. Static RAMs are two to eight times faster than

Whetstone's triply overlapped processing consists of three independent elements: an arithmetic/logic processor, a memory address processor and a separate state-logic sequencer, each of which runs concurrently.



HOW THE XS-100 STACKS UP AGAINST DEC

	VAX 11/785	VAX 8600 Venus	Whetstone XS-100
Memory cycle time (msec)	600 to 700 for 64 bits	560 for 128 bits	100 for 16 bits
Virtual address space (G bytes)	4	4	4
Physical address space (M bytes)	32	32	32
Dynamic memory parity	8/64	7/32	6/32
Microcycle time (nsec)	133	80	none
Control store size (K bytes)	86	86	none
Internal data path (bits)	32	32	16
Instruction buffer (bytes)	8	8	512K
Memory cache (K bytes)	32	16	512
No. of registers	16	16	4
No. of basic instructions	304	304	18
No. of interrupt levels	32	32	16
No. of addressing modes	9	9	4
Power consumption (watts)	2,500	6,500	700
Heat dissipation (Btu per hour)	8,530	22,000	360

Compared with two popular DEC machines, the Whetstone XS-100's advantages include a much faster memory-cycle time and a larger instruction buffer.

dynamic RAMs and provide an access time of 35 nsec or less. Even the fastest dynamic RAMs require 250 nsec to cycle. In addition, static memories do not need error correction as do dynamic memories because static memories are not susceptible to the same soft errors as dynamic memories.

Another key to throughput is how the CPU manipulates and controls data stored in the system. In a typical microprogrammed machine, everything revolves around a large homogeneous memory. The CPU transfers large data blocks into memory from the disk and executes instructions directly out of main memory. Memory-cycle time is 560 nsec in high-performance minicomputers such as the Digital Equipment Corp. VAX 8600. Complex extended instruction sets are used to minimize instruction fetches as much as possible.

Typically, the microprogram controls everything, including the I/O bus. During an I/O channel transfer, the CPU must pause in its processing to control the I/O bus. These wait states obviously restrain throughput, because they interject a hiatus between successive executions of instructions.

Whetstone's RISC architecture requires a hierarchical approach to memory management. Although Whetstone executes instructions directly out of main memory, just as a microprogrammed machine does, the memory is very fast. It cycles about five times as fast as the VAX 8600. The processor and all main memory reside on a single board. To ensure that the CPU is processing continuously, main memory is constantly fed by an intermediate-speed memory, which differs from a cache because it is located

RISC-y business' unlooked-for payoff

The performance of Integrated Digital Products' Whetstone is an example of the benefits that accrue from using reduced instruction sets. About three years ago, researchers at the University of California at Berkeley undertook the development of a computer designed to be as powerful as, but much simpler than, traditional machines. Called the reduced instruction set computer (RISC) project, it proved more fruitful than expected. Although researchers primarily sought to increase the reliability of computers, they were surprised to find that speed had significantly increased as well.

The RISC project illustrates that simple instruction sets actually augment rather than decrease net computer performance, as had been generally supposed. Extended instruction sets

reduce the number of instruction fetches and simplify programming. However, the logic they require greatly increases the number of components, processor size and power consumption. These factors, in turn, decrease overall reliability. In addition, the greater number of components makes it more difficult to position memory close to the processor—another vital factor in maximizing system speed.

Other research into simplified instruction sets includes the MIPS processor from Stanford University, and the 801 project from IBM Corp. The number of instructions implemented into the systems was 120 at IBM, 55 at Stanford and 39 at Berkeley. Although the designs varied, the results substantiated the Berkeley findings.

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between the disk and main memory rather than between the disk and processor.

The intermediate-speed memory cycles in 500 nsec—about as fast as the speediest microprogrammed CPUs. It is available in configurations as large as 32M bytes, sequestered on separate boards. This provides the additional memory necessary for I/O-intensive, multiuser applications. A 32M-byte, intermediate-speed memory provides sufficient memory capacity theoretically to support 512 ports—all serviced by the same 512K-byte main memory.

The intermediate-speed memory functions as a buffer between main memory and disk data. Upon command from the CPU, it copies data from the disk and stores it under the control of a heuristic algorithm. Data is transferred between main memory and the off-board, intermediate-speed memory via a high-speed DMA channel.

Although the intermediate-speed memory functions as a buffer, its purpose is to minimize redundant disk transfers. During periods of heavy I/O, disk transfers hinder throughput because they restrain the CPU's processing capacity. But in most applications, disk transfers also tend to be repetitive—that is, users tend to access the same data over and over again. For this reason, the intermediate-speed memory must constantly evaluate the data it is storing and clear from its space all data blocks not being continually re-accessed.

Whetstone's intermediate-speed memory employs a least recently used algorithm, the concept that data probably will not be reused if it has not been used within a given period of time. The algorithm replaces data after it has fallen into disuse.

Intermediate storage of data blocks allows the processor to run at nearly full speed—regardless of the number of users or the amount of data being transferred to and from the disk. This effect creates a large virtual-memory space—as large as the main and intermediate-speed memories combined. In this arrangement, throughput is constrained only by non-redundant disk transfers.

How pipelining works

In Whetstone, memory cycles are not only faster, but fewer of them need to be devoted to the interruptions of I/O channel transfer. This is due to Whetstone's "three-level pipeline architecture."

Pipelining enables a computer to execute different parts of an instruction simultaneously. For example, a CPU does an arithmetic computation between registers while fetching the next instruction. Whetstone's CPU contains three pro-

cessors, all functioning independently of main memory: an arithmetic/logic processor, a memory address processor and a separate state-logic sequencer designed to control a single I/O or DMA channel.

This arrangement, called "triple overlap," permits DMA transfers to occur simultaneously with normal instruction execution. The parallel execution made possible by the pipeline means that only one in 10 memory cycles needs to be diverted in order to affect an I/O transfer. Thus, processing speed is not noticeably degraded because of data transfers between memories and disk.

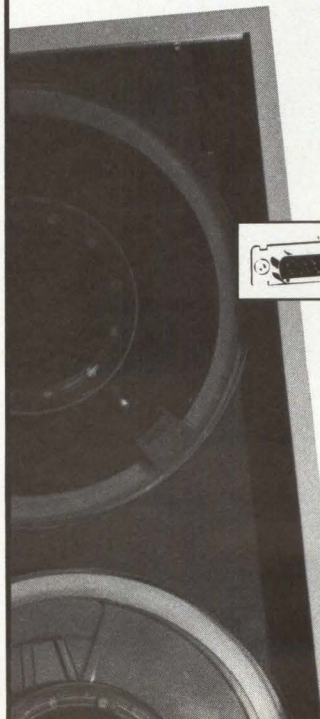
Whetstone can be integrated into any Novacompatible hardware configuration. The computer is software-compatible with several operating systems. A special version of the VMOS operating system, to be made available this year, will make Whetstone fully compatible with DEC PDP and VAX machines. □

Patrick Goodrich

is founder and president of Integrated Digital Products Corp., Anaheim, Calif. He was previously with Point 4 Data Systems, Keronix and International Data Systems. Goodrich holds a bachelor's degree in computer science from California State University.

Interest Quotient (Circle One)
High 471 Medium 472 Low 473

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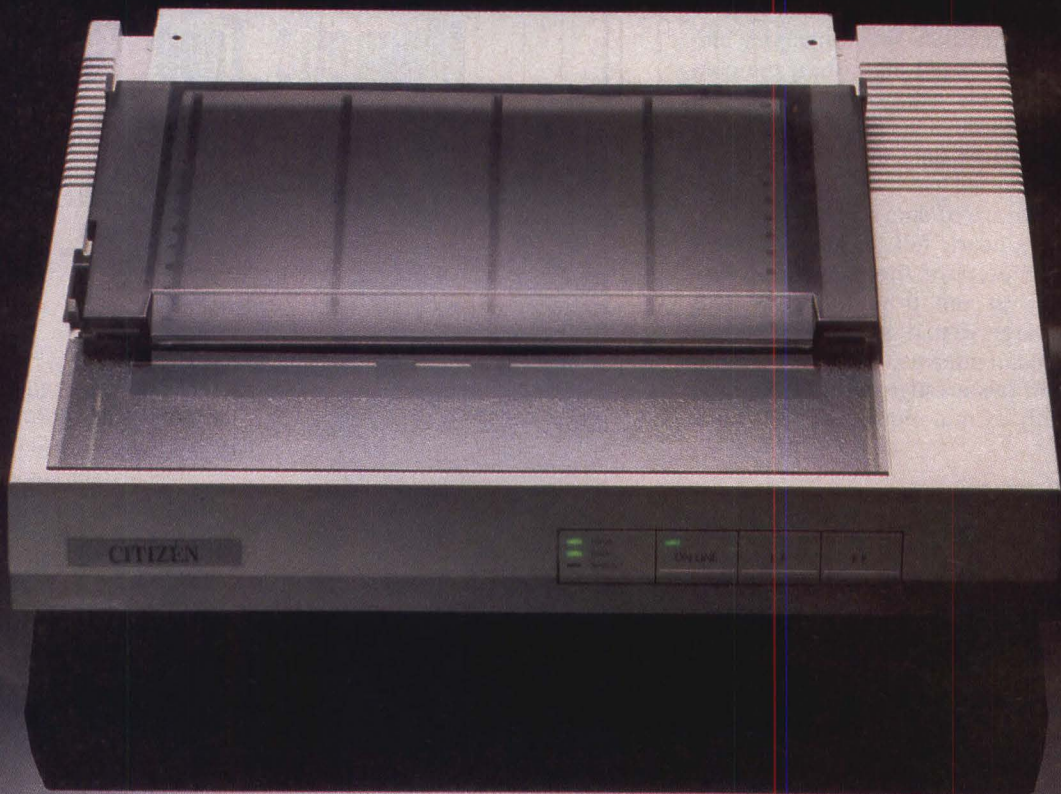
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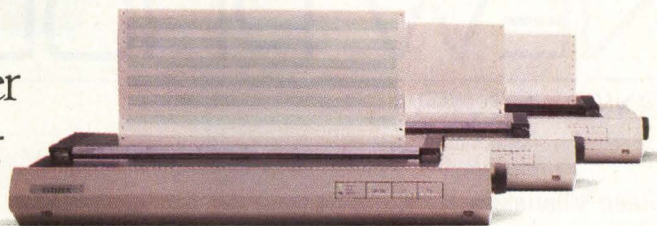
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NEW PRODUCTS

SYSTEMS

Eileen Milauskas, Assistant Editor

Office-automation systems offer compatibility

- Archival retrieval
- VT100 emulation
- SNA protocols

The Lanier Concept 6000 information-processing network is a member of Lanier Business Products Inc.'s Concept III family of integrated office-automation systems. Boasting the most power in the office-automation family, the 6000 also supports laser, dot-matrix and character printers.

A file-server system linking up to 28 workstations or mini-network controllers, the Concept 6000 is compatible with Harris Corp.'s HarrisNet local area network. A fully configured network using Concept 6000 and 4000 systems accommodates over 1,000 workstations.

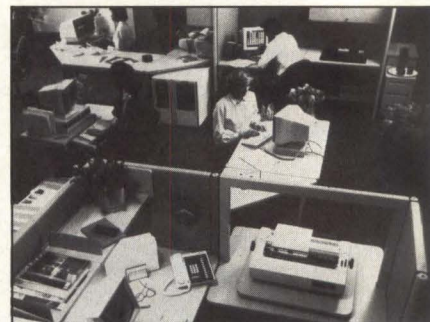
Library Services, a key feature of the Concept 6000, is an archival-retrieval service operating on Microsoft Corp.'s XENIX operating system, that searches large databases for documents by using name, subject and data criteria. The service can scan up to 5,000 pages in 10 seconds.

Applications for the Concept 6000 include electronic filing, data-communications connectivity, personal computing, peripheral-resource sharing and word processing, achieved through the proprietary H-DOS operating system. It runs the proprietary line of office-automation software as well as the XENIX Applications Library, a collection of programs written for XENIX that includes Relational Database Systems Inc.'s Informix and Unify Corp.'s Unify database-management program. Workstation support is provided through Lanier's Data-Manager II, Lanier Business BASIC, EZ-Spell, EZ-Task, EZ-Mail, business graphics, vertical industry packages and ONE-STEP word processing. A VT100 software package emulates the Digital Equipment Corp. VT100 terminal. Text-Saver, a communications converter for documents created on a Wang Laboratories Inc. OIS system, allows compatibility

with Wang office equipment.

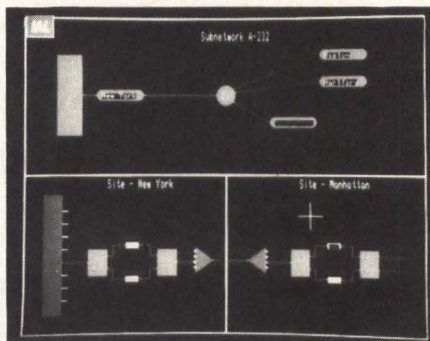
The Concept 6000 supports TTY-ASCII, 3780 and 3270 SNA and bisynchronous communications protocols; additional support for IBM Corp.'s DISOSS or PROFS sessions provides compatibility with IBM's office-automation software. Employing 80186 and Z80B microprocessors, the system comes with 256K bytes of memory, expandable to 1.24M bytes.

The Concept 4000, another member of the Concept III family, is a low-cost network controller that supports six proprietary workstations, addressing the needs of decentralized work groups or small departments requiring access to database management, file and peripheral resource-sharing and word processing. Attached to the Concept 6000 network, the 4000 operates on the H-DOS operating system and runs Lanier application



A fully configured network using Lanier Business Products Inc.'s Concept 6000 file-server system and Concept 4000 network controller accommodates over 1,000 workstations.

software. With 512K or 256K bytes of memory, the controller system accommodates 10M- to 28M-byte Winchester disk drives. \$6,500, Concept 4000; \$22,000, Concept 6000. **Lanier Business Products Inc.**, 1700 Chantilly Drive, N.E., Atlanta, Ga. 30324, (404) 329-8000. **Circle 300**



Management system offers fault detection

- Interactive graphics
- DEC VAX processor
- Incident handling

Suiting medium- to large-scale communications networks, the Medius Network Management System detects and diagnoses a fault and triggers immediate remedial action. Components include a DEC VAX processor as the Network Management Computer, a logging print-

er and an operator workstation. Network Diagnostic Units continuously monitor multiple data-circuit conditions with a digital interface operating at 19.2K bps. The system operates within a five-mode architecture: the system-definition mode defines the networks and their connectivity prior to system start-up; idle mode continuously monitors selected network signals via normal alarm scanning; incident-handling mode modifies, displays or creates system incident reports, allowing the operator to perform tests and switching to resolve the incident; statistics mode allows the operator to request and generate statistic displays on incident summary, network reliability or availability and performance; database-inquiry mode extracts network information on a standard, pre-planned or ad-hoc basis. A color-graphics video display unit presents cartographic, schematic and site-context views of network conditions. \$1,200 per circuit. **Ocean Data Systems Inc.**, 6000 Executive Blvd., Rockville, Md. 20852, (301) 881-3031. **Circle 301**

THE ULTIMATE NETWORK SERVER

for the IBM PC™



**The PCMS—
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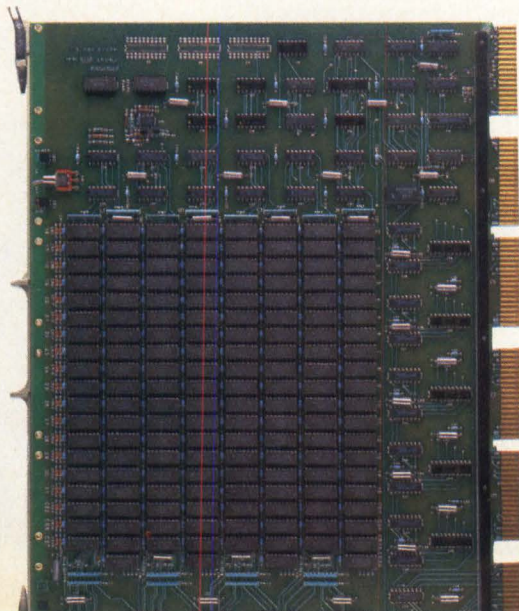
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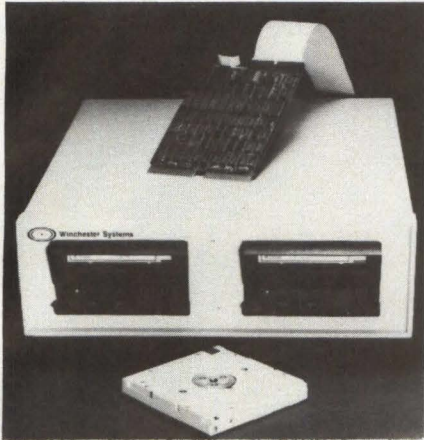
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CIRCLE NO. 85 ON INQUIRY CARD

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Subsystems store up to 83M bytes

- Q-bus-compatible
- 5M bps
- 40-msec access time

DEC Q-bus-compatible, the DataSafe family of Winchester disk subsystems use 5 1/4-inch, removable Winchester cartridges ranging in capacity from 5M to

10M bytes. The model 80/10R fixed/removable drive has 72.8M bytes of maximum storage, fixed, and 10.4M bytes, removable, and addresses multiuser applications. Model 40/20R, suiting single-user applications, offers dual, fixed and removable drives storing 10M bytes each for a maximum capacity of 40M bytes. All storage is accessed with a Q-bus controller board supporting 22-bit addressing. Achieving a 40-msec average access time and a 5M-bps data-transfer rate, the drives suit industrial applications such as CAD/CAM/CAE and data acquisition. \$3,600 to \$8,900, Q100. Winchester Systems, 400 W. Cummings Park, Woburn, Mass. 01801, (617) 933-8500.

Circle 302

Subsystems work with IBM PC, XT, AT

- Mirror-image mode
- File-by-file mode
- 60M-byte tape

Employing Wangtek tape drives, the

QIC-60 subsystem comes in tape-only and tape-plus-Winchester models. In mirror-image mode, the subsystem backs up 10M bytes of data in two minutes; in file-by-file mode, two minutes, 14 seconds. The Q60H tape-only model works with the IBM PC, XT, AT and compatibles while the other tape-only model, the Q60AT, is a drive kit installed internally in the AT. These models use a host adapter (PCHOST) to interface with other systems. Two tape-plus-Winchester models accommodate IBM PCs and PC-compatibles; the Q60W20, offering a 60M-byte tape drive and a 20M-byte Winchester disk drive, suits the IBM PC, XT and compatibles and the Q60W20AT is intended for use only with the IBM AT. All models have three heads: read, write and erase, enabling one pass with read-after-write verification. The models come with power supply and fan. \$2,144, Q60H; \$1,695, Q60AT; \$3,495, Q60W20; \$3,195, Q60W20AT. Tecmar Inc., 6225 Cochran Road, Cleveland, Ohio 44139, (216) 349-1009.

Circle 303

There is a band printer
with an MTBF of
up to 6000 hours.

What more
do you need to know?

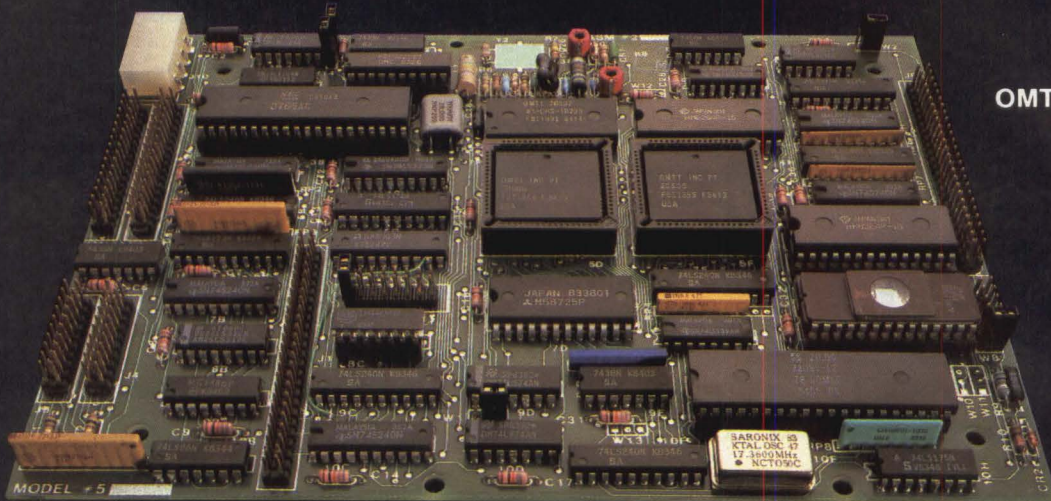
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CIRCLE NO. 86 ON INQUIRY CARD

WINCHESTER, FLOPPY AND TAPE All on one board



OMTI 5400

Our OMTI 5400 SCSI (SASI) controller offers Winchester, floppy and tape support all on a single 5 1/4" footprint PC board. By using our proprietary VLSI chip technology, we were able to squeeze all these functions onto a board size that most controller companies are still using for single function controllers. This means increased capability and improved cost-effectiveness in your application.

As a forward-looking OEM, you want multifunction SCSI (SASI) data controllers that meet your needs today and can meet the challenges of future developments in peripheral device technology. As you would expect, we've applied our new technology to meet these challenges in a whole family of SCSI (SASI) data controllers, the OMTI Series 5000.

OMTI 5100
Winchester



OMTI 5300
Winchester
plus Tape

OMTI 5200
Winchester plus Floppy

UNBEATABLE FLEXIBILITY

Our OMTI Series 5000 family of SCSI (SASI) controllers supports industry standard ST506/412 5 1/4" fixed and removeable Winchester disks, 5 1/4" and 8" floppy disks and QIC-02 compatible streaming tape. Each controller is SCSI (SASI) compatible to protect your software from change as you add next generation disk and tape technologies. And they are all second-sourced to guarantee availability.

HIGH PERFORMANCE

The Series 5000 controllers provide consecutive sector, non-interleaved data transfer and multisector buffering between host and peripherals. In addition, our data buffer supports simultaneous transfers between Winchester and streaming tape for fast image backup operation. No other manufacturer offers you performance like this!

EASY TO USE

Our high-level SCSI (SASI) command set off-loads your host CPU. Only one command is required to completely backup or restore Winchester data to and from tape, all without host intervention. Separate host-initiated commands allow selective file backup and restore. A sophisticated 32-bit ECC and automatic error retry means that reliable data is always available to the host. Finally, automatic Winchester flaw management handling prevents disk defects from corrupting your system.

To learn more about the OMTI Series 5000 data controllers, please contact us for additional information.



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DISTRIBUTORS: United States-Arrow Electronics, Inc. (516) 694-6800; Canada-Allan Crawford Associates Ltd. (416) 678-1500; International-Prima International (408) 732-4620.

CIRCLE NO. 87 ON INQUIRY CARD

Drives access data in 40 msec

- 5¼ inches
- Closed-loop servo system
- 625, 750 and 960 tpi

Incorporating a linear voice-coil actuator and a dedicated surface closed-loop servo system, the ST4000 series of 5¼-inch Winchester disk drives consists of three models. The ST4026, ST4038 and ST4051 hold 25.62M bytes, 38.17M bytes and 50.88M bytes of unformatted capacity, respectively. The ST4026 and ST4038 offer three oxide-coated disks, one servo head and 9,617-bpi recording densities. The model ST4026 records with four minislidder read/write heads; its track density is 625 tpi. The model ST4038 records with five minislidder read/write heads; its track density is 750 tpi. The model ST4051 offers five minislidder read/write heads, three thin-film disks, one servo head, a recording density of 9,848 bpi and a track density of 960 tpi. Aver-

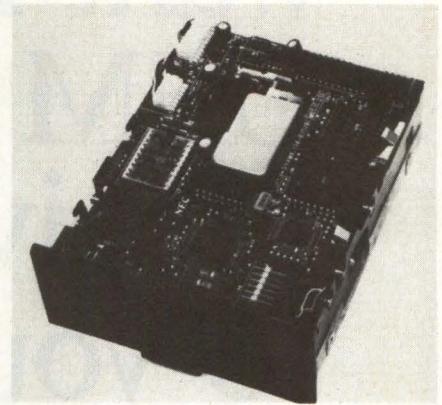
age access time is 40 msec. \$730, model ST4026; \$850, model ST4038; \$975, model ST4051; quantity 1,000. **Seagate Technology**, 920 Disc Drive, Scotts Valley, Calif. 95066, (408) 438-6550.

Circle No 304

Drives store 0.5M, 1M bytes

- 250K bps
- 94-msec access time
- 12,000 POH

The models FD 1034/1035 disk drives store 0.5M and 1M byte on ANSI-standard 3½-inch flexible disk media. The drives are compatible with industry-standard minifloppy interfaces and are easy to integrate. Average access time is 250K bps; the models move at 3-msec rates from one track to another when accessing data. Data-transfer rate is 94 msec. Automatic shutter mechanisms,



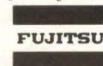
media eject, 12,000 Power-On Hours (POH) and direct-drive DC motors are standard. Suiting portable, battery-powered personal computer system purposes, the units require only 3.9 watts of power. \$131, Model 1034; \$161, Model 1035, quantity 500. **NEC Information Systems Inc.**, 1414 Massachusetts Ave., Boxborough, Mass., 01719, (617) 264-8000.

Circle 305

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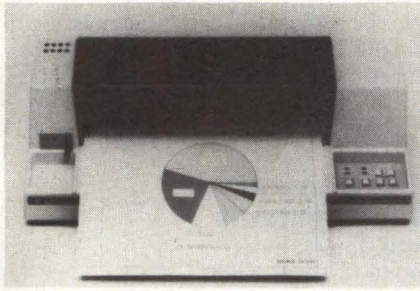
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New to the industry since 1896.



Plotter accepts software

- RS232C interface
- 0.002-inch resolution
- 7.8-ips speed

Suitable for business, scientific and engineering graphics, the 6120 plotter writes at 7.8 ips with a 0.05mm resolution. Its seven multicolor, replaceable-roller and ceramic-tipped pens work on standard bond or coated paper and transparencies. Compatible with microcomputers, minicomputers and mainframes, the unit connects to the IBM PC and PC/XT, HP150 and Apple II+ and IIe

through RS232C or Centronics interfaces. The plotter works with integrated software packages, such as Lotus 1-2-3, Lotus Symphony, Sorcim's SuperCalc and Ashton-Tate's Framework, as well as with Decision Resources' Chartmaster and Signmaster and Graphic Communication's Graphwriter graphics packages. \$895. **Gould Inc.**, Recording Systems Division, 3631 Perkins Ave., Cleveland, Ohio 44114, (216) 361-3315.

Circle 306

Plotters meet HPGL standard

- 6 and 9 ips
- A4, A3 paper
- .1-mm resolution

Serving low-end, business-graphic, CAD and CAE functions, the models 4550 and 4551 pen-plotter systems plot charts, graphs and drawings on paper and transparencies. A Hewlett-Packard Graphic Language (HPGL) emulation capability provides compatibility with business- and CAD-graphics software packages. The 6-ips model 4550 accepts

8½-by-11-inch and European A4-size paper; the 9-ips model 4551, 11-by-17-inch and European A3 size. Resolution is .1 mm. Removable, six-pen cassettes permit changing of pen type and of colors. Ballpoint, water-based ceramic or oil-based, fiber-tip pens come in eight to 12 different colors for drafting and overhead-transparency requirements. RS232C and Centronics interfaces are standard. \$795, 4550; \$995, 4551. **Facit Inc.**, 9 Executive Drive, Merrimack, N.H. 03054, (603) 424-8000.

Circle 307

Matrix printer offers eight colors

- 360 by 180 dpi, text
- 180 by 180 dpi, graphics
- 240 cps, draft-quality

Using a 24-wire print head, the Dot-Max 24 Color printer produces charts, bar graphs, line graphs and text in eight colors. The stationary-cartridge, four-color ribbon prints red, yellow, blue and black on the first pass and green, orange,

There is a band printer
that operates at an acoustic
noise level of 55dBA.

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CIRCLE NO. 90 ON INQUIRY CARD

PRINTERS

purple and brown on the second pass. The model achieves speeds of 80 cps for letter-quality printing; 160 cps for correspondence-quality and 240 cps for draft-quality. Resolution is 360 by 180 dpi for text and 180 by 180 dpi for graphics. Centronics and RS232 interfaces are standard. \$1,325, in quantities of 250. **Fujitsu America Inc.**, 3055 Orchard Drive, San Jose, Calif. 95134, (408) 946-8777.

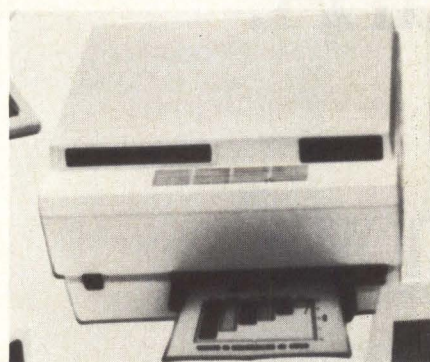
Circle 308

Serial printer operates at 60 cps

- 144 cps, draft quality
- 60 cps, letter-quality
- Bidirectional

Using a 24-wire replaceable printhead, the SB-10 serial impact, dot-matrix printer operates at 144 cps in draft-quality mode and 60 cps in letter-quality mode. The bidirectional, logic-seeking unit prints 80, 96 or 142 columns in a 24-by-14-dot matrix. Block graphics achieve a resolution of 40 by 18 dpi. Character sets include 96 draft-quality and 96 letter-quality characters; 99 international letter-quality and 99 international draft-quality; and 50 block-graphic characters. Handling single-sheet paper 5½ inches to 8½ inches wide, the unit features continuous underline, 7- or 8-bit selectable interface, bit-image column scan, macro instruction and self-test. A Centronics parallel interface is standard. \$949. **Star Micronics Inc.**, 200 Park Ave., New York, N.Y. 10166, (212) 986-6770.

Circle 309



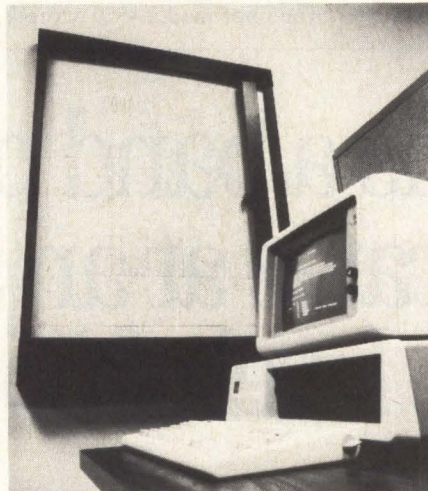
Laser printer offers 72 fonts

- Typesetting
- IBM PC-compatible
- 8 ppm

Operating at 8 ppm with 90,000-dpi resolution, the DTC/Kidron Laser Oc-

tave laser-printing system can be used by eight IBM PCs simultaneously. The system prints on plain paper, card stock, headed notepaper or overhead projector slides and can be upgraded to 24 ppm. A Laser-printer Initiation and Status of Network program controls document flow using parameters such as automatic collation, multiple copy and text orientation and emulates dot-matrix and daisy-wheel printers and Tektronix 4014 plotters. The controller, a separate unit consisting of a 10-MHz, 16-bit, image-processing computer with 2M bytes of virtual memory and 500K bytes of EPROM memory, communicates with the IBM PC via an RS232 interface. Supporting WordStar and MultiMate word-processing packages, the printer comes with K-Graph and K-Page software for creating graphic designs and logos and for "cutting and pasting" graphics and text. \$7,995. **Data Terminals & Communications**, 590 Division St., Campbell, Calif. 95008, (408) 378-1112.

Circle 310



Plotter works with IBM PC

- HPGL compatibility
- Accommodates D size
- 5 ips

A large-format, flatbed plotter, the Mural Plotter connects to an IBM PC or PC-compatible via an RS232C interface. Using the Hewlett-Packard Graphics Language graphics control command language, the plotter accommodates 27-by-36-inch (D-size-plus) media, including roll paper, and accepts standard plotter pens. With a .0035-inch repeatability rate, the plotter runs at 5 ips. A hand-held controller provides local control of

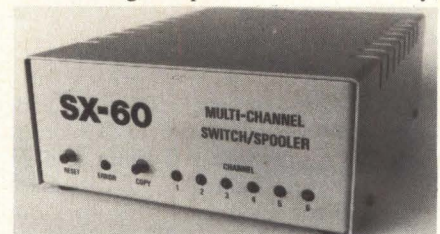
plotter movement and facilitates digitizing. \$2,495. **United Innovations**, Crossroads Industrial Park, Holyoke, Mass. 01040, (413) 534-4400.

Circle 311

Spooler serves four systems

- 8K to 64K bytes
- 150 to 19.2K baud
- Transparent operation

Serving up to four computer systems and feeding two printers simultaneously,



the SX-60 Multi-Channel Switch/Spooler accepts serial data on each channel from 150 to 19.2K baud with each computer or printer set at a different baud rate. Spooler buffer sizes of 8K, 32K or 64K bytes store from 2½ to 20 pages of dense, single-spaced text. An expansion board increases buffer capacity to 384K, or 120 pages. Standard configuration is four computers in, two printers out or two printers in, four printers out. Operation is transparent: all connections are made through 25-pin, D connectors. A multiple-copies copy function is provided. \$469. **Kearsage Industries Inc.**, Reston, Va. 22091, (703) 620-5760.

Circle 312

Printer works with IBM PCjr

- 190 words per minute
- Interface selectability
- 10, 12 and 15 pitches

The Spinwriter elf, offering plug compatibility with the IBM PCjr, prints 190 words per minute with 10, 12 and 15 proportional spacing pitches. Features include bold and shadow print, bidirectional print capability, auto load, cut-sheet guide, single-lever paper control, 55-dB(a) noise level and a control panel with pitch, form, feed and print buttons. Command code and interface selectability allow hookup to many personal computers. \$545. **NEC Information Systems Inc.**, 1414 Massachusetts Ave., Boxborough, Mass. 01719, (617) 264-8000.

Circle 313

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is how much
Fujitsu has improved
band printer technology.”

Norman B. Petersen
Senior Vice President
Fujitsu America, Inc.

Consider that our M304X series band printers are extremely reliable. Easy to use and service. And so quiet they don't have to be banished to an inaccessible corner in the computer room.

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MODEL	LPM (64 char. set)	MTBF (HRS)	SIZE (H x W x D)	NOISE (dBA)
M3040	300	6,000	41.7 x 26.8 x 35.4	55
M3041	600	6,000	41.7 x 26.8 x 35.4	55
M3042	900	4,000	41.7 x 26.8 x 35.4	55
M3043	1200	4,000	41.7 x 26.8 x 37.8	55

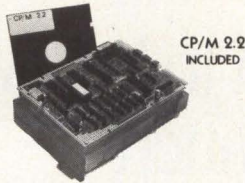


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Maximum Quality. Maximum Value.



Little Board™ \$349*

*UNDER \$900 IN OEM QUANTITIES



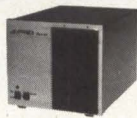
CP/M 2.2 INCLUDED

- 4-MHz Z80A CPU, 64K RAM, Z80A CTC, and 2732 Boot ROM
- Mini/Micro Floppy controller (1-4 Drives, Single/Double Density, 1-2 sided, 40/80 track)
- Only 5.75 x 7.75 inches, mounts directly to a 5 1/4" floppy drive
- Two RS232C Serial Ports (75-9600 baud and 75-38,400 baud), 1 Centronics Printer Port
- Power Requirements: +5VDC at 0.75A; +12VDC at 0.05A/On-board -12V Converter
- CP/M 2.2 BDOS • ZCPR3 CCP
- Enhanced A/PRO BIOS
- AMPRO Utilities included:
 - Read/write to more than two dozen other formats (Kaypro, Televideo, IBM CP/M86...)
 - Format disks for more than a dozen other computers
 - Menu-based system customization
- BIOS and Utilities Source Code available

BOOKSHELF™ Series 100

AS LOW AS \$635 IN OEM QTY

MODEL	QTY 1 PRICE
121 1 400K DSDD Drive	\$ 895.00
122 2 400K DSDD Drives	995.00
142 2 800K DSQD Drives	1,095.00



- Little Board CPU
- Runs thousands of CP/M programs
- Enhanced Operating System including ZCPR3 CCP and FRIENDLY™ Integrated Operating Environment
- Word Processing, Electronic Spreadsheet, Database Management, Spelling Checker all included (complete T/maker Pkg.)
- 10 MB hard disk version available
- 6 1/2" high, 7 1/4" wide, 10 1/2" deep, 12 1/2 lbs.

SCSI/PLUS™ Adapter

Compatible with most Z80 Systems (send \$10 for complete specifications)

- Mounts directly to Little Board
- Multi-Master high-speed parallel bus \$99
- SASI-SCSI compatible QTY 1
- General purpose I/O expansion bus
- Supports up to 64 bus devices
- Allows multi-Little Board Systems and resource sharing
- Little Board hard disk software/source \$79 QTY 1

DISTRIBUTORS

Argentina-Factorial, S.A.	1-41-0018
Australia-ASP Microcomputers	613-500-0628
Belgium-Centre Electronique Lempereur	041-23-45-41
Canada-Electronic Sales Assoc.	(604) 986-5447
Denmark-Danbit	03-66-20-20
England-Quant Systems	01-534-3158
Finland-Symmetric OY	358-0-585-322
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(415) 962-0230 • TELEX 4940302

CIRCLE NO. 92 ON INQUIRY CARD

NEW PRODUCTS

TERMINALS

Terminal line emulates DEC, IBM products

- 14-inch screen
- Green or amber display
- 24 lines by 80 columns

Consisting of models ATL-220, ATL-178 and ATL-3270 MS, this line of terminals emulates the Digital Equipment Corp. (DEC) VT220 and the IBM Corp. 3178 and 3270, respectively. All three 14-inch, non-glare, amber or green phosphor screens offer an optional tilt-and-swivel display.

The ATL-220 supports two levels of selectable-character-display resolution. The DEC mode provides a 7-dot-by-10-dot-matrix character in a 10-dot-by-10-dot character cell. The enhanced mode provides a 7-dot-by-12-dot-matrix character in a 10-dot-by-14-dot cell. Displaying text in 24 lines of 80 or 132 columns, video features include a selectable combination of blinking, bold, underlined and normal or reverse video. Five visual indicators inform the operator of hold screen, lock, wait and compose conditions.

The ATL-220 employs six selectable operating modes. Two 200 modes, providing full ATL-220 capabilities, perform American National Standards Institute (ANSI) functions in 8-bit communications environments with 7- and 8-bit controls. Both modes accommodate the DEC multinational character set.

The 100S mode, equivalent to the DEC VT100 mode of the DEC VT220 terminal, restricts data to 7 bits and generates ASCII, U.K. National or special graphics characters. Not completely compatible with the DEC VT102 terminal, this mode limits keyboard use to VT100 keys. The fourth mode, the 100C, furnishes backward compatibility with existing software written for the VT100 terminal family and runs on operating systems supporting the VT100.

The 52 mode generates the same characters as the 100S and 100C modes and performs DEC private functions. It has a degree of compatibility with the VT102 terminal operating in VT52 mode. Lastly, the setup mode examines or changes terminal operating features via proprietary setup screens.

Emulating IBM functions, the ATL-178 IBM 3178 Category A coaxial plug-compatible terminal interfaces with IBM's 3274 Category A coaxial-based cluster controllers and third-party, IBM-



The ATL-220, an enhanced replacement for the DEC VT220, offers five operating modes.

compatible, Category A coaxial controllers. The terminal displays 224 7-dot-by-9-dot-matrix, IBM 3278 EBCDIC characters and graphics with 24 lines of 80 characters each plus a status line.

In edit mode, the host CPU places protected and unprotected data fields on the display. Protected data cannot be modified from the keyboard. Unprotected data can be entered from the keyboard.

The ATL-3270 MS dual-host, multi-station terminal copies an IBM 3276 Model 2 or Model 12. This workstation combines 3270 capabilities with a four-channel version of the CC74 proprietary cluster controller. Using RS232 or RS422 cabling, it connects to four ASCII terminal devices, including proprietary terminals and IBM PC, PC/XT or PC-AT computers.

Available in bisynchronous or Systems Network Architecture (SNA) protocol, the ATL-3270 MS can be configured several ways. First, the ATL-3270 MS control unit suits point-to-point or multi-point connection to a binary synchronous communications (BSC) protocol or SNA/synchronous data-link control (SDLC) host environment. The terminal allows as many as five devices to be directly attached through RS232C or RS422 interfaces. Second, the ATL-3270 MS also connects to an asynchronous host acting as one of the cluster devices. The host provides the cluster with the same facilities available in CC74 multihost clusters.

Third, dual ATL-3270 MS clusters permit display stations in each cluster to access each of their respective host environments and printer resources. Each unit, using the BSC and SNA/SDLC protocol options, can access a host environment.

In the last configuration, dual ATL-3270 MS clusters tie onto an asynchro-

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Alloy's QICSTOR-PLUS meets all your expansion needs. It's the ideal upgrade for a growing PC or AT system.

QICSTOR-PLUS has five full size expansion slots which are completely compatible with the IBM PC bus and they also support Alloy's PC-SLAVE/16 multi-processor, multi-user capability. Its high performance hard disk has a capac-

ity of 36 to 128 MBytes. And QICSTOR-PLUS has file-oriented streaming tape backup with a formatted capacity of over 50 MBytes. Alloy provides file-oriented QTIP software with a transfer rate of 2 MBytes/minute.

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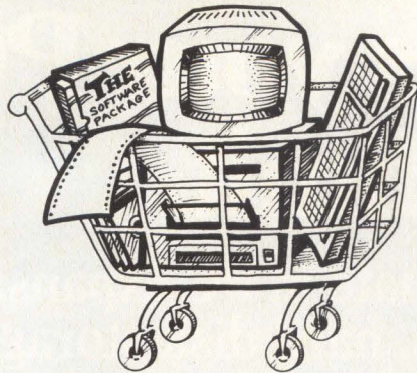
ALLOY QICSTOR-PLUS

COMDEX/Spring '85

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Alloy Computer Products Inc., 100 Pennsylvania Avenue, Framingham, Massachusetts 01701. Tel: (617) 875-6100. TWX: 710-346-0394
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CIRCLE NO. 93 ON INQUIRY CARD



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In fact, MicroFocus '85 will help you take advantage of the Value Added Reseller as a means of reaching the largest number of potential end users with your product. How? By providing...

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CIRCLE NO. 94 ON INQUIRY CARD

NEW PRODUCTS TERMINALS

nous host cluster. This step lets the connected ATL-178s and ATL-3270 MS display stations access their respective IBM hosts and attach to applications operating on the asynchronous host. \$1,095, model ATL-220; \$1,395, model ATL-178; \$2,795, model ATL-3270 MS, BYSC; \$2,995, model ATL-3270 MS, SNA. **Beehive International Inc.**, 4910 Amelia Earhart Drive, P.O. Box 25668, Salt Lake City, Utah 84125, (801) 355-6000. **Circle 314**

Terminal is user-definable

- 15-inch display
- 96 ASCII characters
- Windowing capability

Meeting word-processing and form-filling requirements, the Genie XL ANSI-standard terminal displays 18 to 30 user-selectable lines by 80 characters on a 15-inch, amber screen. With two cursors and multiple page and windowing capabilities, the terminal creates forms with protect, guard, numeric, justify and security areas. Editing functions include scrolling through two pages of text without pause and a proprietary zoom feature. Data transmission speed is 110 to 19.2K bps in character-by-character, line-by-line or block mode. Features include an ASCII 96-character set and a 111-key, detachable keyboard that is fully programmable on up to 30 levels. \$1,395. **Ann Arbor Terminals Inc.**, 6175 Jackson Road, Ann Arbor, Mich. 48103, (313) 663-8000. **Circle 315**

Terminal emulates Wyse model 50

- 14-inch screen
- 80, 132 columns
- 16 function keys

Emulating the Wyse model 50 terminal, the Fame 50 terminal is also compatible with TeleVideo's models 925, 920 and 910 and Lear Siegler's model ADM-31. Providing 16 programmable function keys, the unit stores 256 characters. Its 14-inch screen produces a 7-by-9-dot matrix within a 9-by-12-dot cell; display format is 80 or 132 columns. Programmable editing keys permit the terminal to meet software requirements. A buffered, bidirectional printer port is included. \$595. **Falco Data Products Inc.**, 1286 Lawrence Station Road, Sunnyvale, Calif. 94089, (408) 745-7123. **Circle 316**

OEM PLOYS.



Designed to give you an unfair advantage over your competition.

With Lear Siegler terminals you'll enjoy a distinct advantage over the competition, because you'll have the combination of reliability, functions and ergonomic styling that other terminals can't match.

Another advantage is that we'll work right along with you in designing a terminal that fits your specific needs—from simple logo changes to completely unique terminal designs and proprietary firmware.

And still another advantage is our dedicated OEM sales and engineering groups, video display terminal experts who specialize in serving your needs. All backed by the stability and resources of a \$1.9 billion corporation. When you add up all the advantages it's easy to see why the competition might think it's unfair.

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 **LEAR SIEGLER, INC.**
DATA PRODUCTS DIVISION

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CIRCLE NO. 95 ON INQUIRY CARD

Network products extend connectivity

- Full-, half-duplex
- SNA network support
- Remote, local networks

NCR Comten Inc. of St. Paul, Minn., offers a series of network connectivity products accommodating NCR hosts as well as IBM Corp.'s Systems Network Architecture (SNA) network. A small-scale communications processor, the Comten 5620 handles application switching, routing, polling, automated dialing, error recovery and multiplexing for as many as 32 full- or half-duplex lines on small or remote network sites.

The processor operates as both a front-end processor for a local host and as a remote concentrator in a large network. When used as a nodal processor the unit functions as an SNA PU Type 4 via standard SNA trunk protocols.

The 5620 supports combinations of IBM, IBM-compatible or proprietary hosts and asynchronous, bisynchronous and SDLC line protocols. Line speeds can reach 64K bps with a 19.2K-bps automatic baud-rate detection capability. The unit runs on the proprietary COS2/20 operating system, using COS2-based networking software. Storing 1M, 2M or 4M bytes of main memory, it comes with a 10M-byte, fixed disk drive.

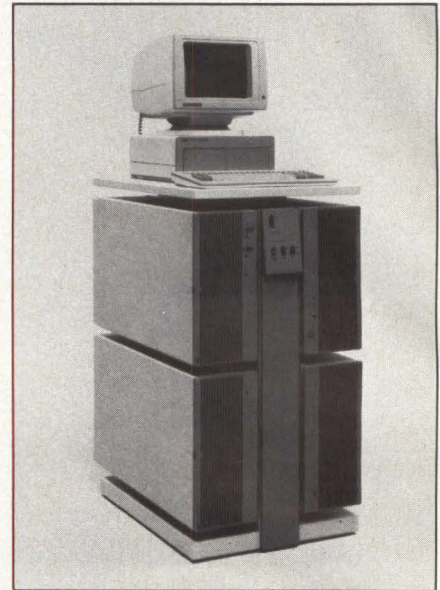
The Comten 2200 Matrix Switch connects communications processors and modems, enabling them to control line switching without physical recabling. It allows as many as 512 DTE communica-

tions processor connections by 512 DCE modem connections, with 9,600-bps, half- or full-duplex line speeds. Supporting RS232 and V.35 interfaces, the switch is software-controlled by commands from the matrix switch console.

The Comten Network Gateway shares information and accesses data and application programs among eight multiple SNA networks. It translates addresses and accepts, processes and translates SNA commands to establish and terminate sessions between SNA networks. The gateway operates in networks with mixed IBM 3705, 3725 and Comten 3600 communications processors.

The Comten Advanced Communications System for NCR hosts (NCR/ACS) Release 1 consists of three components: the Virtual Resource Executive Interface Module (VIM), a software interface for the Bit Serial Link Channel Interface Adapter; the Comten Communications Access Method, a communications access method residing in the Comten 3600 communications processor; and the VRX Comten Support, a set of COBOL application programs residing in the NCR host. The host prerequisite for Comten NCR/ACS is an NCR 8500 or 8600 VRX utilizing the Telecommunications Access Method and/or an IBM 370, 303X, 308X, 43XX or compatible host.

NCR/ACS Release 1 is supported under Comten 3600 System Control Software (SCS) and can coreside with other



Employing VLSI technology, the Comten 5620 communications processor supports up to 32 full- or half-duplex lines and one or two host computers.

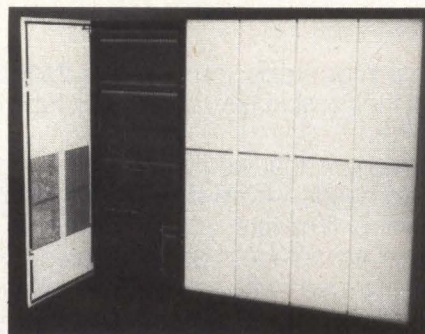
SCS-based products. Terminal support includes SNA, bisynchronous and asynchronous protocols. The price for the 5620 communications processor is \$22,000, while the matrix switch costs between \$300 and \$380. The Comten Network Gateway is \$2,200. VIM and Communications Access Method license fees are \$2,145 and \$6,050, respectively. The Bit Serial Link is \$8,000. **NCR Comten Inc.**, 2700 Snelling Ave. N., St. Paul, Minn. 55113, (612) 638-7777.

Circle 317

Networks combine voice, data, text

- Messaging
- Multiprocessing
- 40M-bps LAN

The Meridian SL-1 and Meridian SL-100 integrated network services support 30 to 5,000 and 5,000 to 30,000 lines, respectively, and can integrate voice, data, text and graphics in one system. The networks incorporate a 40M-bps parallel transport system featuring dynamic bandwidth allocation, a multiprocessing architecture and a 2.56M-bps, twisted-pair, digital distribution system. The systems' 40M-bps local-area networking capability, LANSTAR,



interconnects terminals and systems into a single network and provides switched access to wide-area networks. Information services includes Directory, which constantly accesses an organizational di-

rectory, and a personal directory with as many as 999 entries; Messaging, which permits voice and text information exchange through multiple media without requiring user presence; Forms, which creates and stores forms on-line; Access, which handles speed, code and protocol conversions to facilitate access to information stored in different computers; Share, which makes possible real-time, desk-to-desk multimedia communication; and Computing, which accesses word-processing, database-management, calendar-management and spreadsheet programs. \$80,000, basic system configuration. **Northern Telecom Inc.**, 685A E. Middlefield Road, Mountain View, Calif. 94043, (415) 940-2024. **Circle 318**

Anyone who has an IBM PC XT or AT can get into publishing within weeks by investing \$10,990 in our DataCenter™ with its high-resolution WYSIWYG* terminal and laser printer.

The world is ready to cut the cost of printing and the delays involved in working through typical publications departments.

And you are certainly ready to get some important work out of PC XT's that are just gathering dust around your office.

One insurance company, seeing our DataCenter at a Corporate Electronic Publishing show recently, told us they could save about \$8-million a year on pre-printed policy forms simply by storing them in the computer's memory instead of a warehouse.

The US Army has taken on the task of finding a standard electronic publishing system for all its manuals, training materials, and form generation.

A Big Job! We don't know if anyone else is ready to tackle it, but we are.

***WYSIWYG**

The key phrase we've been hearing everywhere is WYSIWYG: What You See Is What You Get. That's what our DataCenter provides.

The WYSI part

Our large-screen Graphic Display Processor (GD/P) which attaches simply to your IBM PC XT or AT, shows your words, numbers and graphic materials with extraordinary clarity on its 9" x 12" viewing area.

Where the IBM PC has 400 dots (pixels) across and 200 down on its screen, our GD/P has 1024 pixels by 1024.

That clearly means you see what you will get when you decide to send it to the laser printer, mixing text and graphics on the same page.

You can choose from a variety of type fonts and sizes, even shadings. Times Roman *looks like* Times Roman; Bodoni bold is **bold**.

This announcement will be worth seven minutes of your time if your job requires that you know...

The State of Corporate Electronic Publishing on the IBM PC XT or AT.

You can leave a box where you want to insert a photo, and put a caption beneath it in a different type face from the rest of the page.

You can chop a section out of a spread sheet and put it anywhere on the page—along with a chart made from the data, if you like.

When sold by itself, the GD/P costs \$4995. OEM and distributor discounts are available, of course.

...and you get exactly what you saw on the big screen!

Laser printers, which used to cost \$30,000 and up, have proved that they can work tirelessly, precisely and quietly. Our new CDS 2300 laser printer, a significant advance in the technology, costs only \$5995.

It will print a full page of graphics (including near-typographic fonts) in less than a minute.

In a nutshell, for those of you familiar with what's available, the CDS 2300 is capable as Apple Computer's laser printer, at less cost. The HP laser printer cannot handle large areas of graphics, which accounts for its lower price.

Laser in, laser out

The even newer CDS 3300 laser printer, which also provides 300-dots-per-inch resolution, can include a 300-dots-per-inch laser input scanning system.

It lets you take any piece of artwork (even a photo) and put it into your computer as an object.

The CDS 3300 will also function as an office copier when it's not put-



ting what you see into or out of your computer. It is priced between \$15,000 and \$25,000, depending on what you want it to do.

The software

We have developed an integrated package of three major applications software programs:

VTEXT, a scientific word-processing system that handles formulae as easily as invoices;

VDRAW, an extremely quick and powerful graphics program that lets you draw, sketch, or create very precise mechanical drawings; and VESS, a three-dimensional spreadsheet that stores data in row, column and "page" formats. It lets you sort and display data in a really useful fashion.

Like all software, they beggar description; a demo is certainly required. It's also readily arranged.

And now: The WHIZZIE

A large number of our first customers told us they wanted a less expensive display that would give them the WYSI without the expense of high speed bipolar circuitry. Here it is.

We've nicknamed it the Whizzie, because WYSI... well, you get it.

And Whizzie costs only \$2495; less in bunches. You may want to buy bunches of Whizzies once you see what they (and one of our laser printers) can do at the printout nodes of your local area networks.

More?

There is a great deal more to tell you about the Corporate Data Science DataCenter. We will be happy to arrange a demo.

Please call Linda Kazares, Director of Sales, for an appointment. Telephone 408-980-9747.

We have literature and complete technical specs. Just call or drop us your business card with a note about where you saw this ad.

Thanks.



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from Corporate Data Sciences, Inc.

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NEW PRODUCTS SUBASSEMBLIES

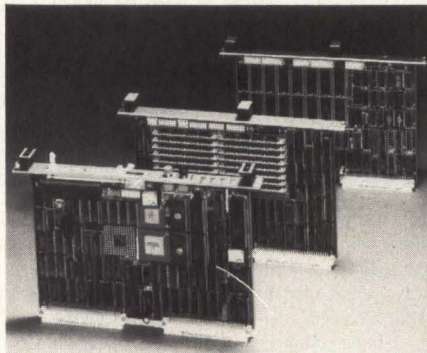
Memory board suits AT&T PC 6300

- RAM cache
- 16-bit bus
- 640K-byte expansion

Fastcard, an add-in memory board for the AT&T PC 6300 microcomputer, stores 384K bytes. Expanding main memory to as much as 640K bytes, the board includes a 16-bit bus interface. Bundled with the proprietary Fastware software, the board increases disk-access speed. The software comes with RAM cache and print buffering. \$595. **Thesys Memory Products Corp.**, 7345 E. Acoma Drive, Scottsdale, Ariz. 85260, (602) 991-7356. **Circle 319**

Board set runs at 2 to 3 MIPS

- Suits VMEbus
- 32-bit addressing
- 1M-byte ROM



Suiting CAD, image-processing, simulation and robotics applications, the MVME130 VME module processor board incorporates the 32-bit MC68020 microprocessor. Operating at 2 to 3 MIPS with burst rates of 6 MIPS, the board includes a VMEbus interrupter, an interrupt handler, a bus arbiter and a 12.5-MHz clock rate. Two complementary boards, the MVME204 and the MVME214 modules, are dual-ported to the VMEbus and the proprietary MVMX32bus. Containing 1M byte of

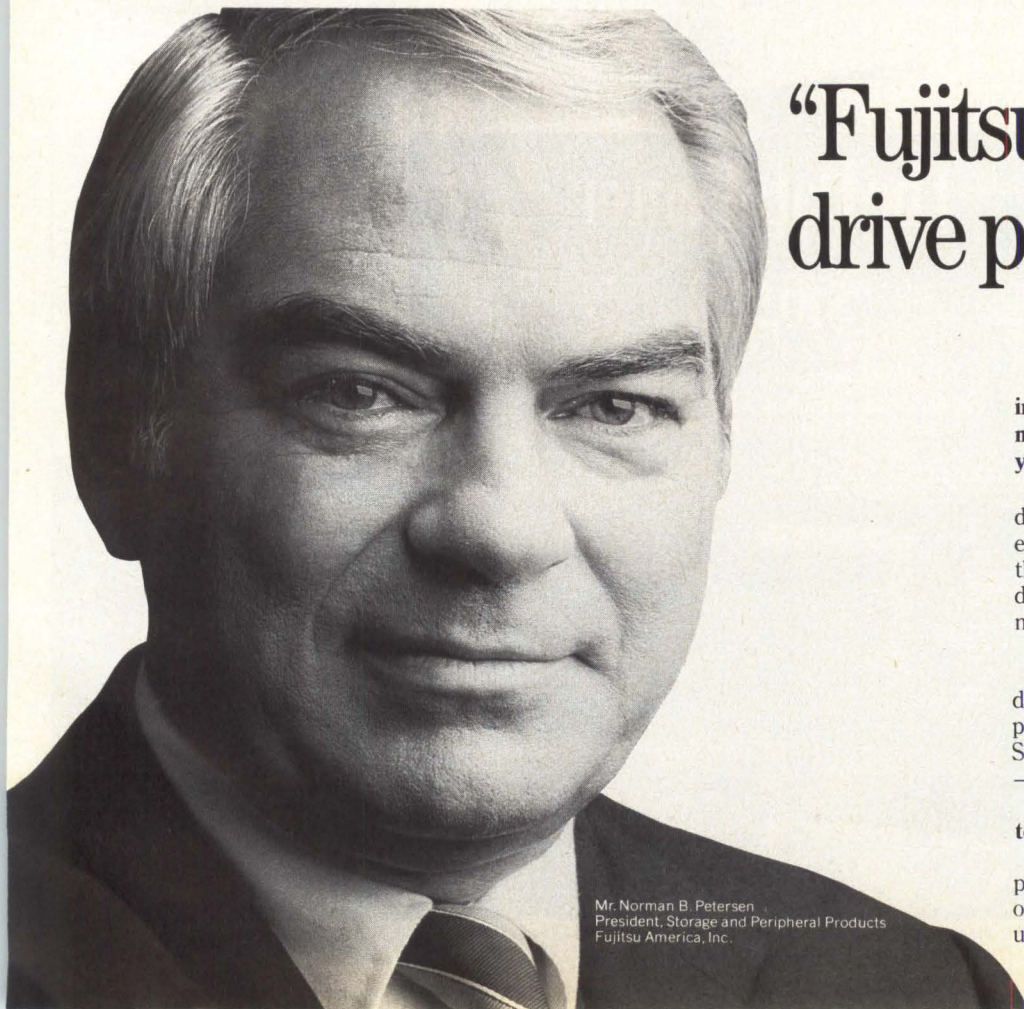
RAM, the MVME204 accommodates 8-, 16- and 32-bit data transfers with byte-parity generation and checking. For applications requiring ROM, EPROM or static RAM, the MVME214 module provides 1M byte of ROM or 128K bytes of RAM. Sixteen sockets provide for JEDEC 24- and 28-pin memories and devices with access times from 100 to 400 nsec. \$3,995, MVME130; \$4,200, MVME204; \$1,400, MVME214. **Motorola Semiconductor Products Inc.**, P.O. Box 20912, Phoenix, Ariz. 85036. (602) 438-3222.

Circle 320

Controller suits two disk drives

- Handles eight heads
- Supports SASI
- Employs 32-bit ECC

Controlling two 5¼-inch or 3½-inch ST506 Winchester disk drives, the WD1002S-SHD controller supports a host SASI. The board handles as many as



Mr. Norman B. Petersen
President, Storage and Peripheral Products
Fujitsu America, Inc.

“Fujitsu has done it drive performance,

Put these new 10½" and 8" Fujitsu drives into your existing design, and with only minor changes you'll significantly increase your system's performance and capacity.

With the introduction of the 10½" Eagle disk drive three years ago, Fujitsu established a new performance standard for the industry. The Eagle quickly became the disk drive against which others were measured. In both performance *and* quality.

And now we've done it again.

We've expanded both our 10½" and 8" disk drive lines with two new maximum-performance models. They set a high-speed SMD (HSMD) standard for data transfer — 2.4 Megabytes per second!

And it's done using RLL encoding technology.

That means you get this new level of performance without sacrificing one bit of our world-proven reliability. These drives use the same basic head, media and

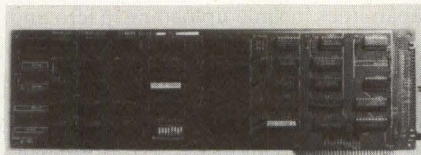
eight read/write heads per drive and incorporates the proprietary WD10C20 self-adjusting data separator. A 32-bit ECC provides data correction. Features include bad-track mapping, automatic formatting, selectable interleaving, multiple sector reads and writes and write pre-compensation. \$245. **Western Digital Corp.**, 2445 McCabe Way, Irvine, Calif. 92714, (714) 863-0102.

Circle 321

Host adapter works with SCSI

- 32K-byte ROM
- IBM PC-compatible
- DMA

Fitting directly into an IBM PC, PC/XT, PC-AT or compatible, the RT 2003 host adapter board allows these systems to work with tapes, disk drives and independent peripherals over a SCSI or SASI bus. Offering 32K bytes of ROM for BIOS space, the board comes with application and diagnostics software.



Provided are full SCSI arbitration and disconnect/reconnect, which permits connection of multiple hosts and/or peripherals on the bus. Features include DMA, SCSI bus parity and SCSI bus termination. Board address is jumper-selectable. \$275. **Rancho Technology**, 10238 Monte Vista, Rancho Cucamonga, Calif. 91701, (714) 987-3966.

Circle 322

Controller works with Multibus

- 4K-byte FIFO buffer
- 4M bytes per second
- Built-in data diagnostics

Transferring data at 4M bytes per second, the Multibus-compatible Tape-master 1000 tape controller serves 1/2-inch streaming and start/stop tape drives.

Data transfers to or from a drive at 1.5M bytes per second. The controller employs parameter blocks in system memory to pass commands from the host to the controller. Parameter blocks can be written in Intel or Motorola format. A 4K-byte, first-in, first-out (FIFO) buffer eliminates data overruns. Features include data throttling, which controls Multibus data traffic, and "scatter/gather" commands, which allow access to system memory at the same time that data transfers between the FIFO and the tape drive. \$1,654. **Ciprico Inc.**, 2405 Annapolis Lane, Plymouth, Minn. 55441, (612) 559-2034.

Circle 323

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To keep your free subscription to *Mini-Micro Systems*, turn back to the requalification card attached to the front cover. Please fill it out and return it to us right away.

again. We've set another standard in disk with a new, high-speed SMD interface"

actuator technology as our previous designs. Plus the same SMD interface.

Both models offer expanded storage capacity as well. The new M2361 Eagle



The M2361 10 1/2" Eagle Disk Drive—689 MB

provides 689 Megabytes and the new M2333 8" drive has 336 Megabytes. And you can stack four of the 8" units in a standard 19" rack, providing 1.3 Gigabytes



The M2333 8" Disk Drive—336 MB

of storage in the space of one 14" drive.

Both units offer fast access (18 and 20 milliseconds, respectively). Both use the same track capacity and controller. And both offer Fujitsu's field-proven quality, backed by a 20,000-hour MTBF specification.

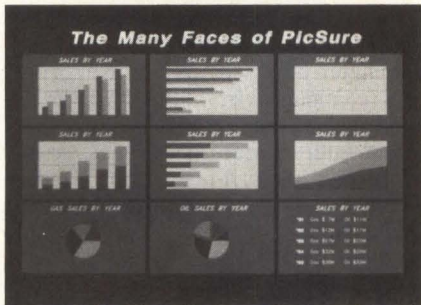
And to top it all off, they offer you the lowest cost of ownership.

For more information or to arrange for evaluation units on the new 8" or Eagle disk drive, call (408) 946-8777 or write Fujitsu America, Inc., Storage Products Division, 3055 Orchard Drive, San Jose, CA 95134 Fujitsu Storage Products. Maximum Performance. Maximum Quality.

FUJITSU AMERICA, INC.

FUJITSU

CIRCLE NO. 97 ON INQUIRY CARD



Graphics package suits IBM, VAX systems

- 24 fonts
- X-Y plots
- Scattergrams

Employing a command-driven interface that minimizes the number of instructions necessary to create presentation-quality graphics, the PicSure software package accommodates novice as well as experienced graphics users. By specifying one of 50 pre-defined layouts, the package produces pie charts, vertical and horizontal bar charts, X-Y plots, text charts and scattergrams. Advanced capabilities include multiple charts, annotation, variable type fonts and color shadings and patterns. It runs on IBM systems with VM/CMS or MVS/TSO and DEC VAX systems with VMS and UNIX System V. Features include windowing capability, 20 additional lines of text, 24 text fonts, support for 80 graphics output devices and four text qualities: filled, outline, stroke and hardware. \$6,500 to \$25,000. **Precision Visuals Inc.**, 6260 Lookout Road, Boulder, Colo. 80301, (303) 530-9000.

Circle 324

Emulation package supports five LUs

- Hotkeys
- Multiple sessions
- Cross-referencing

Supporting five logical units (LUs), the BlueLynx 3270 SNA/SDLC remote-terminal-emulation package allows an IBM PC to emulate an IBM 3276 workstation and IBM 3281 printer. The five LUs supported include two 3278 terminal sessions, one 3278 logical terminal for uploading and two 3287 printers for either printing or downloading. The package permits hotkeying from LU to LU to check sessions or to initiate a session on one LU, or hotkeying from mainframe session to IBM PC applications. Other

capabilities include uploading macro and data files to the mainframe, cross-referencing two mainframe files on a single screen and running one DOS session concurrently with a 3270 session. \$945. **Techland Systems Inc.**, 25 Waterside Plaza, New York, N.Y. 10010, (212) 684-7788.

Circle 325

Compiler works with VAX

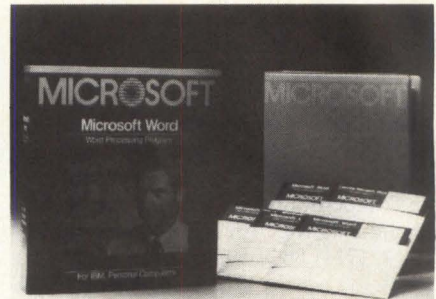
- Employs C language
- Code programming
- Symbolic debugging

Converting the DEC VAX into a multiuser microprocessor development system, the BSO/C C compiler suits Motorola's 6809 and Zilog's Z80 microprocessors. Conforming to the C standard, the compiler eases C language programming for embedded microprocessor systems and applications. Features include optimization functions, microprocessor-oriented interrupt and I/O instructions, an operating system that enables interfacing with other operating environments, recursive and reentrant code programming capability and symbolic debugging support. \$5,000. **Boston Systems Office**, 469 Moody St., Waltham, Mass 02254, (617) 894-7800.

Circle 326

Package enhances word processing

- Spelling correction
- MS-DOS commands
- Text hyphenation



The enhanced Microsoft Word Version 2.0 supports the IBM Enhanced Graphics Adapter Card, the IBM Enhanced Color Display monitor, the Hercules Graphics Card and the Intel 80286 processor. Displaying special character formatting on the screen, the package also supports the HP LaserJet Printer, the IBM Quietwriter and Wheelprinter and Xerox 2700 laser printers. Enhanced capabilities include automatic or interactive text hyphenation, running MS-DOS commands without exiting the word processor, style sheets that save formatting separately from documents, improved page-break setting and interactive repagination and an 80,000-word Microsoft Spell dictionary. Standard features include a merge facility for form letters, glossaries, multiple windows with cut-and-paste, an undo command and creation of running heads and footnotes. Running on an IBM PC, PC/XT or PC-AT with 256K bytes of memory, DOS 2.0 or higher, the software requires two double-sided disk drives or one hard disk. \$375. **Microsoft Corp.**, 10700 Northup Way, Box 97200, Bellevue, Wash. 98009, (206) 828-8080.

Circle 327

ANSWERS TO APRIL'S PUZZLES

C	Y	C	L	E		B	A	U	D	S		R		A	U	O	N	A	L	F	L	O	P	P	Y	N	
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<ul style="list-style-type: none"> • Marketing, engineering, and planning personnel of companies who are using or considering the use of IPI in systems, subsystems, intelligent peripherals, boards, or chips 	<p>WHO SHOULD ATTEND</p>	<ul style="list-style-type: none"> • Engineering, marketing, planning, purchasing, test, quality assurance, and maintenance personnel who are involved in the peripheral selection and integration process of system integrators • Sales and marketing personnel of peripheral suppliers
<ul style="list-style-type: none"> • Hear from the world's leading experts on IPI and IPI applications • Take a guided tour through the interface "jungle" • Participate interactively in workshops and panel discussions and forums • Meet others to share IPI experience • Keep abreast of related peripheral technologies • See the latest in IPI products 	<p>BENEFITS</p>	<ul style="list-style-type: none"> • Hear from the world's leading experts on disk, tape, printer, and optical technology • Participate in interactive panel discussions • Meet others to share peripheral selection experience • Take a guided tour through the interface "jungle" • Learn what's important in an OEM contract • Discuss how to improve your product planning process • Improve your peripheral selection process
<ul style="list-style-type: none"> • The importance of standardization • IPI status with ANSI, ECMA, and ISO • IPI Level 2 Device I/O • IPI Level 3 Intelligent I/O • The impact of IPI on suppliers of chips, boards, peripherals, subsystems and systems • The future of IPI • Comparison of IPI and SCSI • How is IPI being used and who is using it? 	<p>KEY ISSUES AND TOPICS</p>	<ul style="list-style-type: none"> • The importance of standardization • Single-source products • Peripheral selection criteria • Cost of ownership • Testing tips • RAS (Reliability, Availability, and Serviceability) trends • Pricing trends • Product life • How much "technology" to buy
<p>Sunnyvale Hilton 8:00 a.m. Monday, June 3rd through 4:00 p.m. Wednesday, June 5th, 1985.</p>	<p>TIME AND PLACE</p>	<p>Sunnyvale Hilton 8:00 a.m. Thursday, June 20th through 4:00 p.m. Friday, June 21st, 1985.</p>
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The registration fee of \$895 for the 3 day IPI Forum includes attendance at all sessions, conference materials, 2 receptions, continental breakfast and luncheon each day, refreshments during breaks, banquet, gratuities and taxes. The registration fee of \$695 for the 2 day Peripheral Forum includes all of the same items as for the IPI Forum except the banquet.
- **Hotel Accommodation:**
A block of rooms has been reserved for forum delegates at the Sunnyvale Hilton. It is recommended that you register early by returning the hotel registration card mailed to you with your conference registration confirmation or by calling (408) 738-4888 and identifying yourself as a forum delegate.
- **Attendance:**
Since attendance will be limited in order to preserve an appropriate atmosphere within which to learn and interact with other delegates, it is recommended that your registration form and payment be mailed early.
- No cancellations after May 10th, 1985 for the IPI Forum and May 20th for the Peripherals Forum.
- **For further information call (714) 861-3339**

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cover printer line**

Six data sheets describe Anadex's line of serial, dot-matrix printers that operate at 60 to 540 cps and 10 to 16.5 cpi. Three of these cover the Silent/Scribe product line, models DP-9000B and DP-90001B, DP-9500B and DP-9501B and DP-9620B

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Circle 328

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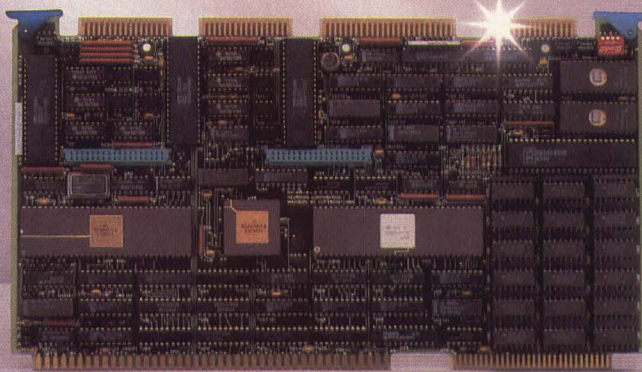
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CIRCLE NO. 99 ON INQUIRY CARD

Brochure describes protection systems

Listing specifications, features and typical construction details of its three series, the "Hitran Power Protection System" brochure covers the company's power-protection equipment for computers, telecommunications equipment, process controllers and similar line-sensitive systems. Included are the UPS series uninterruptible power systems, SFR series sinusoidal ferroresonant regulators and UIS series ultimate isolation systems. Tables list model numbers, standard ratings, inputs, outputs and sizes. **Hitran Corp.**, Route 31, RD 5-65, Flemington, N.J. 08822, (201) 782-5525.

Circle 329

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P.O. Box CN 11250, Trenton, N.J. 08650

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CIRCLE NO. 106 ON INQUIRY CARD

NEW PRODUCTS LITERATURE

Directory offers sales leads

Compiled from the Yellow Pages of over 4,800 current phone books nationwide, the *Computer Dealers Directory* contains 24,666 names listed under the title "Computer Dealers." Listings include business name, address, city, state, zip code and telephone number. Listings are organized alphabetically by state, city within state and business name within city. \$369; \$295, subscription price. **American Business Directories Inc.**, P.O. 5639 S. 86th Circle, P.O. Box 27347, Omaha, Neb. 68127, (402) 331-7293.

Circle 330

Guide lists 5,000 IBM products

The fourth edition of the *IBM PC Expansion and Guide* furnishes information about hardware, software, supplies and services for IBM personal computers including the XT and 3270. The

guide lists more than 5,000 product descriptions from 1,500 vendors. Listings include prices, system requirements and vendor addresses. The 852-page text profiles each company whose products are listed in the guide, their address, phone number, year established, principals and primary products provided. \$19.95. **Que Corp.**, Suite #202, 7999 Knue Road, Indianapolis, Ind. 46250, (317) 842-7162.

Circle No 331

Report analyzes telecommunications market

A report titled "Micro-Mainframe: Telecommunications" examines options open to communications planners, analyzes four micro-to-mainframe communications case studies and provides a means of evaluating technological and organizational alternatives. The case studies include downloading to spreadsheets; advanced micro-to-mainframe

linkages, or how some information system departments have had to write their own communications linkages to accommodate complex applications; microcomputers replacing minicomputer front ends; and manufacturer-supplied communications. Current technical environments, the growth of the communications markets and system-design issues such as security, data uploading and downloading and applications design are included. \$1,950. **Input**, 1943 Landings Drive, Mountain View, Calif. 94043, (415) 960-3990. Circle No 332

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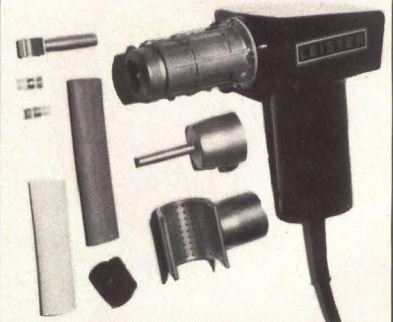
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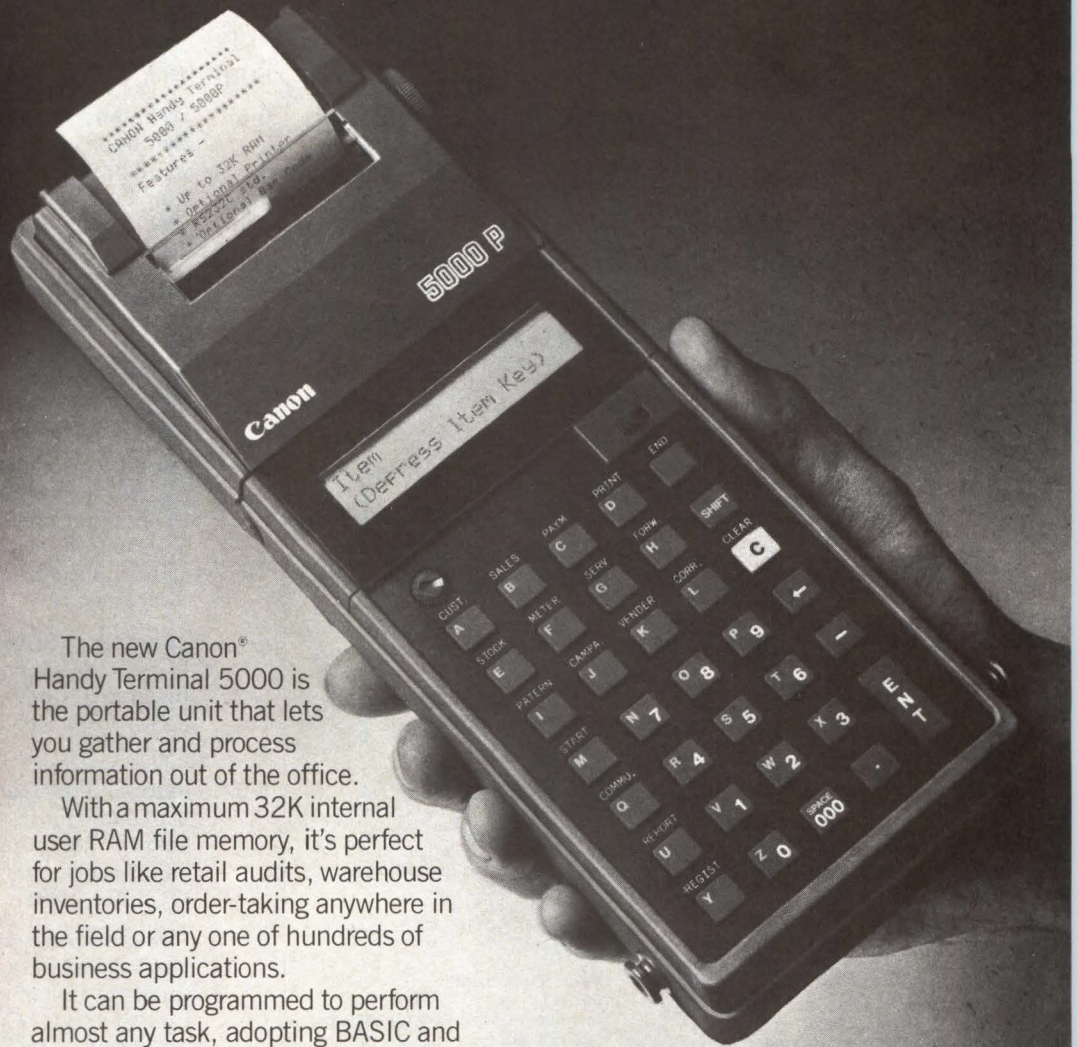
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CIRCLE NO. 101 ON INQUIRY CARD

MINI-MICRO SYSTEMS/May 1985

The new Canon[®] Handy Terminal makes any computer system go farther.



The new Canon[®] Handy Terminal 5000 is the portable unit that lets you gather and process information out of the office.

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3-5 "Mini and Microcomputers and Their Applications Symposium," McGill University, Montreal, sponsored by The International Society for Mini and Microcomputers (ISMM). Contact: Canadian Secretariat ISMM, P.O. Box 25, Station G, Calgary, Alberta, T3A 2G1, Canada, (403) 286-1589.

3-6 ROBOTS 9 Conference and Exposition, Cobo Hall, Detroit, sponsored by Rototics International of the Society of Manufacturing Engineers (RI/SME) and The Robotic Industries Association (RIA). Contact: RI/SME Public Relations, One SME Drive, P.O. Box 930, Dearborn, Mich. 48121, (313) 271-0777.

3-7 "Solid Modeling" Course, the University of Rochester, Rochester, N.Y., offered by the University of Rochester. Contact: Gunta Lidars, Administrator, Production Automation Project, College of Engineering and Applied Science, The University of Rochester, Rochester, N.Y. 14627, (716) 275-3106.

4-7 "Computer Graphics" Course, Boston, sponsored by Integrated Computer Systems. Contact: Ruth Dordick, Integrated Computer Systems, 6305 Arizona Place, P.O. Box 45405, Los Angeles, Calif. 90045, (800) 421-8166.

5-6 Independent Computer Maintenance Conference, Halloran House, New York, sponsored by Frost & Sullivan Inc. Contact: Wendy Engelberg, Frost & Sullivan Inc., 106 Fulton St., New York, N.Y. 10038, (212) 233-1080.

6 "Measurement and Testing of Fiber Optics" Seminar, Logan International Airport Hilton, Boston, sponsored by Communications and Information Institute. Contact: Bob Casey, Sales Manager, Information Gatekeepers Inc., 214 Harvard Ave., Boston, Mass. 02134, (617) 232-3111.

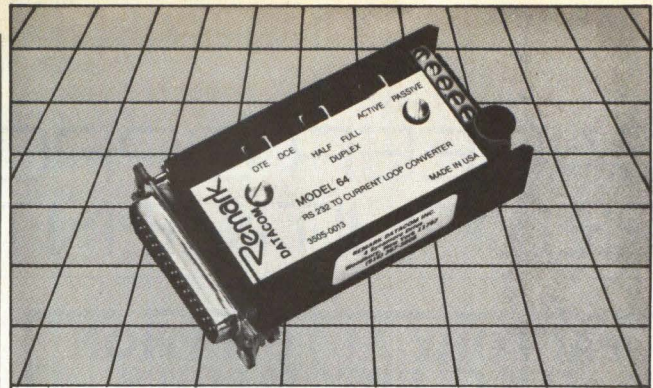
11-12 "Making Sense of Data Communications" Course, San Diego, offered by Timeplex Inc. Contact: William A. Flanagan, Timeplex Inc., 400 Chestnut Ridge Road, Woodcliff Lake, N.J. 07675, (201) 930-4600. Also to be held on July 16-17, Washington.

11-14 "Statistical Data Analysis and Forecasting" Course, Los Angeles, sponsored by Integrated Computer Systems. Contact: Ruth Dordick, Integrated Computer Systems, 6305 Arizona Place, P.O. Box 45405, Los Angeles, Calif. 90045, (800) 421-8166. Also to be held on June 25-28, Washington; July 9-12, Boston; July 23-26, Palo Alto, Calif.

12-14 The Western Information Management Exposition & Conference (INFO/WEST), Anaheim, Calif., sponsored by Cahners Exposition Group. Contact: Show

Manager, INFO/WEST, 999 Summer St., Stamford, Conn. 06905, (203) 964-8287.

- 12-15 1985 Rochester Forth Conference**, University of Rochester, New York, sponsored by the Institute for Applied Forth Research Inc. Contact: Maria Gress, Institute for Applied Forth Research, 70 Elmwood Ave., Rochester, N.Y. 14611, (716) 235-0168.
- 13 "Distributed Data Switching" Seminar**, San Diego, offered by Timeplex Inc. Contact: William A. Flanagan, Timeplex Inc., 400 Chestnut Ridge Road, Woodcliff Lake, N.J. 07675, (201) 930-4600. Also to be held on July 18, Washington.
- 17-19 Third Annual PC EXPO Conference Program**, New York Coliseum, sponsored by PC EXPO Inc. Contact: Steven Gross, PC EXPO Inc., 333 Sylvan Ave., Englewood Cliffs, N.J. 07632, (201) 569-8542.
- 17-21 Third European Fiber Optic Communications and Local Area Network Exposition**, Maison Des Congres, Montreux, Switzerland, sponsored by Information Gatekeepers Inc. Contact: Joan Barry, Conference Director, Information Gatekeepers Inc., 214 Harvard Ave., Boston, Mass. 02134, (617) 232-3111.
- 24-26 VIDEOTEX '85 - Fifth Annual Videotex Industry Conference and Exhibition**, the New York Hilton, New York, sponsored by Online Conferences Inc. Contact: Cynthia A. Parsons, Press Relations Coordinator, Online Conferences Inc., 989 Avenue of the Americas, New York, N.Y. 10018, (212) 279-8890.
- 25-27 Computer Graphics '85 West**, Los Angeles Convention Center, Los Angeles, sponsored by National Computer Graphics Association (NCGA). Contact: Chris Radiske, NCGA, Suite 601, 8401 Arlington Blvd., Fairfax, Va. 22031, (703) 698-9600.
- JULY**
- 8-12 "Foundations of Modern Telecommunications Systems" Course**, Washington, offered by the George Washington University Continuing Engineering Education Program. Contact: Shirley Forlenzo, The George Washington University, Washington, D.C. 20052, (202) 676-8530.
- 10-12 World Computer Graphics '85 Exposition and Conference**, New York Coliseum, New York, sponsored by the World Computer Graphics Association and the National Computer Graphics Association. Contact: American Communications Group Inc., Suite 690, 8300 Greensboro Drive, McLean, Va. 22102, (703) 893-4545.



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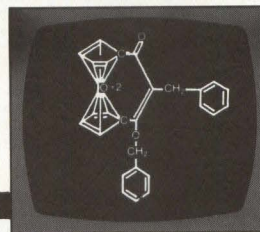
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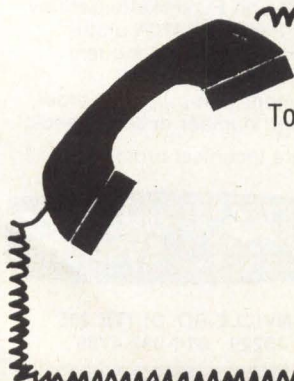
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MARKET TRACK

Sharon Hassell
Assistant Editor

Teeming AI market expected in 1989

The market for artificial-intelligence products and services is booming, according to a recent report by Business Communications Co. Inc., Stamford, Conn. Valued at \$142 million in 1984, the market for AI software, hardware and services is expected to reach over \$1 billion by 1989. The market research company says the 1989 figure reflects an annual growth rate of 50 percent.

The software segment, involving natural language, utilities, framework systems, application products and generic tools, will represent the largest share of the total AI market in 1989,

the report states. Business Communications says that AI software products will then total \$434 million.

By 1989, natural-language software revenues will total \$200 million, with an annual growth rate of 65 percent, according to the report. Framework systems, with an estimated value of \$100 million, software utilities at \$65 million, application software at \$53 million and generic tools at \$16 million represent the remaining AI software product projections.

Although hardware may be considered one of AI's early driving forces, having claimed 53 percent of total AI products and services sales in 1984, 1989's expected \$310 million hardware market should account for only 28 percent of AI products and services.

The AI service market, which Business Communications defines as com-

prising general AI education, consulting services, training in special projects or languages and prototyping, will experience a 90 percent increase by 1989. A \$32 million market in 1984, AI services are expected to reach \$347 million by 1989.

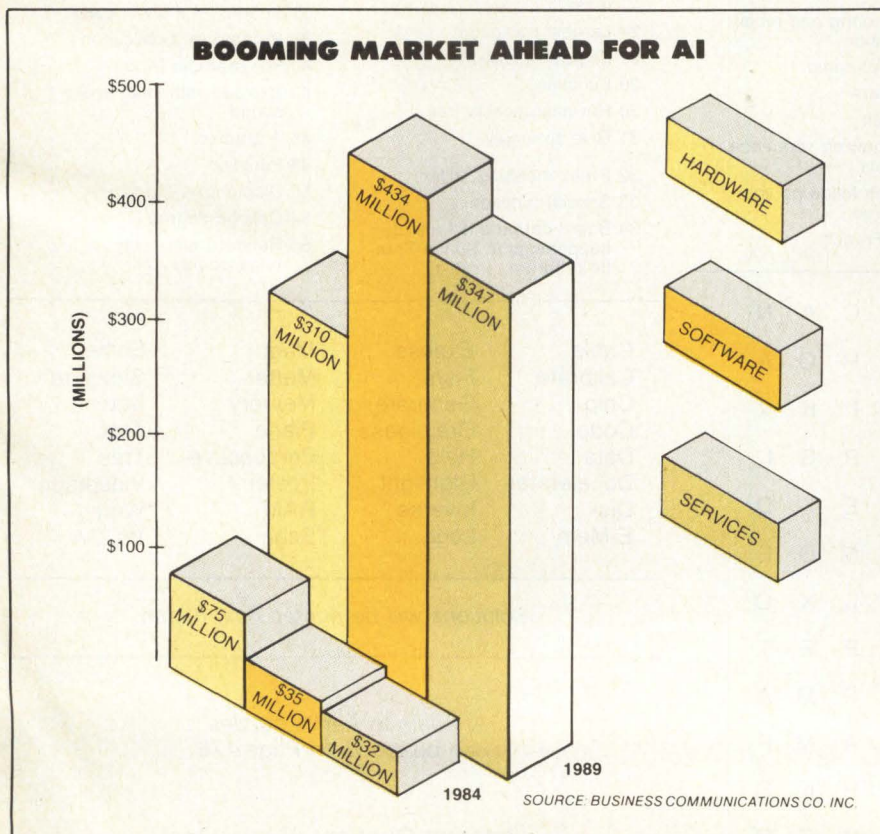
The report attributes the AI market surge to a number of factors, including increased U.S. government programs that plan to implement AI expertise, the growing number and strength of U.S. AI research centers and foreign-government projects involving AI.

Higher prices seen for CRT monitors

The market for CRT monitors sold to U.S. computer and instruments manufacturers will grow from \$495 million in 1983 to \$3.9 billion in 1992, according to a report by Stanford Resources Inc., San Jose, Calif. However, during the same period, the average price paid by manufacturers for CRT monitors will increase from \$132.70 to \$210.80 per monitor.

Fueling the price increase will be higher performance requirements, such as increased resolution, greater use of color and more stringent operating standards. Stanford Resources says that, while price declines in specific equipment categories will continue, the migration toward more sophisticated monitors will cause a price increase at the aggregate level.

According to the report, the demand for monitors with higher bandwidth specifications, increased color options and higher resolution is occurring as a result of host equipment manufacturers' demands for clear, flicker-free monitors with improved text and graphics. As in the past, the main pressure for technological improvements and innovations for CRT monitors will come from the graphics terminal manufacturers. □



By 1989, the total AI products and services market is expected to exceed \$1 billion—an 86 percent increase over the 1984 market.

Interest Quotient (Circle One)
High 474 Medium 475 Low 476

ARTFUL INTELLIGENCE

By John K. Young

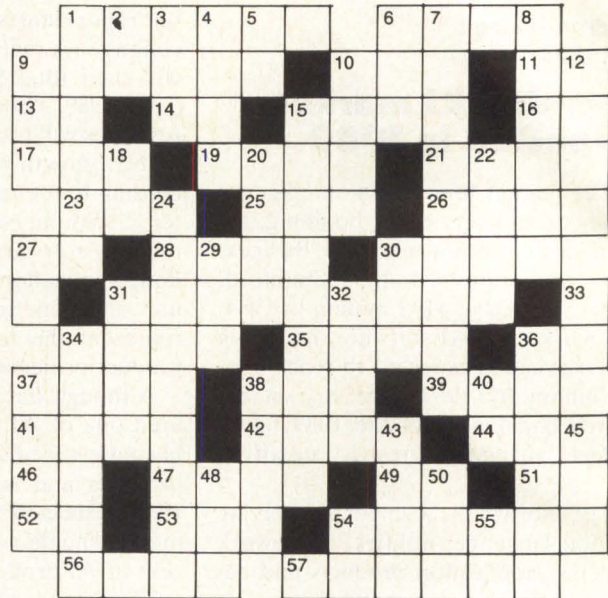
ACROSS

- 1 Standard-setting program
- 6 Glide swiftly and lightly over
- 9 Computer trespasser
- 10 Symbol of busyness
- 11 Wing at right angle
- 13 International forum (Abb.)
- 14 Its capital is Des Moines
- 15 Crafty
- 16 Yours truly
- 17 Wires connecting different sections of computer
- 19 Prefix meaning thousand
- 21 Section of CP/M keeping track of disk files
- 23 It pivots on graphic tablets
- 25 Kind of printer: _____ matrix
- 26 Belonging to us
- 27 Suffix meaning "an alcohol"
- 28 A small number (2 words)
- 30 Her name means "pure"
- 31 List of files on disk
- 34 Used up
- 35 _____ disk assembly
- 36 In precisely this manner
- 37 50 percent
- 38 Organ of hearing
- 39 Statement
- 41 Group that supports computer owners
- 42 Powerful graphics command

- 44 Building equipped for physical training
- 46 Printer's measure
- 47 Dismounted
- 49 Breezy greeting
- 51 Musical note
- 52 Compass direction of San Diego from Silicon Valley
- 53 Encountered
- 54 Streaming tape role
- 56 Person aged 13 to 19
- 57 Bits of descriptive writing

DOWN

- 1 Part of documentation that comes with computer
- 2 Kind of electrical current
- 3 Runner for gliding over snow
- 4 Hard wood used for furniture
- 5 Erbium (Chem.)
- 6 Characteristic of being male or female
- 7 They're usually laid out in standard "QWERTY" pattern
- 8 Place for storing and recalling information
- 9 Boston's nickname
- 10 Load software
- 12 Not so much
- 15 Diagram showing sequence of operations
- 18 Abbreviation following your father's name
- 20 "Idea" in France



- 22 When it calls, youth says "I must"
- 24 Largest computer
- 27 Logical operation
- 29 Function
- 30 Hawaiian acacia tree
- 31 Give sparingly
- 32 Prefix meaning trillion
- 33 Special function
- 34 Board carrying details of happenings in Space Shuttle program
- 36 Electronic pencil
- 37 Shades of a given color
- 38 Prepare for publication
- 40 For example (Abb.)
- 43 Explode with loud, sharp sound
- 45 A graphic
- 48 Function
- 50 Diamonds
- 54 College degree
- 55 Render (opponent) unconscious

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Answers to April's puzzles can be found on Page 176.

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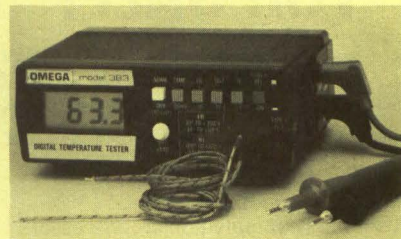
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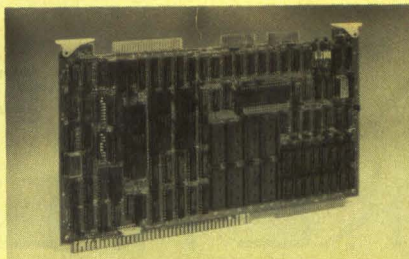


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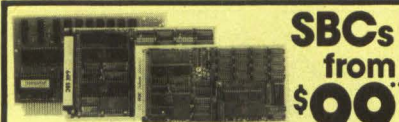
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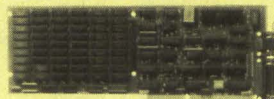
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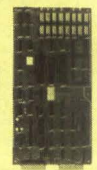
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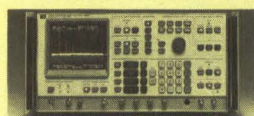
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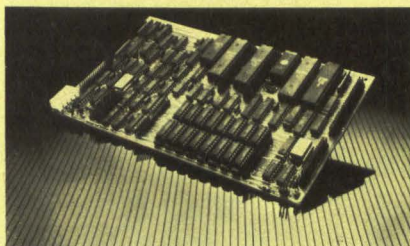
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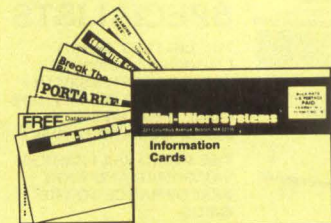
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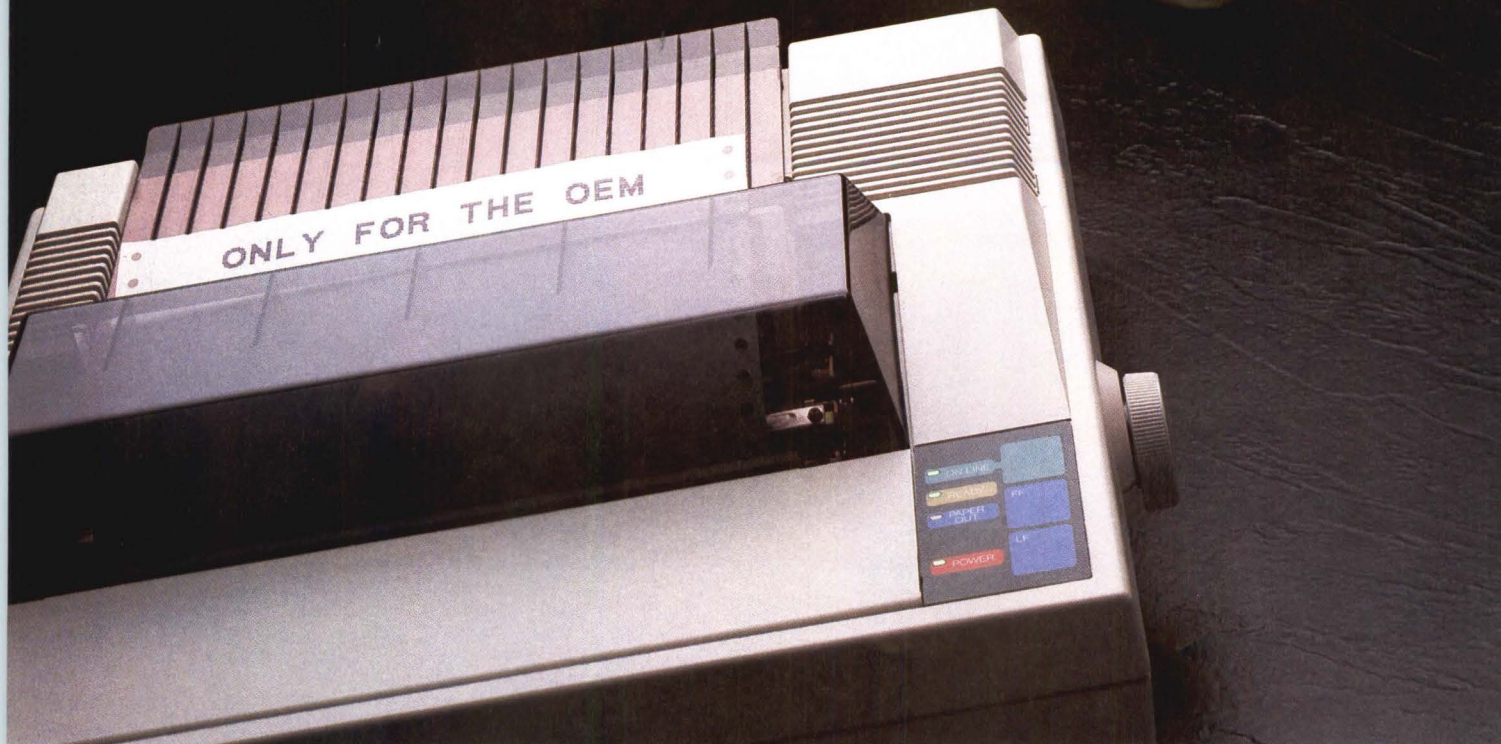


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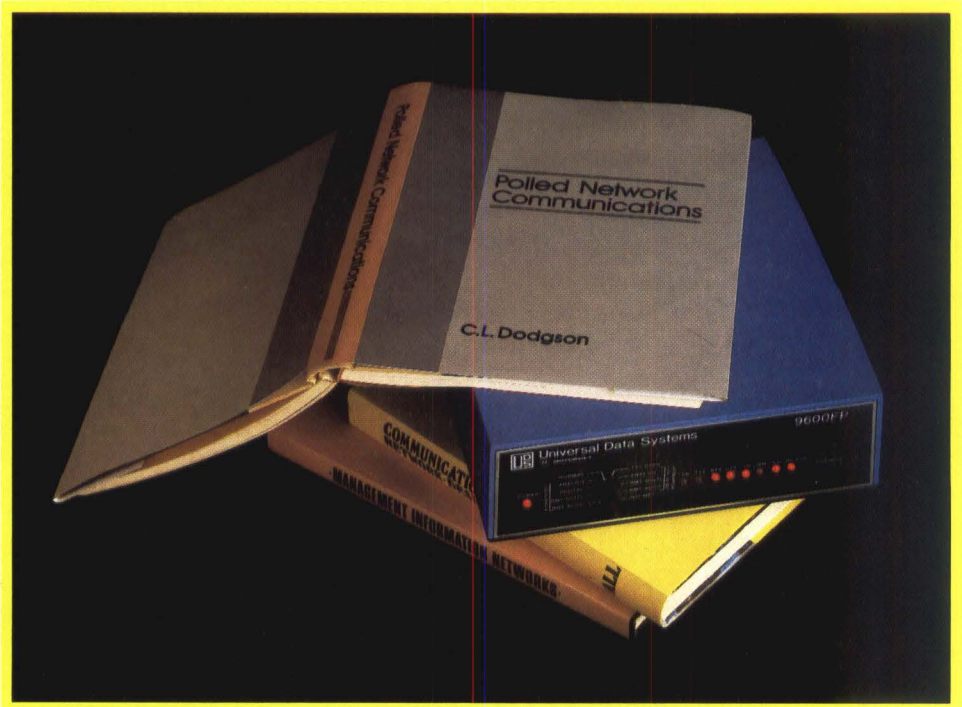
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