

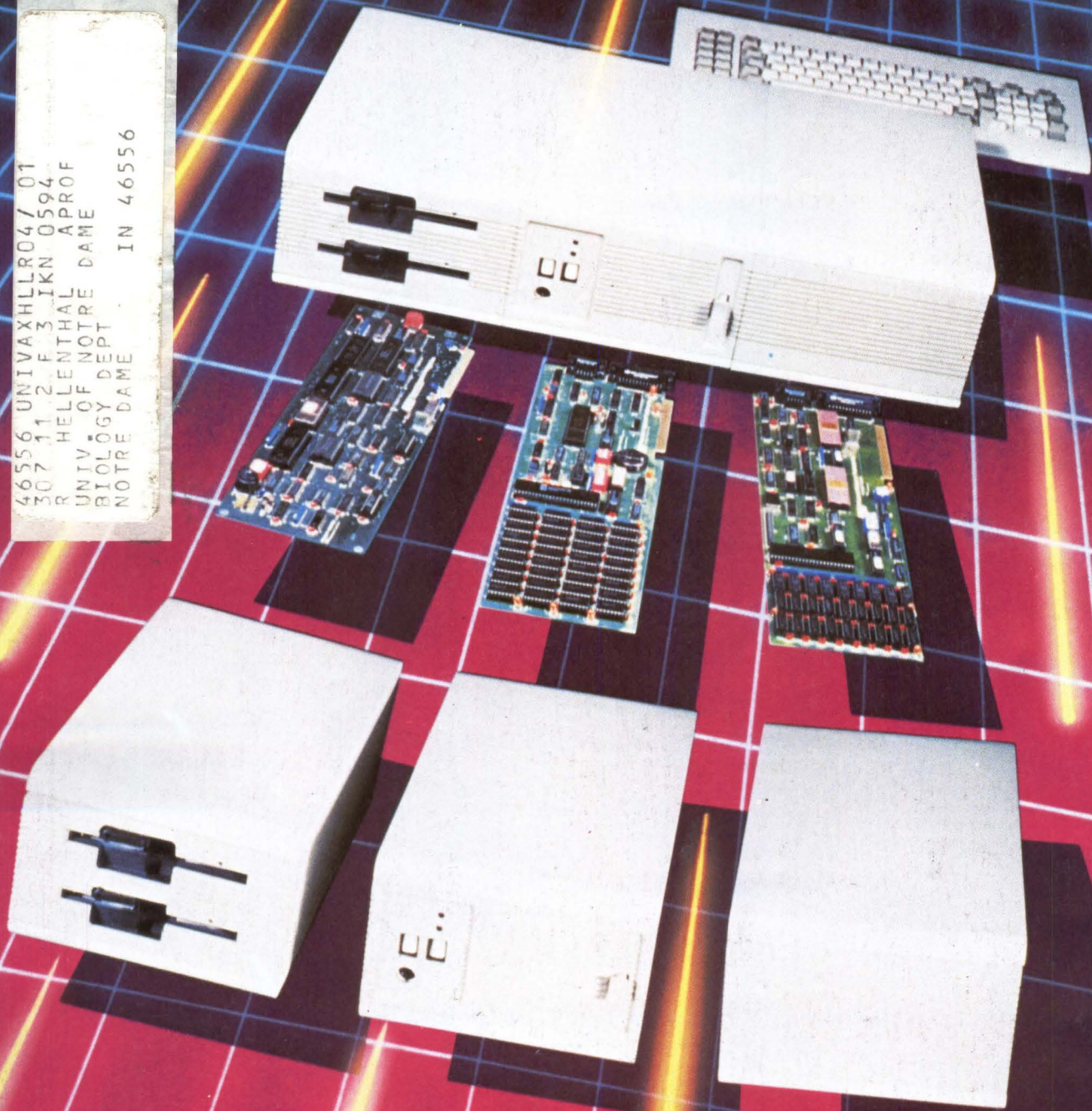
# Mini-MicroSystems

A CAHNERS PUBLICATION

JUNE 1984

## PC-compatible system achieves low cost via modularity

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State of the Market Report: What's hot and what will be  
Front-end processor/J11 chip combo boosts PDP-11 performance  
AI, personal computers, standards set the tone for this year's NCC



...from DATARAM



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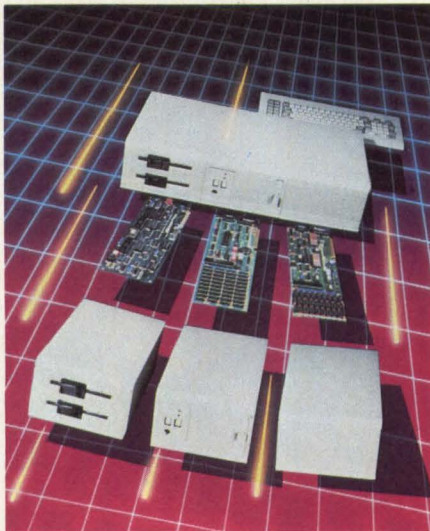
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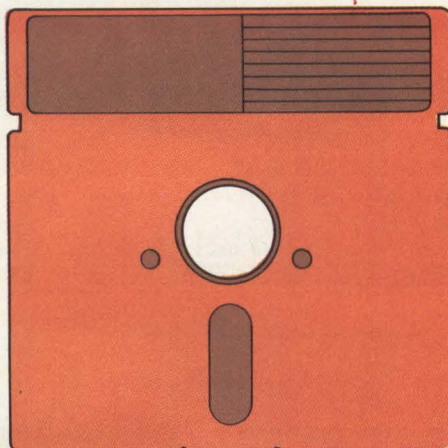




# Mini-Micro Systems



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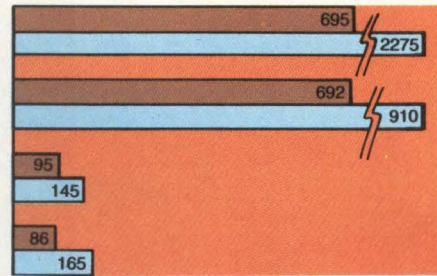
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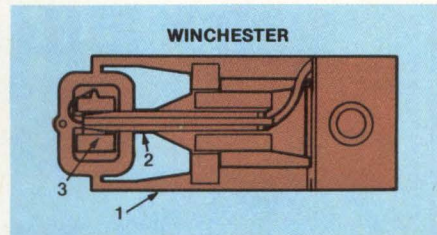
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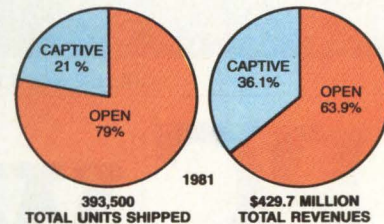
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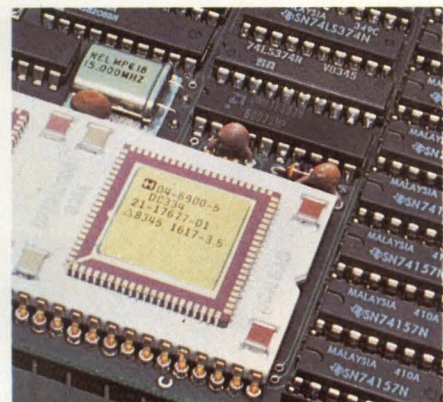
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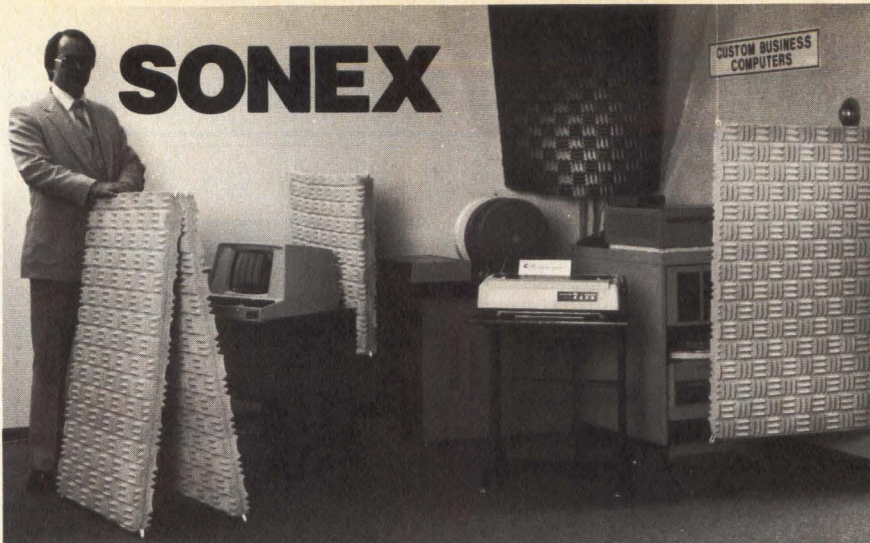
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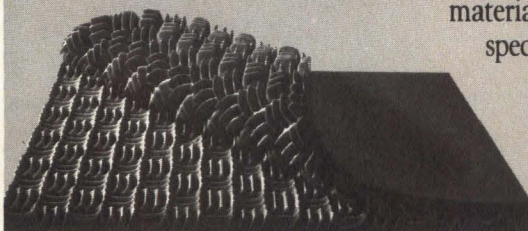




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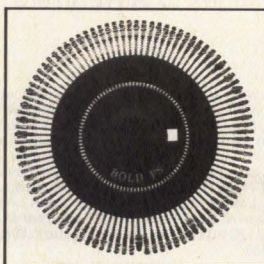
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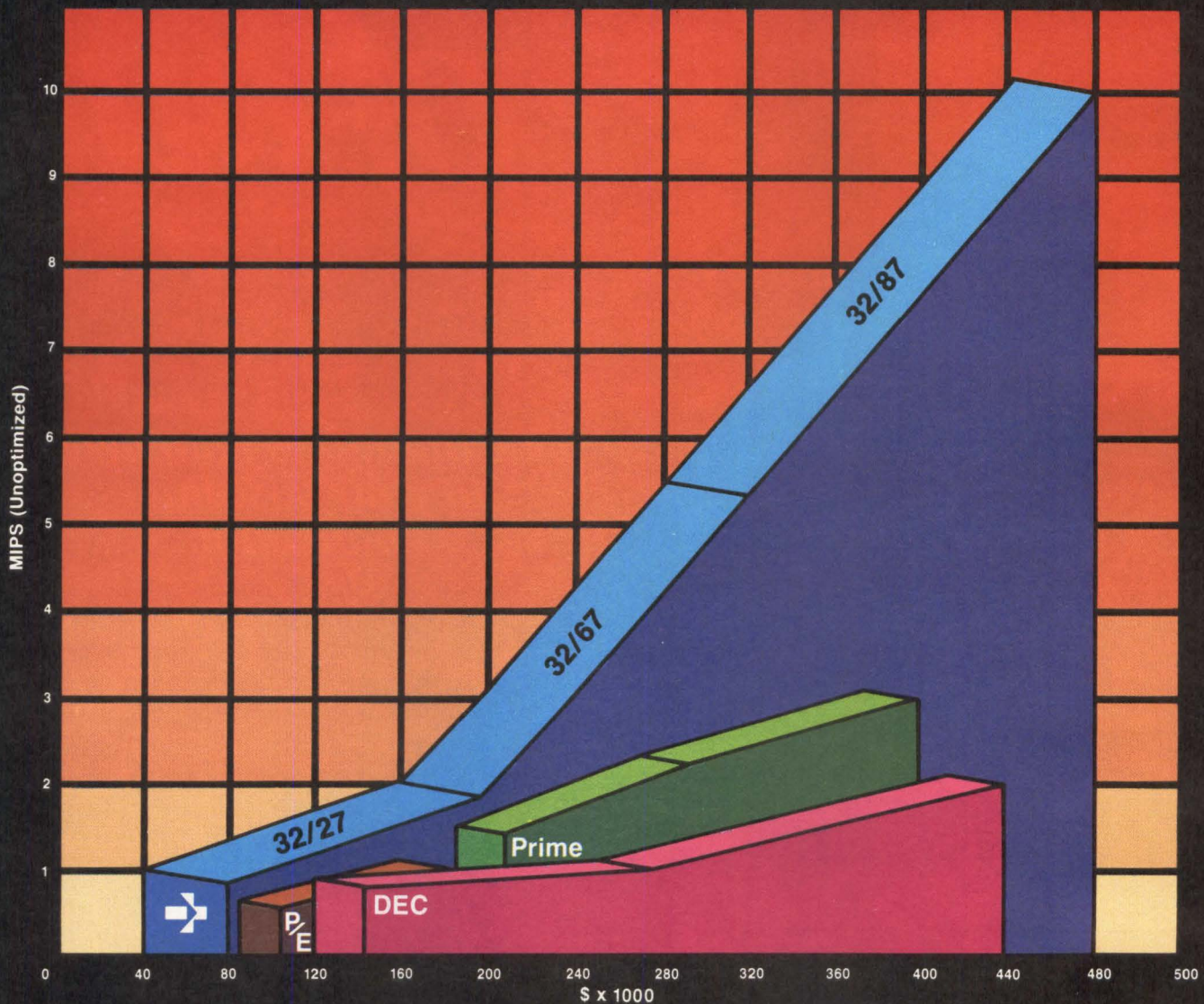
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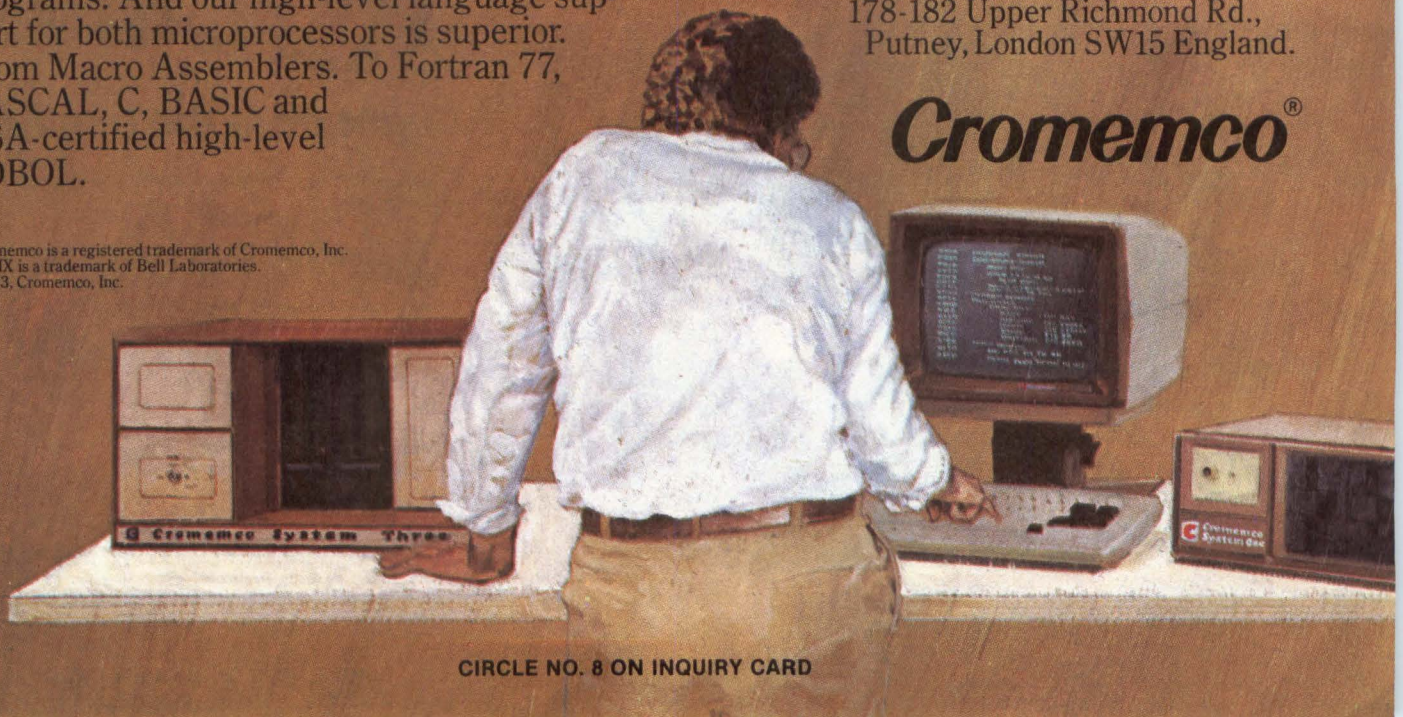
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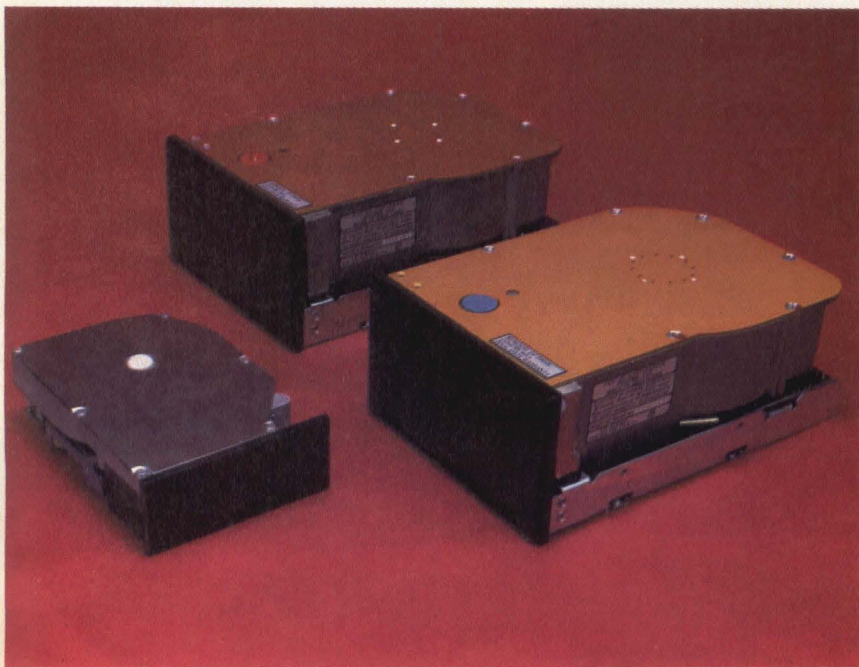
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## Market research: Scheme or strategy?

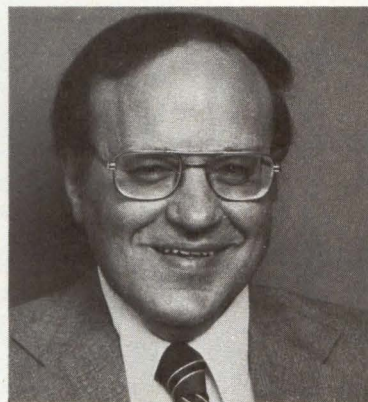
Market research is a science to some and a black art to others. We side with the science camp. Done properly, market research deals objectively with accumulated data, develops predictive models and evolves "truth-seeking mechanisms" built on hypothesis, experiment, analysis and revision.

The articles in this issue that make up our *State-of-the-Market Report* are similarly derived. They have their roots in real data and are expressed in the graphical language of quantitative relationships. Their authors are skilled at collecting and analyzing enough of the world as it is to depict a world that might be. It is a process that takes courage as well as skill. Of course, the testing place of market research is the marketplace.

Alas, like any other occupation—editing and writing no less than marketing—not all those engaged are up to the task. Some market researchers are simply inadequate scientists. Many are only quoters: regardless of how much good evidence they've mustered, they are unable to predict what hasn't already been predicted. Others will offer predictions on no more than gut feeling. Some are statistical librarians at best and guessers at worst, passing off consensus for prediction. There are sages whose wisdom is to be accepted without numbers and mages whose magic is nothing but numbers. One of our pet "nasties" is the "wringer," adept at squeezing 100 pages of text from 10 phone calls and a spreadsheet.

These *State-of-the-Market* articles were solicited from companies and individuals who impressed us with essential scientific attributes: access to demonstrably good data, analytic resources, originality and presentational skills.

But even these sources cannot cover every subject. We know there's a lot more to be written—and so we're asking for your help. Please drop us a line with your own thoughts on market research. What do you think of the quality of available research? On what sources do you depend? How much weight do you place on published research? Finally, let us know which of these market articles you found most or least valuable—and why. We believe that the market research in this issue is what you're looking for. But we have too much respect for scientific methods to believe we can provide good research without doing good research ourselves.



*George V. Kotelly*

George V. Kotelly  
Editor in Chief





ORDER NUMBER: 97422936  
 DESCRIPTION: 1982 Ford Fairlane Sedan, left rear brake shoe  
 COST: \$5.72  
 PART NUMBER: 1982-95-320  
 QUANTITY: 4  
 ON HAND: 22  
 DATE: 8-18  
 COMMENTS: See 8-18 confirmed to Bill Mc. Drivers via truck 8-18  
 Note: 1 item ordered. Please Note. Date

ORDER ID: 10000000000000000000  
 ORDER DATE: 01/11/79  
 ORDER TIME: 15:30  
 ORDER NUMBER: 10000000000000000000  
 ORDER TYPE: NEW ORDER  
 ORDER STATUS: OPEN  
 ORDER CATEGORY: OTHER  
 ORDER SUB CATEGORY: OTHER  
 ORDER ITEM: 10000000000000000000  
 ORDER QUANTITY: 1  
 ORDER UNIT: EACH  
 ORDER PRICE: 10000000000000000000  
 ORDER TOTAL: 10000000000000000000  
 ORDER TAX: 0  
 ORDER TOTAL WITH TAX: 10000000000000000000  
 ORDER DATE: 01/11/79  
 ORDER TIME: 15:30  
 ORDER NUMBER: 10000000000000000000  
 ORDER TYPE: NEW ORDER  
 ORDER STATUS: OPEN  
 ORDER CATEGORY: OTHER  
 ORDER SUB CATEGORY: OTHER  
 ORDER ITEM: 10000000000000000000  
 ORDER QUANTITY: 1  
 ORDER UNIT: EACH  
 ORDER PRICE: 10000000000000000000  
 ORDER TOTAL: 10000000000000000000  
 ORDER TAX: 0  
 ORDER TOTAL WITH TAX: 10000000000000000000

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 ANYTOWN, CA 90000  
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 FAX: (415) 555-5678  
 WWW: WWW.EXAMPLE.COM

CHIEF ENGINEER: J. SMITH  
 CHIEF DESIGNER: M. DAVIS  
 SUPERVISOR: S. WILSON

SPECIAL NOTES: Construction must start on or before 01/15/79. All requests must be given in consultation of the health of employee and the environment.

START EXPIRATION: 01/15/79  
 INITIAL PHASE: 01/15/79  
 100% PAYMENT: 01/15/79  
 START BYPASS: 01/15/79

ADM 24E

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ADM 24E

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# Lear Siegler

## Quality and Reliability You Trust.

### High Touch™ Style You'll Prefer.

This new generation of Lear Siegler video display terminals brings elegant High Touch™ style to our American Dream Machine (ADM™) tradition. The family features three new ergonomic terminals designed to meet the needs of OEMs and end users alike: the ADM 11, the ADM 12 and the ADM 24E.

Here is a whole new way for terminals to relate to people. Dozens of little touches add up to the convenience and comfort of High Touch.

For example, we put the power "on/off" switch and contrast control knob in front where they're easy to reach.

The monitor not only tilts and swivels, it stops positively in almost any position.

The clean, crisp display features a large character matrix on an easy-to-read green or amber non-glare screen—made even easier to read by the hooded bezel. Screens are available in 12" or 14" sizes.

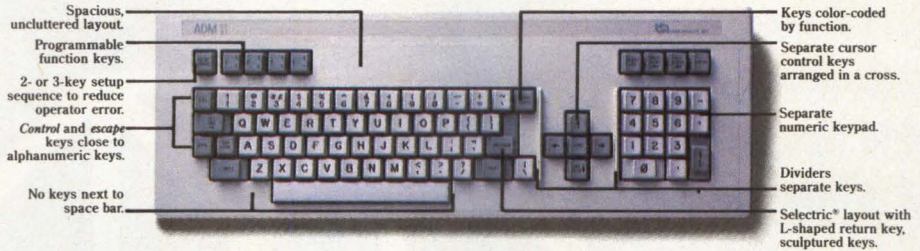
You get the best in style and ergonomics, plus all the outstanding performance features you'd expect from Lear Siegler (see chart).

Lear Siegler High Touch terminals are backed by the broadest network of full service centers anywhere, serving 3000 cities nationwide. And they're made in America—designed, engineered, manufactured and shipped from Anaheim, California to provide you with the best local support.

Place your order today by calling your local Authorized Distributor or, for quantities in excess of 500 units, your Regional OEM Sales Office.



Lear Siegler's new VersaPrint™ 500 Series printers combine with Lear Siegler video display terminals for hard copy output.



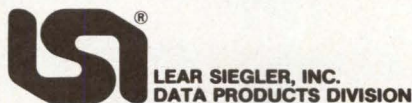
Low-profile, tapered, DIN-standard keyboards with Selectric layout feature logical key groupings and adjustable tilt for comfort and efficiency. ADM 11 shown above.

	<b>ADM 11</b>	<b>ADM 12</b>	<b>ADM 24E</b>
	Conversational	Editing	Host Programmable
Programmable Function Keys	4 (Shiftable to 8)	16 (Shiftable to 32)	16 (Shiftable to 32)
Non-Volatile Function Keys	Optional	Standard	Standard
Function Key Legends on 25th Line	From Host	From Host	Standard Non-Volatile
No. of Pages of Display Memory	1	2	4
Display Memory Configurations (Plus 25th Message/Status Line)	24 Lines by 80 Characters	(2) 24 x 80 or (1) 48 x 80 or (1) 24 x 158	User Definable up to 96 x 80
Scrolling	Standard Scrolling	Smooth, Jump or Horizontal Scrolling Split Screen	Smooth or Jump Scroll Split Screen
Transmission Mode	Conversation Mode	Conversation or Block Mode	Conversation or Block Mode
Editing	Limited	Full Editing & Protected Fields	Full Editing & Protected Fields
Visual Attributes: Reduced Intensity, Blink, Blank and Reverse Video. Underline also on ADM 12 and ADM 24E	3 Embedded 1 Non-Embedded	4 Embedded, 1 Non-Embedded or All Non-Embedded, plus Full Screen Reverse Video	5 Embedded, 1 Non-Embedded or All Non-Embedded, plus Full Screen Reverse Video and Highlight
OEM Flexibility	Modifiable Set-Up Characteristics	Modifiable Set-Up Characteristics & Personality	Modifiable Set-Up Characteristics. Add to Program in ROM or Down-Line Load in RAM (56K ROM or RAM. Up to 22K Display Available) Room for additional Logic Boards.
Terminal Compatibility	ADM 3A, ADM 5, ADDS Viewpoint & Regent 25, Hazeltine 1400, 1420 & 1500, DEC VT-52	ADM 3A, ADM 5, ADM 31, ADM 32	ADM 3A, ADM 5, ADM 31, ADM 32, ADM 42

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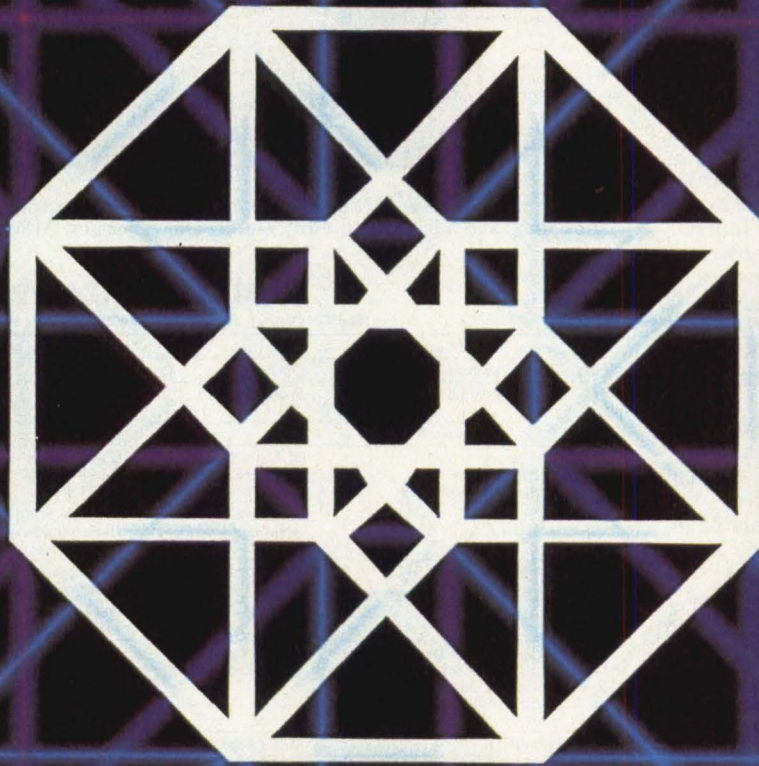


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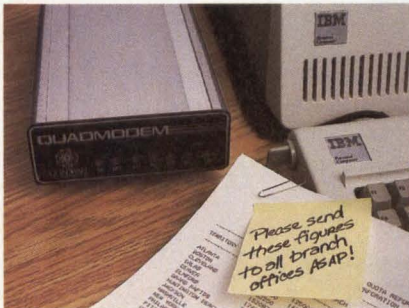
Now Quadram applies their expertise to communication devices. Not just modems, but a full range of other products, too. So that you can do anything from networking many PC's together to giving your PC full 3278 terminal emulation in an IBM mainframe environment.

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Just pick the model that's right for you and your computer.

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## 2. Quad3278.™ Let an IBM PC communicate with an IBM mainframe.



To integrate your PC into a mainframe environment, look to Quadram first.

Because now you can have all the features of the IBM PC (mass storage and peripherals) plus the incredible power of a mainframe right at your desk. All it takes is Quadram's 3278 emulation package which includes hardware, software, even cabling.

To make your IBM PC emulate the 3278 Display Work Station, get the Quad3278.™ Once you're on-line the IBM mainframe sees you as just another 3278 terminal. Little does it know that you're actually a high-performance, intelligent work station, with all the functions of the Personal Computer. With mainframe support you can download data, process it on your PC, even store it on your own disk for later reference.

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## 3. Quadnet.™ Turns your IBM PC's into a Local Area Network.

Local Area Networking (LAN) is one of the most interesting and useful ideas to come

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And now with Quadnet, you don't have to compromise your system to fit our system. Instead, you can easily link as few as two, or as many as 255 IBM PC's together in a hard-wired network. And you can configure them almost any way you want. They can work independently of each other or share resources and peripherals.

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Quadnet grows as you grow. Yet the user commands stay the same, thanks to the upward compatibility of the Quadnet operating software.

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CIRCLE NO. 11 ON INQUIRY CARD



# Model 6455 Cartridge Tape System

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**Feature:** Start/Stop Operation

**Benefit:** Drive can emulate a 1/2" tape drive by providing the ability to perform selective file back-ups, file-restructuring, journaling and software updates.

The drive is effectively a 1/2" Tape Drive in a smaller package.

**Feature:** Hard Read Error Spec. of 1 in 10<sup>11</sup> bits.

**Benefit:** Best data reliability of any tape cartridge drive. Gives the user confidence in the integrity of the back-up medium.

**Feature:** On-board Diagnostics

**Benefit:** Drive can be tested off-line with no test equipment required. Use of S.A. also lowers the MTTR.

**Feature:** Cartridge Jam Protection

**Benefit:** Protects the cartridge from damage if cartridge jams. This is accomplished by sensing a current surge and then disabling the motor, thus insuring that the cartridge will not be damaged.

**Feature:** High Density Recording

**Benefit:** Storage capacity of 23 MB on a single cartridge.

**Feature:** Optional industry standard 1/2" tape interface.

**Benefit:** Operates with existing tape couplers and software. The drive operates as though it were a 1/2" tape drive without having to modify existing hardware or software.

**By now you can see what we're driving at. Model 6455 is full of unique features and benefits for you. For the complete story, write or call us today.**

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# **KENNEDY • QUALITY • COUNT ON IT**

CIRCLE NO. 12 ON INQUIRY CARD



# Breakpoints

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## **MULTIFUNCTION WINCHESTER BOARDS SUPPORT SEVERAL INTERFACES**

A new Winchester controller board from Adaptec Inc., Milpitas, Calif., is designed for the multiuser microcomputer market and is compatible with storage module device (SMD), small computer systems interface (SCSI) and American National Standards Institute interfaces. Designated the ACB5500S, the board is one of the first to have both 8- and 14-inch Winchester drives compatible with all three standard interfaces. That makes it compatible with almost any drive on the market. Priced at \$980 with significant OEM discounts available, the controller will become available in late June. Concurrent with this month's ACB5500S announcement, Adaptec plans to unveil several host adapters to fit between host computer buses and the SCSI intelligent I/O bus. Included will be support for products from Altos Computer Systems Inc., Molecular Computer and Eagle Computer Inc. Priced at \$425 each, the adapters should become available in the third quarter.—C. Bailey

## **TELEVIDEO TO INTRODUCE DEC VT220-COMPATIBLE TERMINAL**

TeleVideo Systems Inc., Sunnyvale, Calif., expects a July introduction for a video display terminal said to be code-compatible with the Digital Equipment Corp. VT100 and VT220 terminals. The \$995 TeleVideo 922 has a tilt-and-swivel screen and a low-profile DIN-standard keyboard. The keyboard combines features of the DEC terminal keyboards. The 922 has 30 programmable function keys. TeleVideo expects the 922 to be available in August.—T. Moran

## **DG MAKES MAJOR ENGINEERING WORKSTATION PUSH**

Data General Corp., Westborough, Mass., is preparing a major push into the engineering workstation market. The first two products to be released should be the DS4000 and DS4200, both of which are based on the company's 32-bit MV/4000 superminicomputer. The duo is packaged in a 25-inch-high-by-15-inch-wide cabinet that fits under a desk. The DS4000 has a 19-inch, 1,024-by-1,024-dot monochrome display. The DS4200 has the same display in color. Also expected from DG is a native UNIX System V operating system with the Berkeley extensions. The two products are not meant to replace the MV/4000, says a DG spokesman, because they have more limited memory and configurability options.—L. Valigra

## **VADEM, MORROW TO PRODUCE 10-POUND PORTABLE**

Vadem, a Milpitas, Calif., start-up, in conjunction with Morrow Design Inc., San Leandro, Calif., plans to produce a 10-pound portable computer code-named "Walnut." Morrow will market the machine and provide Vadem with parts. Vadem will manage third-party production of its design. The 16-bit MS-DOS machine will have a 16-line-by-80-column liquid-crystal display, a one-third-height 5¼-inch floppy disk drive and 128K bytes of RAM, expandable to 512K bytes. Vadem president Chi Kok Shing says the system is not fully IBM-compatible but will run most top productivity software including Lotus Development Corp.'s 1-2-3 integrated package. Expected to retail for less than \$3,000, the portable was to be shown at the Comdex show in Atlanta.—T. Moran



# Breakpoints

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## **MICROPOLIS TO BOOST WINCHESTER CAPACITY**

Micropolis Corp., Chatsworth, Calif., plans to unveil a family of high-capacity 5¼-inch Winchester disk drives at next month's National Computer Conference. The family consists of three drives: the 85M-byte model 1353, the 127M-byte model 1354 and the 170M-byte model 1355. All use plated media and will sport the enhanced small disk interface (ESDI) standard, thus enabling a 10-MHz transfer rate. Evaluation units are expected in the fourth quarter.—C. Warren

## **SMALL ROBOT ARM INTERFACES WITH PCs**

Microbot Inc., Mountain View, Calif., plans to introduce the Alpha II programmable robot arm this month. Able to lift 2½ pounds with its mechanical gripper, the \$13,900 arm and controller are said to perform simple tasks with human precision. These tasks include solder-masking printed-circuit boards. Programming can be done on any computer generating ASCII characters or on an optical \$595 hand-held unit non-programmers can operate. On-board memory stores 227 program steps, while a computer can store additional steps that can be down-loaded. Microbot plans to sell the Alpha II mainly through third-party distributors and OEMs.—S. Glazer

## **HP UNVEILS LOW-COST LASERJET PRINTER**

At the recent Comdex show in Atlanta, Hewlett-Packard Co.'s Boise, Idaho, division expected to show its LaserJet printer, which will sell for under \$3,500. Based on Canon U.S.A. Inc.'s LBP-CX laser-beam print engine, the LaserJet uses dry electrophotography to create 300-by-300-dot-per-inch (dpi) resolution for text and 75-by-75 dpi for graphics. The compact desktop prints the first page in about 8 seconds and thereafter produces 8 pages per minute, depending on the application and the computer system. Rated for noise at less than 55 decibels adjusted, the LaserJet will be positioned against daisy-wheel printers in business and personal computer applications. HP expects to ship the LaserJet to about 1,100 of its personal computer and plotter dealers on June 1.—T. Moran

## **START-UP LAPINE TO OFFER RUGGED 3½-INCH WINCHESTER**

Designed for portable computer applications and incorporating shock- and vibration-resistant suspension and a specialized head-retraction system, the 5M- and 10M-byte Ranger 3521 and Ranger 3522 3½-inch Winchester disk drives will be offered by LaPine Technology Inc., Santa Clara, Calif. The drives are said to withstand forces of up to 100 G's in the power-off mode. These ST-506/-412-compatible Winchesters are half the height of ordinary 5¼-inch minifloppies. As many as four fit into the same volume as one 5¼ inch minifloppy or Winchester drive. Sporting an access time of 85 msec. and densities of 11,200 bits per inch and 600 tracks per inch, the drives are expected to be price- and performance-competitive with standard Winchesters. First units are planned for availability by year-end. Volume shipments are expected to begin in the first quarter of 1985.—C. Bailey





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CIRCLE NO. 13 ON INQUIRY CARD





Here's our newest arrival: the PINCOMM 73S! And we're as proud of it as we are of each of its predecessors in the STANDARD MEMORIES product family. Every one of them has gone out into the world and earned the respect of customers ranging from the Fortune 500 to government, universities, and the military. No small accomplishment.

Our new PINCOMM 73S is a 4 megabyte block mode CSR parity semiconductor memory card for large DEC Q-bus applications, including use in the MicroVAX I and the PDP-11/73. It is equivalent to the DEC MSV11PL (M8067) memory, but with up to eight times more capacity, and can be installed in H9273-A or DDV11-B backplanes.

The last addition to our STANDARD MEMORIES family back in August, was the PINCOMM 780SX, a 1 megabyte memory for use in late model VAX-11/780 computers. Installed at sites throughout the United

# Great Memories.

States, Canada, Europe and Japan, it has given our customers the high levels of dependability and reliability that STANDARD MEMORIES is known for. Every one of our DEC add-in memory boards is backed by a 4-year warranty. Just shows what you can do when you have over *seventeen* years experience in building Great Memories.

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CIRCLE NO. 14 ON INQUIRY CARD



# Breakpoints

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## **BOARDS BRING 32-BIT PERFORMANCE TO 16-BIT DEC MINIS**

Bringing plug-in performance to 16-bit minicomputers is the aim of American Information Systems, a Palo Alto, Calif., start-up manufacturer of 32-bit National Semiconductor Corp. NS32032 processor-based board products. The initial product will include a standard quad-sized Digital Equipment Corp. Q-bus-based CPU board, the AIS/3212, a four-member set of memory boards, the AIS/3218, and the XENIX-16K UNIX-based operating system. Fully integrated into the DEC architecture, the add-in system is said to achieve VAX-11/780 performance. Shipments of production quantities are scheduled for June. The price for a system that includes the AIS/3212 CPU, a 512K-byte AIS/3218 memory board and XENIX-16K is \$6,900. A 1M-byte add-on memory board is \$3,600. Substantial OEM discounts are available.—C. Bailey

## **PORTABLE PC-COMPATIBLES FEATURE FLAT-PANEL LCDs**

International Quartz Ltd., Kowloon, Hong Kong, has developed a family of three IBM PC-compatible transportable microcomputers for OEMs. The Models 9240 and 9230 use a 25-line liquid-crystal display, and the model 9231 comes with a 9-inch CRT. The units, expected to be unveiled at Comdex, are built around the Intel 80186 microprocessor. They include serial and parallel ports, built-in 320K-byte floppy disk drives and 128K bytes of memory. The units range in weight from 20 pounds for the model 9240 to 34 pounds for the models 9230 and 9231. U.S. availability is expected for the fourth quarter; pricing has not been set.—C. Warren

## **SHUGART READIES 20M-BYTE, HALF-HEIGHT WINCHESTER**

Extending its Jade series of Winchester, Shugart Corp., Sunnyvale, Calif., is halving the drive size but keeping the capacity at 20M bytes. The new model 724 is expected to make its debut at next month's National Computer Conference. The two-platter drive has 720 tracks per inch, 9,036 bits per inch and uses a closed-loop servo. The servo information is embedded in each track. Shugart plans to ship evaluation units by the third quarter and production units by the fourth quarter; pricing has not been set.—C. Warren

## **VOTAN ADDS VOICE RECOGNITION TO IBM PC**

Votan, Fremont, Calif., has developed a speaker-dependent continuous-voice-recognition system for the IBM PC. The VPC 2000 Voice Card holds as many as 75 double-trained words and allows voice macro commands of up to 30 characters to be defined. With integrated spreadsheets, for example, single voice commands can trigger macro commands that move the cursor, set up graphics or do other functions normally requiring several keystrokes. The system also has a voice-store-and-forward capability. OEMs can write applications for the Voice Card using the included Voice Key software or Voice Operating Software. Voice Card consists of the software, a main board, a piggyback board, a microphone and a speaker. Price is \$2,450.—D. Bright



# Breakpoints

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## **INTERSTATE VOICE GIVES THE IBM PC AN EAR**

To extend the IBM PC for specialized data entry that requires hands-off functionality, Interstate Voice Products, Orange, Calif., has developed a speech-recognition board. The \$1,650 board slips into any available slot on the IBM PC and forms a path between the PC and the keyboard, thus allowing keyboard commands to be simulated by speech commands. This means off-the-shelf applications can be controlled via speech. The company plans to unveil the board at the National Computer Conference and to start shipments in the first week of August.—C. Warren

## **IMAGEN INTRODUCES TWO NON-IMPACT PAGE PRINTERS**

Imagen Corp., Mountain View, Calif., has developed two new intelligent non-impact page printers that merge multiple text fonts and graphics. The Imagen 60/240, due late this month, prints 60 pages per minute (ppm) at 240-dot-per-inch resolution (dpi) and lists for \$75,000. The Imagen 5/480, due late last month, prints 5 ppm at 480 dpi. Price is \$19,950. The 60/240 produces composition-quality printing; the 5/480 produces publication-quality material for pre-typesetting inspection.—D. Bright

## **KNOWLEDGE-ENGINEERING SOFTWARE RUNS ON PC**

Software aimed at helping users explore and determine the commercial applicability of knowledge-system software should be released this month by Teknowledge Inc., Palo Alto, Calif. Knowledge-system software has been the province of R&D laboratories until now. The Teknowledge M.1 package runs on the IBM Personal Computer and is used to design, build and run the knowledge-system software that solves problems typically requiring human intelligence.—L. Valigra

## **INTERPHASE COMBINES DISK/TAPE CONTROL ON ONE BOARD**

Interphase Corp., Dallas, this month plans to ship evaluation units of its Storager controller for Multibus-based systems. The controller brings storage module device (SMD) capability to small systems by combining the enhanced small disk interface (ESDI), HP-412 and ST-506 interfaces on the same board. The \$1,800 board supports as many as two 5¼-inch Winchester drives, four ½- or ¼-inch tape drives and two floppy drives simultaneously. The Storager has an MC68000 microprocessor plus two custom state machines to provide the intelligence. The cache permits data backup without host intervention and allows pre-fetching of sectors or tracks. Production quantities are planned for the fourth quarter.—C. Warren

## **TECHFILES: A QUICK LOOK AT INDUSTRY DEVELOPMENTS**

**RANDOM DISK FILES:** Disk controller manufacturer **Xebec Corp.**, Sunnyvale, Calif., plans to introduce a 5¼-inch Winchester disk drive family in August. The drives will include a controller and a Shugart Associates systems interface (SASI). The drives initially will house 10M to 20M bytes and will be compatible with Seagate Technology's ST-506 and ST-412 drives. The drives will be offered with a board combining the controller and drive electronics, thus simplifying system integration: many new CPU boards come with a built-in



A minimum of moving parts and an exceptionally rugged design make the CI-600 from CIE Terminals the *first* 600 LPM matrix line printer you can depend on.

And when you compare the CI-600 with other 600 LPM line printers, you'll find others either do a lot less, cost a lot more, or both.

# A 600 LPM built on a simple principle.

The CI-600 is plug-in compatible with virtually every type of computer system, including IBM and DEC.<sup>®</sup> It doubles the throughput of our CI-300.

It gives you 600 LPM data processing and letter quality to 170 LPM. It has variable shuttle speeds. And it delivers graphics up to 4800 DLPM.

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You get high resolution graphics for Bar Codes, Optical Character Recognition, Form Generation, Labels and Word

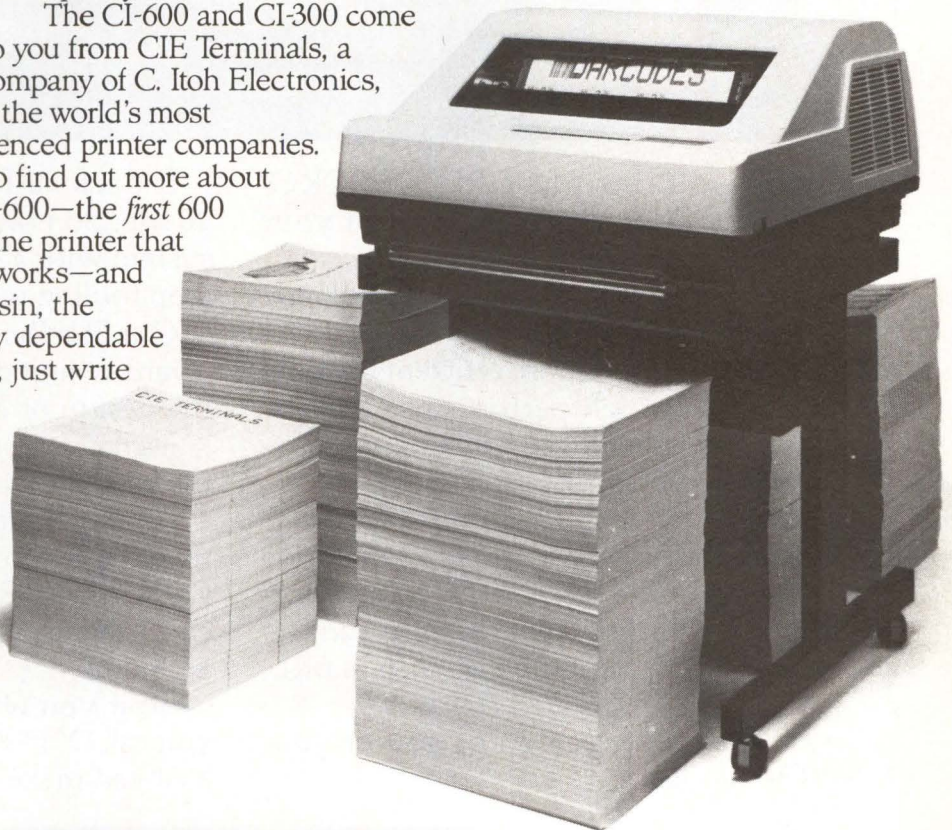
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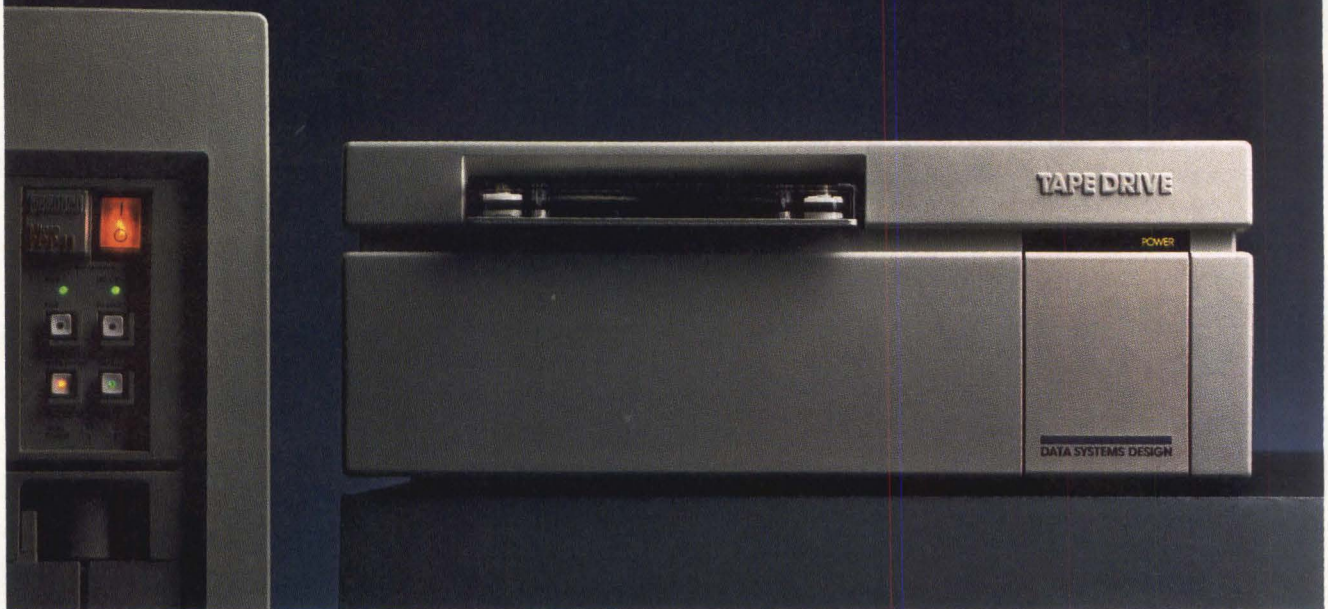
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CIRCLE NO. 16 ON INQUIRY CARD



# Breakpoints

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SASI-compatible host adapter. Higher-capacity models, planned for late 1985, are expected to use the enhanced small disk interface (ESDI). Evaluation models should be shipped to specified OEMs in July, and full production should begin in the fourth quarter.—C. Warren

**MICRO FILES:** Supermicrocomputers using wide-word microprocessors have been usurping traditional minicomputer markets by offering comparable performance at considerably lower costs. Later this month, **Advanced Computing Technologies Inc.**, Ann Arbor, Mich., plans to turn the tables by introducing a full single-board-computer implementation of its ACT-3 8080/Z80-compatible 16-bit bipolar processor introduced last November. Unlike minis-on-a-board that rely on bit-sliced microprocessors, the ACT-3 is a VAX-like processor consisting of 208 discrete TTL chips. Unlike 16-bit microprocessors that require some code modification to run 8-bit programs, the ACT-3 handles even the expanded Z80 instructions without reprogramming. Offered now with serial I/O and 64K bytes of on-board RAM, the ACT aSBC 80/300 Multibus board should be available in September for \$2,547 in 250-unit quantities.—A. Kaplan

Is **Franklin Computer Corp.** in trouble? For over a year, the Pennsauken, N.J., manufacturer of Apple-compatible systems had been preparing to introduce its first portable computer. Just a month before May's scheduled introduction, president Avram Miller resigned, and the company consolidated operations into one building and laid off 70 employees. Only five days before the introduction, chairman Barry Borden and sales and marketing vice president Eugene Sherman resigned, while co-founder Joel Schusterman, who quit in February, returned to become executive vice president and acting president.—D. Bright

**COMMUNICATIONS FILES:** **Sydis Inc.**, San Jose, Calif., has reached a three-year, \$142 million agreement with GTE Corp. to supply Voice Station One data/voice workstations and Information Manager shared-node controllers (MMS, May, 1983, Page 193). The equipment will be integrated into GTE's Omni PBX systems for local-area network applications. The OEM agreement could be extended for two years at an annual value of \$90 million. It provides for the purchase of as much as 20 percent of Sydis' stock by GTE.—S. Shaw

**Racal-Vadic**, a supplier of modems and communications software to the OEM market, will be stepping into retail territory for the first time next month with two single-board modems for the IBM PC, PC/XT and compatible microcomputers. The 300-bps model will retail for \$350 and the 1,200-bps model will sell for \$595.—M. Stenzler-Centonze

**PRINTER FILES:** The M3071A desktop OEM laser printer from **Fujitsu America Inc.**, Santa Clara, Calif., prints either 16 or 20 pages per minute with 240- or 300-dot-per-inch resolution, respectively. It can be configured with scanning, copying and optical image overlay options, depending on the OEM controller design and application. The print-only M3072S version is also available with 300-dot-per-inch resolution. It includes the controller, RAM and font



# Breakpoints

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cartridges and power supply. Both versions can come with either RS232C or Centronics-compatible parallel interfaces. The M3071A is priced at \$5,620; with the options, \$8,380. —R. Shinn

**NOTES FROM ICA: Voice communication** is a hot technology, and a number of companies are getting on the circuit. Among these are: Octel Communications Corp., San Jose, Calif., with the Automatic Speech Exchange Network (ASPEN); Centigram Corp., Sunnyvale, Calif., with VoiceMemo; Ericsson Communications Inc., Garden Grove, Calif., with the MD110 private automatic branch exchange (PABX) that combines voice and data; and Honeywell Inc., Minneapolis, whose integrated PABX for voice and data, called the Delta-Plex Series 2000, comes with a desktop unit with a liquid-crystal display and digital-speech capability. Another company offering a voice data system is Voicetek Corp., Newton, Mass. Its VS 700, built around the DEC PRO 350 microcomputer, operates under UNIX. —C. Warren

**NOTES FROM OVERSEAS: Convergent Technologies Inc.'s** European headquarters may have been overzealous a few weeks ago when it denied reports circulating on the continent that **Burroughs Corp.**, Convergent's primary OEM, will be moving manufacture of the Convergent-made B20 and B25 (alias N-Gen) to China and Hong Kong, respectively. Convergent president Al Michaels seemed to be saying the story is true when he described it as a leak. The story came from Wang Guang Ying, a ranking Communist party official and head of the Hong Kong-based, Beijing-controlled Ever Bright Industries, with which Burroughs reportedly will join in the manufacturing venture. —M. O'Gara

**IBM Corp.** insiders expected Big Blue to announce an integrated **VM/UNIX** operating system, dubbed VMix, during the first week of this month. That timing is just before the USENIX UNIX users meeting in Salt Lake City on June 11 at which VMix should run on a 4300 computer. Sources say the operating system is the result of further collaboration between IBM and Interactive Systems Corp., the Santa Monica, Calif., company supplying the UNIX that IBM has named PC-IX. VMix should allow users access to either operating system and in all probability micro-to-mainframe connection with PC/IX. —M. O'Gara

Some of the first Intel 80286 machines are debuting in Europe. Following Northern Telecom's recent debut of its aggressive 80286-based Vienna microcomputer, all of whose initial sales will be limited to the continent, comes the new **Rair Ltd.** supermicro. It uses the 80286 and 80287 arithmetic coprocessor and is priced at about \$15,000 including 512K bytes of internal memory, 50M bytes of storage, 45M bytes of streaming-tape backup and eight ports. Currently, it is running Digital Research Inc.'s Concurrent DOS operating system, but Rair expects to add UNIX System V this year. —M. O'Gara



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CIRCLE NO. 19 ON INQUIRY CARD



# Mini-Micro World

NEWS

## PC-compatible boards and boxes form low-cost modular systems

Ron Shinn, Senior Editor

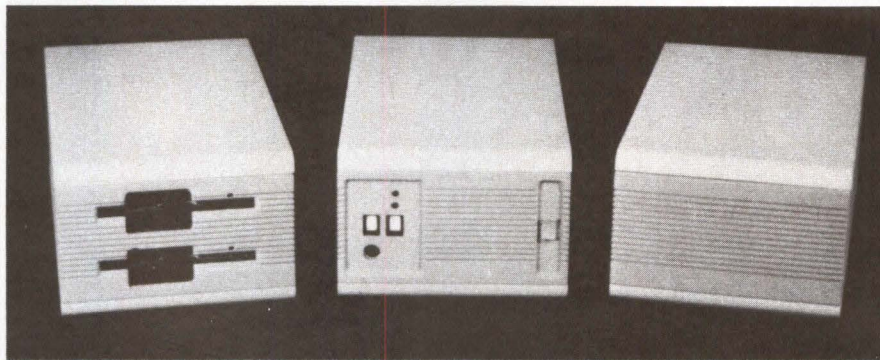
One of the first IBM PC XT-compatible series of products available as bits and pieces to OEM system integrators comes from Personal Computer Products Inc. (PCPI), San Diego. Called the PC/Solution series, it offers boards, card cages and finished packages sold as separate items or as complete systems.

According to Ed Savarese, PCPI president and co-founder, the idea is to provide OEMs with a CPU, I/O capability, a card cage and a keyboard for less than \$1,000. The product is for use in applications requiring IBM PC compatibility but not the fully loaded, standalone personal computer as currently marketed.

Savarese says, "Our benefit is a boards - boxes - and - systems approach. If someone wants to buy a PC-compatible device that controls only an instrument, we can sell a product to them for less than \$1,000 because we can take away all the packaging and other luxury items that are not needed for the typical system integrator."

Savarese claims PCPI will offer products that give integrators PC compatibility that allows them to provide their own products to the IBM PC environment.

To address the OEM concept, PCPI offers its PC/Solution series system boxes as three separate subsystems that can be integrated—CPU, expansion and storage. The storage-system box can be an addition to any IBM PC-compatible system. In addition, the system boards plug into any IBM PC-compatible product. PCPI products support MS-DOS, PC-DOS and CP/M-86



The three boxes of the new PC/Solution series are the PC/Disk unit (left), the PC/Unit (center) and the PC/Expansion unit (right). The CPU (PC/Unit) and expansion boxes directly connect a 62-pin connector, thereby eliminating cabling. The disk box can be used with any IBM PC-compatible computer system as an add-on.

operating-system software.

PCPI attempts to fill the gaps in the current IBM PC-compatible market, which is boards-only or complete-systems-only. "Because of the basic nature of our system, we leave a lot of room for so-called added value by third parties," says Savarese. "To maintain system compatibility with IBM PCs, there is a minimum entry fee of \$3,000 to \$5,000 per workstation. With our unbundled system, it's \$1,000 to \$2,000, and integrators can add their own special I/O interfaces, which might include analog-to-digital and AC-to-DC conversion, sensors and/or special software."

The three boxes in the PC/Solution series are the PC/Unit (CPU), the PC/Disk unit (storage) and the PC/Expansion unit (board expansion). Each system box complies with U.S., Canadian, European and Underwriters Laboratories standards and is constructed of 50 percent metal (card cage) and 50 percent injection-molded plastic (outer panels). The unit has a power supply and a 2-inch muffin fan (front-to-rear airflow). The top and side panels are interchangeable. The boxes

measure 5.1 inches high by 8.2 inches wide by 15 inches deep.

### Proprietary motherboard

The PC/Unit contains five slots on an IBM PC-compatible Bus-Board, which is a proprietary motherboard design giving each slot a clearance of 0.82 inch, a 100W switching power supply and a front panel with power and rest switches. It also contains a keyboard connector that follows the Deutsches Institut für Normung standard, a power-on light and the female side of a 62-pin side connector for the PC/Expansion unit interface.

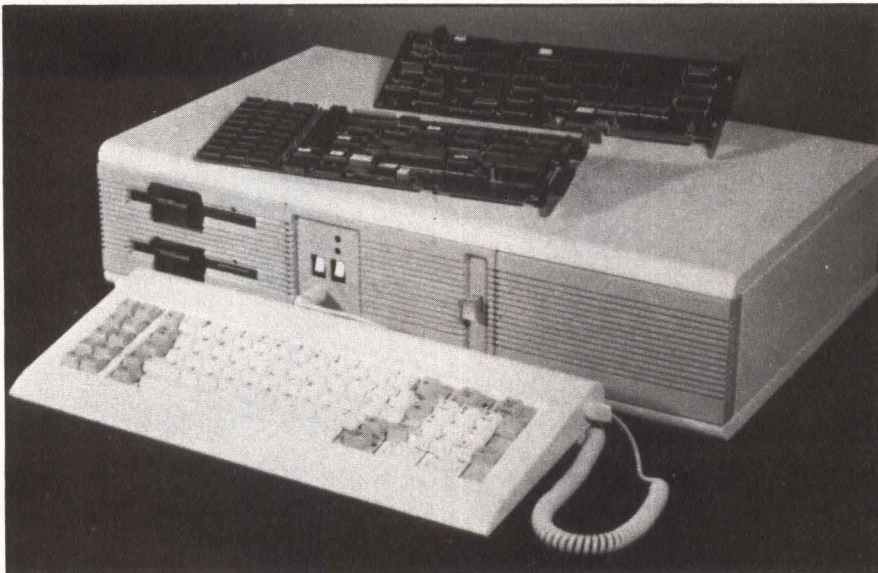
The PC/Disk Unit houses two standard half-height floppy disk drives or one floppy drive and one hard disk drive, a 50W switching power supply and connection cabling to the PC/Unit.

The PC/Expansion Unit contains five slots on the IBM PC-compatible proprietary Bus-Board, with four slots spaced at 0.82 inch and one slot spaced with slightly more than 1 inch for piggyback boards. There is a 100W switching power supply, a rear-mounted power switch and the male side of a 62-pin connector for



# Mini-Micro World

## NEWS



When placed together, the three boxes of the PC/Solution leave seven card slots for expansion add-ons and give a footprint roughly the same as that of an IBM PC. The CPU card (background) combines control logic and CPU into a single field-replaceable card, and the multiple function card (foreground) contains memory, I/O and a clock/calendar or a disk controller.

interface to the PC/Unit.

The four basic boards available for use in the PC/Unit box are the PC/CPU board, the PC/Disk multicard, the PC/Multicard and the PC/Multivideo board. All PCPI boards are designed as IBM PC-add-on standard cards, which measure 4.2 by 13.13 inches.

The PC/CPU board contains an 8088 microprocessor with an optional 8087 coprocessor, 8K bytes of erasable programmable read-only memory (EPROM) space supporting 2764 or 27128 EPROMs, a PC XT-compatible ROM basic input/output system, four direct-memory-access channels (one refresh), three timer channels (one refresh), eight levels of interrupts and an on-board mini speaker.

The PC/Disk multicard disk, memory and communications board contains a floppy disk controller based on NEC Information Systems Inc.'s 765 or on a compatible chip. The controller handles one or two floppy disk drives, 64K bytes of dynamic RAM expandable to 192K bytes (or 256K bytes expandable to 768K bytes using 256K-bit chips), a parallel port with IBM- and Centronics-standard connectors and a synchronous serial communications

port with rates programmable to 9,600 baud.

The PC/Multicard has the same memory and I/O as the PC/Disk multicard but replaces the disk controller with a lithium battery-powered clock/calendar.

The PC/Multivideo board supports IBM monochrome and color monitors under software selection, providing 132 columns by 44 rows. The board also runs color graphics software on monochrome displays.

Users can add a 10M-byte hard disk and a hard disk adapter board to the basic system from off-the-shelf selections. GWBASIC and MS-DOS implementation software licensing is available from PCPI.

Fred Young, PCPI vice president of engineering, describes the PC/Solution this way: "We provide the least expensive hardware for the solution. A communications value-added company, for instance, can bundle its communications product with [PCPI's] box and make the whole thing a node concentrator or controller. That is, in some local-area networks, [the PC/Solution] can serve as a printer controller or a disk server. By putting a special application package with the box, such as a 3270 emulation package or

an 8780 [remote-job-entry (RJE)] type of package, you can turn the box into a remote network controller or an intelligent terminal."

The emulation hardware and software, readily available from a variety of sources, eliminates the need for 3270 or RJE terminals, which might spend a lot of time off-line. Adding these terminal functions to the PC/Solution series allows users to switch quickly from one mode to another, says Young. "You're talking about switching from one mode to another mode in a split second—almost like concurrent operation. That is, in one mode you're a 3270, and suddenly you get all the data from a database to process a spreadsheet, for instance. At that point, you sign off as a 3270 and do the local processing for the spreadsheet."

Young says remote users of PC XT's or 3270s can use the PC/Solution components in networks operating as nodes for printer servers, disk servers or other resource controllers. This setup creates a PC-style data center that can control laser, dot-matrix and solid-font printers as well as incorporate the network controller cards that are available from many vendors.

PCPI constructed the PC/Solution series with OEMs in mind. The motherboard's upper layer, exposed to physical damage from tools, is made of metal. The middle layers carry all signal paths; the bottom layer is ground, and the top layer is power. The 62-pin direct-connect expansion-unit connector has no cable between the expansion unit and the CPU unit. □



# Undaunted by IBM, Phoenix will announce a PC-compatible ROM BIOS

Lori Valigra, Senior Editor

Phoenix Software Associates Ltd. is throwing down its glove before IBM Corp. by offering an off-the-shelf ROM basic input/output system (BIOS) that will allow IBM PC emulators to speed MS-DOS operating-system and hardware development and fatten the flourishing PC-compatible market.

The BIOS stands at the center of the "how-compatible-can-compatible-be?" controversy that has won IBM lawsuits against competitors such as Eagle Computer Inc., Corona Data Systems and Handwell Corp. The IBM PC's BIOS resides in both hardware and software. Its functionality must be "recreated" by every PC-compatible manufacturer desiring to be as close to IBM's BIOS features as possible. The software BIOS resides on a diskette and is loaded with the PC-DOS operating system. But IBM has published and therefore copyrighted the hardware ROM BIOS specifications in its technical reference manual. IBM has challenged those companies closely mimicking its ROM BIOS specifications.

Phoenix, Norwood, Mass., claims to have done many MS-DOS ports, and offers a \$30,000 off-the-shelf software BIOS. The company's bold move to offer the hardware BIOS stems from observing market wants and figuring how not to duplicate the IBM ROM BIOS while achieving its functionality.

## Phoenix hires an outsider

"We took a defensive position," says Lance Hansche, director of marketing at Phoenix, when de-

scribing how his company approached developing the ROM BIOS. Phoenix talked to lawyers of two companies considered to sell close PC clones, Eagle Computer and Compaq Computer Corp. It then signed on an outside programmer who hadn't read IBM's technical specification for the ROM BIOS. Hansche says Phoenix gave the programmer a description of the technical specification, which he says is in the public domain, and had the programmer design the ROM BIOS.

The programmer documented all communication and "coaching" about software bugs during the five-month development cycle in a log. Phoenix's primary correspondence with the programmer was written and also serves as documentation. Hansche explains Phoenix noted only that a bug existed; it was up to the programmer to find a way to fix it. Hansche notes the procedure was to ensure that any unwitting similarities between IBM's ROM BIOS and Phoenix's were by chance rather than by copy. "This way we can stand up in court," explains Hansche. "He [the programmer] can say he hasn't seen the technical reference manual." Hansche says Phoenix had invited IBM's lawyers to audit the ROM BIOS before it was introduced, but at press time, he didn't think they would.

Regarding concerns that potential customers would be scared off by IBM's watchful eye, Hansche says IBM could sue Phoenix's customers, but "if those customers had PC compatibility, they would run the risk of an IBM lawsuit anyway."

The Phoenix product carries no name yet. For \$90,000, buyers obtain unlimited use of the ROM. The source code is priced separately. A package with ROM BIOS, GW BASIC (configured to look like BASICA), MS-DOS 2.11 and Phoenix's PC-DOS utilities is priced at \$290,000.

Market researcher Future Computing Inc., Richardson, Texas, which developed definitions of levels of IBM PC compatibility, will test the product, Hansche says. Future charges \$5,000 for its test, he explains. The test had not been completed at press time.

## BIOS may spark price war

With PC-clone makers able to purchase and integrate boards, operating systems, applications and both software BIOS and ROM BIOS as canned items, little may distinguish those configured microcomputers in the market. Hansche foresees a short market window for the Phoenix product and "lots of price wars" stemming from the commonalities. He suggests that PC compatibles will be differentiated by support and maintenance offerings from manufacturers.

In anticipation of IBM's possible separation from the MS-DOS competitive environment, Phoenix is preparing to adopt quickly whatever new operating system to which IBM gives the nod. □

## LOOKING AHEAD IN MMS

The premier issue of Mini-Micro System's Computer Digest is coming soon. It is MMS' first ever guide to mini-computers and microcomputers.



# Mini-Micro World

NEWS

## Industry braces for impact of AT&T computers

**Marjorie Stenzler-Centonze**  
Associate Editor

American Telephone & Telegraph (AT&T) Co., which began the year by announcing its entrance into the general-purpose computer business, recently introduced its first line of six computers, the 3B series, and two networking products with the promise of additional, significant announcements soon to come.

The 3B series ranges from a desktop multiuser supermicrocomputer starting in price at \$9,950 to a high-end minicomputer that sells for \$340,000. The machines use AT&T's 256K-bit dynamic RAM chips and 32-bit WE 32000 microprocessor. All models are based on the UNIX System V operating system.

AT&T's Ethernet-compatible 3BNET local-area network links 3B computers, and the AT&T PC interface enables personal computers that run the DOS operating system to communicate with each other and with 3B computers.

AT&T vice chairman James E. Olson says the products are a natural extension of a business AT&T has been in for years within its own operation. "AT&T is no Johnny-come-lately to the computer business," he states.

The company plans to sell its computers initially through OEMs and value-added resellers as well as to sophisticated end users. Olivetti SpA, of which AT&T owns 25 percent, will sell the products in Europe.

AT&T has not announced plans to sell through retail channels, but industry insiders say the company will address those channels as more System V software becomes available and when AT&T makes its long-awaited personal computer announcement. Analysts expect the

company to unveil a personal computer system this summer. That system will be priced at less than \$5,000 and will be sold through major computer retail chain stores such as ComputerLand and Businessland.

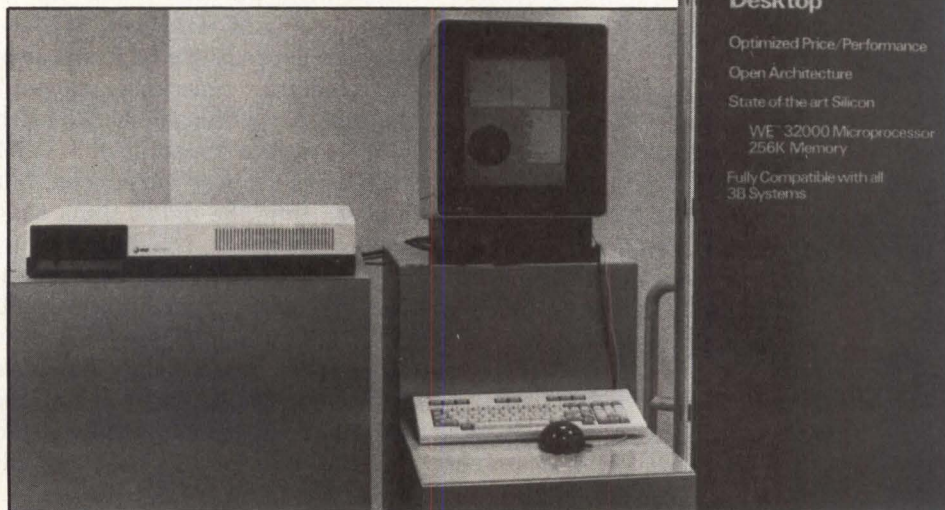
### AT&T's unified software

What is most significant about the new product introductions, according to Jean Yates, president of research company Yates Ventures, Los Altos, Calif., is that AT&T has introduced a line of computer products that all run the same operating system. "That should indicate to the industry one of AT&T's major marketing strate-

gies—the fact that they will be able to offer easy networking, software transportability and data exchange between different types of computers."

Most AT&T watchers are keeping a close eye on the low-end products. Yates says the 3B2 is particularly significant at the low end because it can act as a file server, as can IBM Corp.'s rumored high-end product, which is code-named Popcorn. Industry analysts theorize that Popcorn operates as a file server to an IBM PC network along with being a multiuser UNIX box for multiuser applications and a high-end MS-DOS box. "If IBM doesn't announce the Popcorn with that kind of capability, they'll really lose an opportunity, and AT&T is likely to step right in," Yates states.

**James E. Olson,** vice chairman of AT&T, says the new computer line is a natural extension of a business that AT&T has been in for years.





She says the demand is increasing for multiuser software, multiuser databases and business applications that the PC could access via a file server running UNIX.

Alex Stein, senior analyst at research company Dataquest Inc., Cupertino, Calif., agrees that the low end of AT&T's line, including the models 100 and 200 mid-range minicomputers, bear close watching. "The low end is considered more of an issue because AT&T is considered to be a very significant factor in local-area networks through its ability to connect to its own private-branch exchanges," he says.

Stein says AT&T is competing against IBM on the low end, but he sees "a gaping hole" in IBM's product line between the single-user PC and the multiuser minicomputers. "AT&T's \$10,000 product fits that gap perfectly," he states.

Penetrating the high end of the market will require AT&T to vie for accounts that are currently commit-

ted to such companies as IBM, Data General Corp. and Digital Equipment Corp., Stein says. But AT&T may have a significant edge over these vendors, according to Yates, because the 3B20D runs UNIX in real time. "This could theoretically allow voice/data switching to occur on the same computer. A user could have a terminal that incorporates a telephone on his desk, and the 3B20D would allow voice messaging and data to run through the same wire coming off the terminal," she says. Although AT&T has not detailed its plans for the voice side of its network, Yates believes the company will shortly firm up plans.

### Market anticipates AT&T's moves

Meanwhile, the industry is bracing itself for the impact of AT&T's products. Though analysts disagree about whether the company will have problems getting its systems into volume production quickly, they agree when that happens AT&T will spell trouble for many vendors.

Maureen Fleming, senior analyst with research concern International Resource Development, Norwalk, Conn., says AT&T's computers will have a delayed impact on the market. "I really can't see AT&T getting the supermicro or the

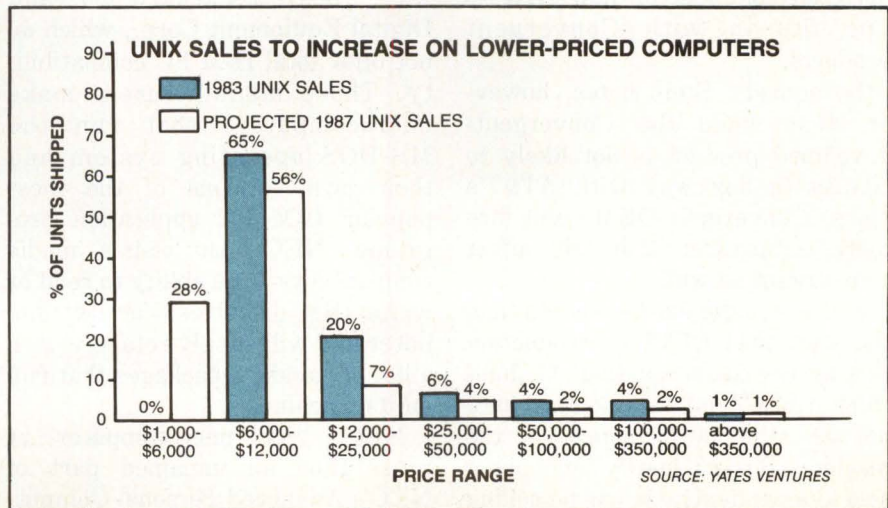
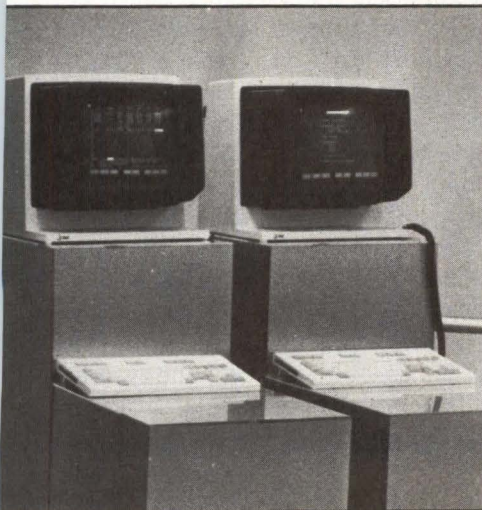
minicomputers out for a while," she says.

Dataquest's Stein, however, says the important issue will be what AT&T can configure out of its available products. "Since AT&T hasn't announced its PC yet, it may mean that it will have to make some compromises in the types of configurations it develops, like using dumb terminals instead of personal computers as workstations," he says.

Most likely to feel the pinch as AT&T products hit the market will be IBM, DEC, Wang Laboratories and DG. "This is the biggest competition that IBM has ever seen, and it is taking AT&T very seriously," states Yates. She predicts that AT&T will be at least the number-three U.S. computer company within five years. She also predicts that DEC "will take a real bruising" at the high-end of its VAX line, particularly at the VAX-11/780 level.

Meanwhile, AT&T is accelerating the development of broad-based applications to run under UNIX System V, according to Jack Scanlon, vice president of AT&T's Computer Systems Division. "In 1982, the installed base of computers running UNIX systems or their derivatives was about 45,000,"

**AT&T's 3B2 desktop microcomputer features 32-bit processing, 256K-bit memory chips and the UNIX System V operating system. The 3B2 can be configured as a single-user system or can serve as many as 18 users.**





# Mini-Micro World

## NEWS

### AT&T's 32-BIT LINEUP AT A GLANCE

- 3B2 desktop multiuser microcomputer; handles as many as 18 users or can be configured as a single-user system; prices start at \$9,950.
- 3B5 mid-range minicomputer for office use;  
Model 100 accommodates as many as 30 users; basic system price: \$57,000.  
Model 200 accommodates as many as 60 users; basic system price: \$73,000.
- 3B20S high-end superminicomputer; basic system price: \$230,000.
- 3B20A an enhanced version of the 3B20S; basic system price: \$330,000.
- 3B20D high-end minicomputer features UNIX real-time reliable (RTR) operating system with real-time and fault-tolerant features; basic system price: \$340,000.

Scanlon says. "Today, that number has grown to about 70,000, and we expect that number to at least double by the end of the year." He expects the number of available software packages to total about 600 by then.

### Convergent deal still a mystery

AT&T is making no further details available on an OEM agreement it signed this year with Convergent Technologies Inc. Under terms of the agreement, Convergent will design and manufacture a proprietary line of products for AT&T.

Some observers say the Convergent product is likely to be a low-end desktop system that integrates telephone technologies. Pauline Alker, vice president and general manager of the special products division at Convergent, does not comment on how AT&T's line fits in with Convergent products.

Dataquest's Stein notes, however, that while the Convergent-developed product is not likely to conflict in any way with AT&T's plans, Convergent OEMs will face more competition that will affect Convergent as well.

Stein says the market should take the view that AT&T's introduction is a systems-solution sale. "I don't think [AT&T is] selling hardware because the performance of the machines doesn't justify their being sold independently. It will be selling

an Ethernet network system that has multiuser capabilities at the department level."

Stein notes that AT&T is selling much the same system that IBM intends to sell. "By adopting the IBM standards AT&T has avoided the kinds of problems that IBM has

### UNIX SYSTEMS GROW FIVEFOLD IN FIVE YEARS\*



\*DOLLAR FIGURES INCLUDE MINIMUM CONFIGURATION HARDWARE, OPERATING SYSTEM AND ONE-YEAR MAINTENANCE.  
SOURCE: YATES VENTURES

had in establishing a market standard. AT&T is building on IBM's strength and going a little bit further," he says. □

## NEC offers an alternative PC-compatible microcomputer

Lori Valigra, Senior Editor

Choosing to sidestep the mainstream IBM PC-compatible suppliers competing head-on with IBM Corp., NEC Information Systems Inc., Boxborough, Mass., instead plans to become an alternative to vendors such as Texas Instruments Inc., Hewlett-Packard Co. and Digital Equipment Corp., which do not offer total IBM PC compatibility. Those manufacturers make microcomputers that run the MS-DOS operating system and their own versions of the most popular IBM PC application programs. NEC also claims media compatibility—the ability to read or write IBM diskettes—for its computer and will supply retailers with a list of standard packages that run on its machine.

NEC's "A1" microcomputer, at press time an unnamed part of NEC's Advanced Personal Comput-

er (APC) line, is available initially only to U.S. buyers. It is based on a version of the Intel Corp. 8086 processor manufactured by NEC, runs MS-DOS version 2.11 that includes a basic input/output system implemented in hardware and software and has 32K bytes of ROM and 8K bytes of video-display RAM. It comes in four versions aimed at home and professional buyers; the versions differ in mass-storage capacities. The choices are one 320K-byte floppy drive, two 320K-byte floppy drives, one 320K-byte floppy drive and one 640K-byte floppy drive and one 320K-byte floppy drive and one 10M-byte Winchester drive. A 128K-byte entry-level system with one slimline 5¼-inch floppy disk drive is tagged at \$1,595. With the CRT the system sells for \$1,995. Adding an integral hard disk to that system raises the price to \$3,895. Memory can be expanded to 640K bytes.



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# Mini-Micro World

## NEWS

Output devices for the A1 include the new Series 8000 Spinwriter fully formed character printer, expected late last month, and the forthcoming Series 2000, expected in the fall. The \$2,100 Series 8000 prints at 55 characters per second (cps), while the \$1,200 Series 2000 prints at 23 cps. The company's dot-matrix Pinwriter models also are available. Parallel and serial interfaces are included.

The A1 incorporates a new eight-color monitor with NEC's 7220 graphics chip, which includes graphics primitive commands. Available monochrome or color monitors offer 640-by-200-dot or 640-by-400-dot resolution, respectively.

### PC not wholly IBM-compatible

The product's design forsakes total IBM hardware and software compatibility in many ways. For example, the function keys are

parallel to the display, while IBM's are positioned in a cluster on the left side of the keyboard. It can't accommodate standard IBM PC add-in boards, and NEC does not guarantee that third-party add-in boards will work in the A1's four expansion slots. Lotus Development Corp.'s 1-2-3 integrated package had to be modified to run on the machine. As of press time, NEC still was testing the machine's degree of hardware and software compatibility with IBM's PC.

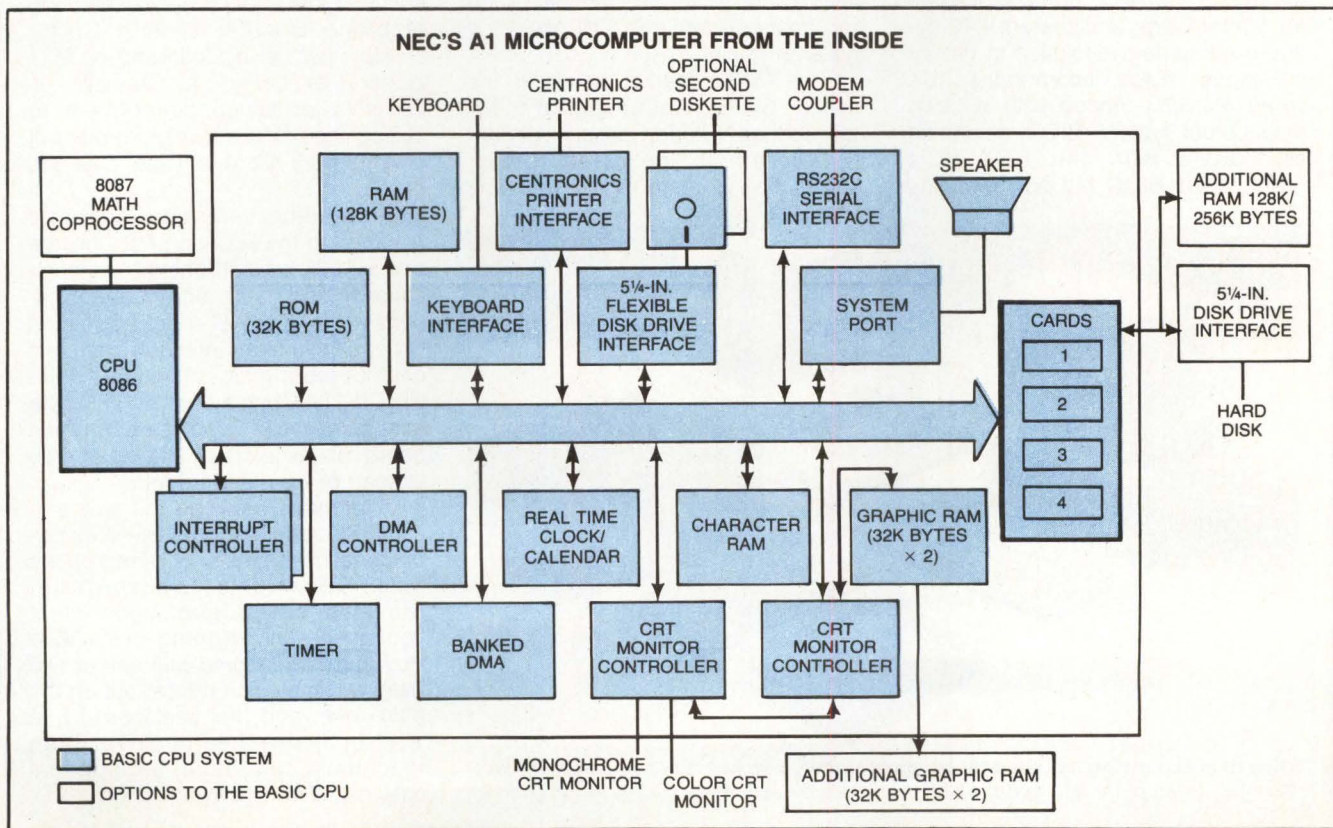
But NEC does not want to be completely IBM compatible. "We don't want to be completely vulnerable to IBM's moves by being 100 percent compatible," explains Peter J. Schlegel, product line manager for personal computers at NEC. "There's also a sense of pride in developing unique capabilities on a machine," such as being able to program each of the 12 function keys four ways to get more than

double the number of functions offered by IBM. But, he admits, "There's no question that if it were fully IBM-compatible we'd sell more units."

The A1 represents the stepping-stone in NEC's attempt to align an industry-standard general-purpose microcomputer line. Earlier APC models, which also run MS-DOS as well as CP/M, are more limited and mostly are used in graphics applications, Schlegel notes. He says the earlier APCs incorporate 8-inch diskette drives, which precludes them from being mass-market products. Schlegel says NEC will continue to support earlier APC models and keep them and the A1 as parallel product lines.

### Multiuser systems in the works

NEC is planning to make a UNIX System III operating system with Berkeley enhancements available in September. With that announce-





# Mini-Micro World

## NEWS

ment, it appears NEC is signaling its future direction with personal computers: multiuser networking systems. In this way, NEC is paralleling IBM in fleshing out its product line. IBM recently announced an MC68000 multiuser microcomputer running XENIX (MMS, May, Page 48). UNIX will be available on a combination hardware/software "softcard" incorporating an 8087 math coprocessor and memory-management func-

tions. NEC's parent in Tokyo developed the \$1,500 product.

NEC is also readying networking capabilities to let products such as NEC Home Electronics' 8200 lap-sized computer hook into a network with AIs, APCs and Astra series small business computers, says Schlegel. One option is a fiber-optic local-area network NEC has been demonstrating at computer shows for the past year. This networking would give NEC microcomputer

users hooks to larger computers similar to those that users of Tandy Corp.'s model 100 lap-held computer enjoy. Tandy users can link their machines to IBM PCs.

### NEC vies as TI, HP alternative

NEC will compete with TI, HP and DEC for dealer shelf space beginning in mid-month. Schlegel estimates that IBM and Apple Computer Inc. now occupy half of the available retail shelf space. "We

### Olivetti makes its IBM PC-compatible bid

**Keith Jones**  
European Editor

After a false start with the non-standard M20 microcomputer, Olivetti SpA, Ivrea, Italy, now offers two machines claimed to provide compatibility with IBM Corp.'s Personal Computer.

The desktop M24 and the 3-pound transportable M21 are configured around the 8-MHz 8086 processor from Intel Corp. and feature 640-by-400-pixel screen resolution in graphics mode. Each incorporates 16K bytes of ROM loaded with a basic input/output system (BIOS) said to be compatible with the IBM PC's ROM-based BIOS but not infringing

the copyright on IBM's ROM.

Price of the M21 with 256K bytes of memory, two floppy drives and a display is \$2,900, which equals the price of a 128K-byte similarly configured M24. Adding a 10M-byte hard disk brings the price to \$6,100.

An option for both machines is a processor board employing the Zilog Inc. Z8000 processor. It gives software compatibility with the M20, which is configured around the Z8000 and hosts Olivetti's PCOS operating system.

"The M20's market share in the United States was marginal," acknowledges Vittorio Cassoni, marketing director of the Olivetti Group. Anticipating a much bigger welcome

for the IBM-compatible machines, Cassoni notes, "Our main aim is to find distribution channels for the M21 and M24." Massimo Samaja, the Olivetti Group's commercial director, suggests as possible outlets the phone shops of AT&T Co., which owns 25 percent of the Italian company. "But we cannot put our computers into shops without suitable salespeople," Samaja adds. He confirms that the U.S. sales setup will embrace Docutel Olivetti Corp., Dallas. Less certain following the M21 launch, according to Samaja, is Olivetti's continued commitment to selling the M18, a transportable unit bought from Corona Data Systems Inc.

Some other standard features common to the M21 and M24 include one RS232 asynchronous communications port and one Centronics-compatible parallel port. Common options include an Intel 8087 numeric coprocessor, main memory expansion to 384K bytes from a 128K-byte minimum and a graphics expansion board for 16 colors or shades of gray instead of the standard four.

Differences between the two machines include screen size—9 inches diagonal on the M21, 12 inches on the M24. The M24's bus converter provides seven expansion slots compared with only three on the M21. Both machines come with one or two integral floppy disk drives, but on the M24 one can be replaced by a 10M-byte Winchester drive. Both machines can have an optional external 10M-byte Winchester.



Olivetti is expanding its personal computer family with two IBM-compatible models, the M24 desktop (far left) and the M21 transportable (far right).



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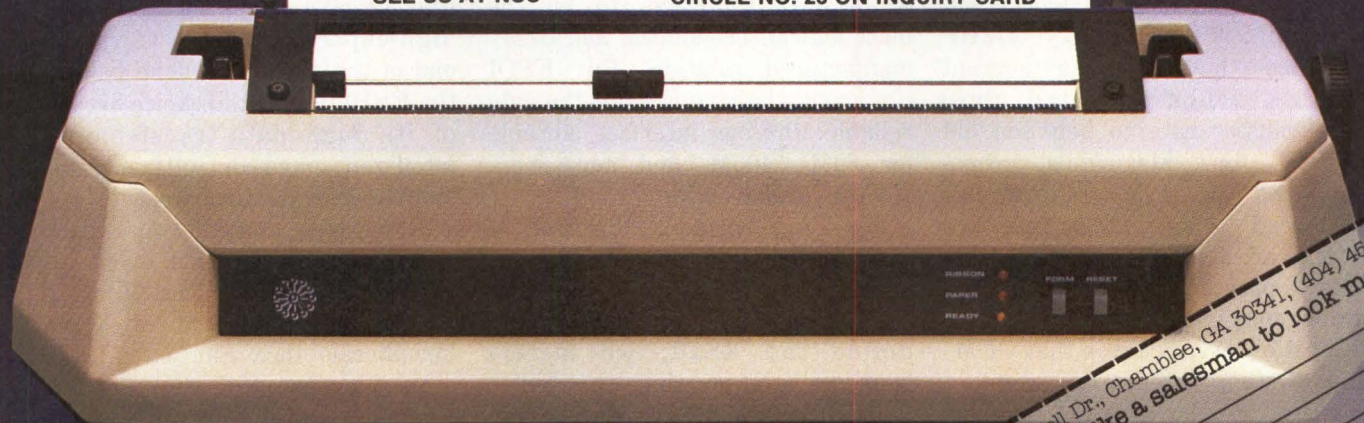


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# Mini-Micro World

## NEWS

want to have an alternative [in the A1] to displace some of that other 50 percent," he says. If the 3,000 U.S. NEC dealers each sell 40 units per month as he projects, this means that 50 percent of that monthly number, or 60,000 units, is NEC's target market. NEC hopes to glean 10 percent of those sales in two years—an overall 5 percent market share among retailers. Schlegel estimates that 80 percent to 90 percent of first-year sales will be through retail channels.

NEC will also offer the A1 to large corporate accounts and system houses. Schlegel notes that, to these customers, the A1 is more attractive when communications capabilities are added.

NEC plans to supply dealers with a list of generic application software it doesn't offer but has qualified for use on its machine. Languages that run on the A1 off-the-shelf and not offered by NEC include Microsoft BASIC, FORTRAN and Pascal.

Schlegel says NEC does support some software, such as the operating system and communications. NEC will initially offer the Acculink communications software package, priced at about \$300. The company also will support Dow Jones news-retrieval database connections and third-party software tailored to the A1, such as MicroPro International's Wordstar word-processing program. NEC is looking into offering Lotus' Symphony

integrated package and Digital Research Inc.'s language library. The company also plans support of Concurrent CP/M 3.0 with MS-DOS.

NEC is revising its dealer-support program—going directly to dealers rather than through distributors. Typical dealer margins will exceed 35 percent, Schlegel claims, especially with hard disk A1s. The company also is setting up national NEC distribution centers to sell to the dealers. These are planned to open in Chicago, Dallas, Seattle, Atlanta and Westboro, Mass. NEC will supply dealers with spare parts so that they can maintain the hardware if they wish. But NEC offers purchasers a warranty on hardware for the first year. □

## Winchester interface controversy heats up

Chris Bailey, Western Editor

Amid the clamor of claims and counterclaims, system OEMs and integrators are facing a difficult choice in determining which disk drive and controller manufacturers to believe when choosing a high-performance, 5¼-inch Winchester disk interface.

Seagate Technology, Scotts Valley, Calif., is touting its ST-412HP interface that ups the current ST-412's 5M-bit-per-second (bps) data-transfer rate to between 5M and 15M bps. Meanwhile, proponents of the 10M- to 25M-bps Enhanced Small Disk Interface (ESDI) are attracted by its on-drive data separator and disk/controller intelligence.

Most observers agree that OEMs and system integrators want a low-cost standard with a higher-than-5M-bps data-transfer rate, but there is no consensus yet on which proposed interface will become the

de facto standard. In the meantime, system builders are moving ahead with planned new systems while waiting for a definitive standard to emerge.

### Some support both

Seagate is proclaiming the ST-412HP, essentially a higher-speed ST-506/-412 interface, to be the most logical, economical and easily manufactured solution. But ESDI proponents believe ESDI is the only reliable 10M-bps interface suitable for 50M-, 100M- and more-than-100M-byte drives.

For Skip Kilsdonk, director of marketing at ESDI proponent Maxtor Corp., San Jose, Calif., there is no controversy. "We did not define the ESDI; we merely sponsored the meetings that led to its creation. The ESDI in its present form is a result of the input of 35 to 40 companies including drive manufacturers, controller manufacturers,

system integrators and even tape-drive manufacturers. It was derived after looking at the system-level problems and determining which features best met the needs of the ultimate end customer." Kilsdonk feels that the ST-412HP could find a place in low-end, medium-capacity drives with capacities of 50M bytes or less in the high-capacity, high-performance end of the market. But he believes the ESDI will be the choice because of its high data-transfer rate, intelligent drive/controller interface and superior data reliability.

Many drive and controller manufacturers claim they will eventually support both interfaces. Jim Adkisson, vice president of Vertex Peripherals Inc., San Jose, Calif., says Vertex will support the ST-412HP in the company's upcoming 84-byte drives in the third quarter of 1984 and the ESDI in the first quarter of next year.





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# Mini-Micro World

## NEWS

Taking a different point of view is Donald Redmond, vice president of engineering at Xebec Systems Inc., Sunnyvale, Calif. "The ST-412HP has not solved any of the problems of the ST-506 interface," he declares. "Primarily, the data reliability problems will intensify at the doubled data rate, and the specified driver/receivers at the data-bus level do not yet exist."

### Integration causes problems

Redmond says the major problem of any interface is system integration, which caused Xebec customers the most problems with the ST-506. Integrating ST-506/412 drives into small systems resulted in excessive soft-error rates. Redmond believes this problem is compounded by the fact that the data separator is not located on the drive itself. Since the ST-412HP calls for the data separator to be on the controller

interface board, this problem remains.

In contrast, the ESDI, first touted by Maxtor in early 1983 and now supported by Control Data Corp. (CDC), Micropolis Corp., Xebec, Memorex Corp., Fujitsu America Inc., OMTI and others, calls for placing the data separator electronics in the drive. Proponents contend that this architecture solves the soft-error rate problem by eliminating the major source of noise and timing problems. They also bill the ESDI as the higher-performance interface because it supports data-transfer rates as high as 25M bps.

Xebec's Redmond disputes that figure: "The ST-506/412 interface is already pushing transistor-to-transistor logic limits. No one will support the HP at more than 7M bps this year, and 10M bps and beyond is unlikely."

Seagate's Don Manneman, product manager for high-performance drives, points out that the ST-412HP is a logical evolution of the older interfaces. "The similarity of the 412HP to the existing ST-506/412 standard should result in a lower cost as compared to the other alternatives," he states. He does not foresee problems with parts availability for the 412HP. Manneman expects the interface to first appear in high volumes in mid-1984 in the 100M-byte, half-height, 8-inch ST-8100 drive.

Manneman suggests that the 412HP can reduce overall system costs in multidrive systems due to the placement of the data separator. "When you place the data separator logic in each drive, the end user or OEM pays that cost in each drive of a multidrive system. With the 412HP, that cost is paid only once—in the controller board."

### A COMPARISON OF THE WINCHESTER INTERFACES

The initial ST-506 interface was designed for the original 5¼-inch Winchester, the 5M-byte ST-506. The ST-412 interface improves on the ST-506 by supporting buffered seek, which improves access time when moving the read/write heads across many data tracks by bunching the positioning commands rather than sending commands singly, track-by-track. The ST-412HP ups the data rate of the ST-412 to between 5M and 15M bps and adds another head-select line, bringing the number of selectable heads to 16.

The ESDI takes a different approach, even though in its step mode it operates similarly to the ST-412. It calls for the inclusion of the data-separator logic within the drive. The aim is to reduce the data-error rates by eliminating one source of tolerances in the drive/system interface. Additionally, it adds a serial command/status interface that permits a number of configuration, status and command data to be passed between the drive

and the controller.

Finally, it specifies non-return-to-zero (NRZ) data coming out of the drive that allows the use of advanced run-length-limited (RLL) data-encoding schemes that can effectively increase the amount of data stored by

as much as 50 percent without altering the basic bits-per-inch capabilities of the disks. The use of NRZ data and RLL encoding represents the migration of these large disk techniques to the emerging small 5¼-inch and smaller disk systems.

	ST-506/412	ST-412HP	ESDI
<b>Basic function</b>	basic drive/controller interface	similar to ST-506, faster	upgraded ST-506, faster, more intelligence
<b>Data rate</b>	5M bps	5M to 15M bps	10M to 25M bps
<b>Data encoding</b>	MFM	MFM, NRZ possible	NRZ
<b>Data separator</b>	on controller	on controller	in drive
<b>Additional functions</b>	buffered seek	same extra head-select line, recovery mode line for error recovery	same extra head-select line, step mode (similar to ST-412 but with overlapped seek); command mode: serial mode for passing commands from controller to drive including direct track addressing; status mode: permits passing of parameters, fault conditions and configuration information between drive and controller



# Mini-Micro World

## NEWS

Xebec's Philip Devin, director of marketing, disagrees. He says the cost of the data-separator circuitry is low and should not impact multidrive configurations. Further, the relaxation of phase-margin problems on the heads and media due to on-board data separation will help reduce the cost of the interface.

Xebec's Redmond disputes the lower-cost notion. "There has been so much finger-pointing at the 5M-bps data rate between drive, controller and system manufacturers that from a customer-support point of view it would be cost-prohibitive for us to even consider manufacturing a 412HP product."

According to John Worden, manager of disk systems engineering at CDC, the increase in the data-window margins can provide drive manufacturers with more design leverage in the rest of the drive. "With today's ST-412 and the proposed ST-412HP, 30 percent to 50 percent of the theoretical data-detection window is allocated to the controller subsystem. This means that drive manufacturers must produce a drive to tighter tolerances in the head, media and positioning system. With the ESDI, drive manufacturers have control over the data separator, write-precompensation circuitry and data-recording code and thus 100 percent of the data-detection window. This gives them more options in designing the more costly portions of the drive. Reduced costs in the heads, media and positioning system should result in a less expensive drive."

CDC announced its ESDI support with the introduction of the Wren-2 family of 86M-, 174M- and 213M-byte, 5¼-inch drives, which are expected to be in production in early 1985. Experience from using parallel production lines for modified-frequency-modulation and non-return-to-zero (NRZ) models of the

36M-byte Wren-1 drives has led CDC to favor the NRZ, or ESDI, interface.

Larry Boucher, president of Adaptec Inc., Milpitas, Calif., takes a softer view. "Technical superiority is by no means the determining factor in winning the acceptance battle. Almost everyone agrees that the American National Standards Institute (ANSI) standard is the most well-thought-out proposal from a technical point of view, but it has failed in the marketplace." Early supporters of the ANSI standard have now adopted more mainstream interfaces.

A recent ANSI supporter to switch allegiances is Micropolis, Chatsworth, Calif. Vice president of marketing Chet Baffs cites a lack of demand from OEMs and system integrators and says, "ESDI meets the requirements for a higher-performance interface. It's an economical and relatively easy migration from our ST-506/412 interface."

One of the early members of the ESDI committee, Western Digital Corp., Irvine, Calif., is now supporting the ST-412HP. Explains Kathy Braun, director of marketing of storage-management products, "As the proposed ESDI standard became more complex and expensive, we began to lose interest. When Seagate and Tandon [Corp.] announced its support of the ST-412HP, we felt that the company's market presence would result in wider use of this interface." Adds Joseph Jaworski, director of strategic planning, "We are driven by our ability to produce [very-large-scale-integration (vlsi)] components, and to do this we need volume markets. With Seagate and Tandon behind the ST-412HP, we feel comfortable that there will be the volumes we need to support VLSI development." In addition, Western Digital's interface components are more adaptable to the ST-412HP than to the ESDI. □

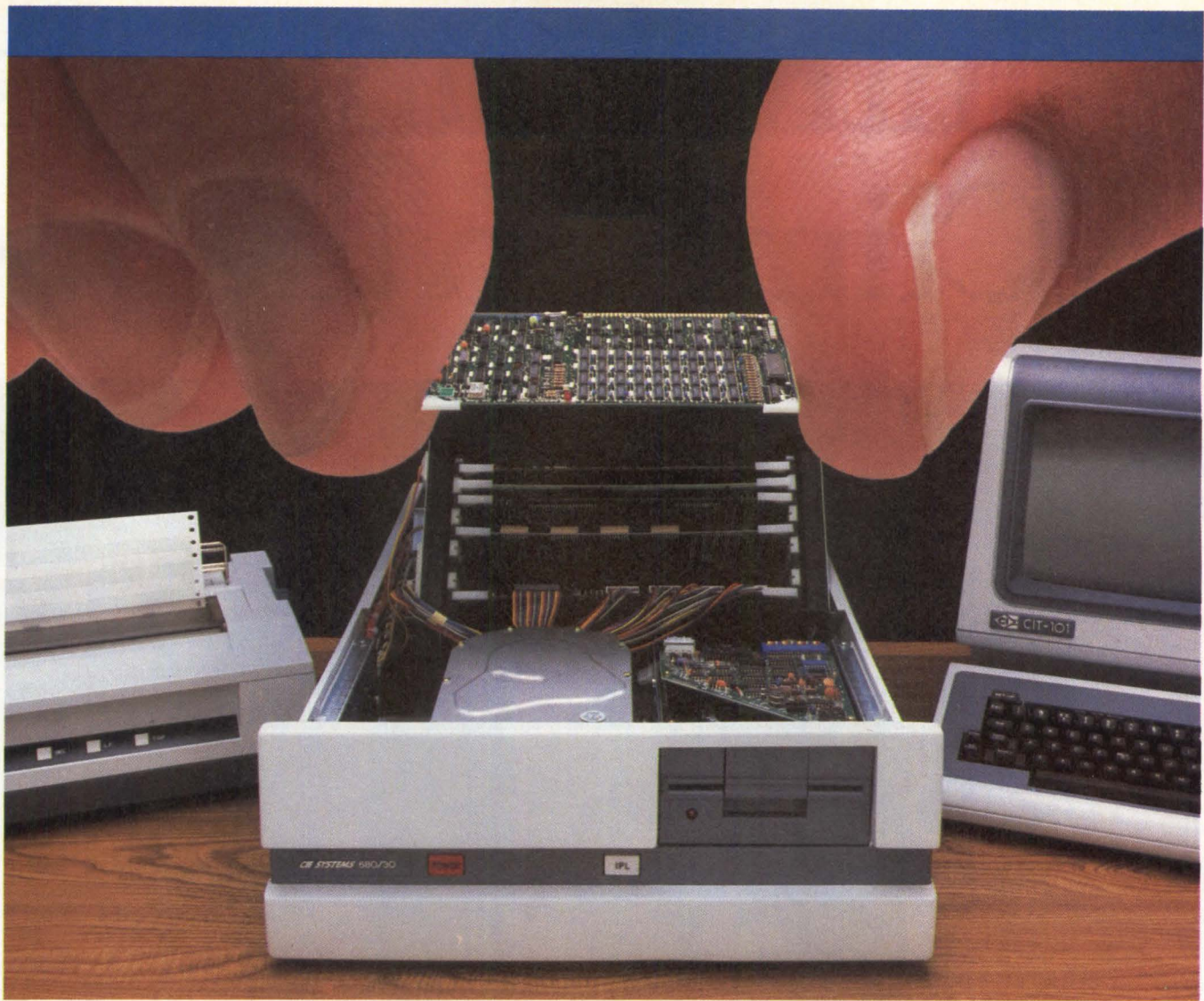
### TANDON TO SUPPLY SOME WINCHESTERS TO IBM

Tandon Corp. insiders making the Hannover Fair rounds reported that the company recently made a serious play to supply all of IBM's current needs for 10M-byte Winchesters—some 750,000 units. IBM declined the offer in favor of signing a second source but reportedly bought 400,000 drives from Tandon because the price was low—\$325 each. Deliveries should start this month.

### BASF UNVEILS 5¼-INCH WINCHESTER

BASF unveiled the top-of-the-line 6190 5¼-inch Winchester drive at the Hannover Fair. The 6190 incorporates high-performance Winchester features that include a dedicated servo system and a voice-coil actuator. Unformatted capacities are 52M, 73M and 94M bytes on models with five, seven and nine recording surfaces, respectively. BASF officials note that the company is delaying the re-establishment of a full U.S. disk drive sales operation. But international accounts manager Hans Wallner is using BASF Systems Corp., Bedford, Mass., the company's U.S. media outlet, as a base to contact U.S. computer companies wanting drives for their European sales and manufacturing operation.





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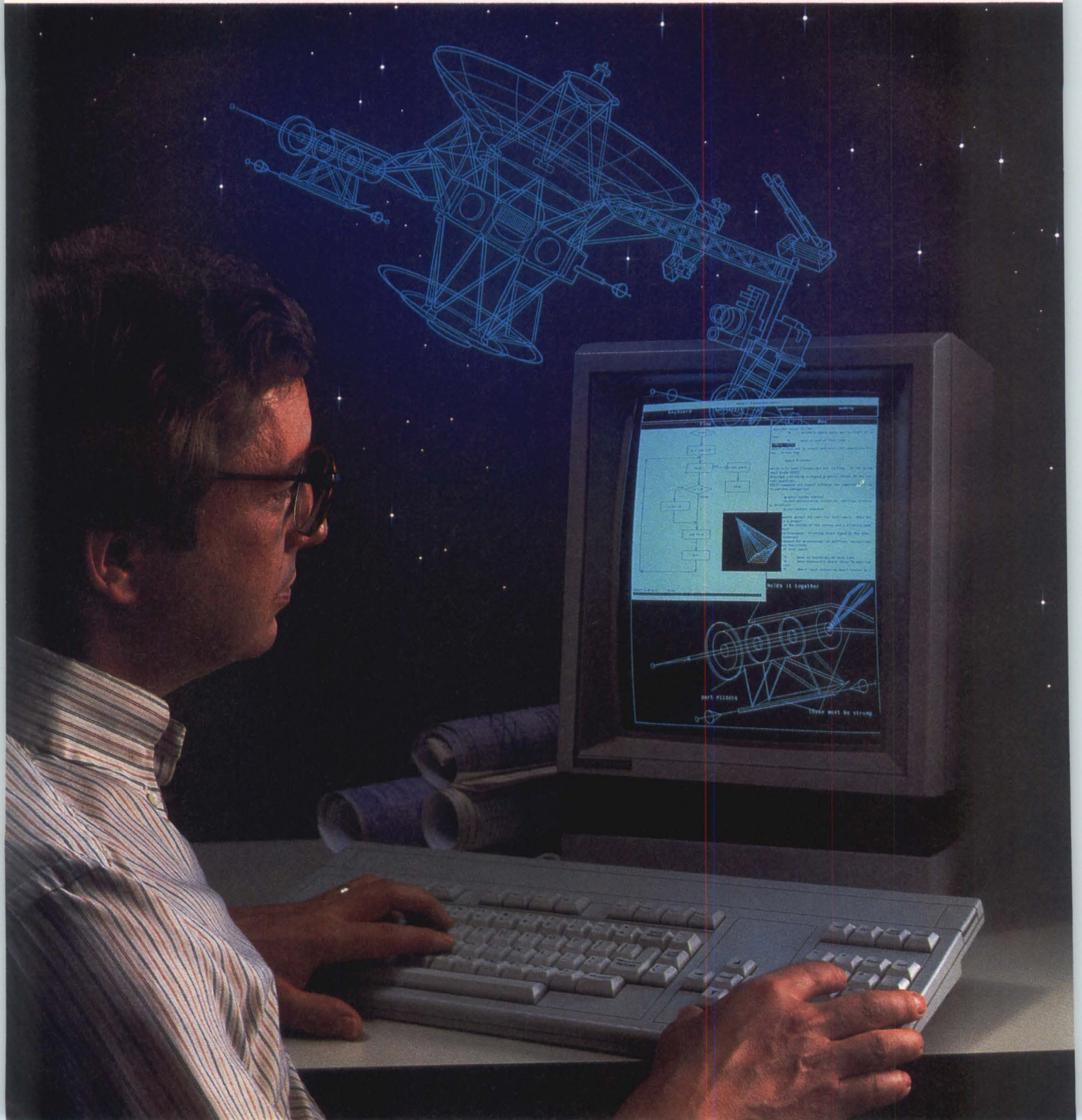
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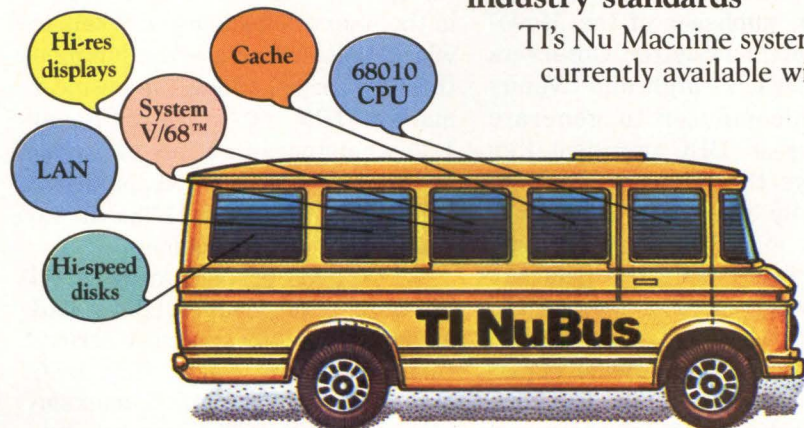
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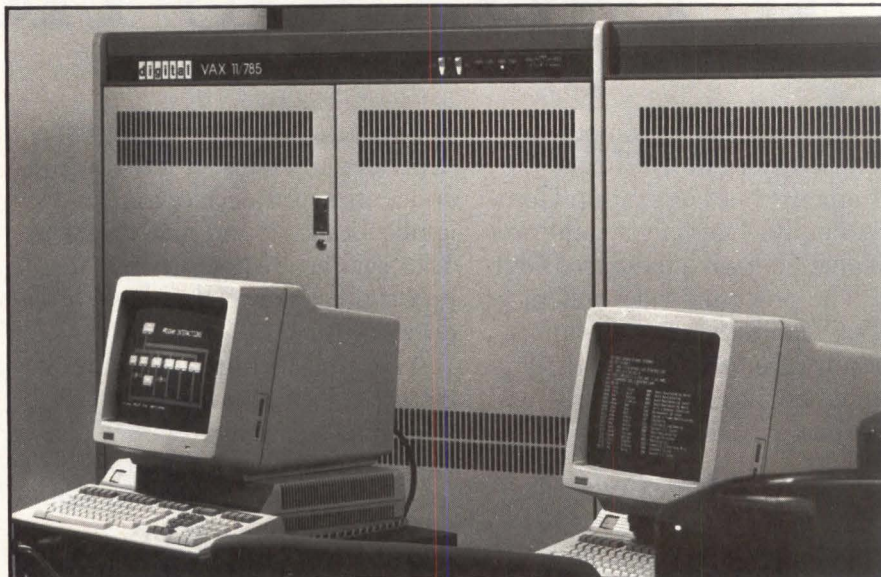
NEWS

## DEC announces its most powerful VAX

David Bright, Assistant Editor

Digital Equipment Corp. has finally announced its top-of-the-line, single-processor VAX-11/785 superminicomputer. The announcement comes amid new and intensified competition from all quarters, including the formidable AT&T Co. and IBM Corp. DEC claims the new system provides 50 percent to 70 percent more throughput than the 11/780—its first superminicomputer—which was introduced in 1977.

The VAX-11/785, which is compatible with the other VAXs, runs the VMS and ULTRIX-32 operating systems and can be configured in VAXclusters. A VAXcluster is a loosely coupled group of as many as 16 VAXs connected via 70M-byte-per-second coaxial cable. DEC says the new machine has hosted at least 196 users and that there is no theoretical limit to the number of users. Virtual memory, like on other



DEC's high-end VAX-11/785 is housed in the same cabinetry as the VAX-11/780 but provides a 50 percent to 70 percent throughput increase, DEC says. Prices start at \$195,000.

VAXs, is 4G bytes. A building-block system with 2M bytes of main memory, a VMS license and cabinetry sells for \$195,000, and a similarly configured VAX-11/780 system sells for \$145,000.

Many observers were unenthusiastic about the VAX 11/785 system. It is "nothing shocking, surprising or new," comments Adolph "Sonny" Monosson, publisher of the *Monosson on DEC* newsletter. Observers expect DEC's high-end Venus superminicomputer to generate more interest. DEC president Ken Olsen says the Venus will be announced by year-end. The Venus will use emitter-coupled logic, which is faster than the Schottky transistor-to-transistor logic (TTL) that the current VAXs use.

DEC leads in worldwide superminicomputer shipments. The company's market share of shipments jumped from 37 percent in 1981 to 49 percent in 1982, according to International Data Corp. figures. But several announcements by other companies threaten DEC's

lead. These threats include IBM's 4300 series mainframes, which were announced last fall, AT&T's 3B20 and 3B5 superminicomputers, which were unveiled a week before DEC's announcement of the VAX-11/785, and Data General Corp.'s MV superminicomputers. IBM is targeting its new \$200,000 4361 Group 5 processor at DEC's OEMs in the scientific/technical market, in which DEC so far has the jump on the 4300 series, and at the business market. IBM rates the 4361-5 at 1.45 whetstones in a mix of single- and double-precision computation. DEC rates the VAX-11/785 at 1.6 single-precision whetstones.

VAX-11/785 product manager Al McGuire acknowledges IBM's 4361 as the DEC system's most serious competition but claims that DEC has several advantages. For example, the VAX-11/785 can be clustered and can be linked via the Ethernet local-area network. DEC designed the system for timesharing applications and claims this is another advantage over IBM's 4361.

### VAX VS. IBM

	DEC VAX-11/785	IBM 4361 Group 5
Word length (bits)	32	32
CPU cycle time (nsec.)	133	100
Whetstone rating (MIPS)	1.6 (single precision), 1.0 (double precision)	1.45 (mix of single and double precision)
Maximum memory (bytes)	32M	12M
Virtual memory (bytes)	4G	16M (under VM)*
Cache memory (bytes)	32K	16K
Price	\$195,000 (w/2M bytes memory, VMS license)	\$200,000 (w/2M bytes memory)
Availability	September	now

\*VSE 2.1.0, scheduled for April 1985 availability, will support 40M bytes of virtual memory



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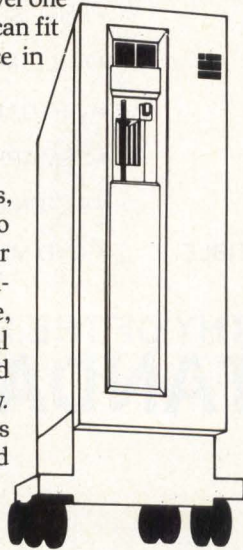
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# Mini-Micro World

## NEWS

But IBM value-added reseller support representative William Bozarth counters that, although the 4361 is batch-oriented, the VM operating system, which is installed on roughly half of the 4300 systems, enables the system to support real-time timesharing equal to the VAX's.

McGuire says he is not worried about further competition from AT&T's 3B20 and 3B5 supermini-computers. Although AT&T has used the systems internally for several years, the company continues to buy a lot of VAXs from DEC, he points out.

### DG remains a leader

DG's MV/10000 superminicomputer, rated at 2.5 single-precision whetstones for a \$150,000 system, apparently remains a price/performance leader. DEC says its optional FP785 floating-point accelerator can enhance the VAX-11/785's floating-point performance by an average of 47 percent. The FP785 uses the same technology as the VAX-11/785 CPU and is priced at \$14,000.

Previously, DEC offered its VAX-11/782 to scientific and technical customers desiring more computational power. The VAX-11/782 incorporates two VAX-11/780 processors and two shared-memory controllers. But DEC rated the system's performance to be 60 percent to 80 percent greater than the VAX-11/780's, which makes the VAX-11/782 and VAX-11/785 about equal in performance. Because a VAX-11/785 lists for \$200,000 less than the VAX-11/782's \$395,000, DEC's McGuire says it could reduce the demand for the VAX-11/782. However, customers may still want to use the VAX-11/782 in some applications, such as when a second CPU is needed for I/O.

DEC boosted VAX-11/785 CPU performance through the use of ad-

### Wang adds high-end supermini

A week before Digital Equipment Corp. introduced its VAX-11/785 32-bit minicomputer, Wang Laboratories Inc. announced its most powerful superminicomputer—the VS 300. It is more compact and three times faster than their second most powerful system, the VS 100, Wang says. Prices start at \$170,000 for the VS 300 and \$113,000 for the VS 100. A new version of the VS operating system, which will be compatible with current VS machines, will support the VS 300.

The VS 300 uses a pipelined processor that overlaps instruction cycles. In every 120-nsec. processing cycle, the CPU executes one instruction, decodes a second and fetches a third. The system includes 4M to 16M bytes of memory using 256K-bit RAM chips.

The system sports 32K bytes of cache memory and a dedicated, buffered memory-control unit. It also features 15 intelligent I/O controllers for serial devices, disk and tape drives, telecommunications links and networking gateways. Wang says the VS 300 supports as many as 255 concurrent user tasks and 192 workstations and printers. A floating-point accelerator is available.

The VS 300 measures 36 inches high by 48 inches wide by 25½ inches deep, and the VS 100 measures 48 by 41 by 32 inches.

A basic VS 300 configuration, including 4M bytes of memory, the operating system, a serial I/O controller and an assembler language license, sells for \$170,000.

vanced Schottky TTL, a shorter cycle time, quadrupled cache memory—to 32K bytes—and the use of a writable control store for microprogrammed instructions. The company shortened cycle time on the VAX 11/785 to 133 nsec. from 200 nsec. The storage of VAX-11/785 microcode in RAM simplifies microcode updates and reportedly increases CPU performance. VAX-11/780 microcode is stored in ROM. DEC also increased console memory for the VAX-11/785 to 48K bytes from 16K bytes. The VAX-11/780 and -11/785 use the same cabinetry.

Customers can upgrade their VAX-11/780s to VAX-11/785s for \$91,200, or for \$95,000, including the FP785 floating-point accelerator.

An All-In-1 office-automation configuration, including a VAX-11/785 with 6M bytes of memory; a 456M-byte disk drive; a tape drive; four DECmate II systems with word-processing software; and licenses for VMS, the All-In-1 office menu, VAX DECmail and DECdx/VMS communications, sells for

\$322,735. Shipments are scheduled for September.

### Relational DBMS for VAX

DEC also announced its first relational database-management systems and the VTX videotex system for the VAX. The Rdb/VMS software supports local and remote database applications under VMS, and Rdb/ELN is designed for the VAX ELN execution environment on low- and mid-range VAXs. License fees are \$9,000 for Rdb/VMS, \$7,500 for Rdb/ELN and \$25,000 for VAX VTX. □

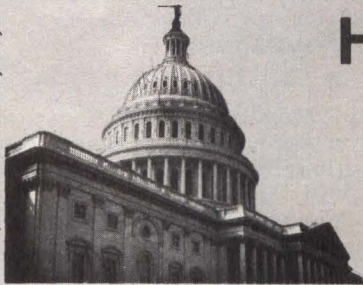
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## HEARD ON THE HILL

### FCC advocates pro-U.S. communications policies

**Stephen J. Shaw**  
Washington Contributor

The Federal Communications Commission (FCC), the philosophical champion of the deregulated U.S. telecommunications industry, is trying to export its vision of a laissez-faire market for advanced computer information networks to the rest of the world.

In April, the FCC issued an interim report on the development of international standards for integrated services digital networks (ISDNs), all-digital communications networks that bundle a variety of information services—packet switching, protocol conversion, high-speed data, digital voice and video—into a single transmission stream. The report states that international ISDN standards should be in accord with the pro-competitive attitude of U.S. policies. The commission also criticized the International Consultative Committee for Telephone and Telegraph (CCITT), the agency responsible for drawing up ISDN standards, for failing to consider some technical and policy characteristics of evolving U.S. ISDNs.

The first technical concern of the FCC is that CCITT draft recommendations do not specify the form of network interface needed at the input to the network-channel terminating equipment (NCTE). The CCITT plan calls for communications carriers to provide NCTE. In the United States, such equipment can be sold on an unregulated basis. Many network-interconnection functions are embedded into U.S. telecommunications and computer equipment, such as digital private-branch exchanges and integrated workstations, on a custom-

er's premises. "Our viewpoint is that the [network-interface] box can still be a carrier function, but it's not a carrier monopoly," says Michael Slomin, legal adviser to the FCC.

The second technical concern of the FCC is to ensure that multiple information service providers will be allowed access to foreign countries' ISDN networks. Foreign governments and their telecommunications agencies must recognize the importance of allocating adequate numbering codes to satisfy the needs of a variety of vendors, states the report.

The FCC urges other countries to give due consideration to the U.S. distinction between basic and enhanced information services. A basic service is one that does not alter the format, protocol or code of the transmitted information, except for technical clarity and fidelity. An enhanced service, according to the FCC, is one that employs computer-processing applications that add value to information transmitted through common carrier facilities. In the United States, enhanced services are not subject to regulation. The FCC has vowed not to allow carrier monopolies to charge improper cost subsidies for basic and enhanced services. But the CCITT ISDN plan would commingle the two services.

U.S. industry participants disagree about whether to abandon the basic-vs-enhanced distinction for international ISDN service. AT&T has argued in comments to the commission that the distinction was "parochial" and "may require appropriate modification." IBM Corp. recommended that FCC policies be incorporated into ISDN network policies. The FCC agrees, saying that the CCITT is moving to treat basic and

enhanced services separately.

The FCC questions the CCITT's use of the International Standards Organization's Open Systems Interconnection (OSI) model as the starting point for designing ISDN network architecture. A potential problem the FCC sees is that the network processing of protocols invoked across the OSI may limit the information-transmission capabilities available to users. The OSI model, states the FCC report, should not be used to draw basic/enhanced service distinctions or to determine those services that must be performed as part of the network and those that can be offered separately.

The FCC believes that private, unregulated vendors will be able to offer a far more extensive array of new information services than tightly regulated, government-owned carriers can offer. The commission asks for more reliance on market forces to evolve ISDN technical standards and less on by-committee international mandates. Whether the FCC's voice is loud enough to be heard by the CCITT remains to be seen. The FCC's role is to advise the CCITT and the U.S. State Department on the U.S. domestic industry—not to design international communication networks.

It remains to be seen what scope of services can be bundled into the developing digital networks for international applications. The FCC thinks its decade-old recipe that has helped produce a smorgasbord of domestic information services is ready to be shipped abroad. But will it sell? "It's nice to have sundaes with hot fudge and jimmies, but some people like just plain vanilla ice cream," comments FCC adviser Slomin. □



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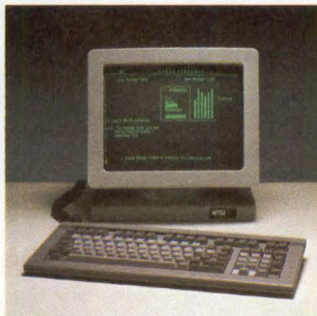
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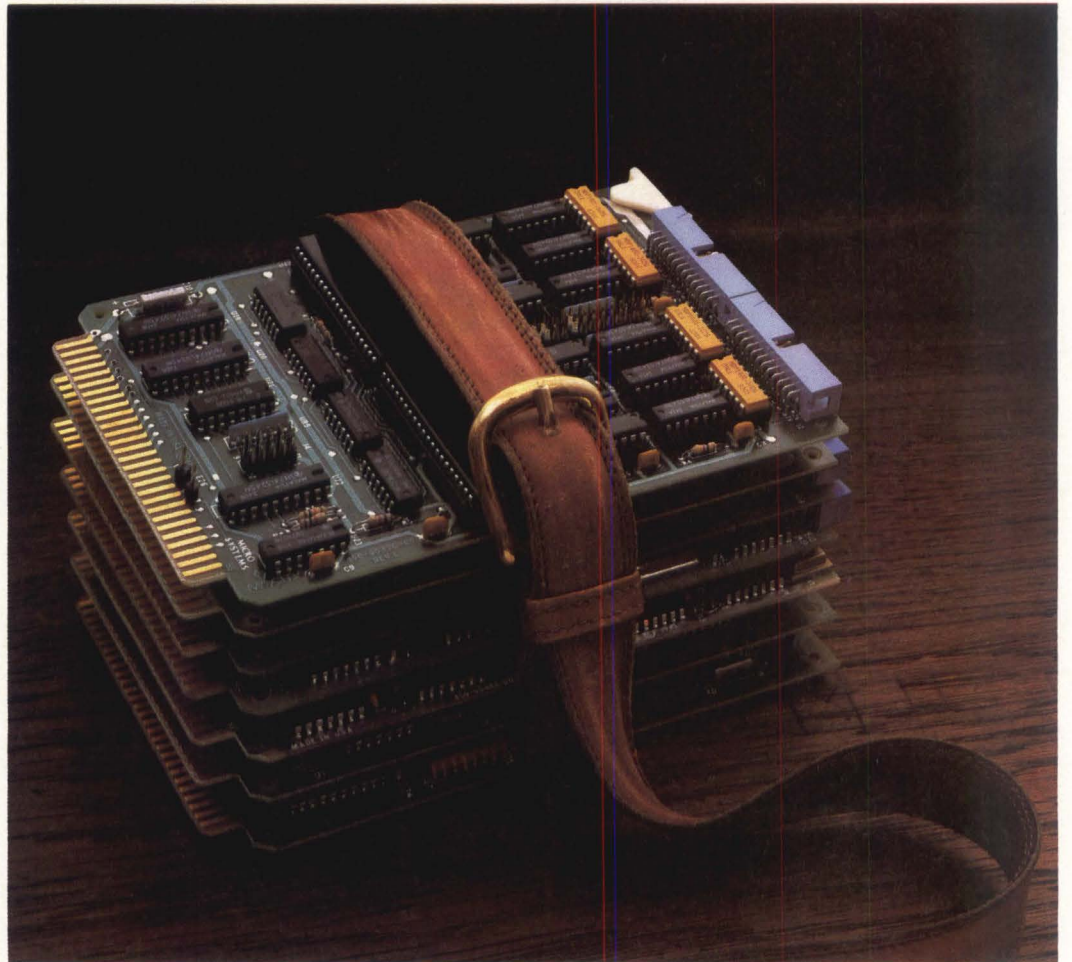
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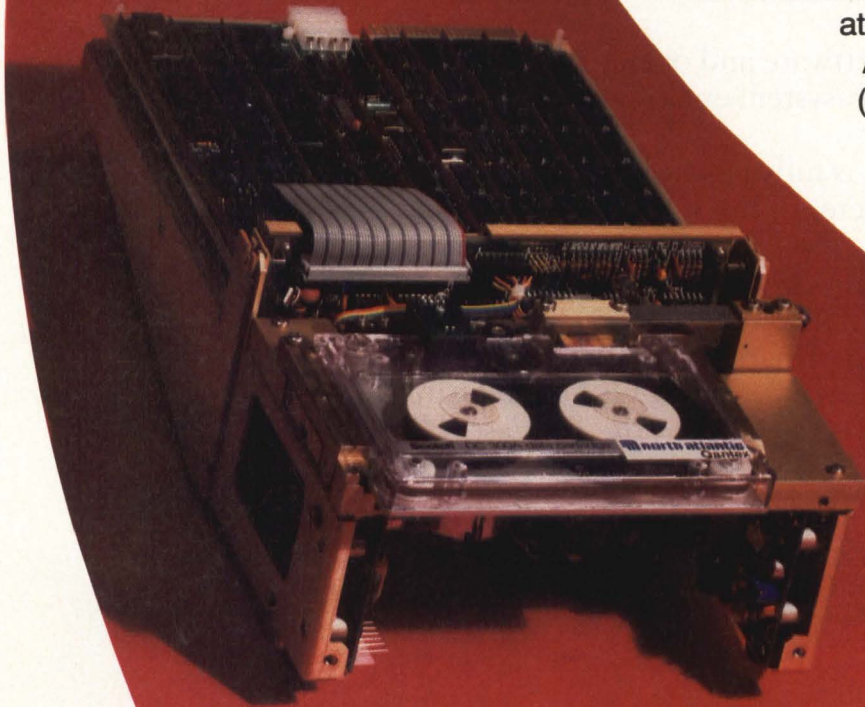
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# **JETSTREAM™ 16**



### Sperry's PCs provide micro-to-mainframe link

**Marjorie Stenzler-Centonze**  
Associate Editor

As part of a new focus on the microcomputer market, Sperry Corp., Blue Bell, Pa., recently introduced the Mapper 5 and Mapper 6 multistation desktop microcomputers that provide a microcomputer-to-mainframe link to Sperry and IBM Corp. systems.

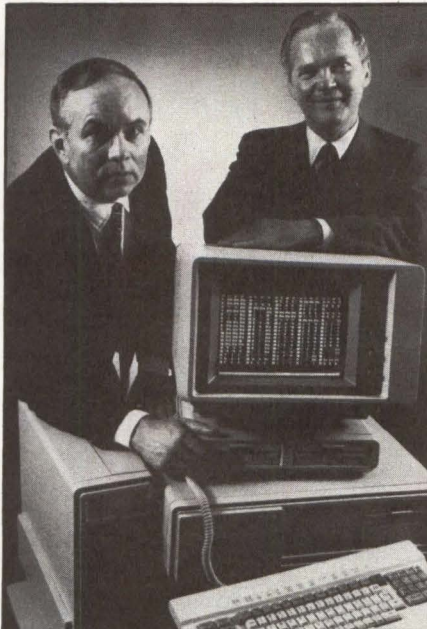
Both systems are based on the Motorola MC68000 microprocessor and can control as many as 16 workstations. The systems, which can be used with Sperry's UTS display stations or connected to the Sperry personal computer, use Mapper software, which until now was available only on mainframes.

Mapper is written in assembly-type language and, according to the company, acts as decision-support software, an application-development system and a real-time language tool that extracts and organizes data for operations control.

"Over the past two years, Mapper software has become well-recognized for going beyond even the fourth-generation language category in functionality and ease of use," says Dewaine Osman, vice president of the Americas Division of Sperry. Now support is available on a chip instead of a mainframe at a multiuser system entry-level price of less than \$40,000, he states.

The Mapper microprocessor systems can be used for standalone or for mainframe connection and are being aimed at current Sperry customers, at new users and, as a supplement, at IBM users.

As a standalone desktop system, Mapper is aimed at the data-processing needs of middle managers. It features color graphics,



**Jan Brundin** (left), vice president of product strategy and management at Sperry, demonstrates the Mapper 5 microcomputer system with **Tom McCaffrey**, vice president of worldwide marketing.

message sending and related office functions. A typical configuration of a Mapper 6 system providing IBM connection consists of a processor, a freestanding mass-storage and backup system with integrated streaming tape and 30M bytes of disk storage and a choice of eight

display stations.

To launch Mapper 5 and 6, Sperry is expanding its distribution by adding a value-added remarketer (VAR) program and instituting a marketing-assistance program for software houses, according to Thomas S. McCaffrey, vice president of worldwide marketing at Sperry. The VAR program enables third-party software houses and system integrators to add specialized application software to the Mapper system. The marketing-assistance program is designed for software houses that have their own applications operating on the Mapper system. These companies can use Mapper 5 and 6 at no charge to develop specialized applications to sell to their customers.

"We are going into alternate distribution channels for two reasons," McCaffrey says. "First, the marketplace has changed radically, and we can't rely solely on selling systems in our traditional way. Second, the Mapper systems provide an ideal vehicle for moving into additional distribution channels."

Mapper 5 is available for immediate delivery, and Mapper 6 will be available in late fall. □

#### DG PLANS NEW RETAIL APPROACH

Data General Corp. has been seeking ways to mass-market its low-end Desktop Generation microcomputer in the United States and abroad. DG research shows a niche in retail channels for a multiuser machine such as DG's entry-level, four-terminal Desktop model 10. But DG wants to avoid the cutthroat discounting of retail channels. General Business Group European marketing manager Tom Weanie says DG plans to fix prices and exercise tight control over retail inventory, having retailers order machines as they sell them. DG Europe intends to test-market the concept in Britain, probably by the summer. Weanie declines to disclose the names on his European and U.S. prospect lists. DG may try to qualify as many IBM Master Distributors, dealers and retailers as it can.



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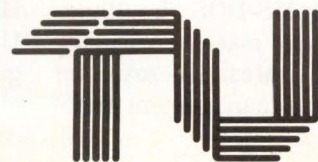
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### Pick enhances OS flexibility with 'open architecture'

**Marjorie Stenzler-Centonze**  
Associate Editor

Pick Systems, Irvine, Calif., recently unveiled a machine-independent "open architecture" operating system, the culmination of a 20-year effort. "Open architecture is like the operating system's operating system," states Dick Pick, chief executive officer of the company. "It's a very powerful, complete machine architecture but not in the sense that it ties into a specific computer because it can run on any computer." The new software also increases the possible size of individual records.

"We've built a framework that is a machine-independent generalized tool for other software," Pick explains, "making it easier for us to put up other software tools or standards under the open architecture."

Pick Systems' Release 80 will be the first operating system to run under the open architecture, Pick says. Pick claims there is a 30 percent efficiency improvement in Release 80 running under this system.

Pick Systems is developing a C compiler this year. "When that is completed," Pick says, "the UNIX operating system will effectively run as a subset of [our software]."

Pick says versions of open architecture Release 80 that run under PC-DOS, for example, will be able to coexist with programs written for the IBM PC XT. "You can have a WordStar or a VisiCalc running under MS-DOS simultaneously on the same machine with our system," Pick states. He says the system has data-management functions at its core.

#### Records can occupy 5M bytes

In past implementations of the operating system, items and records stored on file were limited to 32K bytes. "This was fine when we started with the system, but with word processing that's a tough limit," Pick says. "Now if you want to have a record out on the disk that's 5M bytes in size, you can do it with open architecture."

The company plans to introduce an integrated word processor/editor to update data management and an integrated word processor.

Pick has about 18 licensees for its Release 80 operating system, most of which are likely to take on the open architecture, Pick says. "We are looking for good licensees that we feel can open alternative distribution channels. We need strong, mature companies that can take our product to market and run with it."

Pick says many companies are too ready to license other companies. "If you want to make a standard I think [too much licensing] can be counterproductive because a lot of these [licensees] can get you into very deep trouble."

#### Pick must market actively

But some observers see deep trouble around the corner if Pick Systems does not actively market the system. Jean Yates, president of the Los Altos, Calif., market research company Yates Ventures, says marketing is still a major problem for Pick. "With AT&T and IBM [promoting their versions of UNIX], it's going to be difficult to get the Pick operating system to be a primary focus," Yates says.

The product will grow, she



**Dick Pick**, chief executive officer at Pick Systems, says open architecture represents the culmination of 20 years of work including suggestions from users.

predicts, but mostly in specialized vertical markets. "The growth of Pick will depend on the manufacturer getting behind it with a consistent campaign of media advertising, shows, etc.," Yates maintains.

#### Licensees may market software

Kirsten Sanders, an analyst with Yates Ventures who attended the recent Pick Spectrum '84 held in Reno, Nev., says licensees at the show may come up with their own marketing effort. "Companies are paying a license fee to use the Pick name, yet only a small group of people really know the name," Sanders says.

Rick Vieth, OEM marketing manager for Pick licensee Altos Computer Systems Inc., San Jose, Calif., says a joint marketing effort would not overcome the difficulties he sees. "Our concern is a general lack of office productivity and



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# Mini-Micro World

## NEWS

communications software," Vieth says. Altos offers the Altos 586 and 986 microcomputers, which range in price from \$10,500 to \$14,500 and which are bundled with the Pick operating system.

"We are best known for being a UNIX-based system manufacturer, and there's a wealth of UNIX

software compared to Pick," Vieth comments.

Vieth says there have been reports that Pick will integrate some communications software into the operating system. "That would be more help than any sort of marketing effort on the part of Pick or any group of licensees." □

## Quarter-inch streamer group eyes standards

Edward Foster, Associate Editor

The working group for quarter-inch cartridge (QIC) drive compatibility is developing a proposed set of recording format and interface standards for a 100M-byte class of ¼-inch streaming-tape cartridge drives. Manufacturers in the group expect to introduce products employing the new standards as early as July's National Computer Conference (NCC) in Las Vegas, Nev.

"By the end of the QIC meeting in Oslo, Norway, on June 13 and 14, I expect we will at least have agreements on the basic interface and the intelligent interface, and a proposal on the recording format will be well along, if not completed," says Raymond C. Freeman, QIC facilitator and president of Freeman Associates, a Santa Barbara, Calif., consulting company. The group, consisting of 10 QIC members and several observing companies, agreed in early March on the need to establish standards for 100M-byte cartridge drives. "The 100M-byte product class is a logical evolution from 45M-byte-compatible products and provides an upgrade path for users," notes Freeman.

As several companies have demonstrated products or prototypes that achieve 100M-byte capacities through different methods, the

principal challenge to manufacturers appears to be agreeing on which technical means to employ. The major trade-off facing designers of the new class of ¼-inch streamers is number of tracks vs. recording density. Several proposals the QIC committee began studying in March involve the use of 16 tracks recording at 10,000 flux changes per inch (fcpi). "With 16 tracks, edge referencing will be required, although not necessarily full-time servo-tracking capability," says Freeman.

Another proposal the QIC committee is considering is a 12-track version of the ¼-inch streamer that records at 12,500 fcpi and does not need a track-sensing facility. Other approaches under consideration employ nine tracks—as does the QIC-24 standard recording format—while increasing bit density.

"Some suggestions have been made for as much as doubling the bit density, but the consensus of the manufacturers appears to be toward not getting hung up on new technologies," observes Whitney G. Lynn, vice president of marketing for Wangtek, Culver City, Calif. Part of the reason for the committee's preference for established technology is that each component is progressing at a



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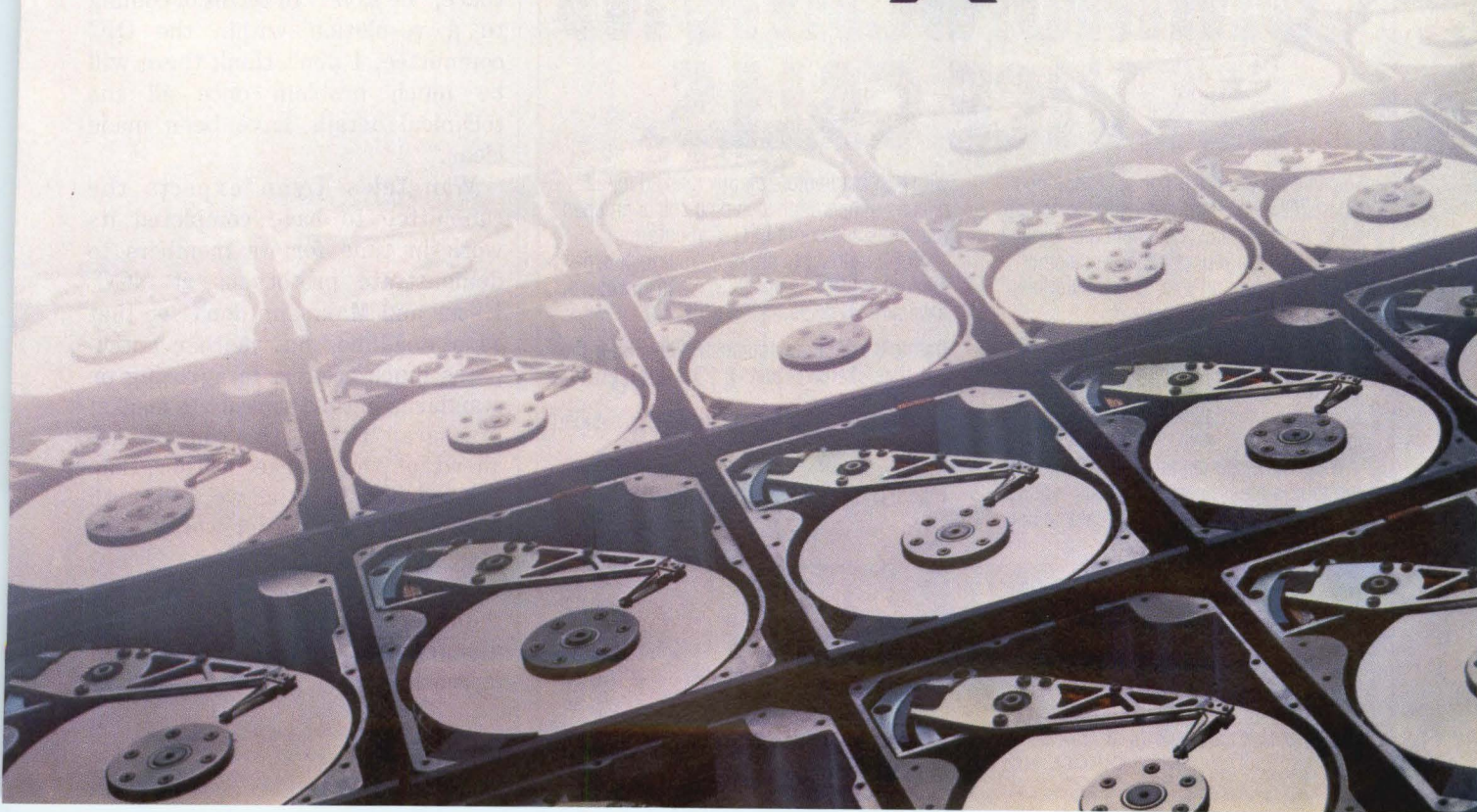
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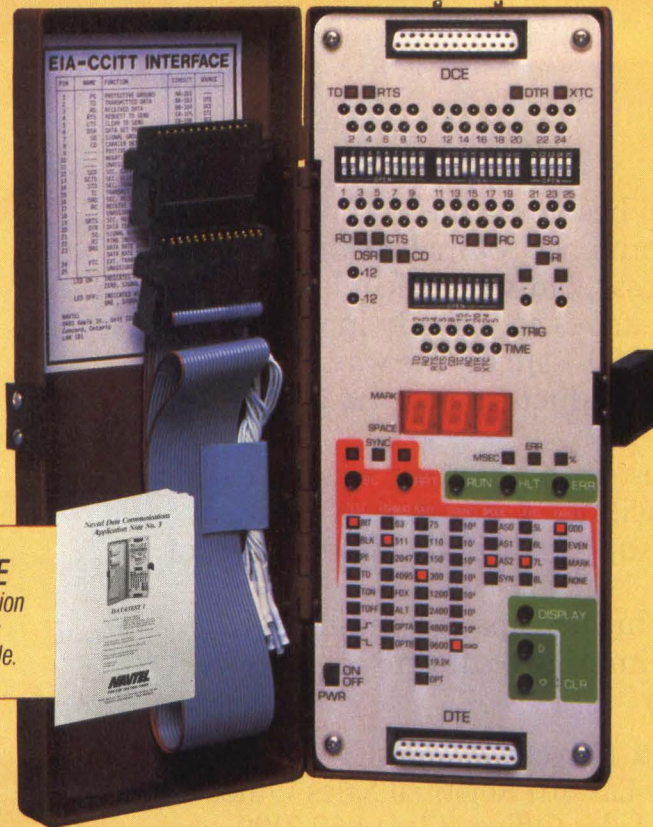
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different rate. "Recording-head manufacturers told us at one of the meetings that it would be at least two years before there would be heads in sufficient commercial production for recording densities of 20,000 bits per inch," Lynn says.

Lynn and other manufacturers on the QIC committee emphasize that they are willing to consider any approach to achieve 100M bytes as long as it can be implemented soon. Several of the initial proposals—including 12 tracks at 12,500 fepi and 16 tracks at current densities—are workable, says Lee Elizer, vice president of product planning for Cipher Data Products Inc., San Diego. "Right now, it is mostly a matter of all of us analyzing what the various proposals will mean in terms of manufacturing costs."

Thomas Makmann, vice president of marketing and sales for Archive Corp., Costa Mesa, Calif., believes his company could accept more than one proposal as a standard. "The only absolute requirement we see is backward-compatibility because of the products we already have out there," he says. "In terms of coming to a resolution within the QIC committee, I don't think there will be much problem once all the technical details have been made clear."

Wangtek's Lynn expects the committee to have completed its work in time for its members to demonstrate prototypes at NCC. Elizer and Makmann don't see that as a deadline, but neither anticipates much trouble in agreeing on standards in time to react to market pressure. "I think this time we are ahead of the market rather than being driven by it, as we were with the committee's earlier work," says Makmann.

Elizer sees no overwhelming requirement for 100M bytes in the market yet but stresses that increasing capacities of hard disks



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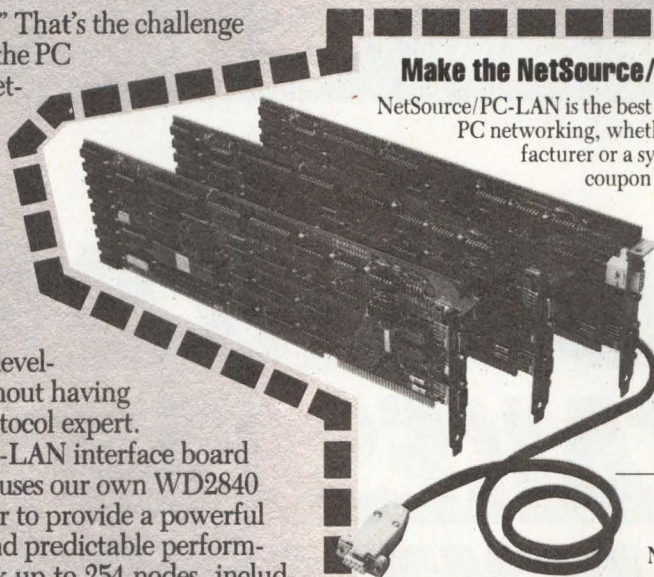
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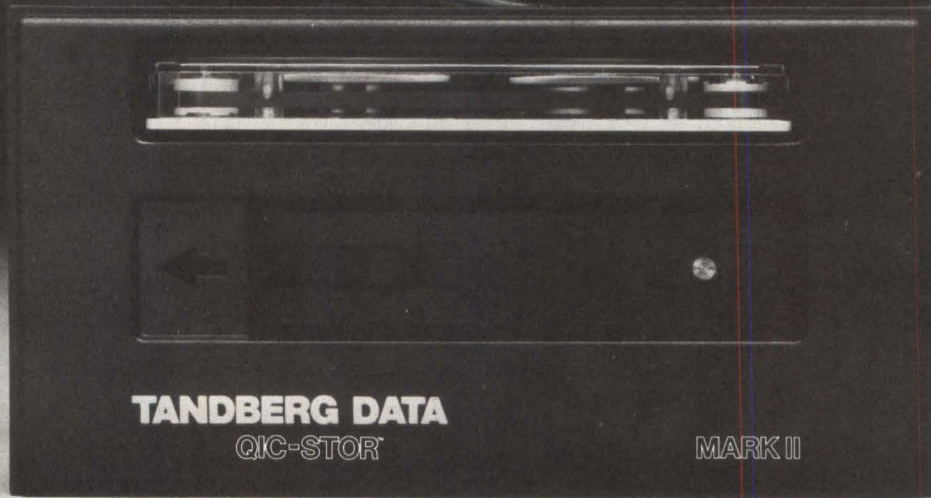
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*into a half-high 5 1/4" form factor. It has all the best features of our new 8" Mark II,™ including precise track locating and rugged cartridge locking/loading to totally eliminate the machine interchangeability problems that have plagued the industry. You get all this, plus capacities of up to 60 megabytes on a single 1/4" tape cartridge!*

*We've stepped up our facilities and capabilities too, just to keep up with demand. But that's another story. If you'd like the full story on our growing lineup of QIC-STOR streamers, you'll have to take the next step and contact Tandberg Data, Inc., DATA STORAGE DIVISION, 571 North Poplar, Suite H, Orange, CA 92668.*

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CIRCLE NO. 38 ON INQUIRY CARD



# Mini-Micro World

NEWS

will mandate 100M-byte streamers in the near future. "The QIC committee is not set up to be an ongoing body; we're going to reach an agreement as fast as we can." Elizer is optimistic about the likelihood of agreement. "All companies in this business know that before QIC got started the amount of market activity in 1/4-inch streamers was not extremely significant. The customer base wants standards."

Freeman agrees that the success of the QIC committee in reaching previous standards has had much to do with the dynamic growth in the 1/4-inch cartridge-drive market. He estimates 1983 worldwide shipments at 80,000 units and predicts that 145,000 units will be shipped this year. □

## Capitol Records division plays the flip side of diskettes

Lori Valigra, Senior Editor

A division of Capitol Records Inc. appears to have taken the analogy "records are to a turntable what software is to a computer" to heart and carried its recording-media expertise into the computer industry. The Capitol Data Systems division, Los Angeles, recently entered the disk drive supply business with a 5 1/4-inch diskette designed to run on both of its sides.

Capitol claims its new Platinum series diskette runs on single-sided/single-density, single-sided/double-density, double-sided/double-density and quad-density floppy

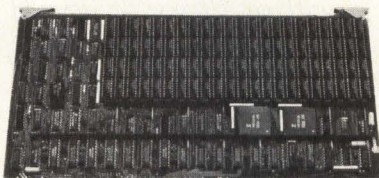
disk drives. Allowing the soft-sectored diskette to be flipped over and used on both sides are two data-protection notches and two index holes that let users register and index recording tracks on either side of the diskette. Suggested retail price is \$55 for a box of 10 diskettes. Initial release of the product is in Southern California, but that will expand nationally over this year through retail channels.

Company officials say Capitol's experience in manufacturing master lacquer disks, audio tapes and other magnetic media made the transition to computer storage media logical.

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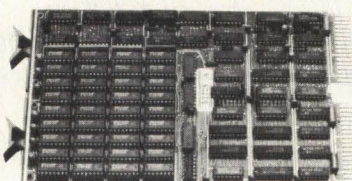


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CIRCLE NO. 40 ON INQUIRY CARD

MINI-MICROSYSTEMS/June 1984



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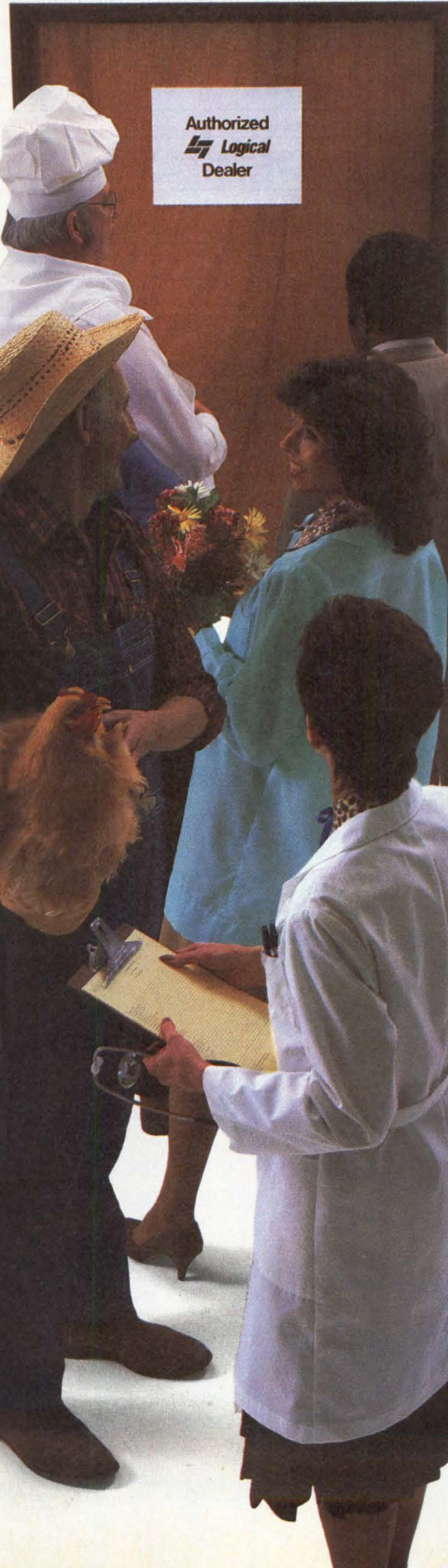
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# Floating Point Systems array processor to break

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Four basic product groups make up the new FPS-5000 Series: the 5100, 5200, 5300 and 5400. Peak performances range from 26 million floating-point operations per second (MFLOP), to 62 MFLOP. Data memory of 0.5M to 1M words is available along with program memory to 32K words.

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Typical performance examples of geophysical, medical imaging and signal/image processing applications.

Application Example	AP-120B	FPS-5410	5420	5430
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3. Multispectral Image Classification (512 x 512 pixels 8 Bands, 4 classes)	49 sec.	25 sec.	13.3 sec.	10.5 sec.
4. 2D FFT (512 x 512 complex)	3.4 sec.	1.4 sec.	.7 sec.	.5 sec.
5. Matrix Multiply (100 x 100)	439 msec.	177 msec.	96 msec.	71 msec.

Based upon specifications subject to change.

FPS-5000 Series sets a new standard for cost-effective computing, breaking the \$2,000 per MFLOP\* barrier—the first time this has been achieved in any floating-point computing system.

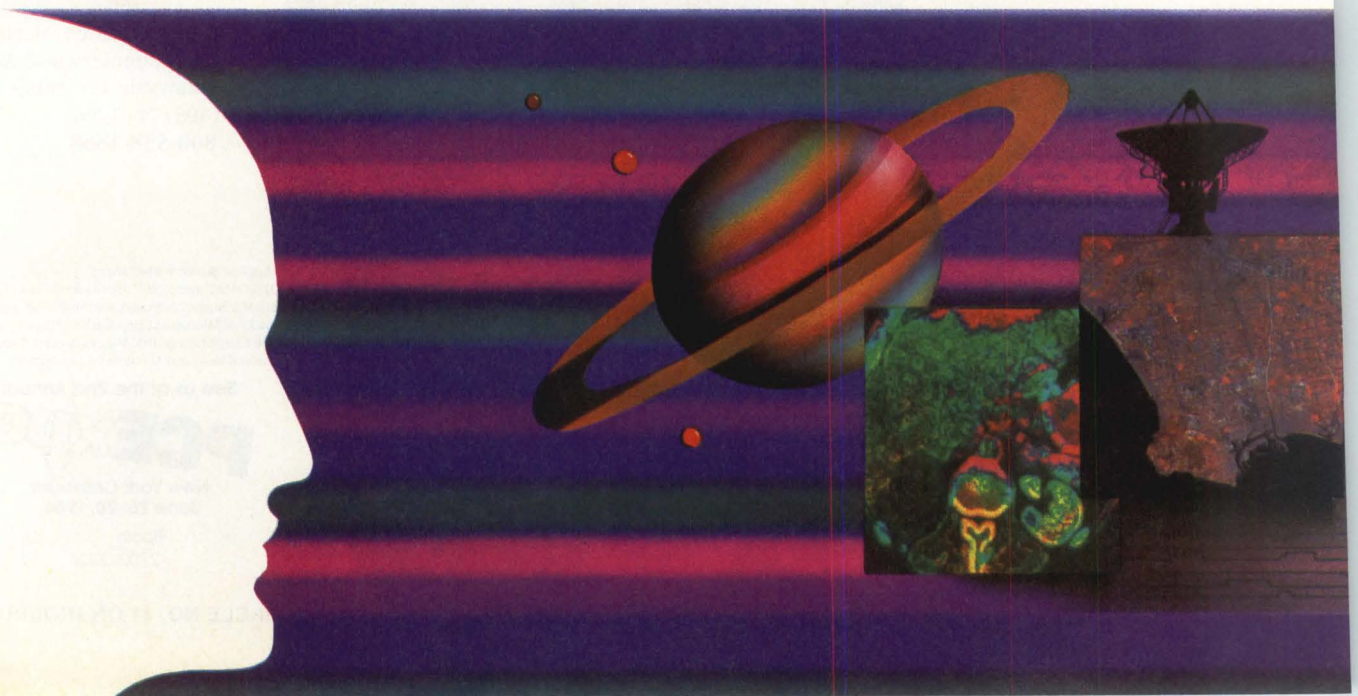
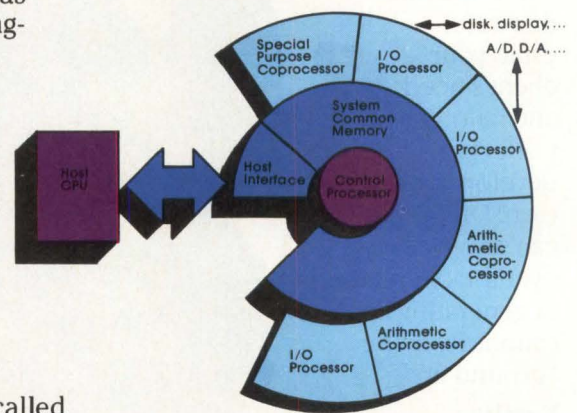
\*Based on U.S. Domestic Prices

## Distributed processing architecture

The FPS-5000 Series is a distributed processing system that maximizes throughput by allocating the computational load to a set of high-performance, independent, floating-point processing elements called

Arithmetic Coprocessors. Data flow is simultaneously managed

## FPS-5000 Series Architecture





# introduces the first the \$2,000/MFLOP barrier.

by a combination of independent I/O Processors and the central Control Processor.

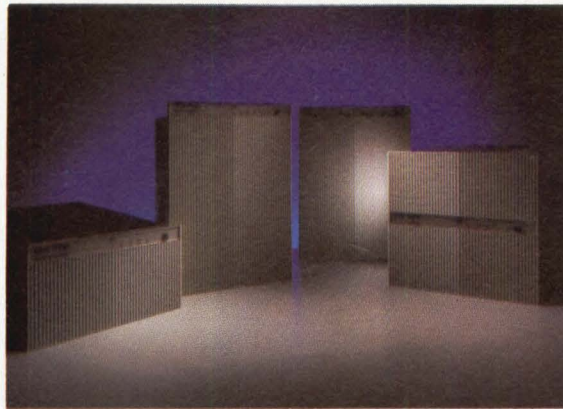
Each Arithmetic Coprocessor, with synchronous architecture to allow simple application debugging, functions as a self-contained unit.

The new Multiple Array Processor Execution Language (MAXL), based upon FORTRAN 77, allows the user to construct an integrated system environment which can be tuned to application requirements.

Increased performance can be achieved by adding Arithmetic Coprocessors as a field-installable upgrade as the user's requirements evolve.

## Compatibility

The FPS-5000 Series maintains software compatibility with previous FPS 38-bit processors and is supported on a range of host computers. Thus, the extensive



software support developed for FPS-100 and AP-120B products is maintained and users are able to move existing applications onto the FPS-5000 Series with minimal effort.

## Quality and Reliability

The FPS-5000 Series was designed and built with the same quality standards inherent in all of the previous Floating Point Systems products—standards that have earned those products a reputation for unprecedented reliability and one of the best

meantime between failure (MTBF) rates in the industry.

The Series is backed by the same outstanding worldwide support services that distinguish Floating Point Systems from other manufacturers.

For more information about how the FPS-5000 can be used in your specific application, call (800) 547-1445 or your local sales office.

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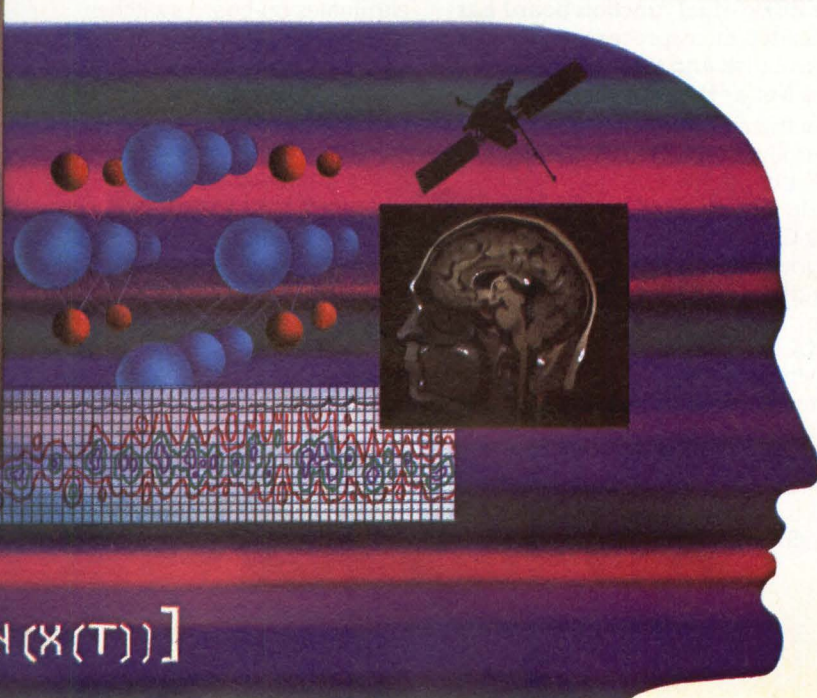
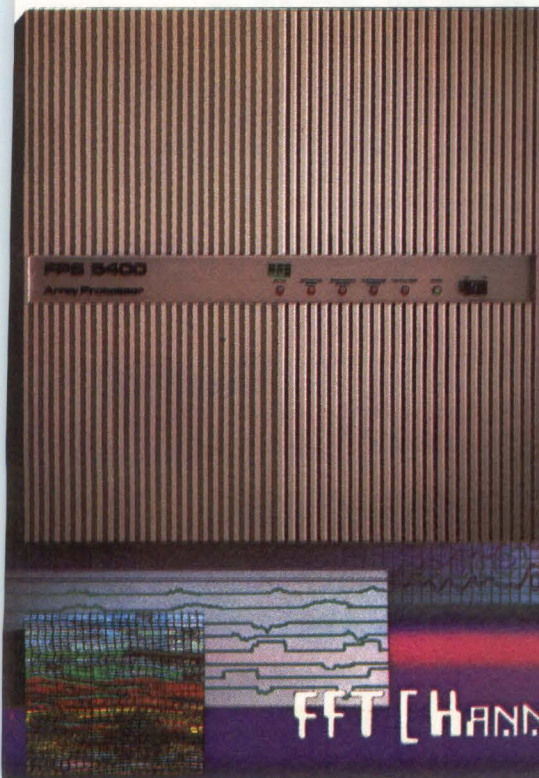
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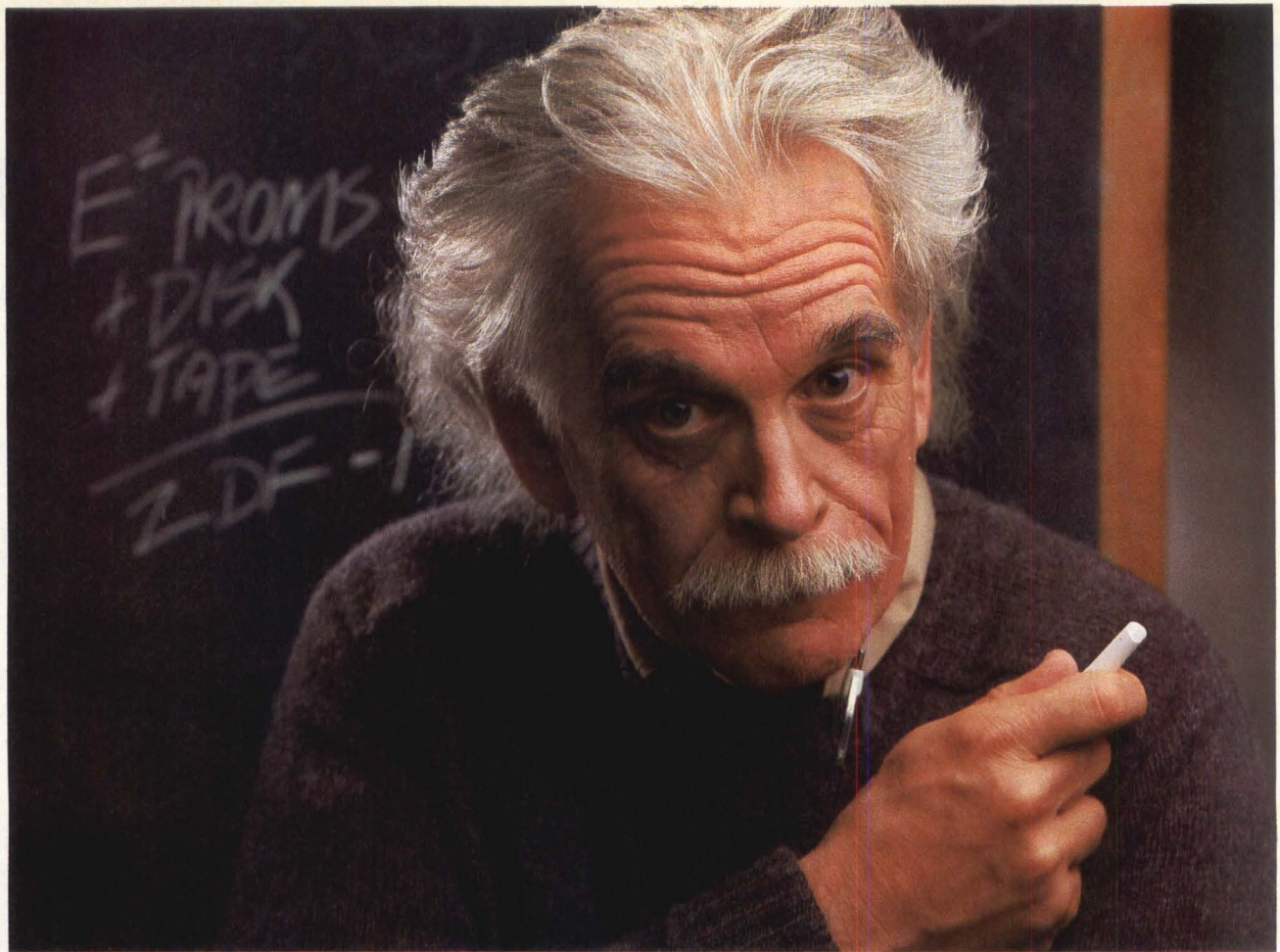
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CIRCLE NO. 42 ON INQUIRY CARD



FFT [ HANN (X(T)) ]





## Zetaco's newest Slot-Saver<sup>T.M.</sup> uses a touch of genius to control both disk and tape.

The ZDF-1 dual function board has dedicated microprocessors to control disk and tape drives for DG's Nova/Eclipse series.

Now there is a dual function controller you can trust. Zetaco's ZDF-1 combines two well-proven products and more: our Model 295 Disk Controller and our Model 133 Magnetic Tape Coupler. Two complete controllers on a single board, with full emulation of DG's 60XX and 61XX series disk sub-systems and 6021 and 6125 tape systems, enhanced to provide higher transfer rates and maximum use of your storage capacity.

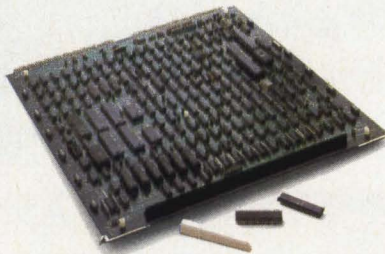
There's more. On-board ECC and the ability to run unmodified RDOS/AOS. E<sup>2</sup>PROM technology

eliminates on-board switches, making each drive configurable from your keyboard. ZDF-1 has true "plug-and-go" compatibility: it needs no software patches, and backplane cabling is compatible with DG's new FCC-compliant chassis.

Zetaco designed the ZDF-1 as a controller to grow with. As technology

advances to higher transfer rates, beyond 600 MB Winchester, beyond 150 ips GCR tape drives, you'll find the genius of ZDF-1 is ready. Now, and in the future.

Get the full ZDF-1 story from Zetaco, 6850 Shady Oak Road, Eden Prairie, MN 55344, (612)941-9480. Telex 290975. European Headquarters: 9 High Street, Tring, Hertfordshire, HP23 5AB, England. (044282) 7011. Telex 827557. ZETACO G.



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Controller Division, Custom Systems Inc.



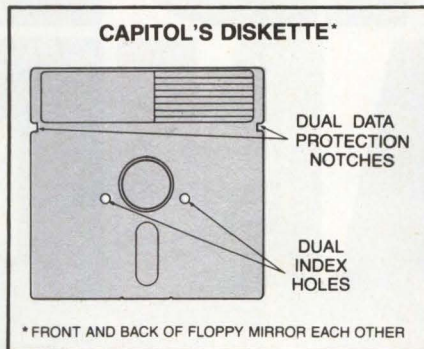
# Mini-Micro World

## NEWS

"We are putting our years of experience in the magnetic media and recording business into an area for which I believe we are uniquely qualified—data-recording devices for personal computers," notes Edward Khoury, president and chief executive officer of Capitol Data Systems.

Capitol's parent company, Thorn EMI Plc., London, spearheaded the project. Thorn's central research laboratories are said to have invented the technique used to produce stereo records.

Capitol guarantees the diskettes, which it claims undergo stringent quality-assurance tests, are error-free. Capitol will give a lifetime warranty; the disks must be maintained properly, however. Capitol tests all diskettes on both sides



to meet quad-density standards. This is important, notes Bob Gaskin, a senior industry analyst

following the floppy disk drive market at market researcher Dataquest Inc., San Jose, Calif. Gaskin says the difficulty has been with people or companies converting regular diskettes to two-sided diskettes. Both sides of these diskettes typically aren't tested.

Capitol Data, formed in 1983, is Capitol Records' newest venture. Another household name, Eastman Kodak Co., is expected to bring notable brand identification to the market with its rumored forthcoming floppies. □

### ALCYON TO SHIP MC68000 COMPILER

Alcyon Corp., San Diego, is ready to ship its C-68 MC68000 C language compiler. The compiler not only works with a number of UNIX and XENIX operating systems and Motorola Inc.'s VersaDOS but also operates stand-alone. The package is priced at \$295 and is delivered on 5¼-inch floppies.

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**CIRCLE NO. 46 ON INQUIRY CARD**



# THE CASE F

It measures 5.00'x 6.62'x 14.75". And it fits smartly beside many of today's popular microcomputers. But the case in point, Xebec's new 10-megabyte 9710 Universal Storage Subsystem, has more to do with the components inside—specifically, the controller and the disk drive—than with the dimensions and the aesthetics outside.

Actually, the most important thing on the outside of the case is the name. Xebec. A company whose 5.25" hard disk controllers are found in more business micros—including those of IBM, Hewlett Packard, TI and Eagle—than any other, anywhere. What put us there was—and remains—our ability to *engineer in* more features and *manufacture in* more quality—zero defect quality, delivered on time and in quantity.

What puts us here, in the subsystem business, is at once a derivative and encompassing quality issue. The fact is that the more sophisticated we make our controllers, the more obvious become the deficiencies of the disk drives they control—the very drives found in all of the subsystems for small business computers being sold today. And all the more obvious becomes the need for someone to create a new standard for bringing these critical components together.

The Xebec 9710 is that new standard. First, it houses the industry's best selling 5.25" hard disk controller, the Xebec S1410, with its patented architecture, state-of-the-art feature set and VLSI design. But the real key is the incorporation of a disk drive that is "quality matched" to that controller, not just "component compatible." A drive that goes through the most rigorous testing possible before it goes into a 9710.

The results are directed at the serious end users and system integrators of microcomputer mass storage. Superbly matched components that deliver unmatched performance and reliability, right down to a complete range of host adaptors—for the IBM PC, Apple IIe, S-100, Multibus and Q-bus—that give the Xebec 9710 its impressive "universality."

And lest you think that our case for quality is made at the expense of other important considerations—like price and availability—consider this. The 9710 is founded on a commitment to the processes that optimize all of these factors—computer-aided design, manufacturing and test. A commitment most recently demonstrated by our \$20 million investment in advanced robotics equipment.

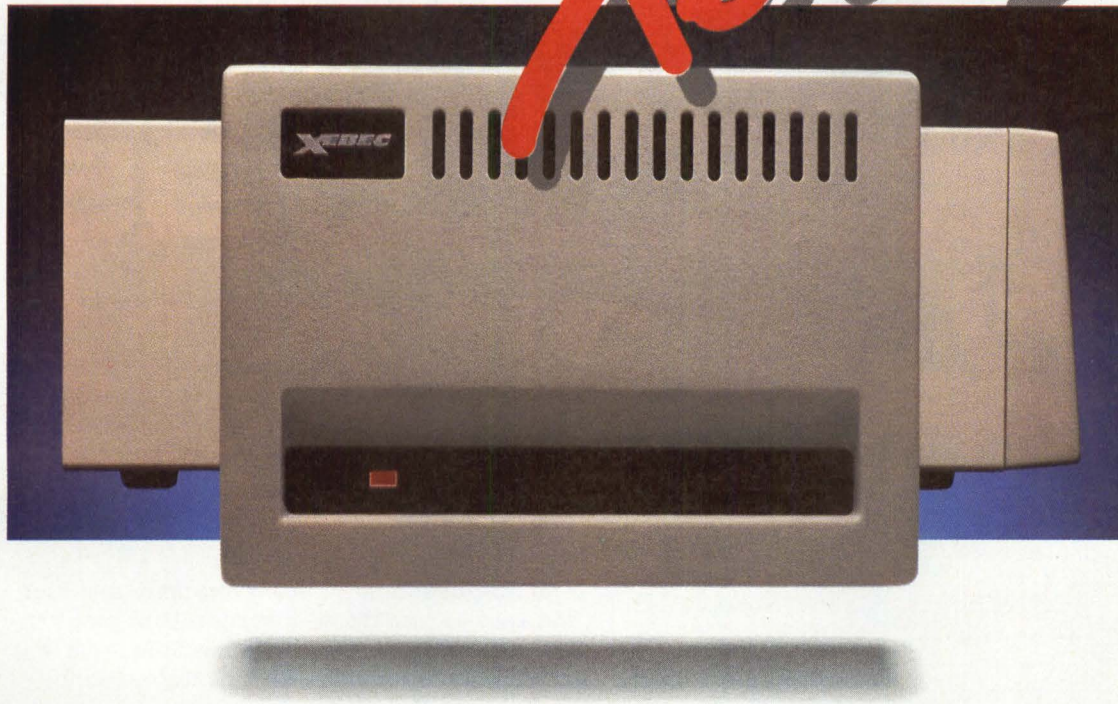
The case we are making is not, then, an empty one—no high-minded cliché thrown into the promotional fray. It is solid and smart.

It is, bottom line, an open and shut case for quality.



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Standard Equipment includes:

- 16 host definable or user programmable function keys to provide 48 functions. User programmable functions are programmable from the keyboard and saved in non-volatile memory.

- \* "MT" video attribute control means the ERGO 201 can display 17 combinations of reverse, underline, half, blink and blank on the same screen without using a character space.

- Custom mode allows the operator to define the terminal's control codes and escape sequences and save designations in non-volatile memory.

All these features, plus a built-in tilt mechanism, 7 x 9 character matrix, green, non-glare screen. Check the comparison chart at left and you will agree that ERGO 201 is the performance leader.

FEATURE	ERGO 201	Visual 50	ADDS Viewpoint	Hazeltine Esprit II	Televideo 925
<b>LIST PRICE</b>	<b>\$795</b>	<b>\$695</b>	<b>\$650</b>	<b>\$645</b>	<b>\$995</b>
User defined function keys	16	0	3	0	11
"MT" Video Attribute Control	Yes*	No	No	No	No
Custom Mode	Yes	No	No	No	No
Keyboard LED's	7	1	0	0	0
25th Status Line	Yes	Yes	No	No	No
2-Speed Smooth Scroll	Yes	No	No	No	No
Graphics Characters	Yes	Yes	No	No	No
Configurable Print & Send	Yes	Yes	No	No	No
Set Up Mode	Yes	Yes	No	No	Yes
Settable Tabs	Yes	Yes	No	No	Yes
Choose Protected Attribute	Yes	Yes	No	No	No
Screen Saver	Yes	Yes	No	No	Yes
Max. Number of Displayable Characters on one screen	**	128	128	128	128
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\*\* 128 Characters Standard; 256-Optional

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CIRCLE NO. 48 ON INQUIRY CARD



# Mini-Micro World

CORPORATE AND FINANCIAL

## DEC pushes AI with new marketing group

David Bright, Assistant Editor

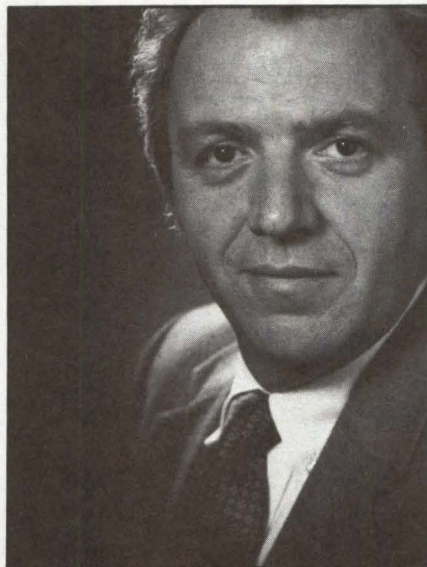
Digital Equipment Corp. recently formed the Artificial Intelligence Marketing Group that will emphasize the active role artificial intelligence (AI) will play in DEC's future. In the next five to 10 years, "everything that DEC does will somehow tie in with AI, and, 15 years from now, there may not be an AI group [at DEC]," states group manager Gale Morgan. Instead, all DEC operations—not just one group—will involve AI.

The use of AI in the general computer market should increase rapidly, according to International Resource Development (IRD) Inc., a Norwalk, Conn., market research company. From a total size of \$70 million last year, the AI market should triple to \$220 million in 1985 and grow to \$8 billion by 1993, according to IRD. Software will make up the largest sector of that market.

### DEC may lead in AI installations

With its expert systems XCON, XSEL and XSITE for the VAX supermini running the VMS operating system, DEC may be the leader in installed AI products in the industry. DEC's configuration engineers, salespeople and planners, respectively, use XCON, XSEL and XSITE, which mimic the way experts perform their jobs. The systems are written in the commercially available OPS language, which is based on the LISP AI language.

DEC plans to introduce a version of LISP for VAX/VMS this year, sources say. LISP has many "dialects," and one of DEC's objectives is to help standardize the language. The industry-wide version may be called Common LISP.



Gale Morgan, manager of DEC's new Artificial Intelligence Marketing Group, says the group will have an open-ended strategy because the field changes so fast. "I'm not sure we can figure out what's needed five years from now," he says.

### Natural language is a goal

Besides expert systems, DEC's AI research comprises natural-language interfaces, voice recognition and robotics. A long-term goal is to make natural-language systems available for commercial applications. Natural-language systems could eliminate the need for using menus and detailed proce-

dures. For example, a business end user might type: "How many of my customers are credit risks?" and "What percentage is that of all customers?" Because natural-language systems typically have longer programs than conventional programs, natural-language systems would have to be highly specialized for each task, Morgan notes.

DEC works with AI research leaders Carnegie-Mellon University, Pittsburgh, and Stanford University, Stanford, Calif., on AI projects, but Morgan points out that the research often is not directed at specific products.

DEC's AI work extends beyond the marketing group. Last year, about a dozen U.S. companies, including DEC, Motorola Inc. and National Semiconductor Corp., backed an AI research venture (MMS, December 1983, Page 33). Morgan says the Marketing Group will not deal directly with that organization.

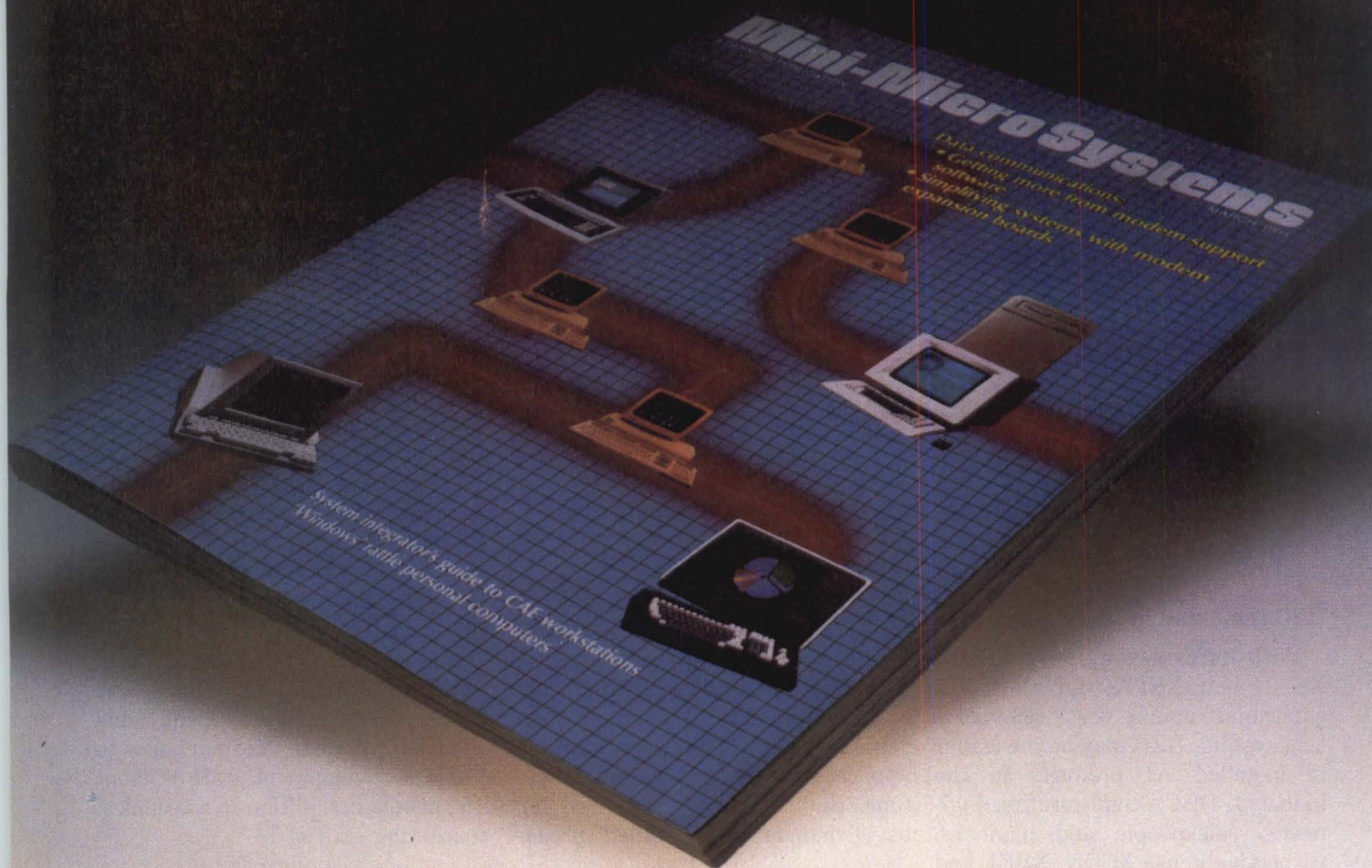
The Marketing Group has headquarters in Hudson, Mass., and offices in Sacramento, Calif., and France. This year, Morgan hopes to guide a development staff of about 150 people in addition to a technical marketing staff of 15. □

### DOW JONES ANNOUNCES THREE MODULES

Dow Jones Information Services, Princeton, N.J., has introduced the first three modules of an integrated, seven-part software accounting series for the IBM PC XT hard disk-based computer. The modules—general ledger, accounts payable and accounts receivable—should be available this month for \$995 each. The company expects the modules to be able to be integrated with the rest of the series, which is due out early next year. The forthcoming modules include sales-order entry, purchase order entry, inventory and management analysis. The menu-driven programs are for first-time users, and the price includes a training seminar. The series features automatic audit trail to enable users to track summary account balances back to the original transactions and pencil posting, which enables users to create preliminary journal entries.



# This year Mini-Micro Systems readers will spend almost \$50 billion on Minicomputers and Microcomputers\*

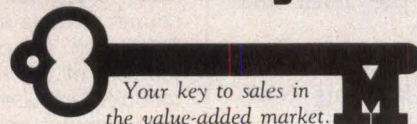


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\*Based on the 13th Annual Mini-Micro Computer Market Report

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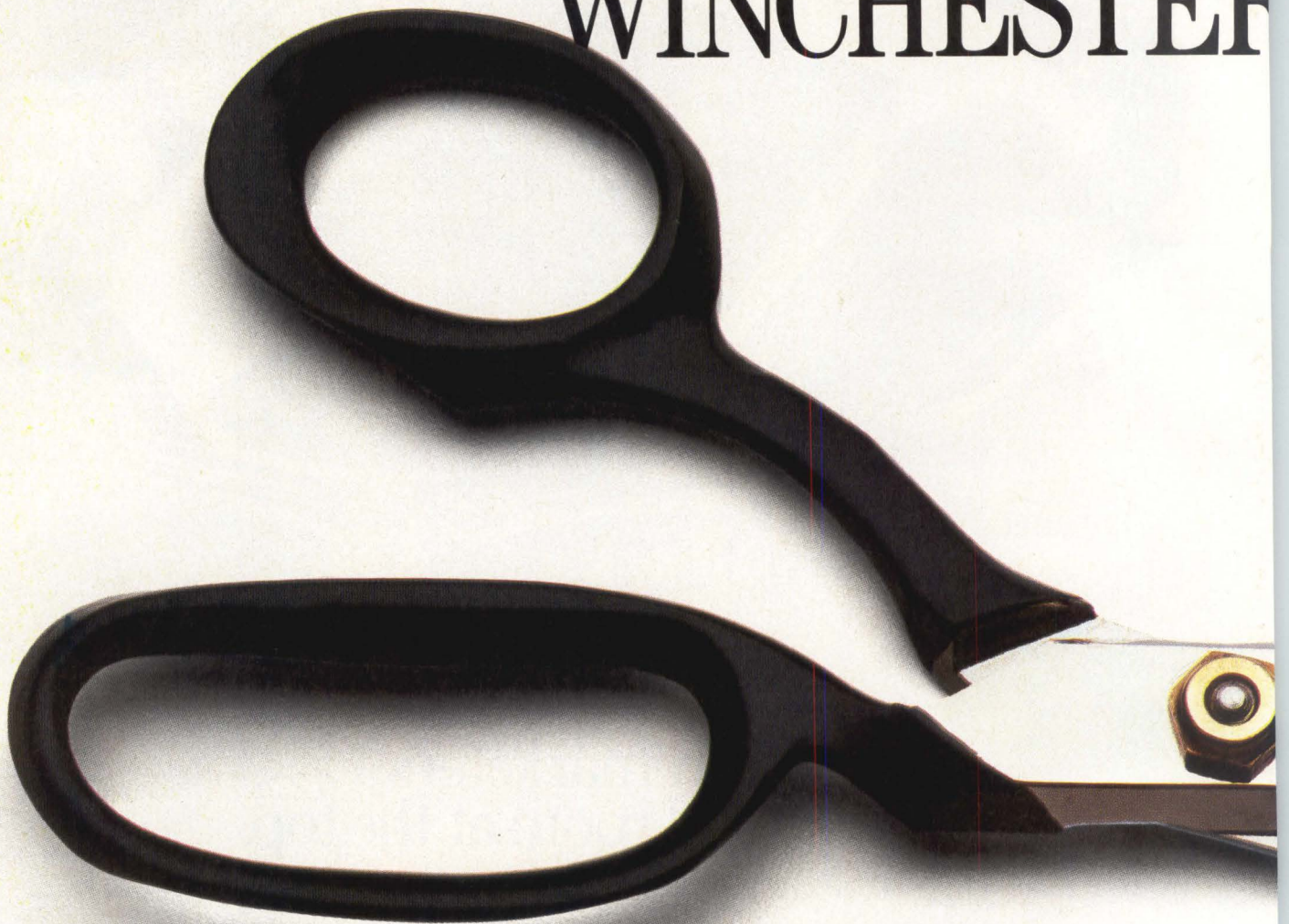
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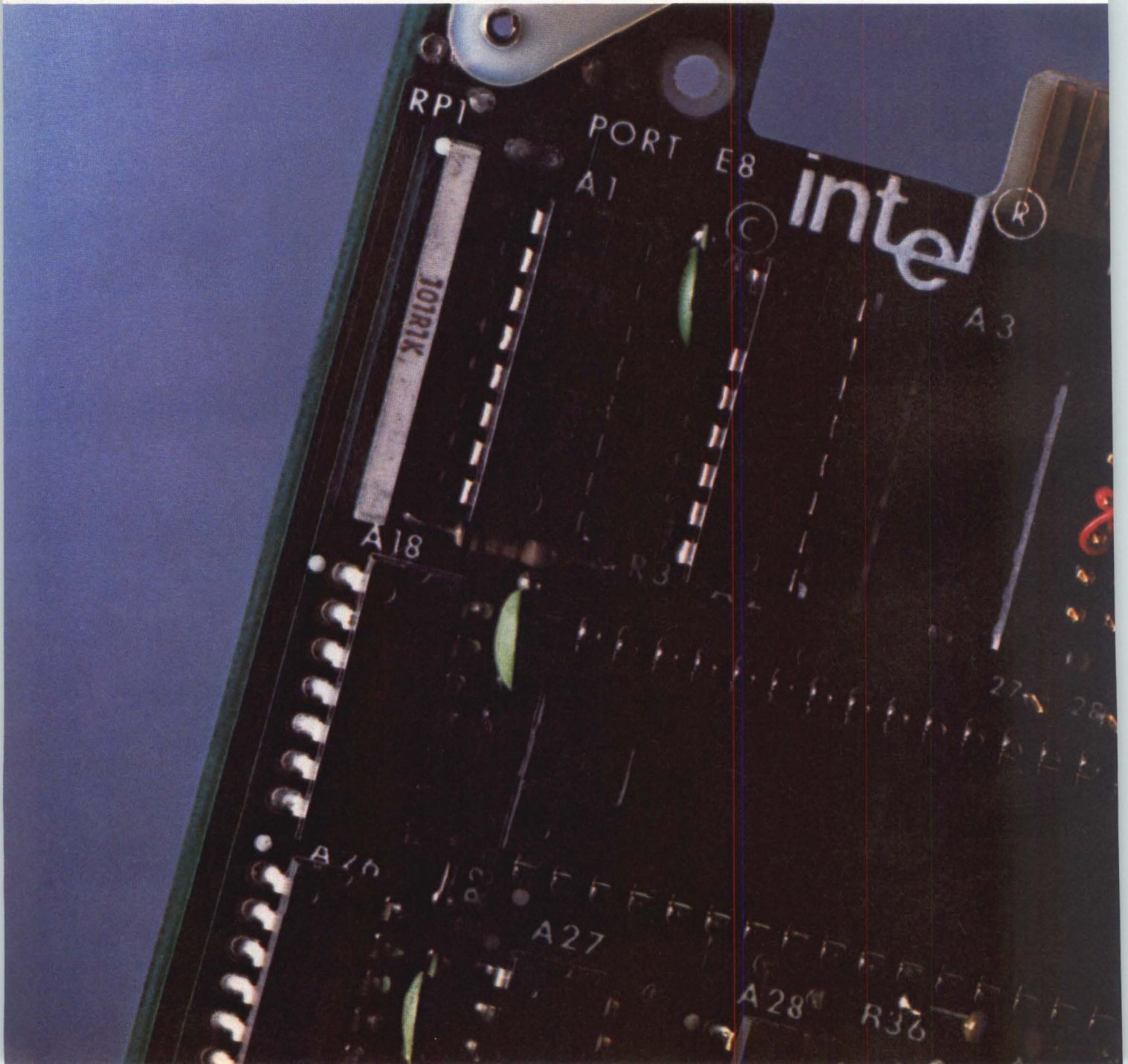
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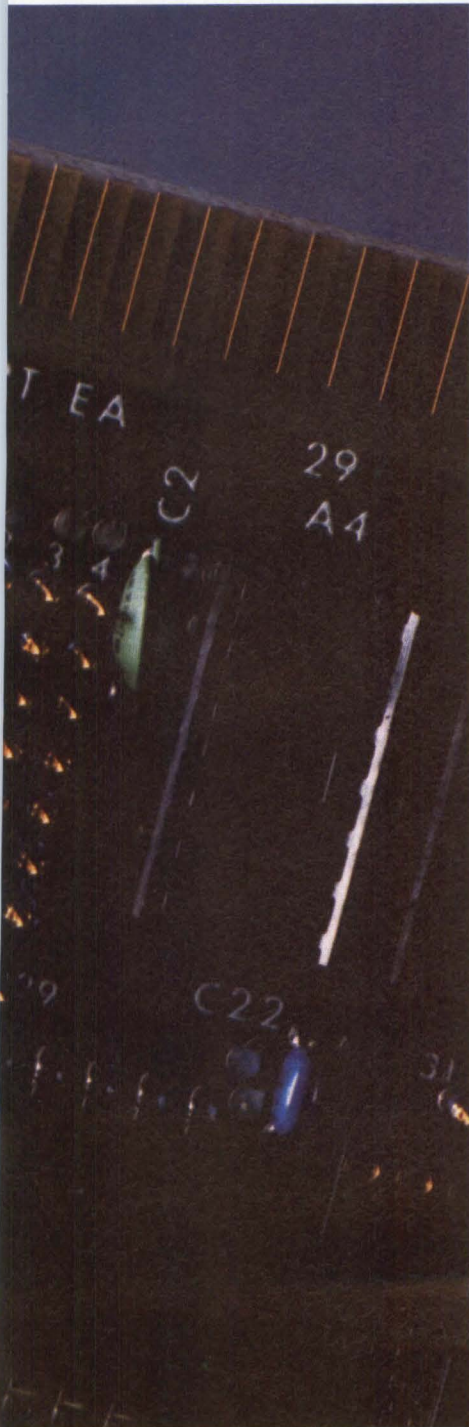
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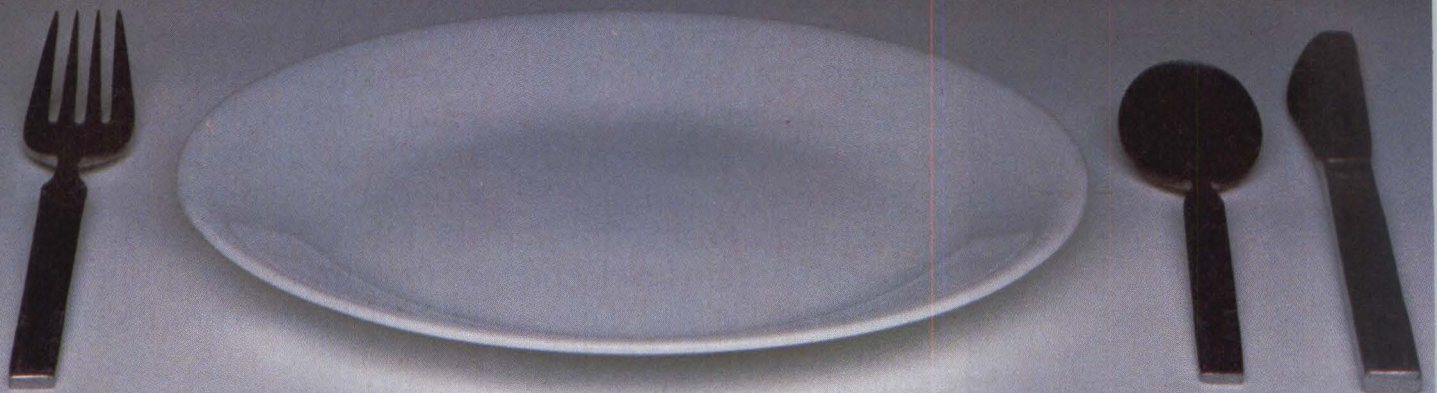
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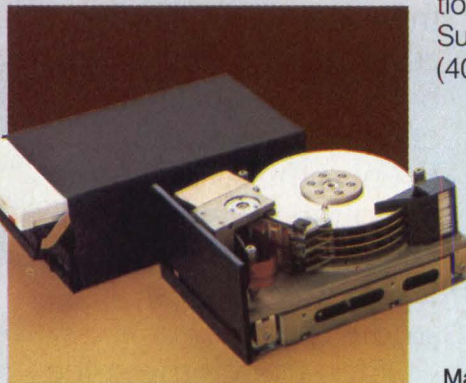
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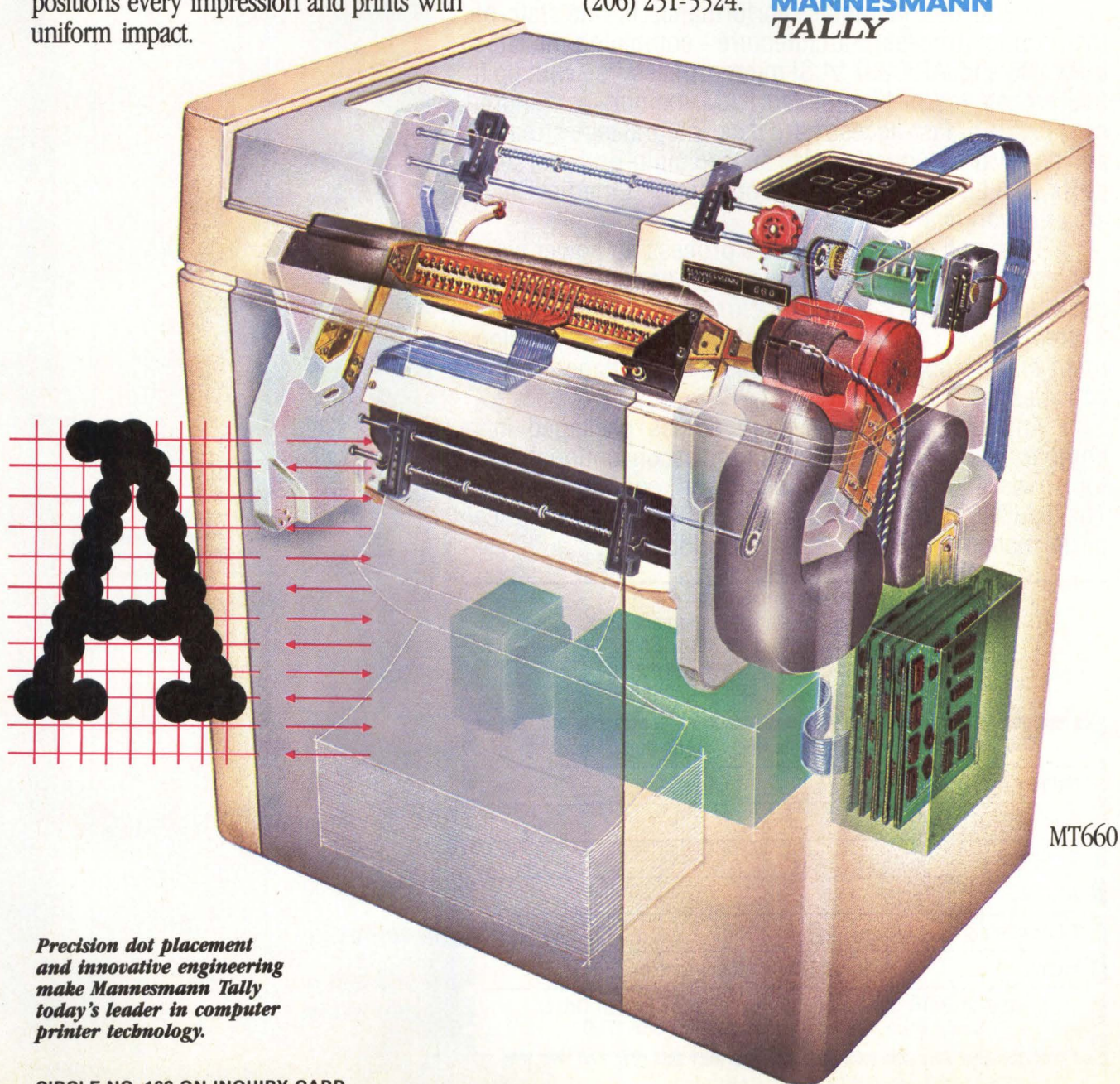
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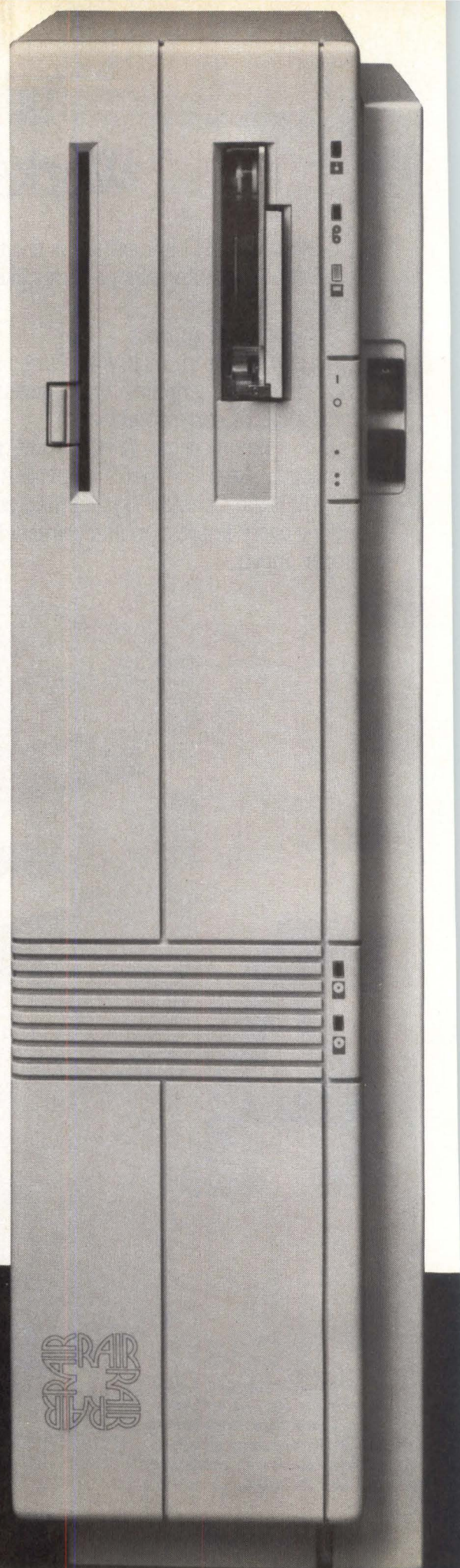
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# Mini-Micro World

INTERNATIONAL

## Taiwanese companies march into U.S., Europe seeks sellers for PC clones

Lori Valigra, Senior Editor

Taiwanese companies' expertise in high-volume, low-cost manufacturing, backed by their government's push to help them catch up in the high-technology race, has almost assured the next wave of low-priced Taiwanese products: IBM PC-compatible microcomputers (MMS, July 1983, Page 11). List prices for the new desktop computers should run as much as 25 percent lower than comparable PCs. Their degrees of software and hardware mimicry will vary.

About 75 percent of the companies exhibiting at Taiwan's booth at

the recent Hannover Fair Show in Hannover, West Germany, sported IBM PC look-alikes. The companies this year are seeking dealers and OEMs in Europe and the United States. In some cases, Taiwanese companies may sell their products under their own labels, a feat few have attempted outside their domestic market. In other cases, OEMs such as Applied Digital Data Systems (ADDS) Inc., Hauppauge, N.Y., have signed up to sell the products.

Two Taiwanese suppliers showed PC-compatible systems resulting from a design adopted from government-sponsored research group

Electronics Research & Service Organization (ERSO), says Ramone Ju, marketing director for CAF Computer Corp., Taipei, Taiwan. CAF markets a look-alike manufactured by its sister company, Advanced Datum Information Corp., Taipei. Ju adds that some companies in Taiwan have reverse-engineered PC-like machines in much the same way that other Taiwanese suppliers have reverse-engineered the many Apple Computer Inc.-compatible microcomputers. But CAF, Multitech Industrial Corp., Taipei, and Sony Taiwan (which did not show its product in the grouped Taiwan booth) all worked from an original

COMPARING TAIWAN'S IMMINENT PC-COMPATIBLES

Manufacturer, Model	CAF Computer Corp., PC (ADI Corp.)	MITAC Inc., MPC160	Multitech Industrial Corp., MPF-PC	President Enterprises Corp., BC-5000	Tatung Electronics Corp., MCS-1616
<b>Processor(s)</b>	8088, 8087 (option)	8088, 8087 (option)	8088, 8087 (option)	8088, 8087 (option)	80186, 80286/8087 (option)
<b>Operating system</b>	MS-DOS 2.11	MS-DOS, CP/M-86 (option)	MS-DOS 2.0, CP/M-86 (option)	MS-DOS, CP/M-86 (priced separately)	MS-DOS, CP/M-86 or MP/M-86
<b>Memory, expandable to:</b>	64K bytes RAM, 256K bytes (also 8K bytes ROM, expands to 48K bytes)	128K bytes RAM, 512K bytes (also 8K bytes ROM)	128K bytes RAM, 256K bytes (also 8K bytes on-board ROM; expands to 48K bytes)	128K bytes RAM, 256K bytes (also 8K bytes ROM)	256K bytes RAM, (also 16K bytes ROM)
<b>IBM-like keyboard</b>	yes	yes	no (function keys parallel screen)	yes	yes
<b>Display</b>	25 lines x 40/80 col., 640 x 200 black/white, 320 x 200 4-color, APA* or alphanumeric	24 lines x 80 col., monochrome, color/graphics	25 lines x 80 col., 640 x 200 black/white, 320 x 200 4-color	25 lines x 80 cols., 720 x 240 color, monochrome	color & monochrome available separately
<b>Mass storage</b>	2 5/4-in. slimline FDDs*	2 5/4-in. slimline FDDs, 1 10M-byte WDD* (option)	2 5/4-in. slimline FDDs, 1 WDD halfhigh (option)	2 5/4-in. slimline FDDs, (can expand to 4 FDDs)	2 5/4-in. slimline FDDs, 2 10M-byte or 20M-byte 5/4-in. WDDs (option)
<b>Ports</b>	parallel, RS232C serial	parallel, RS232 serial	parallel, RS232 serial	2 parallel, 2 serial	1 parallel, 4 RS232 serial
<b>Expansion slots</b>	5	9 (5 are occupied)	5	6	6
<b>Price</b>	25 percent below IBM's (excluding monitor)	\$3,000 (excluding monitor)	\$2,550 (monitor excluded), \$4,500 HDD (monitor excluded)	\$1,720 (with monochrome monitor)	\$2,000 with 2 FDDs (excluding monitor); \$3,000 with WDD (excluding monitor); \$4,000 with 2 WDDs (excluding monitor)
<b>Availability</b>	now	next month	now	now	October

\* APA = all points addressable graphics      FDD = floppy disk drive      WDD = Winchester disk drive



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INTERNATIONAL



Mitac's IBM PC-compatible MPC 160 desktop unit is one of a half-dozen products for which Taiwanese manufacturers are seeking U.S. and European dealers and OEMs.

design by ERSO and created their own products from it.

## CAF's priced 25 percent lower

CAF's PC runs the MS-DOS 2.11 operating system under license from Microsoft Corp., Kirkland, Wash. The PC is based on Intel's 4.77-MHz 8088 processor and can include an optional 8087 math coprocessor. The 64K bytes of main memory can be expanded to 256K bytes. Its U.S. introduction came at last year's November Comdex show in Las Vegas, Nev., but CAF has not yet signed any customers for the machine. Its European debut was at Hannover. Ju says the CAF PC's list price is 25 percent lower than IBM Corp.'s list price for the PC.

Multitech, which also took advantage of ERSO's efforts, is seeking European customers for its PC- and PC XT-compatible units. Multitech's Micro-Professor line includes both IBM- and Apple-compatible microcomputers. Price for the PC-look-alike without a monitor is

\$2,550 with floppy disk drives and is \$4,500 with a hard disk drive, notes William Lu, director of Multitech's international marketing division.

Multitech's 8088-based MPF-PC has 8K bytes of on-board ROM and 128K bytes of RAM, which can be expanded to 48K and 256K bytes, respectively. It runs the MS-DOS 2.0 operating system. The function keys parallel the CRT screen, a setup different from IBM's cluster at the left portion of its keyboard. The MPF-PC includes a color/graphics adapter card and a floppy disk interface circuit. A company spokesman says Quadram Corp.'s Quadlink "Apple" board does not work with the system. Concurrent CP/M and UCSD Pascal do not run, but he says all other software works, including Microsoft's Flight Simulator and Lotus Development Corp.'s 1-2-3 integrated package.

## ADDS signs for Multitech PC

Exclusive distribution of the product in the United States reportedly will begin this month through ADDS. ADDS will sell the product under its own name as the PC-1, notes Michael Genes, ADDS technical support specialist.

The ADDS PC-1 will include a 360K-byte, 5¼-inch floppy disk drive, five expansion slots, a monochrome monitor with a screen resolution equaling that of IBM's product, a serial port, a parallel port, a 10M-byte Winchester drive and 64K bytes of memory for \$2,000. A color screen, a second floppy drive and more memory are optional. ADDS will sell the system through distributors.

Genes says ADDS assumed a fully configured system to save R&D time. "It's quicker to go to fully configured machines."

President Enterprises Corp., Taipei, is searching for U.S. and European dealers and OEMs for its IBM-compatible BC-5000 microcom-

puter. The product is already available for U.S. prospects but is new to Europe. The 8088-based system has the MS-DOS and CP/M-86 operating systems priced separately. Lotus' 1-2-3 package also is available separately for the system. An 8087 math coprocessor is optional. The machine has 128K bytes of main memory, expandable to 256K bytes. Sample units are priced at \$1,300 for the 128K-byte system unit, \$70 for the keyboard (which is laid out similarly to the PC's), \$165 for a monochrome monitor, \$290 for a 720-by-240-dot color display, \$200 for a 560-by-240-dot color display and \$165 for a monitor graphics adapter.

## Tatung has 80186-based machine

Tatung Electronics Corp., Taipei, with more than 20,000 employees, is a leader in Taiwan's electronics business. The company set its sights on high-technology 80186-based PC-compatibles, as many others already have. Tatung exhibited its MCS-1616 at the Hannover Fair, and the system should be available to U.S. dealers and OEMs in October. Price for the system is about \$2,000 with dual floppy disk drives and \$1,000 more for a hard disk version, notes planning manager Chin-Shin Chen. Tatung offers an optional Intel 80286/8087 coprocessor system. Memory for the MSC-1616 is 256K bytes of RAM and 16K bytes of ROM. The system is for multiple users.

Another large Taiwanese manufacturer, Mitac Inc., claims to be the country's "premier" manufacturer of IBM-compatible systems and PC add-in boards. The company also supplies Apple add-on products. Mitac's PC XT-compatible MPC 160HD-10 runs on MS-DOS, and CP/M-86 is available as an option. The system includes 128K bytes of RAM, expandable to 512K bytes, and is based on the 8088



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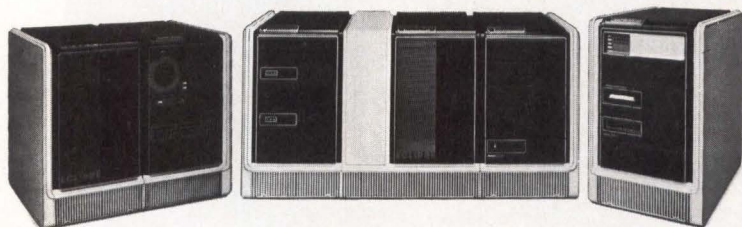


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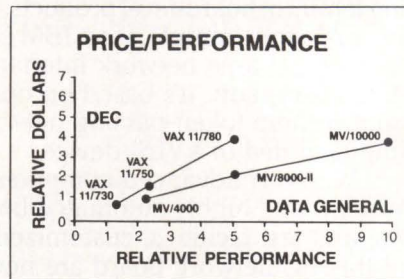
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# Mini-Micro World

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processor. The 8087 math coprocessor is optional. The system includes two half-height double-sided, double-density floppy disk drives. A 10M-byte Winchester disk drive is optional. Price for one unit is about \$3,000. Mitac is seeking OEMs and dealers and will make the product available in the United States after July.

Other PC-line products from Mitac include the CAS-160 PC ex-

pansion chassis with a nine-slot motherboard and a group of add-in

boards including a multifunction board and a color graphics board. □

## GERMAN COMPANY INTRODUCES IBM-COMPATIBLE

Computer Systems Peripherie Geräte, Hannover, West Germany, introduced its CM-86 IBM-compatible professional computer for the European market at April's Hannover Fair trade show. The company is seeking dealers for the 8088-based, 128K-byte machine that runs CP/M-86 or MS-DOS. Price is about 6,950 German marks, or \$2,780.

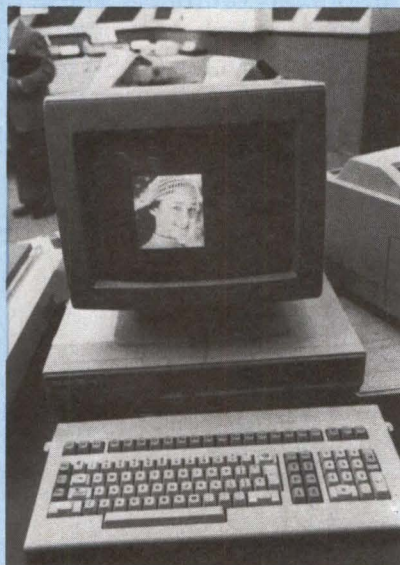
## Complete systems propel integrators into PC-compatible market

In perhaps its swiftest development efforts, IBM Corp. produced its PC microcomputer in less than a year and in double that time carved out a dominant market share. Those following IBM's lead had to respond with compatible designs even more rapidly to take advantage of the fast-paced market.

Most began by designing look-alikes. But off-the-shelf components, including MS-DOS, the Faraday Electronics motherboard, and the ROM and software basic input/output systems from Phoenix Software Associates Ltd. gained popularity. Recently, companies began accessing an even quicker and less expensive route to market: buying complete systems from other manufacturers and tacking on their own labels.

Several such machines were on display at the April Hannover trade show in Hannover, West Germany. Commodore International, for example, displayed the Commodore PC, a portable computer obtained via an agreement with Bytec-Comterm Inc., Ottawa. Bytek designed one of the first IBM PC-compatible portables, the Hyperion. Also sporting the Hyperion at its booth with its own tag, "AGIL," was Anderson-Jacobson Inc.'s German group.

Philips Kommunikations Industrie AG, West Germany, attracted a crowd to its Philips PC, a PC-compatible desktop system from Corona Data Systems Inc. that Philips is selling under its own moniker. Olivetti SpA is selling Corona's portable as the M18, which may be superseded by Olivetti's recently introduced M21 portable.



Ricoh's SBC-16 microcomputer is one of the many complete system products being sold to OEMs wishing to rush into the IBM PC-compatible market.

Ricoh Co. Ltd., Tokyo, showed its SBC-16 PC-compatible for the first time at Hannover. The OEM-only product has attracted one U.S. buyer, which Ricoh spokesmen decline to identify. Ricoh may show the microcomputer at next month's National Computer Conference in Las Vegas, Nev.

The SBC-16 with a monochrome or amber CRT, two 5¼-inch floppy disk drives, 256K bytes of RAM, MS-DOS 2.2 and a keyboard carries a single-unit price of \$4,000. Ricoh assistant manager Kenichi Sato declines to disclose OEM discount schedules. The product is for sale in the United States and Europe to OEMs only, he notes.

The product is based on Intel Corp.'s 80186 processor and has a 12-inch monochrome 640-by-400-dot bit-mapped display or 14-inch high resolution color graphics display. The standard 256K bytes of RAM can be expanded to 896K bytes. The 5¼-inch slimline floppy drives hold 720K bytes of information each. Two RS232C serial ports and one Centronics parallel port are standard. Options include a 10M-byte Winchester drive, mouse cursor controller, 3270 Systems Network Architecture support, 3770 and 3780 emulation software, the CP/M-86 operating system, an expansion RAM board and a Teletext communications adapter unit. Five expansion slots are available. The keyboard differs from IBM's in its placement of the function keys parallel to the display rather than clustered at the left of the keyboard.

Six Taiwanese companies made a big OEM push as well, one with an 80186-based system.

Also offering an 80186-based PC-compatible is Northern Telecom Data Systems GmbH, West Germany. Philips introduced the terminal computer—basically a beefed-up terminal with an 80186 processor and 256K bytes of RAM that can run MS-DOS and serve as a standalone microcomputer. This is part of Philips' recently released Vienna line of shared-resource computers and intelligent terminals that will be test-marketed in Europe and perhaps followed by a parallel product lineup in the United States. Priced at about \$5,500, the terminal computer was jointly developed by Northern Telecom and Nokia Ab Electronik, Helsinki, Finland. □



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## STREAMING TAPE CONTROLLERS

The SCSI/QIC-36 STC is the first controller designed specifically for use in a streaming environment. It links SCSI to the industry standard QIC-36 basic streaming tape interface. ADSI has more controller experience with the QIC-36 interface than anyone else in the world. Maybe that's why we've shipped more than anyone in the world. Data integrity is ensured by bus and buffer parity, 16-bit CRC and read-after-write data check. There is also complete QIC-11 and QIC-24 format support. And arbitration is standard. This advanced device was designed for use with basic 1/4" streaming tape drives such as those from Archive, Wangtek and Cipher.

## FIXED DISK CONTROLLERS

The SCSI 55 FDC product family links SCSI to the industry standard "ST506" 5 1/4" Winchester disk drive interface. Defective media management provides transparent in-line sparing and post-format block re-assignment with no performance degradation. Non-interleaved operation and arbitration are standard features of the SCSI 55 FDC line, producing maximum data throughput. Data integrity is ensured by a 32-bit ECC (transparent to the user) along with bus and buffer parity. The multi-threaded operation of the SCSI 55 FDC offers concurrent access to two physically separate disks, increasing I/O capability per second.

## IBM PC DISK CONTROLLER

The PC 5 FDC links IBM PC to the industry standard "ST506" Winchester disk drive. This advanced device has exclusive LSI technology and a high performance, on-board microprocessor to provide emulation of the IBM controller, establishing full compatibility with PC-DOS. It has an IBM PC expansion form factor and supports two ST506 Winchester disk drives. The PC 5 FDC has IBM PC I/O channel plug compatibility and an 8-bit ECC.

Also available from ADSI is the IBM PC Host Adapter which makes the IBM PC I/O channel compatible with SCSI. This host adapter is designed to provide OEM's with a non-intelligent host interface to yield the highest possible implementation flexibility.



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Setting the Standards in Peripheral Controllers



## DOCdata plans to make 6,000M-byte optical-tape cassette

Keith Jones, European Editor

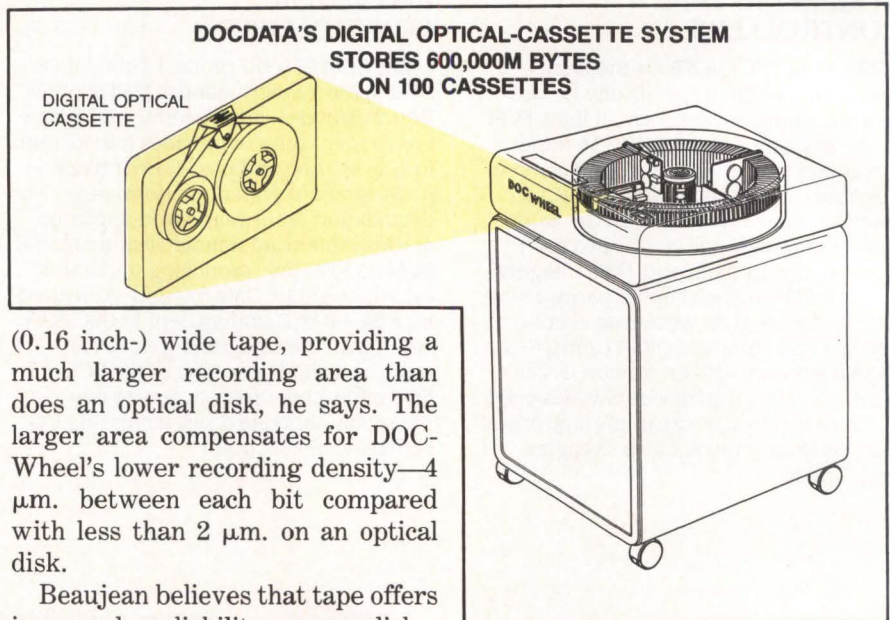
DOCdata N.V., Venlo, the Netherlands, is carrying the mass-storage industry's theme of placing higher capacities into smaller packages one step further by promising an optical-tape cassette with a capacity of 6,000M bytes, which competes with that of optical disks. The optical tape is packaged in a cassette with dimensions similar to those of a regular tape cassette.

DOCdata director Sjef Beaujean says the company has raised more than \$3 million on the Amsterdam, the Netherlands, stock market. The company has used the money to develop a working prototype of DOCWheel, a carousel system that will house 100 6,000M-byte optical-tape cassettes, yielding a total capacity of 600,000M bytes. DOCWheel's average access time will range from 1 second to 10 seconds.

"That access time will create problems in a multiuser environment without magnetic-disk buffering," warns Dr. Leonard Laub, president of Vision Three Inc., a Los Angeles optical storage consulting concern. Beaujean at DOCdata agrees but notes that DOCdata plans to develop buffers for multiuser database applications. The company will initially offer the DOCWheel as a backup medium requiring no buffering, according to Beaujean.

### DOCWheel may be more reliable

DOCWheel will offer the advantages over optical disks of greater compactness, reliability and information security, claims Beaujean. One cassette can hold as much as 250m. (about 273 yards) of 4-mm.-



(0.16 inch-) wide tape, providing a much larger recording area than does an optical disk, he says. The larger area compensates for DOCWheel's lower recording density—4  $\mu\text{m}$ . between each bit compared with less than 2  $\mu\text{m}$ . on an optical disk.

Beaujean believes that tape offers improved reliability over disks. Unlike a disk, tape can be stopped at each data position. It can be written, read, corrected or marked incorrect. The tape is stopped for less than 1 msec. at each data position, which is more than enough time to verify data, says Beaujean. A small metal clamp inside the cassette, actuated by a magnetic coil outside the cassette, stops the tape.

The optical rather than magnetic nature of DOCWheel and the physical lightness of the tape reels will help the magnetic forces that rotate the reels. The company plans eventually to produce a sealed cassette with only magnetic and optical links to the outside world. Beaujean says not having operators load cassettes will further enhance data security.

### Lasers comprise read/write heads

The planned read/write heads comprise a parallel array of semiconductor lasers (gallium aluminum arsenide)—one for each bit.

DOCdata is now working with arrays of 32 lasers, but hundreds of lasers are required. Beaujean acknowledges that problems have arisen from using hundreds of lasers, the worst of which is the problem of wiring the lasers to the rest of the system.

But, according to Beaujean, DOCdata has solved another potentially serious problem—the chaos created when cassettes are read on a different read/write assembly. This problem is caused by the fact that as many as 10 percent of the lasers in arrays of hundreds may be defective because of imperfect yield rates in laser manufacture. Although the defective lasers can easily be identified, the faulty tracks could cause problems when read by different assemblies. The solution, according to Beaujean, is to assign about 40 percent of the lasers to generating bits for parity checking. Software developer Logica B.V., Rotterdam, the Netherlands, has developed an algorithm



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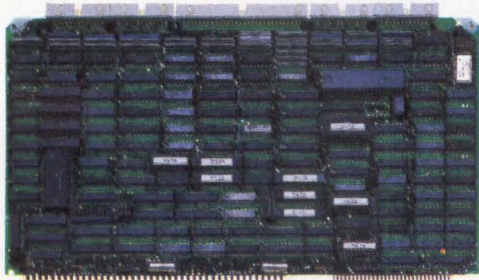
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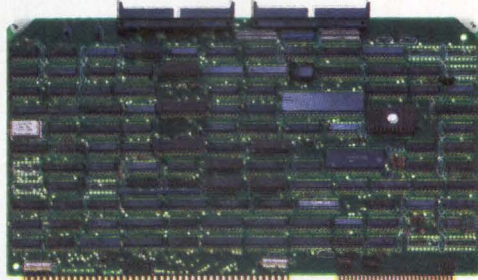
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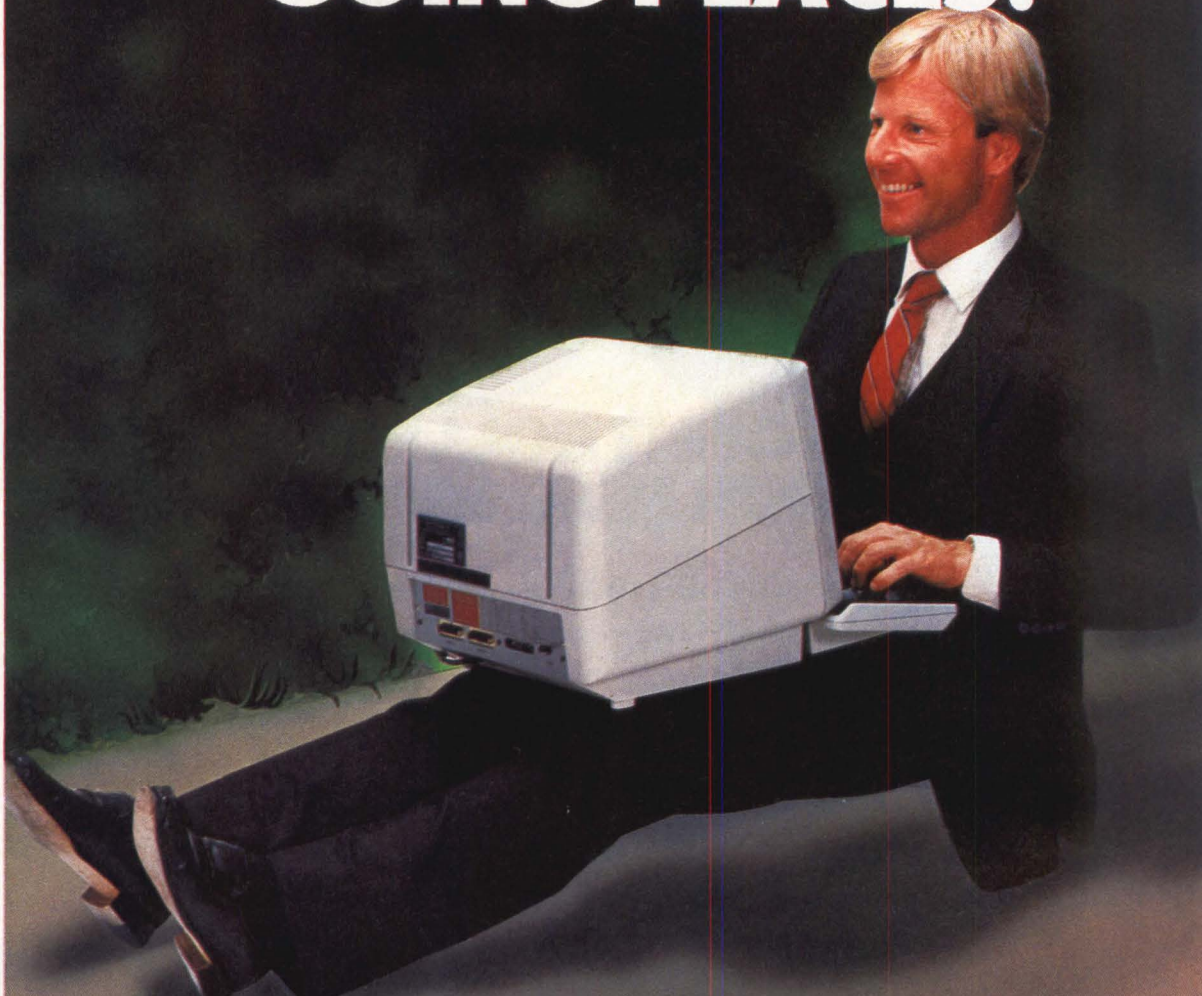


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# Mini-Micro World

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for DOCdata to process these parity bits. Tom de Neef, Logica B.V.'s marketing manager, says the parity-checking algorithm combined with DOCWheel's read-after-write feature will reduce the product's overall error rate.

The DOCWheel tape is made of two transparent layers separated by a metal layer. The transparent layer farthest from the read/write head incorporates preformed holes 4  $\mu$ m. apart. The metal layer hides these holes from the head until information is written. During writing, the laser melts the metal over the hole.

Beaujean says DOCdata is negotiating to license the manufacture of the tape to a large recording-media manufacturer. DOCdata has also hired the Wiesbaden, West Germany, office of management consultant Arthur D. Little Inc. to appraise the commercial potential of DOCWheel. Senior consultant Michael Gora recommends OEM vendors as the best marketing channels for DOCWheel. He believes DOCdata should extend the product's applications to embrace image- and text-retrieval work as well as archival. According to Gora, the U.S. market for optical archival systems will grow from about \$70 million this year to \$300 million in 1991. But document storage-and-retrieval systems may see a much more impressive expansion—from virtually nothing now to \$2 billion by 1991.

DOCdata's Beaujean hopes the company can demonstrate a working prototype of DOCWheel by the end of next year. DOCdata is contemplating enhancing the product by incorporating a read-only mode. This would preclude the use of the tape-clamping mechanism and would substantially boost the data-transfer rate—now around 1M bit per second in read/write mode.

Laub at Vision Three knows of no U.S. company that is working on

products exactly analogous to DOCWheel but points to work on optical recording film at Drexler Technology Inc., Palo Alto, Calif.,

and at chemical giant Du Pont. He also notes that FileNet Inc., Costa Mesa, Calif., is working on an optical disk "jukebox." □

## 3½-inch floppies dominate Hannover Trade Fair

Lori Valigra, Senior Editor

Many major U.S. manufacturers have adopted Sony Corp.'s 3½-inch microfloppy disk drive as a standard, and drives sporting Sony-like specifications dominated small drive introductions at the recent Hannover Fair in Hannover, West Germany. For their part, 3-inch and smaller drives appeared mostly in briefcase or game computers, while the 3½-inch drives were in desktop systems.

TEAC Corp.'s 3- and 3½-inch floppy drives were on display by reseller NBN Elektronik GmbH, West Germany. An NBN representative, however, speculates that the 3½-inch drives will win the controversy surrounding standardization of microfloppy disk drives and their media. The TEAC FD-35 3½-inch drive is available in four models ranging in unformatted capacities from 250K bytes to 1M byte. Track density varies from 67.5 tracks per inch (tpi) to 135 tpi.

*Olivetti OPE's FD-301/-302 3½-inch microfloppy disk drive was one example of several drives that size that made their debuts at the recent Hannover Fair.*

LINING UP THE 3½-INCH MICROFLOPPY DRIVES							
Manufacturer, model	Capacity (unformatted) (bytes)	Average access time (msec)	Transfer rate (bits per sec.)	Track density (tpi)	No. of tracks	No. of heads	Encoding method (*)
<b>BASF</b>							
MDD 6161	250K	59	250K	67.5	40	1	MFM
MDD 6162	500K	59	250K	67.5	40	2	MFM
MDD 6163	500K	99	250K	135	80	1	MFM
MDD 6164	1M	99	250K	135	80	2	MFM
<b>Mitsubishi Electric</b>							
MF 351	250K	94	125K	135	80	1	FM
MF 351	500K	94	250K	135	80	1	MFM
<b>Olivetti OPE</b>							
FD-301	500K	95	250K	135	80	1	MFM
FD-302	1M	95	250K	135	160	2	MFM
<b>TEAC Corp.</b>							
FD-35A	250K	93	125K	67.5	40	1	FM
FD-35B	500K	93	250K	67.5	80	2	MFM
FD-35E	500K	94	125K	135	80	1	FM
FD-35F	1M	94	250K	135	160	2	MFM
<b>Tokyo Electric (Nissei Sangyo)</b>							
FB 352	500K	94	250K	135	80	1	MFM
FB 354	1M	94	250K	135	160	2	MFM
<b>Toshiba</b>							
ND-353 (single density)	250K	79	125K	135	80	1	FM
ND-353 (double density)	500K	79	250K	135	80	1	MFM
ND-354 (single density)	500K	79	125K	135	160	2	FM
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Unformatted capacity (MB)	12.76
Formatted capacity (MB)	10
Average access time (ms)	65

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# Mini-Micro World

INTERNATIONAL

Mitsubishi Electric Europe GmbH, Ratingen, West Germany, is waiting for a double-sided drive standard for its model 353 3½-inch drive before releasing it worldwide this month. The 1M byte drive has 135 tpi and uses 80 tracks. The Mitsubishi 351 single-sided drive is available now in the United States and Europe. Price for the drive in 1,000-unit quantities is 450 German marks, or about \$180. Single-density versions house 250K bytes, while double density iterations house 500K bytes. Track density is 135 tpi. The drives use Sony's hard-jacket flexible media.

Toshiba Corp., Tokyo, introduced its ND-353 and ND-354 3½-inch microfloppy drives. The single-sided ND-353 models have 250K bytes of storage in single-density versions and 500K bytes in double-density versions. Track density is 135 tpi. Average access time is 79 msec. The ND-354 double-sided model has 500K bytes of information in a single-density form and 1M byte in a double-density model. The single-sided, double-density ND-353 model sells for 83,000 yen, or about \$415. The dual-sided, double-density ND-354 model sells for about 85,000 yen, or \$425. All four versions are slated for sale to OEMs in Europe and the United States in 1985. The drives use the media supplied by Sony, Verbatim Corp., 3M and Memorex Corp.

Tokyo Electric Co. Ltd., Tokyo, a sister company to Toshiba, spotlighted its FB 354 and FB 352 3½-inch flexible disk drives. The 354 stores 1M byte of data, while the 352 stores 500K bytes. Average access time is 94 msec., and both have a track density of 135 tpi. Worldwide distributor Nissei Sangyo Co. Ltd. sells the models for Tokyo Electric under the same model numbers. The drives should be available in the United States at an undetermined future date.

Olivetti OPE joined the newcomers with a 3½-inch line, the model FD-301 and model FD-302. The features approximate those of the Tokyo Electric drives. Olivetti exhibited the drives with 3M's hard-jacket floppy media. Shugart Corp.'s 3½-inch drive was being shown by Synelec Datensysteme GmbH. BASF Aktiengesellschaft, West Germany, quietly showed its line of MDD microfloppy drives and FlexyDisk diskettes. Prices of both products were not available.

The 3½-inch drives were incorporated into products by several major manufacturers. Apple Computer Inc. showed the Sony drives in its Lisa and Macintosh microcomputers, Hewlett-Packard Co.'s exhibit showed the drives in the HP150 personal computer, Epson Corp. had it in its SMD-100 series system, and Sord Computer had it in its new 323P portable desktop computer. Sord is one of the few Japanese manufacturers backing the Sony media. □

## OVERHEARD OVERSEAS

### Multiuser micro builders could beat IBM to the punch

Tim Palmer, European Contributor

IBM Corp. regularly leaves windows of opportunity open in the European market, and now there is a gaping one that should be plugged quickly: a multiuser microcomputer.

This window is open to system builders with the courage and imagination to second-guess IBM about what it will do for its follow-on Personal Computer: a multiuser model that is expected to use Intel Corp.'s 80286 microprocessor. European users think they have an idea of what the machine will look like—a combination of PC-DOS and UNIX is likely. It is also likely to be able to run the Displaywriter word processor's software and System 23 small business system applications.

Although 80286s are in short supply, Intel is keen to make a success of its systems business. That business is guaranteed a captive share of the available chips, which means that customers can obtain 80286s by buying them assembled from Intel as single-board computers running the XENIX operating system and can

configure IBM-compatible systems around them.

By beating IBM to market, system integrators could gain a strong market hold, in much the same way that financially troubled Victor Technologies Inc. did. In its heyday, Victor signed an ambitious service bureau in Birmingham, England, to be its exclusive distributor. This distributor, Applied Computer Techniques Plc., was so successful in exploiting the gap between the September 1981 launch of the IBM PC in the United States and the PC's January 1983 arrival in Europe that the Sirius 1/Victor 9000 microcomputer is still the market leader ahead of IBM in Britain, and has done almost as well in Germany.

Others, such as Compaq Computer Corp., probably won't be so fortunate in their timing. Compaq is still gearing up for its European launch of the IBM-compatible Compaq portable computer. But it will get the machine to market just as IBM slams the window of opportunity in its face by launching the Portable PC, due in Europe about now. □



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# The Interpreter

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

## Dual-personality IBM 3270-PC bridges micros and mainframes

*New architecture tests PC compatibility, increases functions for 3270 and PC users*

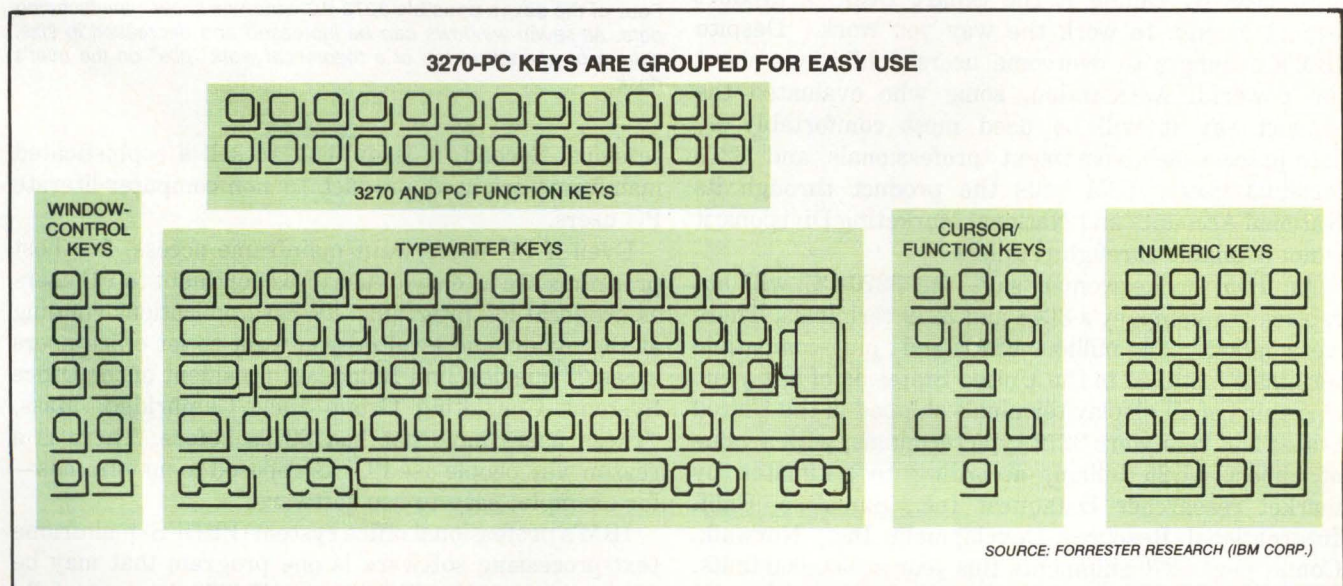
**Lori Valigra**, Senior Editor

IBM Corp.'s recent spate of personal computer introductions, including the PCjr home computer and the Instruments Division's MC68000-based 9002 UNIX workstation, has eclipsed the impact of its 3270-PC multiple window workstation. But the 3270-PC may be the sleeper in IBM's personal computer line. As it represents IBM's first serious attempt to merge its mainframe and microcomputer worlds within large corporate accounts, much remains to be learned about the 3270-PC's capabilities and who will use it.

Users have been testing the product since U.S. deliveries began in late February. Early reactions include questions about whether executives will use the powerful product and whether it is compatible with other IBM PCs. IBM has set some guidelines on what

the machine should be used for. Differences between the system and the standard PC will test the 3270-PC's PC compatibility. Like other manufacturers attempting to dent the microcomputer market, IBM must conform to the industry-standard PC to gain market share. Market researcher InfoCorp, Cupertino, Calif., expects IBM to ship 30,000 3270-PCs this year.

Unlike earlier IBM personal computers, the 3270-PC is technically sophisticated. It combines 3270 terminal functions and a PC in one desktop unit. Under the guidance of a powerful control program, the 3270-PC displays seven windows, or sessions—four showing data from host mainframe applications, two housing electronic notepads and one employing personal computer programs running under PC-DOS versions 2.0 or 2.1. The PC session normally does not communicate with the host. The workstation uses a 122-key keyboard



**There are five key areas on the 3270-PC's keyboard—two sets of control keys for windows and for the cursor, a set of program function keys for 3270 and PC functions, a typewriter area and a numeric pad.**

*IBM claims that the keys are arranged according to frequency of use and logical function groupings. There is an auto-key function to record and save frequently used keystrokes for playback.*



# The Interpreter

combining the PC and the 3270 keyboards. The 3270-PC communicates with IBM System/370, 308X or 43XX processors via a 3274 control unit connected by coaxial cable. Systems Network Architecture (SNA) local channel, non-SNA local channel, SDLC remote and bisynchronous remote communications support network attachments.

Price of a basic 3270-PC, including a new high-resolution model 5272 color display and a 3270-PC control program, is \$5,585. A monochrome display can be used in lieu of the color display. RAM size ranges from 256K bytes to 640K bytes.

IBM expects the 3270-PC to be used in program-

Electric Co., Bridgeport, Conn., who has used the 3270-PC. "The 3270-PC is attractive to people who have occasion to interface to a mainframe through a 3270 link." He says such users will include programmers, order-processing personnel, managers and administrators. But he cautions that the 3270-PC is not for PC users who want to access a mainframe.

"This is an elegant device—a very high-function 3270 with a PC thrown on it," notes Jonathan Art, financial analyst with the Gartner Group, Stamford, Conn. But he specifies two barriers to the 3270-PC's acceptance. First, few users, other than programmers and those making multiple database inquiries, need simultaneous

*While the regular PC has few interrupts, the 3270-PC has many.*

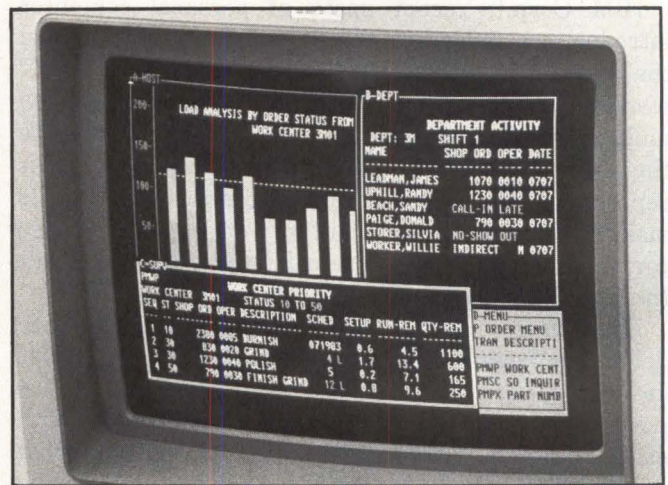
ming, insurance, marketing, finance, manufacturing and other areas in which users need data from multiple mainframe computer files. The 3270-PC also can be used to communicate via electronic mail, to create and send data files through networks, to obtain data from corporate databases for local use by PC functions and to access data from public information networks.

### 3270-PC is meant for sophisticated users

In advertisements, IBM underscores the 3270-PC's usefulness by calling it the Smart Desk, a product "smart enough to work the way you work." Despite IBM's attempts to overcome users' inhibitions about the powerful workstation, some who evaluated the product say it will be used most comfortably by data-processing department professionals and 3270 terminal users. IBM sells the product through its National Accounts and National Marketing Divisions; it is not available through retailers.

An IBM spokeswoman says the 3270-PC will not replace the company's 3278 and 3279 terminals. There were about 2.4 million 3270 and plug-compatible terminals installed in the United States as of last year. One-third of all display terminals shipped in the United States last year were 3270-type terminals, with a value of almost \$1.25 billion, according to estimates by market researcher Dataquest Inc., San Jose, Calif. International Resource Development Inc., Norwalk, Conn., pegs 3270 shipments this year at 560,000 units.

"[The 3270-PC] will be a very strong product, but it's not a product for the general PC user," says Jeff Ehrlich, manager of systems architecture, General



Four of the seven possible 3270-PC windows show manufacturing data. All seven windows can be increased and decreased in size, hidden or placed on top of a theoretical work "pile" on the user's desk.

sessions. Second, it is difficult to sell a sophisticated mainframe-oriented product to non-computer-literate PC users.

Even if PC users want mainframe access, few host programs are as easy to use or as pertinent to PC users as are local PC programs. "What applications running at the mainframe level do you want to let office users access?" queries Tom Billadeau, president of the Office Systems Consulting Group Inc., Cambridge, Mass. "These users have not had 3270s before. There is a reason why people use PCs as opposed to mainframes—for example, easy-to-use software."

IBM's professional office system (PROFS) mainframe text-processing software is one program that may be attractive to office PC users. PROFS has especially strong electronic-mail facilities, Billadeau says.

Researcher George Colony of Forrester Research



# SyQuest Removable and Fixed Disk Drives Doing more in more applications.



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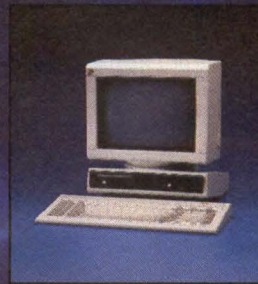
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Inc., Cambridge, Mass., surveyed 25 Fortune 1000 companies and found that each had ordered 20 to 30 3270-PCs. He predicts that in two years the ratio of 3270-PC orders to PC and XT orders will be 1 to 1. Colony estimates there are about 25,000 3270-PCs on back order for Fortune 1000 companies and 10,000 more for smaller companies. Although Colony argues that IBM has not yet shown that it wants to integrate its products, he says IBM's goal is to have a line of personal computers, including terminals and workstations, on which any user can transfer files with full compatibility.

IBM touts the 3270-PC as a valuable programmers'

Don Heiskell, engineering manager for Digital Research's graphics group, explains that GSX is an implementation of the virtual device interface, an ongoing effort by the American National Standards Institute to standardize graphics interfaces for different hardware. GSX makes different machines' screens "look" the same to a programmer and makes different hard-copy devices look like virtual devices. For example, with GSX, a Diablo Systems Inc. ink-jet printer with higher resolution than a computer's display screen could still make a printout of the screen's contents. He notes that Digital Research has a large library of GSX device drivers for IBM. Using the GSX tool kit,

Slot	Option	Standard 3270-PC model		
		2	4	6
1	3270 system adapter	x	x	x
2	64K-byte/256K-byte expansion		x	x
3				
4	display adapter	x	x	x
5	fixed disk adapter			x
6	diskette drive adapter	x	x	x
7	printer adapter		x	x
8	keyboard adapter	x	x	x

Source: IBM Corp.

In the 3270-PC, slots 1 through 6 are long slots; slots 7 and 8 are short. The following off-the-shelf IBM PC options can be ordered and used with the 3270-PC: an asynchronous communications adapter, a communications adapter cable, a printer adapter, a printer cable, 64K-byte/256K-byte memory expansion, a 64K-byte memory-module kit, a 10M-byte fixed disk drive, a fixed-disk adapter and a dual-sided diskette drive.

workstation for interactive software development in a mainframe network. The 3270-PC allows programmers to log onto one or more programs and move data between programs without using the mainframe job-control language. IBM notes the 3270-PC can also be used for network management.

Supporting PC session software development is Digital Research Inc., Pacific Grove, Calif. Digital Research and IBM's National Accounts and National Marketing Divisions will sell Digital Research's programming languages and tools, including Level II COBOL, Pascal MT+, CBASIC compiler, PL-1, Access Manager, Display Manager, Animator, Forms II, and Assembler+ Tools. Digital Research expects IBM to sell the graphics products DR Draw, DR Graph and the GSX tool kit.

## IBM touts the 3270-PC as a valuable programmers workstation for interactive software development in a network.

software developers can write programs on the PC for the 3270-PC. The \$350 GSX tool kit incorporates Digital Research's links to its CP/M and DOS languages and bindings to GSX.

### Window management is strong

The 3270-PC's seven windows move rapidly, controlled by a new video board with a separate processor rather than by software. GE's Ehrlich applauds IBM for giving users rapid windowing capabilities.

The 3270-PC is designed to mimic the way people work, claims IBM. It compiles information from several sources to solve problems, prepare reports and make decisions. Windows can be moved as a person would slide papers for multiple tasks on a desktop. The windows also can be temporarily hidden when not in use, and certain tasks can be given visual priority. The control program allows users to define which portions of windows are visible. The seven windows can be enlarged, reduced and stored in memory in 10 arrangements. Applications on the 3270 or PC windows "think" they have the whole screen; a small window appears as a reduced version of a full screen.

One keystroke transfers control of the 3270-PC's single active session to and from personal computing and host-connected sessions. Two "notepad" sessions are for writing messages and memos, maintaining a calendar or transferring data in blocks of 1,920 characters (one to two paragraphs) between screen sessions. This data transfer is essentially a logical "retyping" of information from 3270 windows to the



## System integrator opportunities depend on IBM

New business opportunities are emerging for those who perceive gaps in IBM Corp.'s recent strategic move to match its mainframe and micro-computer environments in a dual personality product, the 3270-PC.

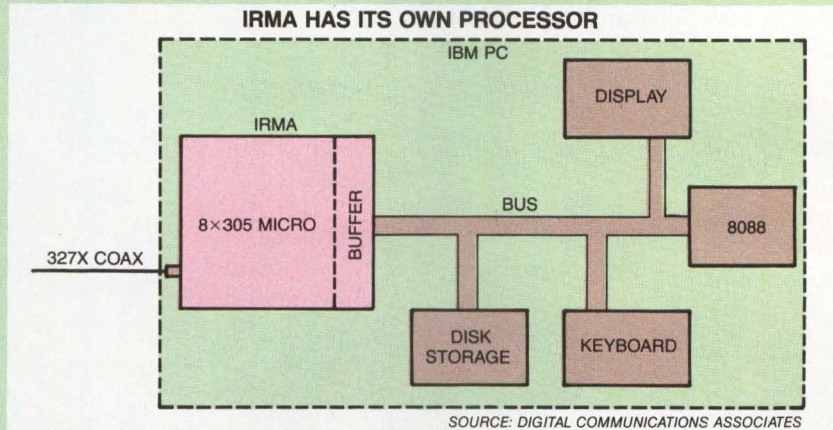
"A lot of companies will buy this because it is safe to buy IBM's solution to the 3270 and PC [combination]," predicts Fred Berry, who is responsible for software support and marketing at Personal Systems Technology Inc. (Persyst), Irvine, Calif. Persyst offers a 3270 emulation family of software and hardware with 3278 or 3279 capabilities for the PC. Berry says Persyst plans to add value to the 3270-PC but declines to specify those plans.

The 3270 add-on manufacturers will feel the brunt of the 3270-PC's introduction, comments Jeff Ehrlich, manager of systems architecture at General Electric Co., Bridgeport, Conn.

Persyst's Berry says add-on board manufacturers' attraction to the 3270-PC will depend on how IBM tries to attract third-party suppliers. He says IBM is not as forthcoming with 3270-PC specifications as it was with those of the PC. IBM has not yet announced an expansion chassis and thus does not guarantee an expansion chassis will work, confirms Larry Schenck, product planner for the 3270-PC in IBM's Kingston, N.Y., Communications Products Division. Schenck says the 3270-PC model 6 has one long slot open, the model 4 has two long slots open, and the model 2 has three long slots and one short slot open. This is assuming that no graphics boards are installed.

Another key to popularizing the 3270-PC will be to satisfy users' demands for functional equivalency to the standard PC, emphasizes Berry. Users want to be able to use PC software, he says. But he questions whether independent software vendors have the marketing motivation to alter software for the 3270-PC.

Instead of moving software or functions to the 3270-PC, add-on board manufacturers are examining adding 3270 functions to the standard PC. "Why can't you convert the ordinary PC to a 3270-PC?" asks



SOURCE: DIGITAL COMMUNICATIONS ASSOCIATES

Digital Communications' Irma communications board features an on-board processor independent of the IBM PC's 8088 CPU. IBM's 3270-PC shares its 8088 between local and host communications.

Ehrlich. He says it would be a technically complicated project to create an add-on to make the PC or XT into 3270-PCs. The new video board is especially complex, as is the 3270-PC keyboard, which combines both the PC and 3270 terminal keyboards, including separate cursor controls and enter keys for each. The keyboard also has a split cable attachment, with half going to the PC session and the other half going to the four 3270 sessions.

Ehrlich describes the 3270-PC as a "clean" product compared with add-ons that attempt to give 3270 functionality to off-the-shelf PCs. He says the add-on products' keyboard is "not right" and the products are "technically complicated and kludgy."

Persyst's Berry anticipates third parties will quickly try to beat the price and performance of an IBM coaxial board released a year ago. The IBM 3278/3279 emulation adapter and control program lets a PC or an XT emulate a 3278 or 3279 display unit. It lets users run most application programs for the 3278 model 2 and 3279 model 2A or S2A, switch between active PC and host processor tasks with a "hot key," transfer files, including DOS application files, between the PC and the host mainframe and print screens with a PC printer. The PC or XT is connected via coaxial cable to a 3274 controller but can also be attached directly to a 4321, 4331 or 4361

processor or a 4701 finance communications controller. Prices for the adapter card and its control program are \$905 and \$235, respectively. IBM also offers a 3270 Personal Computing Attachment Board for 3278 or 3279 terminals.

With the adapter board in mind, Berry points to an apparent case of IBM competing against itself. The board and software with a dual floppy drive PC would be priced at about \$3,500 to \$4,000. The 3270-PC with dual floppy drives sells for \$5,300.

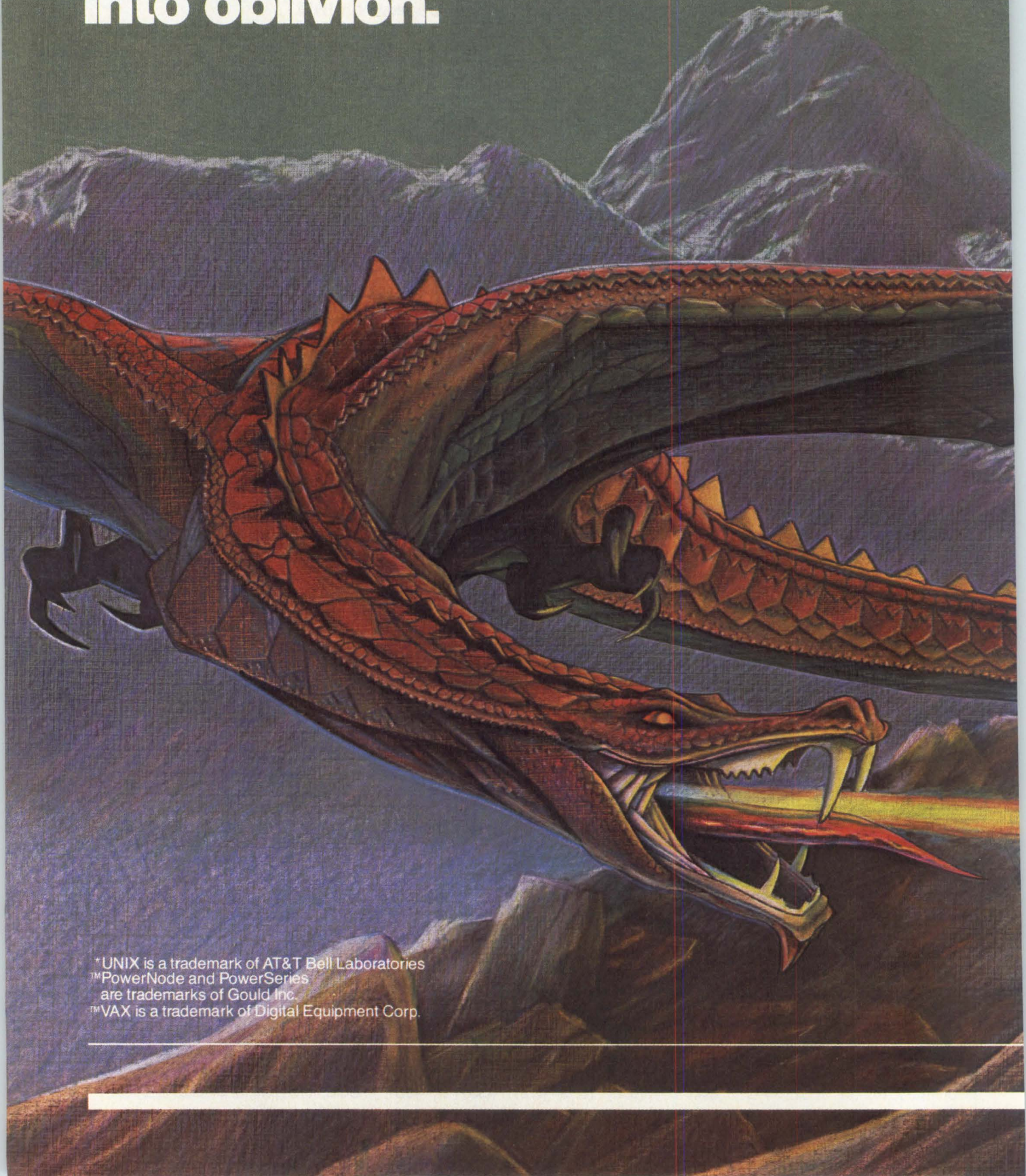
An early add-on communications board supplier is Digital Communications Associates, Norcross, Ga., with its Irma boards for PC, XT and PC-compatible systems. Irma is linked by coaxial cable to most 3270 controllers, including the 3274 and 3276. One difference between the 3270-PC communications and the Irma board is that Irma's on-board processor is independent of the PC's 8088. The 3270-PC shares its 8088 for local and host communications tasks, which some observers believe could cause timing problems.

Persyst offers the Best of Both (BOB) board for the PC, which provides high-resolution text. It also has color graphics but does not use a standard IBM-class monitor. Persyst's Berry says the BOB board takes the program symbols of IBM and implements them to be in parity with the 3270-PC running the same symbols. BOB, available for testing, is \$495.



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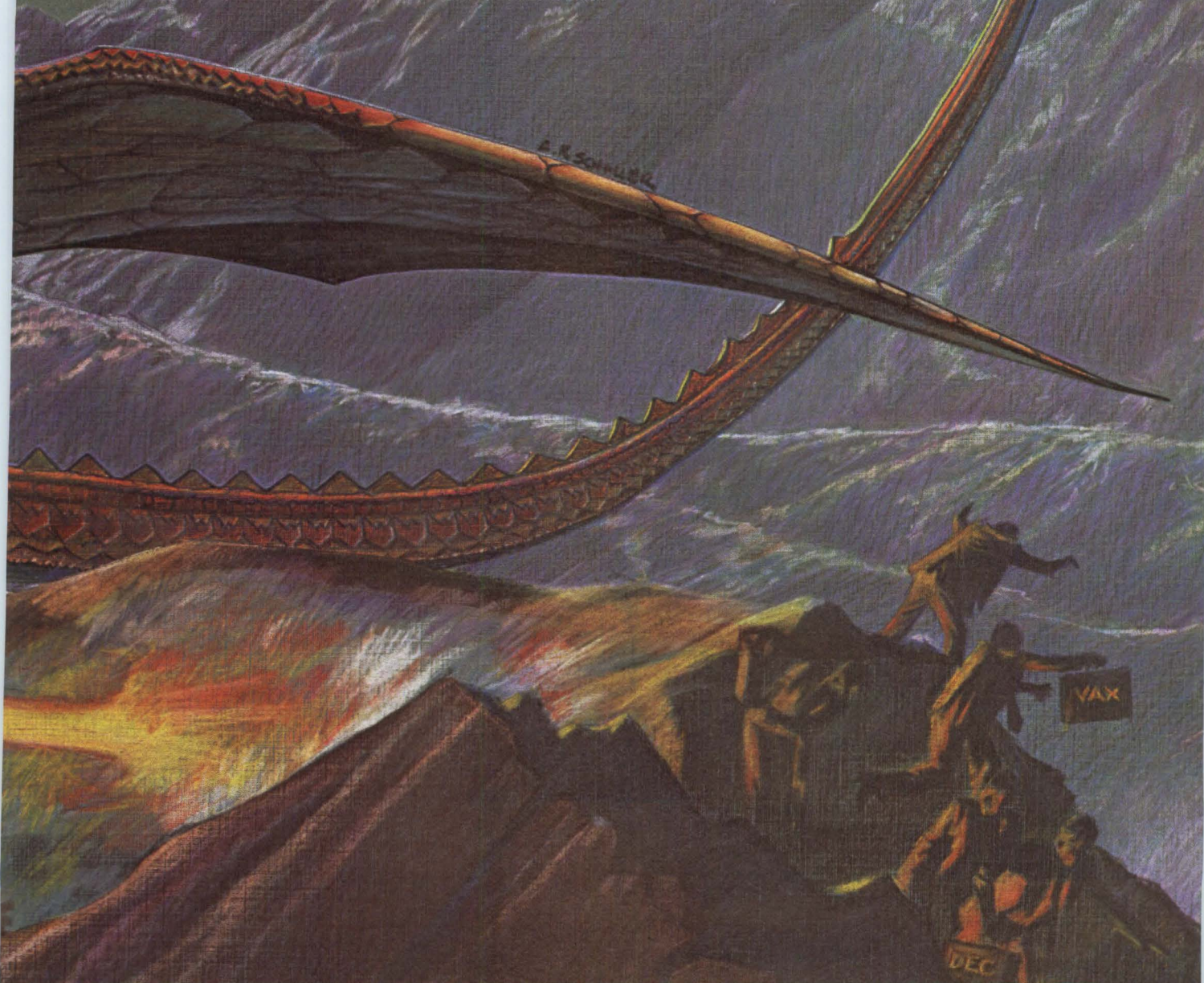
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# The Interpreter

notepad sessions or to other 3270 sessions, explains Larry Schenck, product planner for the 3270-PC in IBM's Communications Products Division, Kingston, N.Y.

## Data transfer is limited

Some users complain that the 3270-PC does not allow them to copy information from the 3270 session into the PC session. "This is because all PC applications are not aware of the screen as an input device. They usually treat input from a keyboard or other device," notes Schenck. Advanced Office Concepts' Billadeau says IBM expects to support multiple data transfers by year-end. "Data transfer is more efficient if done at the terminal rather than the mainframe level," he says.

For now, the host computer reacts to each 3270 window session as though it were a separate display. Schenck explains that windows logically replace as many as four 3270 mainframe displays and a separate PC system in the memory and control environment. Host sessions can contain as many as 3,440 characters, and the local PC session can contain as many as 2,000 characters.

Schenck suggests that IBM will introduce a programmable interface that will allow users to write a local routine monitoring the activity of a function not visible on the screen—taking place, for example, on a main-

frame. The user could transfer the file information to the visible, active PC window. Going back and forth between the active window and a hidden window now requires using the keyboard.

Some users question why the 3270-PC has only one PC session. The reason, says IBM's Schenck, is that it is difficult to convert host windows to PC windows because such a conversion requires changing the program that addresses the hardware. Billadeau suggests that software suppliers may take the alternative approach of offering a 3270 window in a windowing program for the PC.

Users can customize the 3270-PC to transfer informa-

---

*Windows can be moved the way a person would slide papers for multiple tasks across a desk.*

---

tion from the PC window to the mainframe over a host interface as a structured data file or as a screen in 2,000-character blocks, Schenck says. An optional feature can "convert" ASCII data on the PC diskette to EBCDIC data (a format used by mainframes) on the host. Binary transfers also are possible.

## 3270-PC configurations are based on three models

### 5271 model 2

- System unit with 256K bytes of memory (expandable to 640K bytes)
- 5271 keyboard
- Dual-sided diskette drive and adapter
- 5151 monochrome/5272 color display adapter
- 3270-PC keyboard timer/adapter
- 3270 system adapter
- Reference manual and binder
- Operations guide
- Maintenance information
- \$4,290

### 5271 model 4

- 5271 model 2 features plus:
- Second dual-sided diskette drive
- 64K-byte memory-expansion option to 320K bytes
- Printer adapter for 5152 graphics printer
- \$5,319

### 5271 model 6

- 5271 model 2 features plus:
- 10M-byte fixed disk and adapter
- 64K-byte memory-expansion option to 320K bytes
- Printer adapter for 5152 graphics printer
- \$7,180

### 5272 color display

- 14-inch, eight-color
- 720 by 350 pixels
- Anti-glare, smudge-resistant
- Stand with tilt/rotate mechanism
- Line cord
- \$995

### 5271 keyboard

- Low-profile, attached EBCDIC keyboard
- Adjustable slope
- Five key function areas

- Auto-key facility for frequently used keystroke entries
- 3270 host key-top graphics printed in black
- IBM PC operations printed in blue
- 1.8m. (approximately 6-foot) coiled cord
- Included in three models' prices

### 3270-PC control program

- On-line "helper" tutorial
- Object code
- One-time \$300 charge

### 3270-PC file-transfer program

- Transfers bulk data to and from host
- Host computer sessions can include VM/SP or MVS/TSO software
- One-time \$600 charge



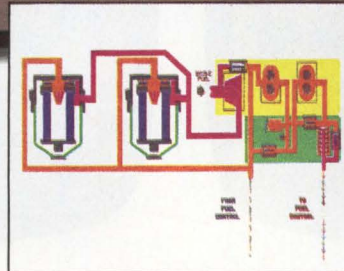
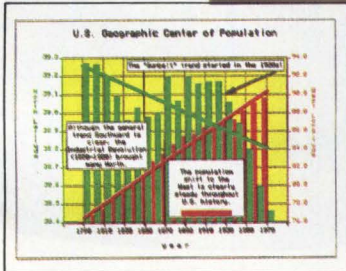
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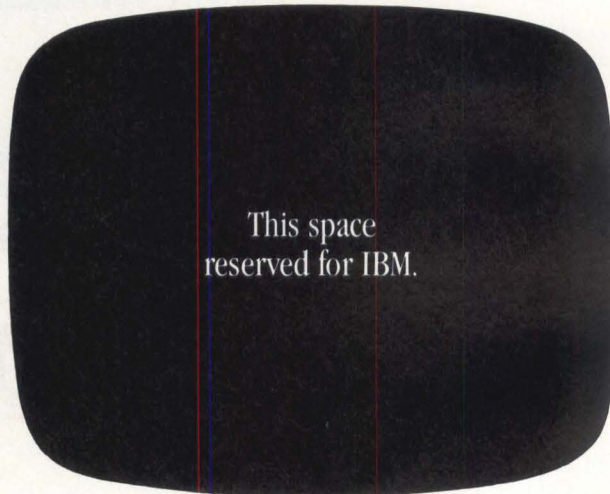


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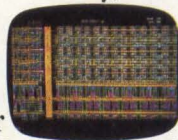
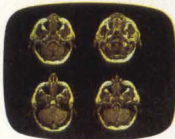
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# The Interpreter

## Two configurations determine 3270-PC windowing

System integrators can configure the 3270-PC in control-unit or distributed-function terminal mode. Control-unit terminal mode allows one 3270 window to emulate a 3178, a 3278 model 2 or a 3279 model S2A with 3278 or 3279 terminals. It requires no change in the 3274 controller's microcode. Control-unit terminal mode makes the 3270-PC a 3278 or 3279 look-alike, so that the 3274 controller "thinks" it is talking to a 3278 or 3279 device. In control-unit terminal mode, the 3270-PC also can attach to 4321, 4331 or 4361 systems via a \$995 display/printer adapter.

Distributed-function terminal mode allows as many

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*The video board has a separate CRT controller, but users can't issue instructions to it.*

---

as four host sessions, handled as separate logical terminals, to run over one coaxial cable. This mode allows the sessions to emulate any 3178, 3278 (except model 2A) or 3279 (except model 2C) terminal. It supports 3270 extended data-stream operation in eight colors. The mode requires that microcode in the 3274 controller change to the T 31 (or higher) or D 61 (or higher) releases. Users of this mode require a larger control unit. Although the 3274 control unit has 32 ports or cables, as many as 128 logical sessions can exist using the 3270-PC in distributed-function terminal mode.

Many users and industry watchers question how many windows are needed, especially by executives. Colony of Forrester Research says four 3270-PC sessions running simultaneously are overkill. Colin Havard, a senior systems analyst at Manufacturers Hanover Trust, New York, concurs: "The 3270-PC probably will not be used with four simultaneous 3270 sessions. I have a tough time seeing executives using PCs, period." He says that, in general, non-technical users could use the 3270-PC only if data-processing personnel set up window size and location.

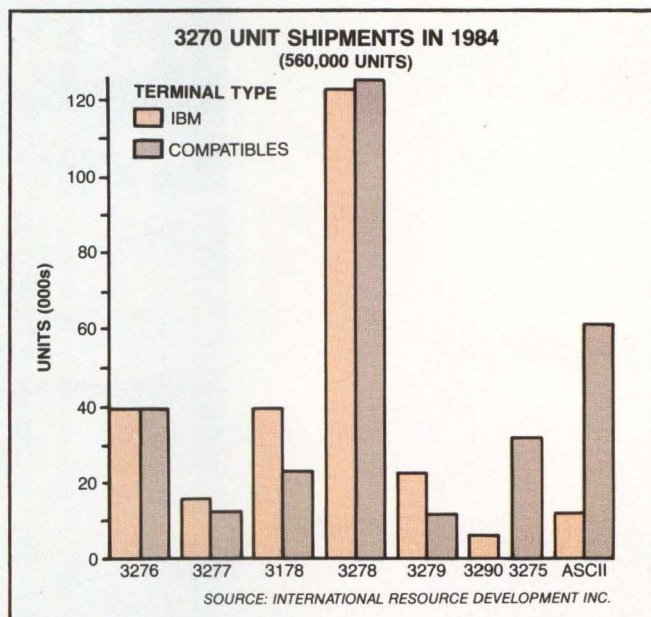
Havard, who acts as an interface between the data-processing department and end users in his organization, says Manufacturers Hanover received an early delivery of 25 3270-PCs. At press time, Manufacturers Hanover was testing the units and installing the 3274 controllers. System analysts and programmers were using the 3270-PCs.

Forrester's Colony expects that IBM will soon announce a hard disk and a CPU option for the 3274

that would let 3270-PC users store applications and files locally, thus reducing the cost of communicating with the mainframe. Now, PC session applications or files can be stored locally on a diskette. But if a user wishes to store 3270 session applications or files locally the 3270 session information must first be copied into a notepad session. Large host applications are copied directly onto a diskette in the peripheral floppy disk drive, an IBM spokeswoman states.

## Graphics users applaud new video board

The 3270-PC's video board has a separate 6845 CRT controller that works from an instruction set, special adapters, logic and a control program. IBM's Schenck



says logic on each board supports the control program, and the control program supports each board. The 3270-PC manages the controller, so users cannot issue instructions to the controller. Instructions for the 3270 sessions are interwoven with the control program, and the PC's instructions are in the 8K bytes of on-board video memory. Users cannot issue instructions to the control program or the video memory.

The 3270-PC has resolution as high as 720 by 350 pixels with two colors and 360 by 350 pixels with four colors. Digital Research's Heiskell, who worked with IBM to implement Digital Research's GSX graphics on the 3270-PC, says the system's high resolution compares favorably with that of Apple Computer Inc.'s Lisa microcomputer. The original PC monitor has 640-by-200-dot monochrome resolution; to get both



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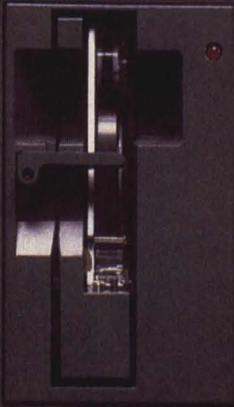
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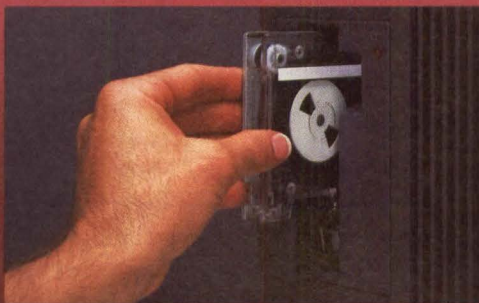
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# The Interpreter

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high-resolution alphanumerics and color requires two monitors. Because alphanumerics and graphics are overlaid on the 3270-PC, only one monitor is needed.

Heiskell explains that an IBM PC has two boards—a monochrome board with one block of memory and a graphics adapter with another block of memory. He notes that on the 3270-PC these blocks of memory are all “laid on top of each other” on the screen under hardware control. Separate video memory exists for the PC, 3270 and graphics portions of the 3270-PC, but this memory is put into hardware in a unique design by IBM. Heiskell hopes that if IBM decides to introduce a windowing product for the PC it will place window control in hardware. Hardware control would keep the

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## *PC users may look at the enhanced color graphics on the 3270-PC as a way to get ‘IBM standard’ enhanced graphics.*

---

windowing fast and would decrease the software overhead.

Heiskell reports that IBM put several new calls into the ROM BIOS on the main board to initialize new graphics modes. Despite the changes, Digital Research used its drivers for the PC without alteration to run its programs on the 3270-PC. He notes that Digital Research’s version of the Wordstar word-processing package runs as fast on the 3270-PC as on the standard PC and that Digital Research’s compilers run with no degradation.

Although the initial 3270-PC does not include all points-addressable graphics, IBM recently released a \$550 PC graphics board for points-addressable graphics. A second \$800 board is for host graphics in the distributed-function terminal mode. Also available is an adapter card that can store six user-defined symbol sets of 190 symbols each. Only one slot is available for add-on boards in a hard-disk 3270-PC configuration. Schenck claims most users will not need both graphics boards in one system at the same time.

Printing is done from any host session using an attached 3274 printer. A PC printer is used for printing documents created during PC or notepad sessions. A quick copy of any window can be printed using the PC printer.

### **Video board may promote a graphics standard**

The subtle differences between the 3270-PC’s video board and the video board on the standard PC may

determine whether a graphics program for the PC will run on the 3270-PC. GE’s Ehrlich notes that GE tested its own software, which he describes as similar to Lotus Development Corp.’s 1-2-3 integrated package. The GE software directly addresses the video memory space for improved performance. That the GE package successfully addressed video memory directly denotes a high level of compatibility between the 3270-PC and the standard PC.

Ehrlich says the primary advantage of the 3270-PC is that it can access 3279 color. The 3279, IBM’s 3270-line graphics terminal, is popular because of its high resolution. Ehrlich contends that no one offers a competitive 3279 emulator for the basic PC. He says emulating the 3270-PC’s video board would be complicated because of the sophisticated display electronics. He speculates that PC users, therefore, will look to the 3270-PC as a way to get enhanced “IBM standard” color graphics: “The graphics [video] board for the 3270-PC might establish a standard for look-alike boards for the PC.” He notes that other manufacturers’ enhanced graphics boards for the PC suffered because their differences from each other kept the manufacturers from building a significant base of software written by independent software suppliers.

Digital Research’s Heiskell will use the 3270-PC to get high-resolution graphics without two monitors. Heiskell says Digital Research will try to use dial-up connections from the 3270-PC to a service bureau to get 3279 graphics, because Digital Research does not have a mainframe.

### **Beware of minor differences from PC**

While the PC has few interrupts (mechanisms that allow high-priority tasks to gain control of the CPU), the 3270-PC has many, Heiskell says. Although he successfully ran a Tektronix Inc. terminal emulator through a serial port that is interrupt-driven, he advises users not to change the interrupt controller chip on the 3270-PC. Another timing concern centers on the 8088 processor, which the PC session and host communications functions “share.” This could cause some timing problems when the PC session communicates asynchronously with a host. But Schenck says the PC session ran successfully when communicating asynchronously to the Dow Jones financial service database.

Some differences between the 3270-PC and PC are less obvious. For example, when Manufacturers Hanover’s Havard ran the dBase II database program from Ashton-Tate, Culver City, Calif., on his 3270-PC, the cursor was not visible in a reverse-video field. This makes the package difficult to use because the right



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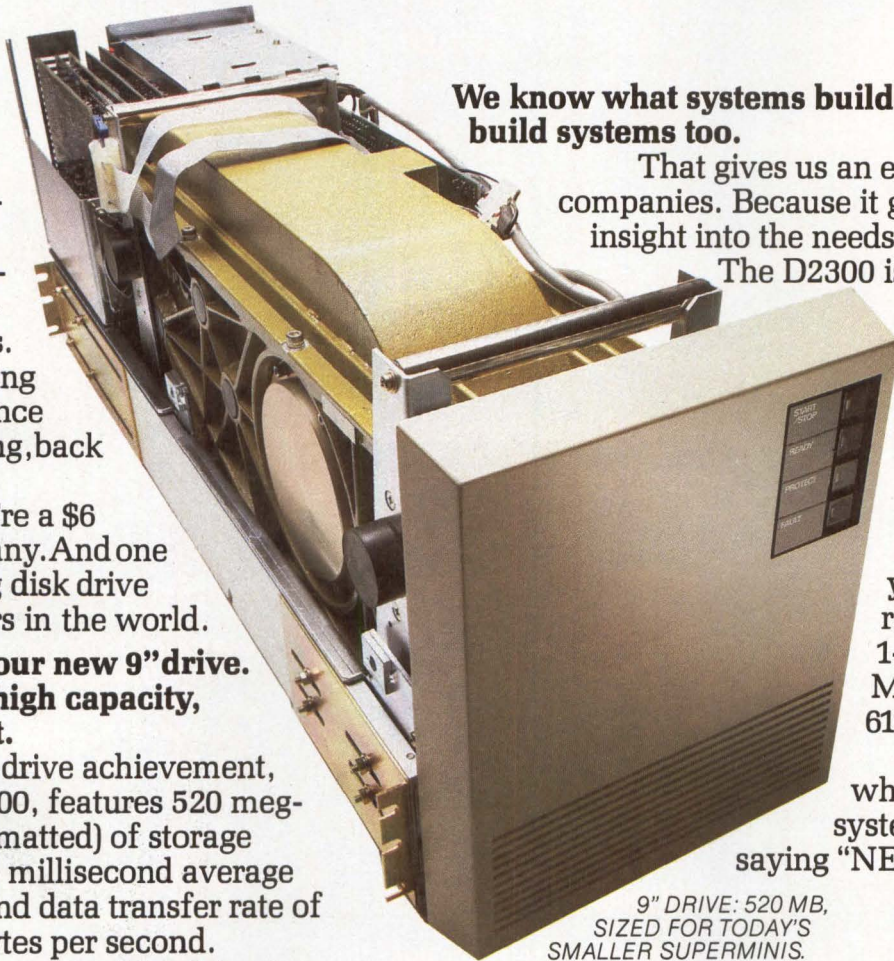
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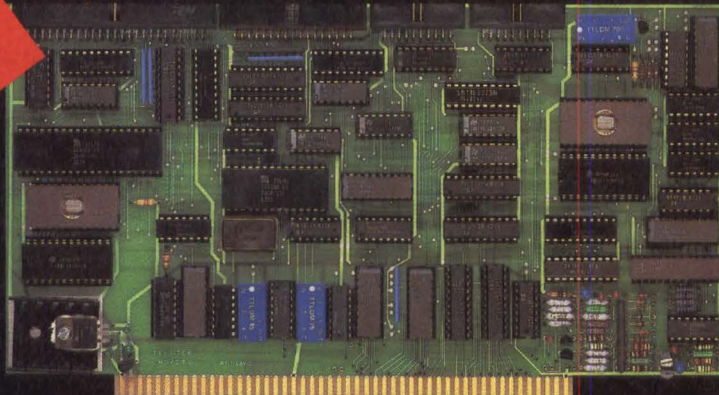
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# The Interpreter

part of the screen appears in reverse video whenever a dBASE II file is appended. Havard notes a similar problem in other programs that use reverse video to highlight certain functions, such as moving a block of text.

Paul Streit, senior product manager for dBase II at Ashton-Tate, explains that, while the PC cursor is defined in hardware as a blinking underline in a blank area of the screen, the 3270-PC cursor is defined as an inverse video box that matches the full box of reverse video in dBase II. Thus, dBase II's cursor disappears on the 3270-PC. Streit says simple commands in dBase II alter the cursor's video attributes and make it visible on the 3270-PC. Ashton-Tate plans to amend dBase II documentation to explain how to make the cursor visible. The company also plans to produce a version of dBase II for the 3270-PC, Streit says.

Lotus adapted its 1-2-3 integrated package slightly for the 3270-PC by doubling the amount of memory recommended to 384K bytes from 192K bytes, reports Brian Stains, manager of product management at the

Cambridge, Mass., company. The increase is necessary to hold IBM's 3270-PC control program. Required to run Lotus 1-2-3 is a graphics card. He recommends 1-2-3 be run in enlarge mode so that the window occupies the entire 3270-PC screen. Price for the 3270-PC package is the same as that of the standard PC package: \$495. Stains says Lotus has not decided whether to make a version of its new Symphony package for the 3270-PC.

More distinctions between the PC and the 3270-PC most likely will emerge as more standard PC software is tested on the device in large corporate accounts. Even so, the major challenge to corporations won't be small software fixes but the large-scale experimenting and education required to get corporate executives to use the 3270-PC successfully. □

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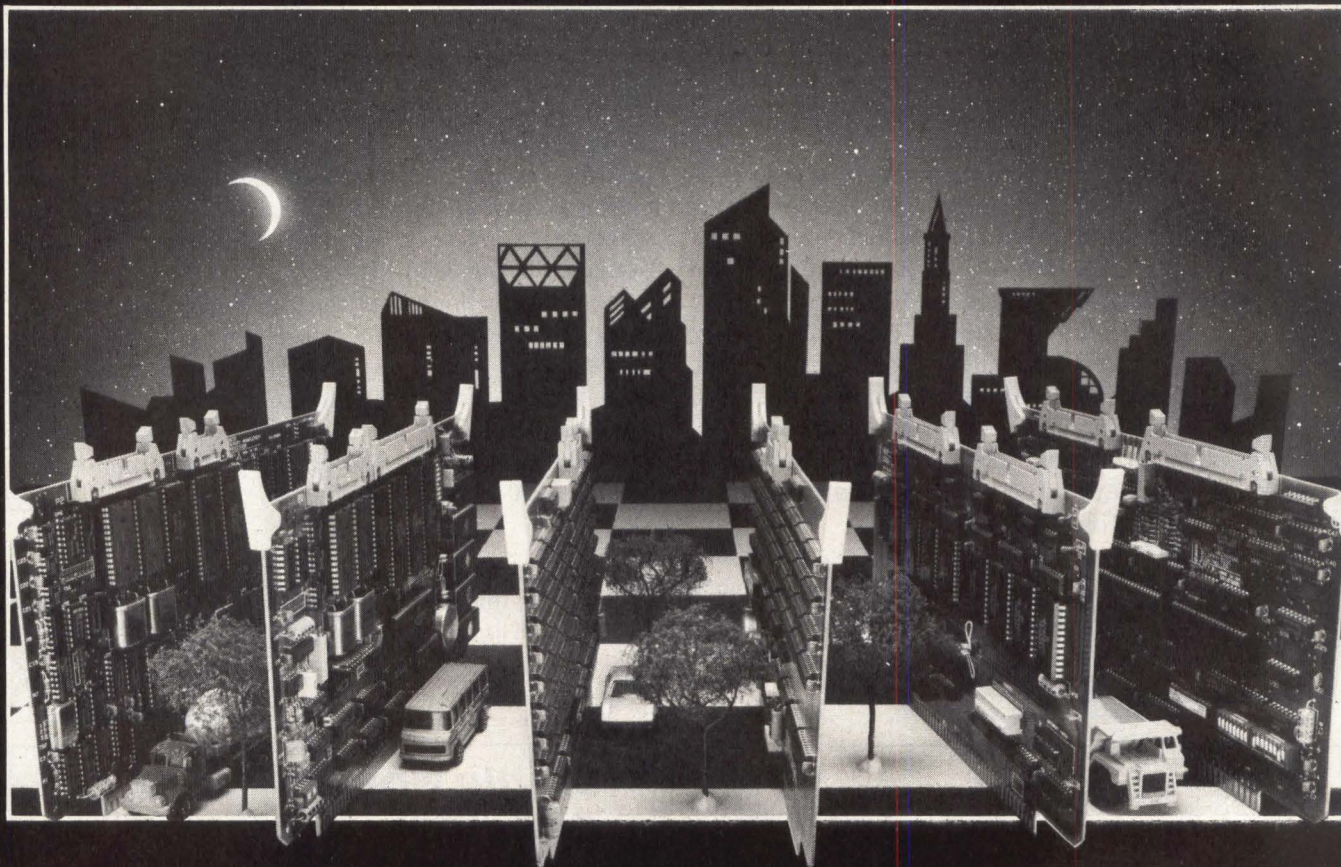
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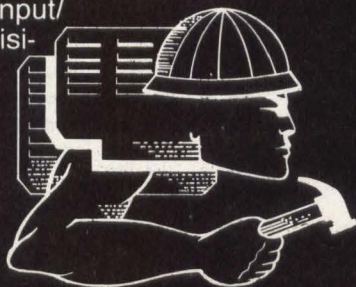
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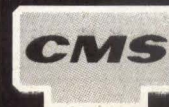
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# The Interpreter

## Alternative operating systems fight trend toward standards

*The p-System, Oasis and Pick continue to attract users*

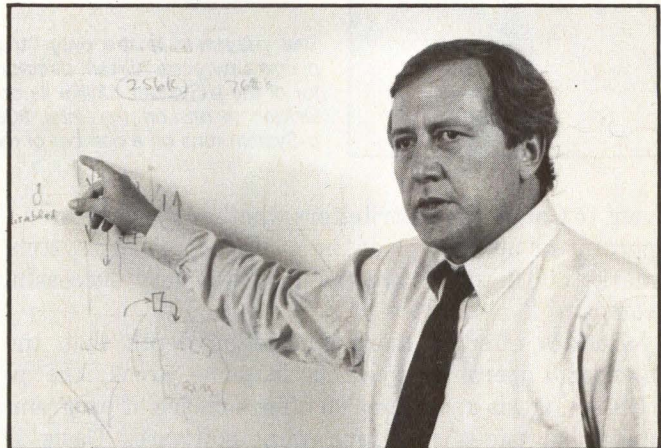
Mary Jo Foley, Contributing Correspondent

Although there are many computer operating systems, only a handful have earned the title of "standard." In the microcomputer operating system market, industry watchers predict that Microsoft Corp.'s MS-DOS and Digital Research Inc.'s CP/M will dominate the single-user world and that American Telephone & Telegraph (AT&T) Co.'s UNIX will dominate the multiuser world for the rest of the decade. Many other operating systems are rapidly losing their share of the market. Despite the trend, some of these microcomputer operating systems continue to prosper. Representatives for the p-System, distributed by SofTech Microsystems Inc., San Diego, Oasis from Phase One Systems Inc., Oakland, Calif., and the Pick operating system from Pick Systems, Irvine, Calif., claim that business has never been better; they're still signing on new licensees and software developers.

But the question remains: what inspires companies to pour development time and licensing and royalty fees into these "non-standard" products? Analyst Brian Boyle of Gnostic Concepts Inc., Menlo Park, Calif., compares the systems' users to followers of a religious cult. "Those who use [one of] these systems either love it or hate it," he notes. "There's no in-between." Blind devotion aside, most of the systems' advocates cite advantages such as a wealth of application software, alternative programming languages for software development and ease of transporting software to and from bigger machines.

### Vertical application software draws supporters

Unlike the most popular operating systems, which have a surfeit of horizontal, general-purpose software, alternative operating systems often attract OEMs and end users because of an abundance of vertical packages, most written by users themselves. Each of the alternatives has developed a fairly precise target niche. The p-System, a single-user operating system, has a well-established reputation for educational and application-development software. Oasis was one of the first multiuser, multitasking operating systems, and is strong in the application development and general



**Pick must retain its identity as a viable standard, insists the father of the operating system, Dick Pick. He rejects the option of running Pick on top of UNIX, stressing that Pick's most recent release "will allow us to run things under our system."**

business areas. And Pick, another multitasking development and business-targeted operating system, is renowned for its database- and file-management capabilities.

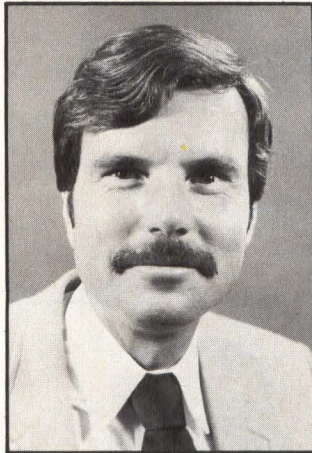
Edmund Malboeuf, vice president of marketing for Phase One, numbers Oasis' application packages in the thousands: "We fall somewhere between the DOS-CP/M world of applications with little sophistication and UNIX, a sophisticated, high-end, flexible system with few applications."

Dennis Brown, president of Computer Distributors Inc., Bellevue, Wash., a value-added reseller of IBM Corp. equipment, argues a similar point about Pick: "There's hardly a Pick application I can't find, but there's hardly one for UNIX that I can. Pick is installed 10 to one over UNIX." In 1982, Computer Distributors implemented Pick on IBM's Series/1 minicomputer by "throwing out all the IBM code and putting in Pick," says Brown. The company also uses a generic Pick-like operating system on the IBM PC 5051.

Two years ago, business was disappointing, Brown says, but "things were going gangbusters" in 1983. He speculates that Computer Distributors will sell as many as 50,000 copies of its operating system for the IBM PC in 1984 but notes, "Even if we do, [Pick] will still lose market share." However, he stresses that it is irrele-

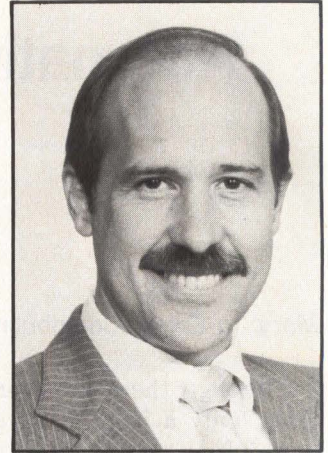


# The Interpreter



**Oasis, one of the first true multitasking operating systems, has thousands of application packages written for it, says Edmund Malboeuf, vice president of marketing for Phase One. The wealth of available application software is a strong selling point for the operating system.**

**The p-System is the only "truly universal operating system," claims Lawrence Allman, director of marketing for SofTech, distributor of the p-System. Unlike its competitors, MS-DOS and PC-DOS, written to run on the Intel 8086 family of microprocessors, the p-System runs on a number of microprocessors, he notes.**



vant to Computer Distributors whether Pick captures 1 percent or 50 percent of the overall operating system market: Pick sales "are making us a very successful company."

Besides offering more application depth than the standard operating systems in some areas, the p-System, Oasis and Pick also offer a choice of programming languages for developing software. Oasis is written in C, as is UNIX. But Pick is written in an extended version of BASIC, while the p-System, which originated at the University of California at San Diego, is written in Pascal.

For Pugh-Roberts Associates Inc., Cambridge, Mass., the ability to use Pascal was the deciding factor in the company's decision to choose the p-System when it ported its simulation-language software package, called Dynamo, from minicomputers to microcomputers. Pugh-Roberts decided to move the package, written in Pascal, to micros in 1980, says senior analyst Ross Hunter. "We knew we wanted Pascal," he explains, but none of the more popular operating systems supported it. "Now, we're looking at other operating systems," to supplement the p-System, he adds. The package should be available on the second, as-yet-unnamed, operating system this summer.

## **OEMs hesitate to abandon old favorites**

Much of the energy keeping alternative operating systems alive comes from their established bases. OEMs that were among the first to port the p-System, Oasis or Pick to their hardware often did so before MS-DOS, CP/M and UNIX became commercially successful. Because they invested so much time and money in the ports, the companies continue to support the original operating systems, often in conjunction with more recent additions. These OEMs are reluctant to give up what they're familiar with, explains Gnostic's Boyle.

Texas Instruments Inc., which offers the p-System as an option on its Professional microcomputer and Business Systems minicomputers, is a case in point. In the "pre-MS-DOS" days, circa 1981, the Dallas-based company was seeking an operating system for its yet-to-be-introduced microcomputer. "Some forecast that the p-System would become the standard," says Roger Roberts, manager of software market development for the Data Systems group. "Its source and

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***Some companies believe the alternative operating systems are far superior to the standard ones.***

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object code were transportable, and we wanted to offer all the systems that were to be standards" under TI's open-system policy.

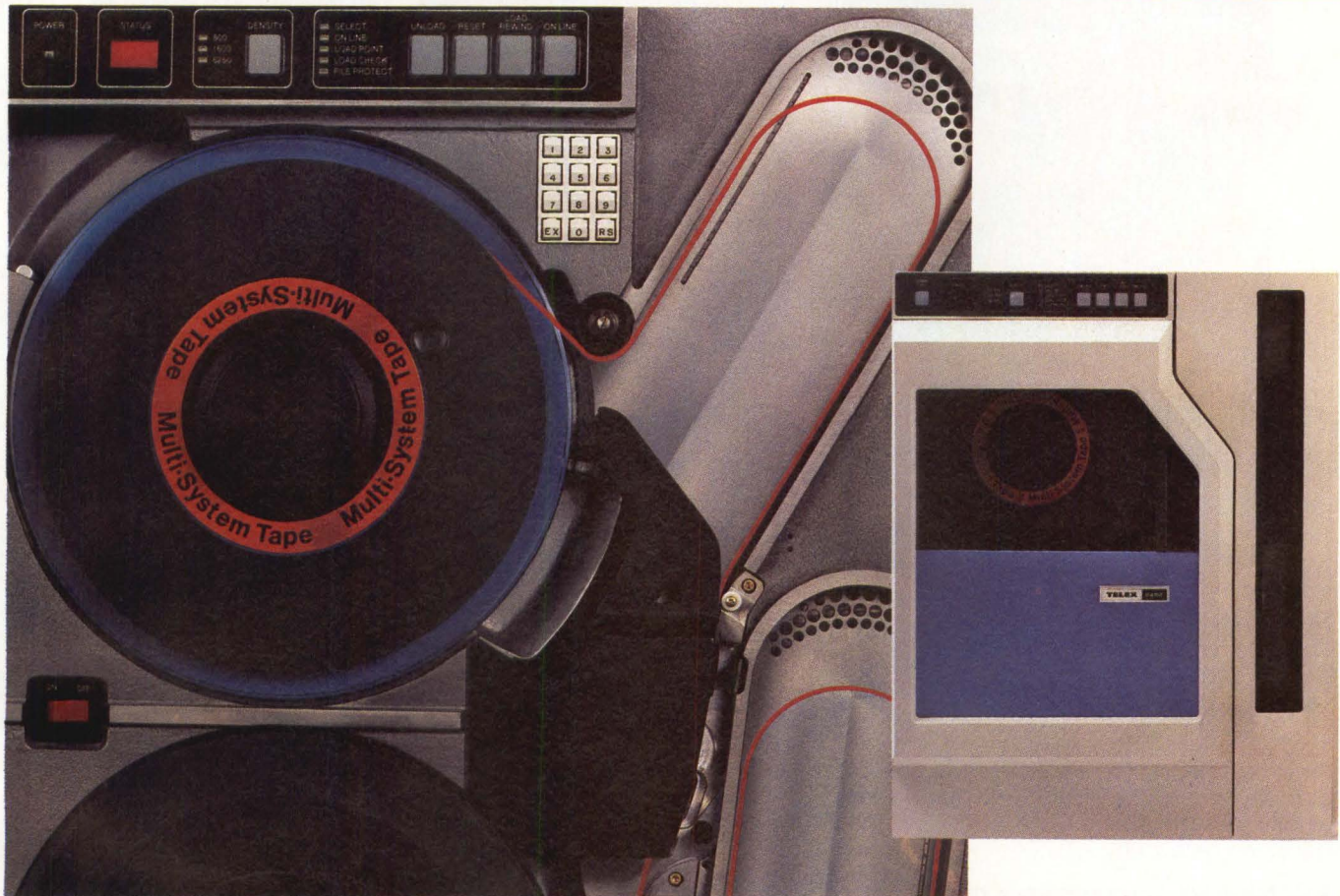
TI now offers MS-DOS, CP/M-86 and the p-System on the TI Professional, Roberts says. The suggested list price for multiple sales is \$75 for MS-DOS 2.1, \$100 for CP/M-86 and \$400 for the p-System, including development tools. Roberts admits that sales of the p-System lag behind those of the other two operating systems but insists that the company is pleased with p-System's prospects.

"The more operating systems you can supply, the more people you can appeal to," agrees Kenneth Bosomworth, president of market research company International Resource Development Inc., Norwalk, Conn. But some companies, including the operating system vendors themselves, may be getting in over their heads by trying to cover all the bases. For example, Pick licensee Automatic Data Processing Inc., El Toro, Calif., is on record as offering a Pick implementation completed in 1980 for the Hewlett-



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# The Interpreter

Packard Co. 3000 minicomputer. But a company spokesperson confirms that the few implementations that ADP has done so far have been internal.

In the heat of trying to prove how portable their products are, operating system vendors are quick to cite the number of machines on which the systems run. However, they don't always distinguish between versions licensed by OEMs and versions the vendors ported without an OEM's cooperation. For example, SofTech Microsystems advertises the p-System as available for Apple Computer Inc.'s II and IIe systems. According to an Apple spokesperson, the company never endorsed the product and doesn't distribute or license it: "We have our own competitive product, Apple Pascal."

## Portable systems attract support

Few people would argue with SofTech's claim that the p-System is portable. Calling itself the vendor of a "truly universal operating system," SofTech highlights a key drawing card for the alternative operating

systems. Although MS-DOS and PC-DOS were written for Intel Corp.'s 8086 microprocessor, the p-System can run on a host of processors, emphasizes SofTech director of marketing Lawrence Allman. Porting p-System packages to different computers is easy because most software is written in machine-independent Pascal and then compiled via p-machine emulators, which enable different computers to display the same user interface.

For Sage Computer Technology, Reno, Nev., portability was the main selling point of the p-System. The company offers seven to nine operating systems with its Sage II and IV microcomputers, including CP/M-68K, IDRIS and HyperForth. For the past three years, Sage has bundled the p-System with both micros. "CP/M wasn't available [for our hardware] until a year ago, and MS-DOS still hasn't been ported to Sage," comments senior systems engineer David Cline. "P is the most portable operating system; P is also one of the only operating systems that goes across chips." He says that CP/M and MS-DOS "are poor on portability."

COMPARING THE ALTERNATIVE OPERATING SYSTEMS

	Softech Microsystems p-System	Phase One Systems Oasis	Pick Systems Pick
Available versions	Version IV	Oasis-8 (8-bit) Oasis-16 (16-bit)	Release 80 Release 84 (Feb. 84)
Type of CPUs	micro mini	micro	micro mini mainframe
Implementation will be done by OS vendor	yes	no	yes
Implementation can be done by OEM	yes	yes	yes
Time for CPU that's already been implemented	keyboard and screen interface: 2 wks. to 1 month	60 to 120 days	90 days
Time for new CPU	p-machine emulator: 1 wk. to several mos.	60 to 120 days	7 to 9 mos.
Licensing fee for CPU that's already been implemented	\$50K to \$300K	8-bit: \$10K 16-bit: \$20K	*\$50K + time and materials, or fixed-price quote
Licensing fee for new CPU	\$50K to \$300K	8-bit: \$10K 16-bit: \$20K	*\$50 + time and materials, or fixed-price quote
Royalty per CPU (range)	\$4 to \$24/copy (depends on volume)	8-bit: \$50/copy 16-bit: \$100/copy	** 1 to 4 users: \$400/copy 5 to 16 users: \$600/copy 16 to 128 users: \$1,000/copy
No. of available applications packages	500 +	900 +	500 +
Processors that have been implemented	Z80, 8080, 8085, 9900, 6502, 6809, 8086, 8087, 8088, 68000, LSI-11, PDP-11	Z80, Z8000, 8086, 68000 (in progress)	8086, Z8000, 68000, NS16000 (in progress), IBM 4300, IBM Series/1, HP 3000

\*For IBM PC, source code is available for \$10K  
\*\*IBM PC royalties: \$125/copy sold for \$495 (suggested price)



# The Interpreter

## Alternative operating systems inspire loyalty

Some companies claim they offer the p-System, Oasis or Pick because they believe these alternative operating systems are far superior to the standard ones. For example, Phillip Wyatt, director of product marketing at Onyx/IMI Inc., San Jose, Calif., states: "Two years ago, Oasis was the best multiuser 8-bit operating system. It still is." Onyx manufactures a wide range of multiuser microcomputers and uses a number of microprocessors: Z80s and Z8000s from Zilog Inc., 8086s and 80186s from Intel and 68000s from Motorola Inc. With its Z80- and 80186-based products, Onyx offers Oasis-8 and -16. Besides professing to be the only Oasis vendor with both licensing and source-code rights, Onyx also claims it sells more copies of Oasis than any other distributor.

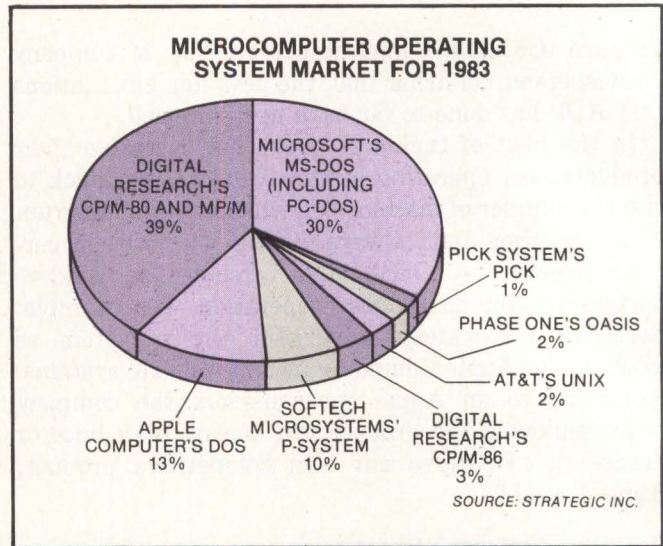
"We're the only vendor really pushing it," Wyatt declares. He attributes this to a disagreement last year over licensing rights between Oasis creator Timothy Williams and distributor Phase One. Despite the trouble, Onyx's Oasis business is better than ever, Wyatt maintains. "Oasis is a nice, stable system with no bugs—and that's saying a lot."

Oasis isn't the only operating system that inspires such praise. Gnostic's Boyle makes a similar comment about Pick: "Whenever Pick comes out with something, it's superlative. By the year 2000, they could have an operating system that solves everything around—if they're still in business."

## The future is murky

For now, UNIX and MS-DOS remain the biggest threats to alternative operating systems, according to analyst Boyle. "Those who do not coexist and become able to take advantage of UNIX/MS-DOS will not survive, except in very specialized niches," he says. One method he suggests for alternative operating systems to ensure their survival is to become advanced application packages running on UNIX. But Phase One and Pick Systems see piggybacking on top of UNIX as a last resort. "A lot depends on this year," admits Phase One's Malboeuf. "Unless we become a lot more visible, we may end up piggybacking on [a system such as] UNIX. It all depends on whether or not we can give ours enough exposure to gain market share."

Pick Systems is determined to preserve Pick's identity as an operating system. "We're not at war with UNIX; they have their marketplace, and we have ours. The two are complementary," claims vice president of sales and marketing Wayne Wahlenmeier. Dick Pick, the brains behind the operating system bearing his name, says that Release 84's kernel, which was slated



**Among microcomputers—the only market in which the p-System, Oasis and Pick all compete—these alternative operating systems are a long way behind MS-DOS and CP/M. Although suppliers of all three claim that business was booming in 1983, only SofTech's p-System captured more than 2 percent of the market.**

to be out early this year, will save Pick Systems. Release 84 allows other operating systems to run under Pick. He says: "It's relatively easy to bring up CP/M, MS-DOS, etc. under our system" and maintains that running other operating systems is "a lot tougher for UNIX, because they're locked under a base-like standard."

Gnostic's Boyle dismisses Pick's insistence on being the primary operating system as silly. He believes UNIX is a better development system and that "it's just ego reasons that are preventing Pick from running on UNIX." Attitudes like Pick's may ultimately result in suppliers of alternative operating systems "slitting their own throats," Boyle concludes.

Hardware and software vendors often choose an operating system because they believe it will survive. But this year's contender for standard status may end up as next year's least-used operating system. Thomas Hanley, president of Resource Control Corp., New York, maker of the Topper executive-recruitment package, explains his company's choice of Oasis: "In 1981, we wanted a multiuser system for Topper, and not many others looked like they'd be around for a while." □

**Mary Jo Foley**, assistant editor for *Electronic Business* magazine, specializes in writing about software.

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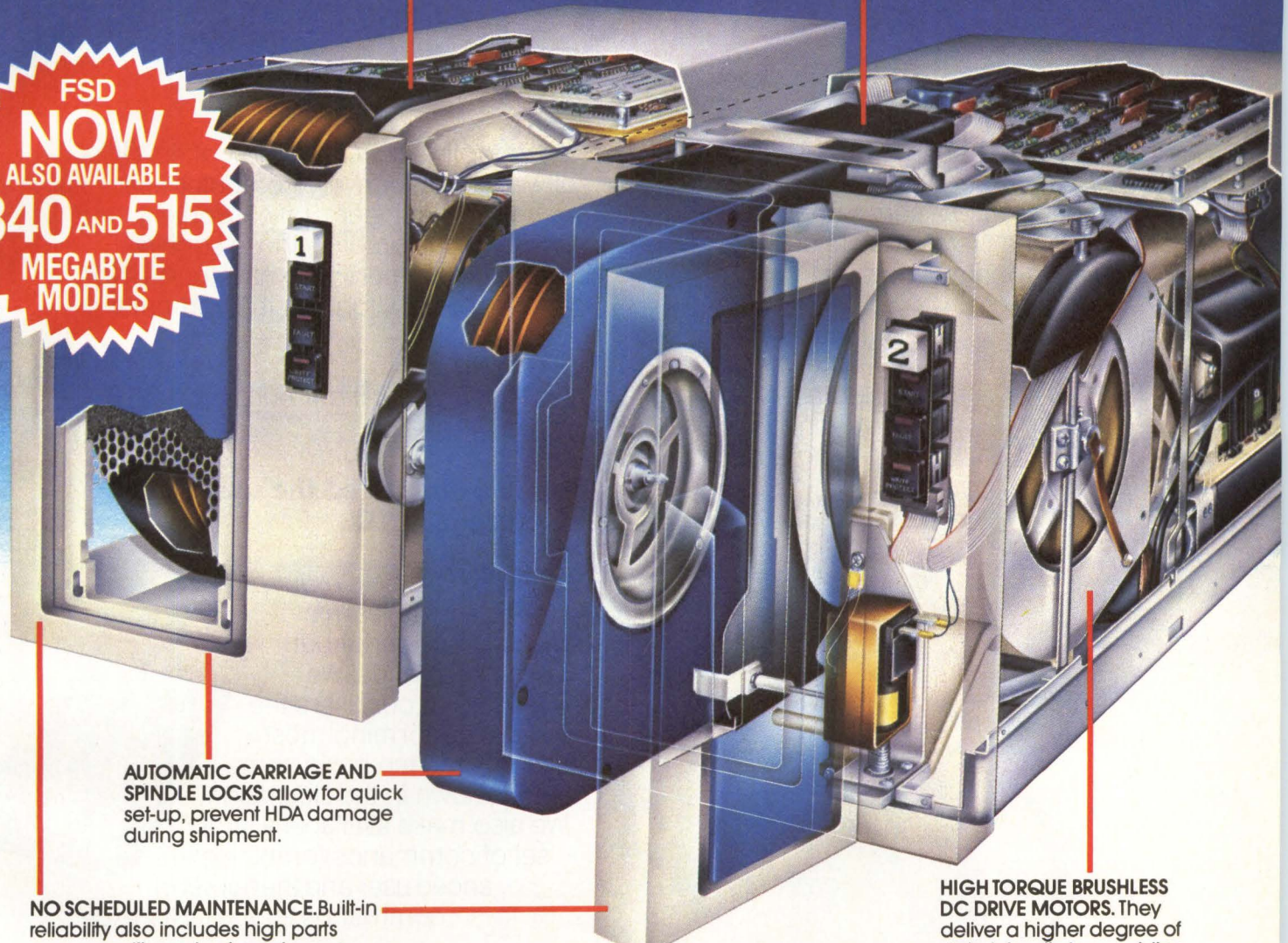


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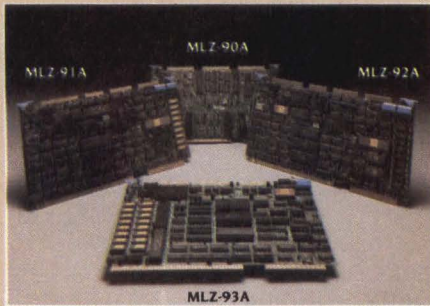
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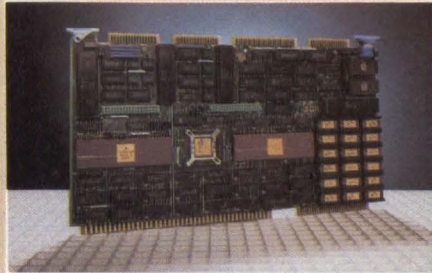


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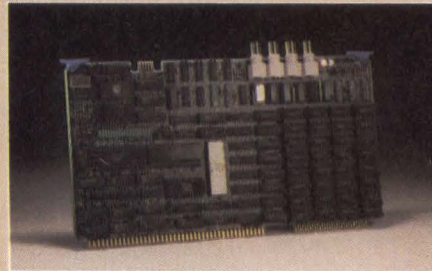
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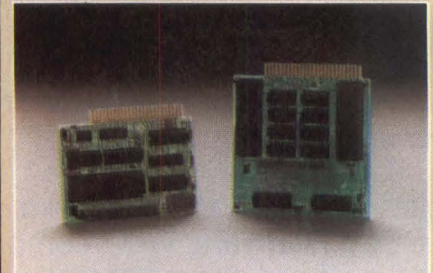
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Jeffrey Swartz, CompuPro

One of the main characters in the film "Wargames" is a supercomputer. Called WOPR (whopper) after the fictional North American Defense Command's (NORAD's) War Operation Plan Response, the computer plans missile deployment and controls the huge display screens in NORAD's war room. WOPR is the brainchild of a warped genius, a pioneer in artificial intelligence, who programmed the machine to learn from its mistakes. To help it learn decision making, he programmed in a variety of games and gave WOPR a strong desire to win.

As the film's title suggests, one of the games WOPR wants to win is global thermonuclear warfare. When the film's protagonist, a teenage computer buff named David Lightman, discovers a "back-door" password that gives him entry into WOPR, global thermonuclear warfare is the game he wants to play. Just for fun, he chooses to play for the Soviet Union and launches "missile strikes" against Las Vegas, Nev. and Seattle. WOPR begins working out a nuclear response, even though it can't distinguish between games and reality. To make matters worse, the computer has gained control of the nation's missile strike force. So when

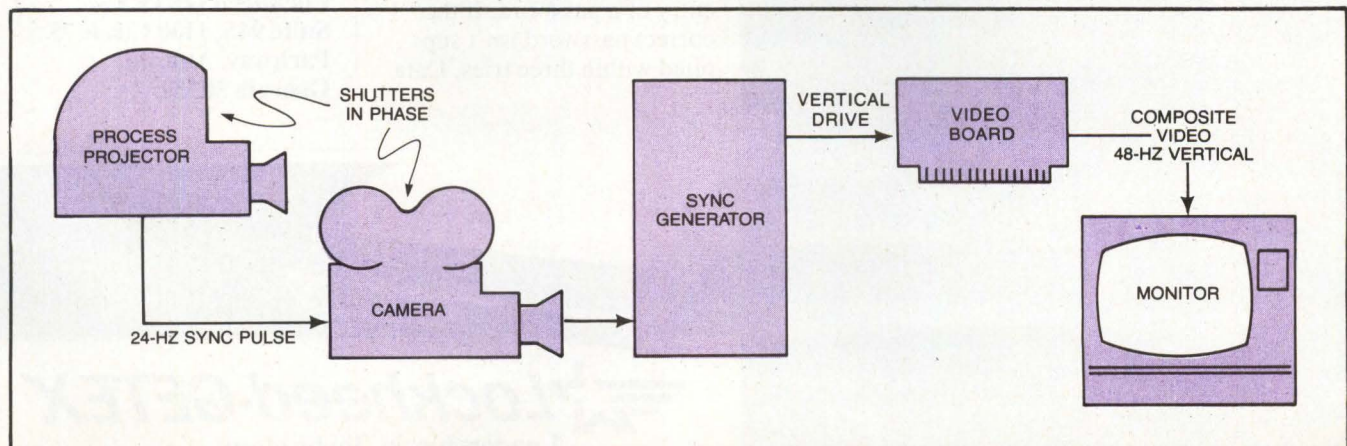
Lightman begins his attack, WOPR prepares to launch real missiles against the Soviet Union in retaliation.

"Wargames" is an exciting film, but it was difficult to make and especially to get the computers and terminals to operate realistically. In one scene, when Lightman doctors his high school grades by gaining access to the school computer, the audience for the first time sees Lightman's computer installation. The machine looks the way an uninformed audience expects it to look—with a front panel that has lights and switches. Yet it must also convince more knowledgeable members of the audience that it could be within the financial reach of an affluent teenager. To complicate matters, the computer must be able to generate at least crude graphics to display the maps produced by WOPR when Lightman begins playing global thermonuclear warfare.

It quickly became clear to the special-effects group that no teenager could afford a computer with the required computing power. Lightman's "computer" would simply be a prop, with the actual computing piped in from an offscreen machine. One of the first personal computers, made in the mid-'70s by now-defunct computer manufacturer IMSAI, met the appearance criteria, so it became Lightman's on-screen computer.

Modified video boards scanned CRTs at the same 24-frame-per-second rate the movie cameras used to shoot. This method solved

the synchronization problem that results in flickering horizontal bars that continually roll up the screens of monitors in low-budget films.





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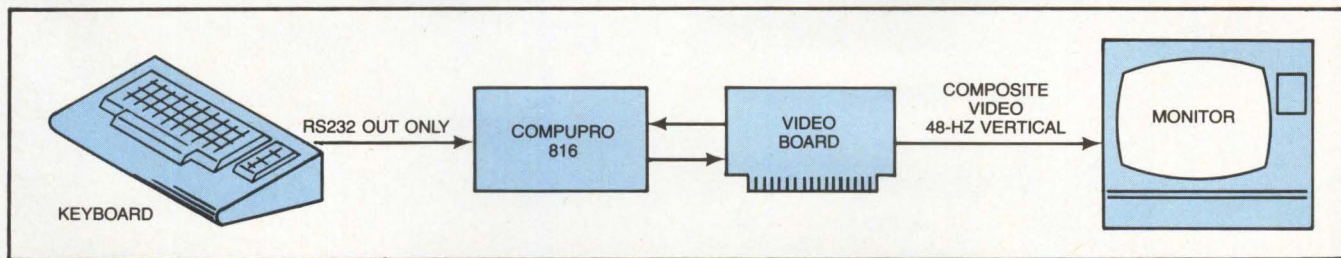


# The Integrator

## Offscreen machine pulls the strings

With the appearance of Lightman's computer out of the way, the special effects people next had to choose the offscreen computer, which would have to drive the CRT in Lightman's terminal, among other things. They first had to resolve a timing problem. Conventional CRT monitors scan 60 interlaced fields, displaying 30 frames per second, but movie cameras shoot 24 frames per second. This asynchronous operation results in the flickering horizontal bars that continually roll up the

The set for the war room's command headquarters had 52 functional consoles complete with keyboards, 120 monitors and 12 large, overhead display screens. Making them look realistic was the task of the special computer effects crew.

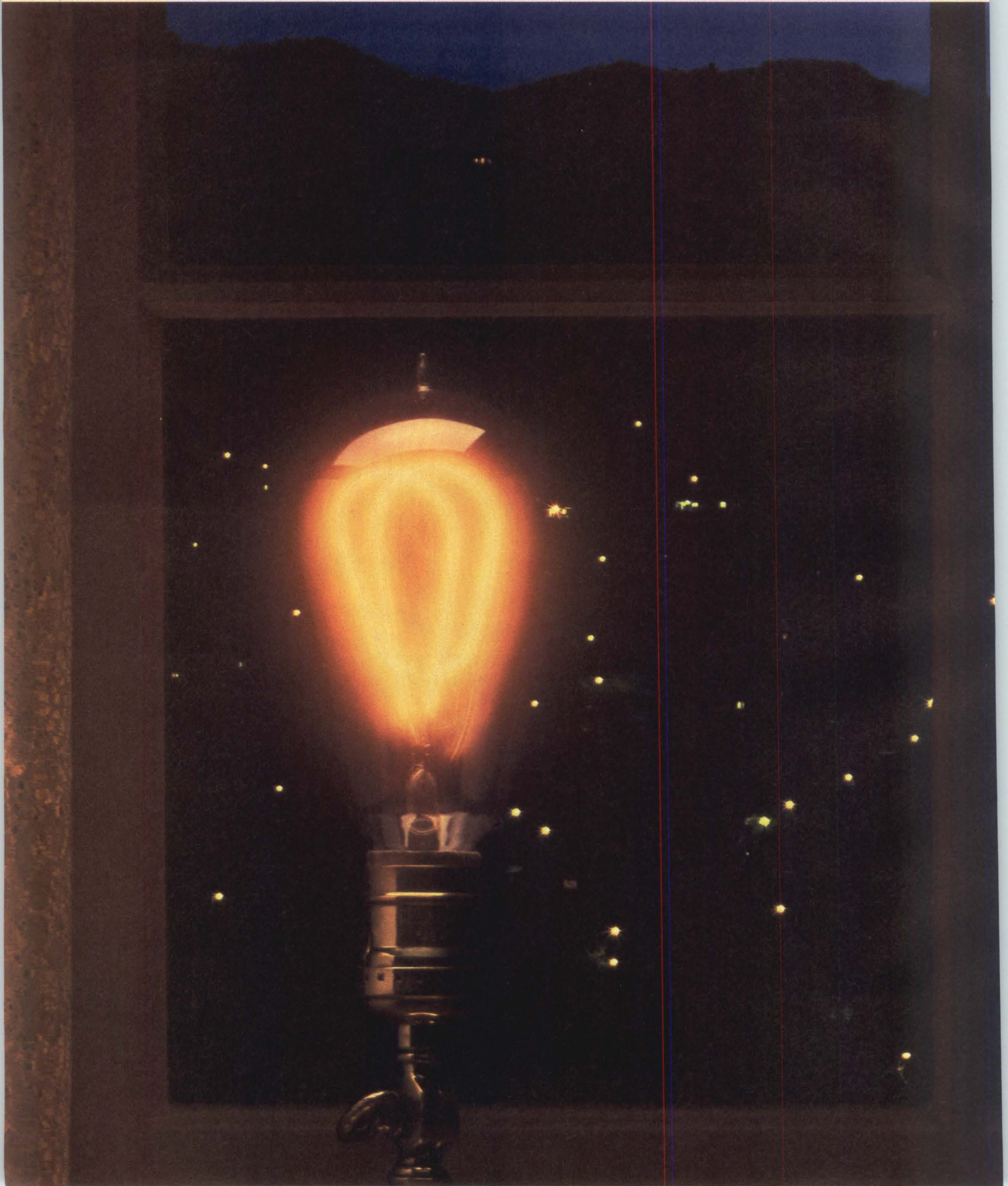


**Echo-replacement software** automatically displayed a predetermined message on the monitor, one character at a time, no matter what key the actor hit. Software also replaced the input signal with a

predetermined output signal and sent it to the monitor through the video board.



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# The Integrator

screens of monitors in low-budget films. The "War-games" visual effects supervisor, Michael Fink, insisted that these scrolling bars were unacceptable for a film built around computer displays.

To solve the synchronization problem, the crew used modified video boards to scan the CRTs at 24 frames per second, synchronizing them with the camera. Most specialized boards conform to the IEEE-696 standard, and their fast timing speeds make them unable to interface with the cameras. This drawback limited the offscreen computer to machines that use an S-100 bus, which handles much lower speeds. To further complicate matters, the offscreen computer needed a large on-board memory to accommodate real-time graphics. And, even more important, it had to be extremely reliable to avoid wasting expensive shooting time.

The job of choosing the computer fell to Steve Grumette of Artificial Intelligence Research Group, Los Angeles, who was responsible for programming. Grumette settled on using two CompuPro System 816s equipped with a 1M-byte M-drive/H solid-state disk. "The CompuPro is the most reliable S-100 computer available," he claims. "With production time running about \$50,000 per day, we simply could not afford to chance the computer going down while we were filming."

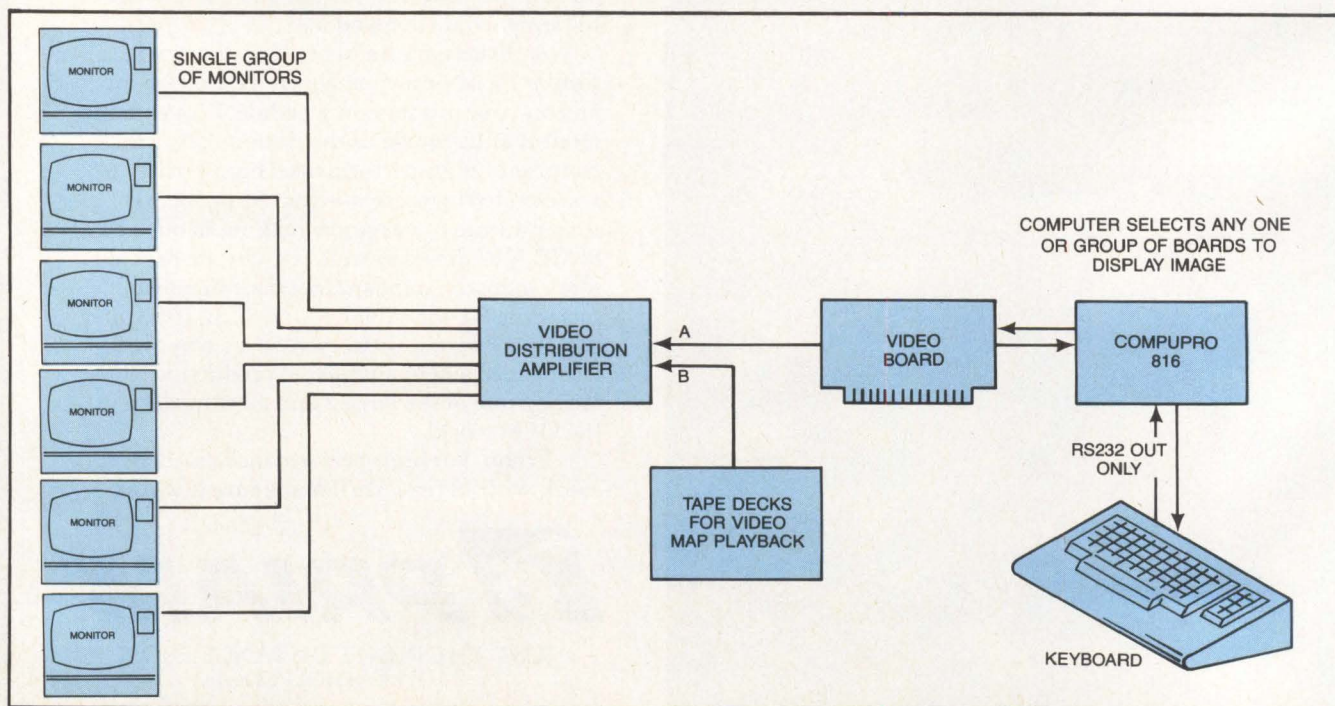
With the hardware defined, the next problem was making the IMSAI appear to be interactive with

WOPR. It was easy enough to wire Lightman's terminal to the CompuPro System 816 and make it look like the IMSAI was actually doing the computing. A parallel-to-serial converter board in the terminal transmitted keyboard commands to the CompuPro through an RS232 interface. The CompuPro, in turn, sent composite video signals back to the terminal's CRT through coaxial cable.

The trick was making the offscreen computer respond to Lightman's keyboard commands so the IMSAI appeared to communicate interactively with WOPR. Although Grumette could have used a simple interactive program, most actors aren't proficient typists. Every keyboard error would mean reshooting the scene. At \$50,000 a day, reshooting scenes can get very expensive.

## Software makes it look real

Grumette solved the problem by creating an echo-replacement routine that automatically displays a predetermined message—one character at a time—on the monitor in response to keystrokes. The program displays the next character in the message string each time *any* key is hit. So Lightman needed only to hit the right number of keys to put an error-free command message on his monitor. When the monitor displayed the last character in the echo-replacement string, the offscreen computer automatically sent an answer



Dividing the set's 120 monitors into 20 groups of six, each controlled by a single S-100 bus video board, enabled 20 different

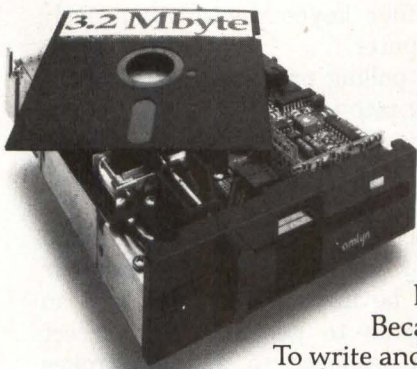
images to show simultaneously. The crew positioned the monitors so that each one in a scene displayed a different image.



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# The Integrator

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message from WOPR to Lightman's terminal.

Putting graphics displays on Lightman's monitor for the war-game maps remained a problem until Grumette noticed that the S-100 bus video board had a complete ASCII character-generating font in ROM and that none of the 32 control characters ever appeared on the monitor. With those 32 characters and two other unused special characters, he had 34 alphanumeric characters that could be replaced with special graphics characters.

---

*'With production time running about \$50,000 per day, we simply could not afford to chance the computer going down while we were filming.'*

---

Grumette wrote code for the graphics characters that produced a set of line segments, each displaced by a few degrees. After debugging the code, he had it burned into a new programmable read-only memory (PROM), along with the remaining active alphanumeric characters. The new PROM, which replaced the original, gave the alphanumeric video board what might be called "pseudographics" capability.

Using Grumette's software and the modified video board, visual effects coordinator Linda Blain Fleischer created the war-game graphics displayed on Lightman's monitor. After placing the monitor's cursor at the desired point on a 24-line, 80-character-cell display, she called up the line segments one at a time by using one of the arrow keys. Each keystroke made the next segment appear, in effect spinning the line through 360 degrees. Another arrow key could reverse the direction of the spin by calling up the previously displayed segment.

When the correctly angled segment appeared, Fleischer saved the segment's character code by striking the return key. She then moved the cursor to another character cell on the screen and repeated the process until she had drawn the entire map display. After she created a file to hold the screen's memory contents, Fleischer made several copies, adding appropriate missile tracks and attack submarine symbols to each. Once in memory, each map file could easily be called up for display on Lightman's terminal to show how WOPR's game playing progressed.

## **War room required large-scale simulation**

Making NORAD's war room computers and screens come to life was more complicated. The set boasted 52

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*Conventional CRT monitors scan 60 interlaced fields, displaying 30 frames per second, but movie cameras shoot 24 frames per second.*

---

functional consoles complete with keyboards, 120 monitors and 12 large, overhead display screens. To facilitate programming, the special-effects crew divided the monitors into 20 groups of six. A single S-100 bus video board in both CompuPro System 816s controlled each group of monitors, so that 20 images could be displayed simultaneously. The crew positioned the monitors so that all those appearing in a scene displayed different images.

The film's director requested that certain screens display specific images for predetermined time periods. To accomplish this, Grumette created these displays and created a file containing lists of the displays, where they were to appear and for how long. The computer then retrieved specific image files from memory, as instructed by the display file, and put them on the appropriate monitors for the specified times.

The script also called for several console operators to communicate simultaneously with WOPR through their console keyboards. However, the director decided that no more than four keyboards needed to be active at once. To simplify programming, Grumette divided the 60 keyboards into four groups of 15. But he still had to create a way to run four keyboards simultaneously from a single-user computer.

The answer lay in a polling program that used the CompuPro 6-MHz clock rate to monitor the keyboards sequentially. Although Grumette programmed the computer to lock out specific keyboards, he added insurance against extraneous monitor displays by converting the "Caps Lock" key on all the keyboards to an on/off switch and by activating only the four keyboards that had to be in use. He again used an echo-replacement program to generate the correct command messages in response to any keystrokes executed by the non-typist actors.

The large overhead screens required intensive design and programming. Images developed on a Hewlett-Packard Co. HP9845C desktop computer with a monochrome vector CRT were then filmed through color filter wheels with movie cameras. According to visual effects supervisor Fink, the film crew printed 128,000 feet of film to provide images for the 12 overhead screens. To complete the task, three pro-





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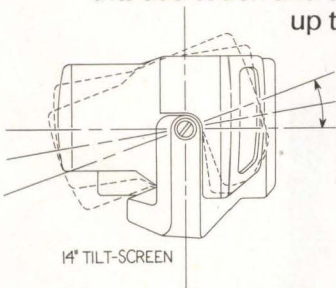
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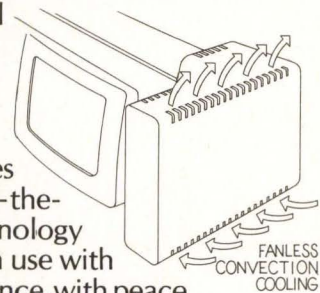
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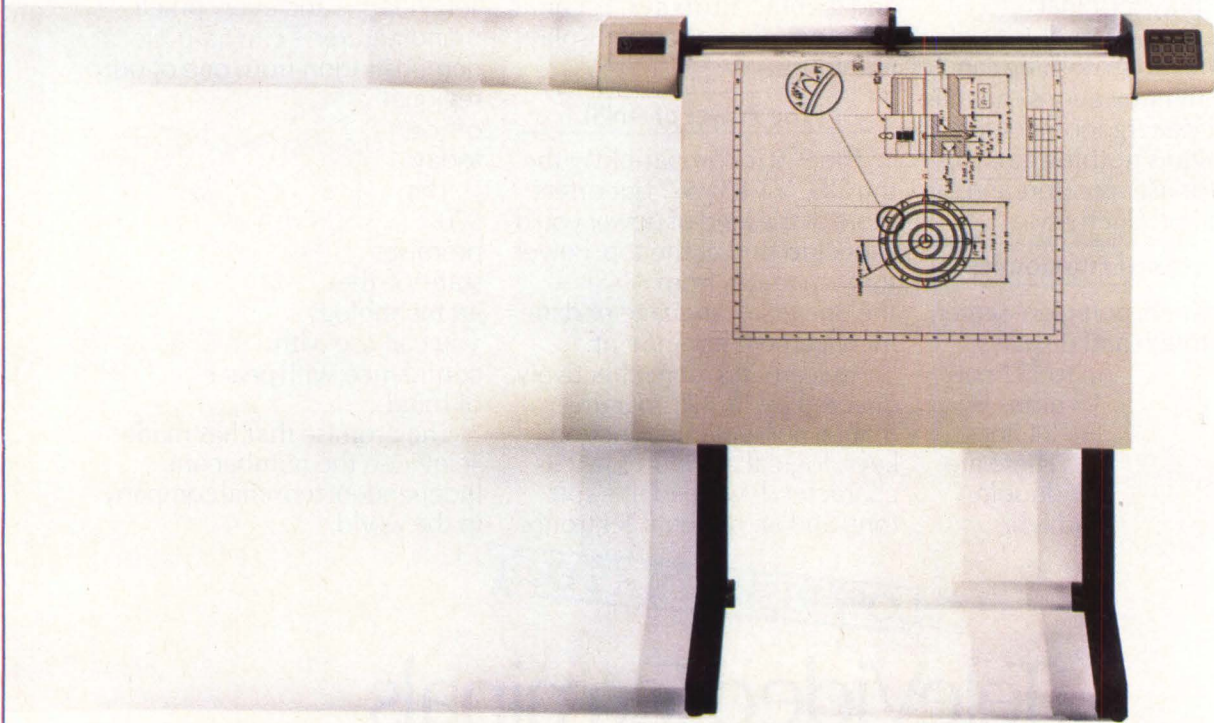
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# The Integrator

grammers and three camera operators worked 10-hour shifts, 24 hours a day, for five months. A dozen process projectors projected prints of the graphics displays onto the big screens. In addition, selected monitors interspersed with the war room's interactive alphanumeric terminals played back some of the high-resolution graphic images, which had been tape-recorded at 24 frames per second.

## Synchronizing the hardware

The special-effects crew had to synchronize the video displays and the cameras with the process projectors used for the big-screen displays. Because the projectors were much less stable than the two CompuPro computers or the cameras, one projector became the master clock to which everything else would be synchronized. The projectors themselves were already synchronized to each other through a high-gain servo loop.

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"WarGames" box office success unquestionably comes from an exciting story line that pits a teenage computer buff against the military. But part of the credit must go to Michael Fink, Linda Blaine Fleischer and Steve Grumette who integrated the on-screen props and offscreen computers with novel software to produce the special computer that gave the story credibility. □

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**Jeffrey Swartz** is vice president, corporate communications, of CompuPro, Hayward, Calif.

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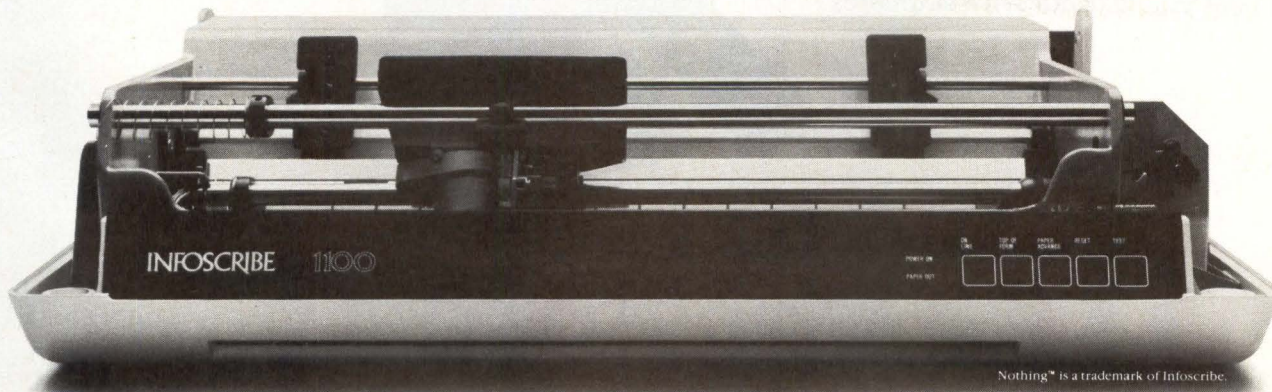
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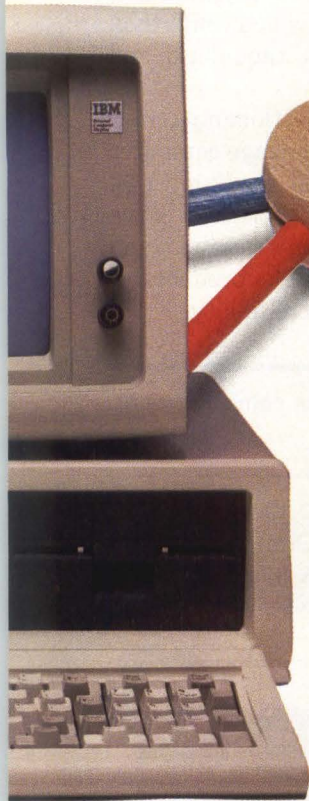
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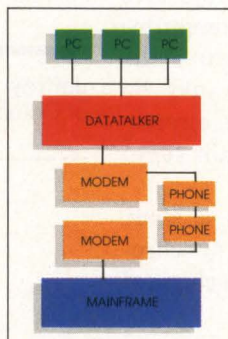
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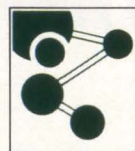
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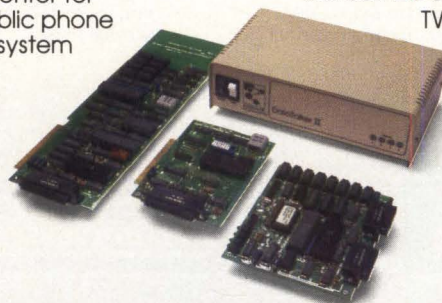
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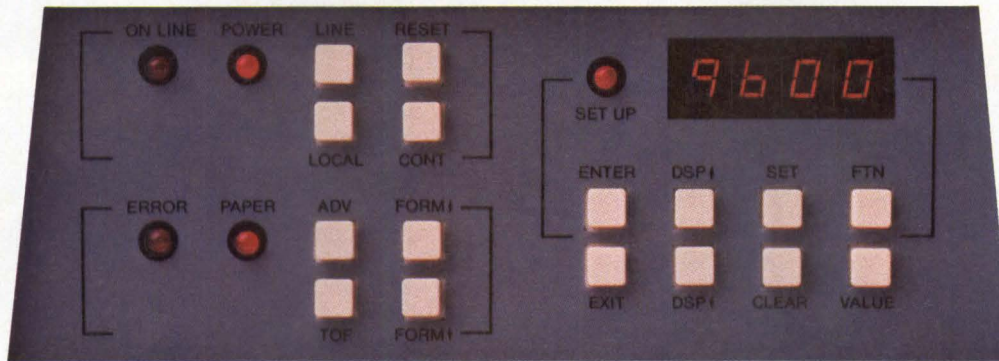
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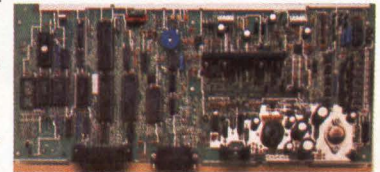
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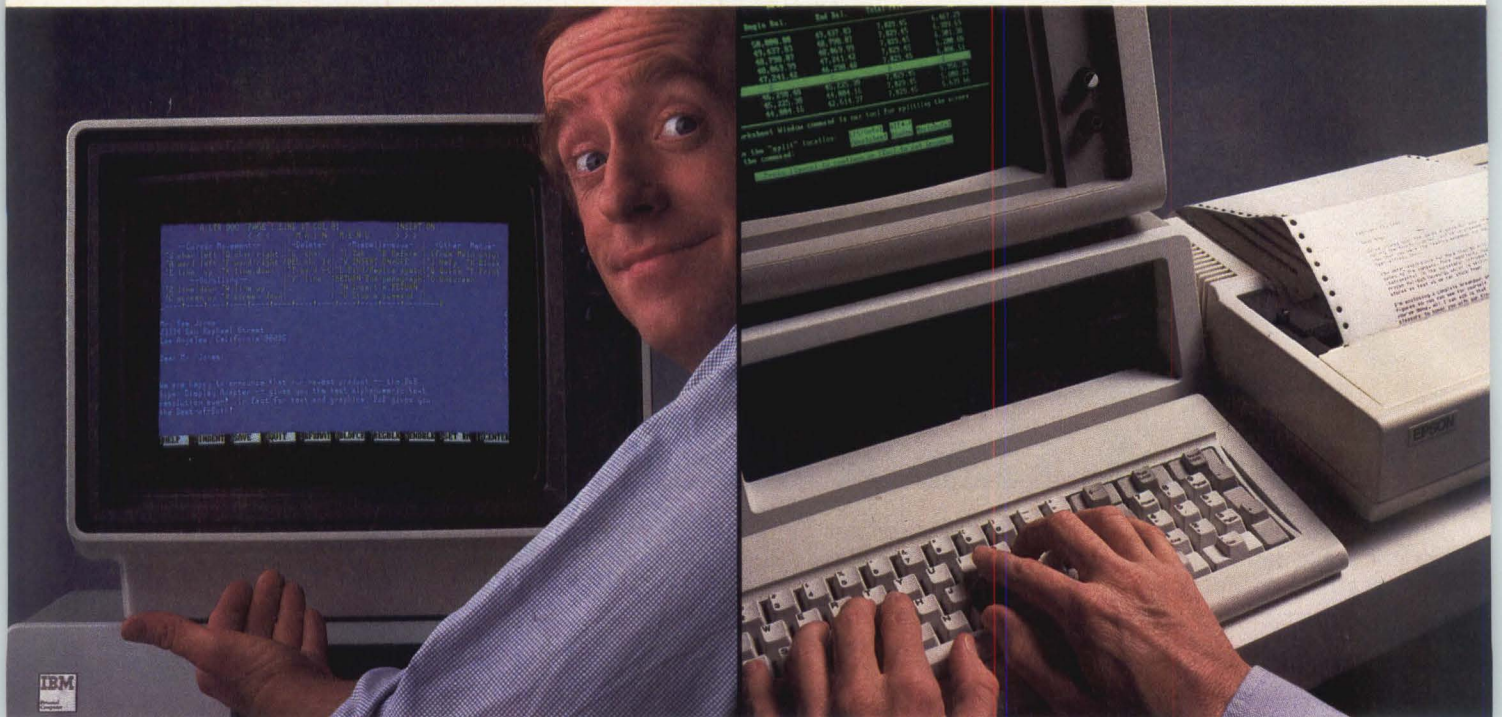
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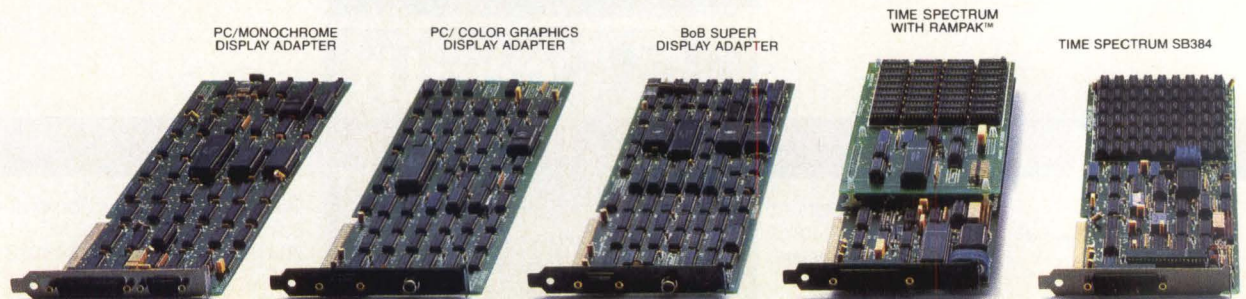
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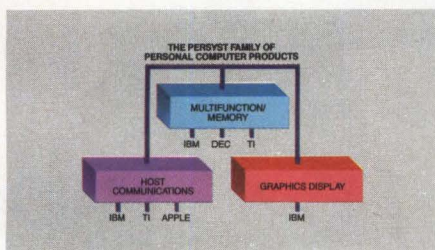
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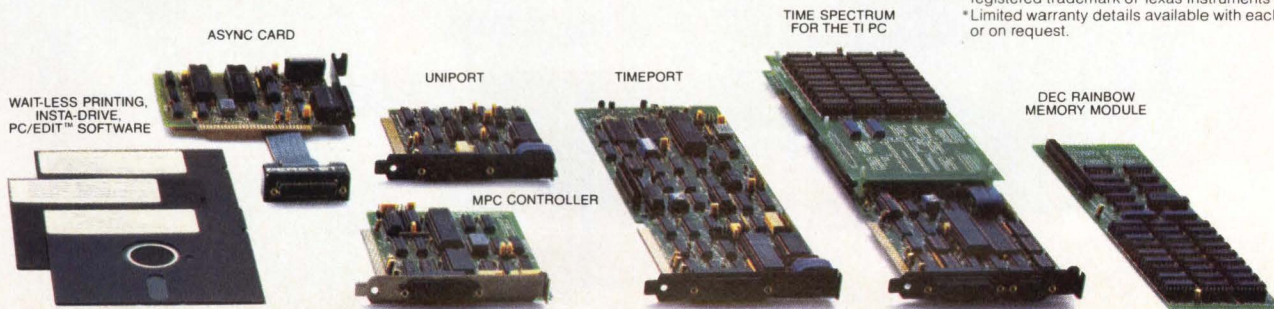
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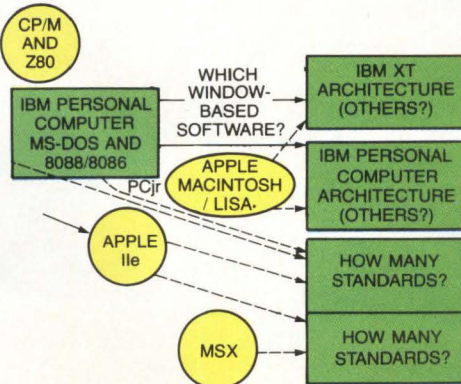
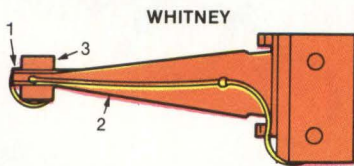
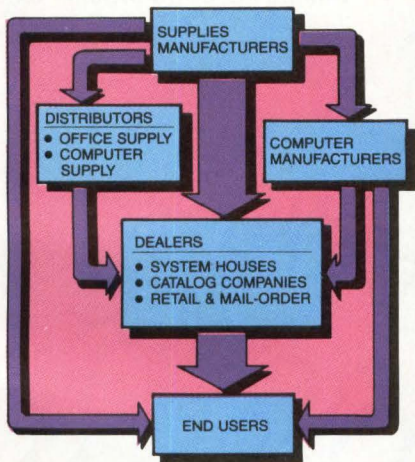
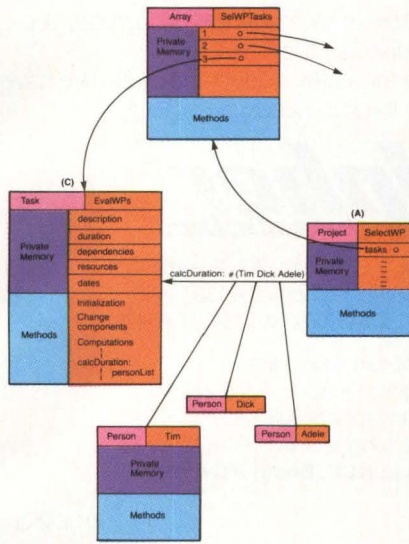
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# FEATURE HIGHLIGHTS

**STATE OF THE MARKET REPORT:** In this special section, *Mini-Micro Systems* takes a look at nine facets of the minicomputer/microcomputer market.



**Distribution channels:** As computer products become more homogeneous and hard to distinguish, many companies are concentrating on *how* to sell as much as *what* to sell. A comprehensive look at the various forms of value-added resellers, wholesalers and retailers begins on **p. 153**.

**Personal computers:** The proliferation of personal computers is pushing sales in almost every area of the computer industry. With IBM and Apple setting the pace, revenues for office-based personal computers jumped 61 percent between 1982 and 1983 while home computer unit shipments doubled. A leading market research company takes a detailed look at the booming market beginning on **p. 167**.

**Software:** Spurred by products such as 1-2-3 and MBA, the integrated software market is attracting more and more newcomers. Unit shipments totaled 630,000 in 1983 and are expected to top 8.5 million in 1987. For a review of current offerings, as well as what to expect in the future, see **p. 177**.

**Software:** Thanks to AT&T, IBM and 20 other manufacturers, shipments of UNIX-based system are expected to double from 1983 to 1984. And UNIX-based application packages have grown from 300 in 1982 to 450 in 1983 with 700 expected in 1984. For an update on the fast-paced UNIX market, see **p. 191**.

**Disk drives:** With more than 40 suppliers jockeying for market share in the small Winchester disk drive arena, the OEM has plenty of products to choose from. To see why shipments are expected to triple over the next three years, see **p. 203**.

**Multuser systems:** The market for less-than-\$30,000 multuser systems is growing at over 30 percent per year, and operating systems and application packages are keeping pace. A snapshot of this increasingly lucrative market begins on **p. 214**.

**Terminals:** Low-cost alphanumeric terminals are losing market share to inexpensive intelligent terminals. A look at what dumb-terminal manufacturers are doing to counteract market share erosion begins on **p. 219**.

**Business graphics:** The total computer graphics market is expected to mushroom to \$22.3 billion by 1987, with business graphics accounting for roughly \$10 billion. For a look at the hardware side of this explosion, check **p. 225**.

**Computer supplies:** Direct-mail specialists are emerging as dominant computer-supply vendors. An overview of the changing distribution patterns for computer supplies begins on **p. 231**.

**DISK SUBSYSTEMS:** Over the past two years, subsystem manufacturers have begun to add value beyond integration and packaging with enhancements such as backup devices and disk caching, giving OEMs higher-performance systems and more uptime. Our survey begins on **p. 237**, with a product table on **p. 243** and a directory of manufacturers on **p. 265**.

**NCC PREVIEW:** What products to look for, what key seminars and instructional conferences are planned, all beginning on **p. 268**.



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# MICROS TRIGGER RAPID GROWTH

**Three classes of marketing channels vie for the lucrative but highly competitive small computer market**

**Gene R. Talsky**  
Professional Marketing Management Inc.

Purchases of small computers by businesses are increasing at annual rates of more than 30 percent. Competition for the business market has led computer manufacturers and resellers to develop more complex distribution networks. These marketing channels have been evolving since the 1950s, when computer manufacturers sold systems through their own sales forces directly to large companies, institutions and government agencies. Three classes of alternative reseller channels have evolved:

- Value-added hardware, software and services companies, including system houses and integrators, OEMs and data-processing service companies;
- Wholesalers that sell manufacturers' systems to resellers and, in some cases, directly to end users;
- Retailers that sell directly to end users and to some value-added resellers (VARs).

## **Value-added channels support systems**

The large direct-selling manufacturers of the 1950s faced two problems: their inability to deliver hardware fast enough (two-year delivery schedules were common) and the lack of a sufficient number of system designers and programmers to implement the systems customers needed. These problems created opportunities for independent companies.

*Service bureaus* provided computer services to companies that were awaiting delivery of systems but had business processing requirements that couldn't wait and to companies that couldn't afford to rent systems. Giants such as IBM Corp. and Xerox Corp. established separate service operations, and Computer Sciences Corp. and

other large system houses also began competing with service bureaus. Some large companies, including Boeing Aerospace Co. and Martin-Marietta Corp., converted their large computer installations into service companies. In the 1960s, timesharing computer systems made possible remote processing in batch mode (remote job entry) and interactive on-line services, thus creating opportunities for service companies.

Service bureaus, including timesharing services, have continued to expand their product lines in the struggle for survival amid increasing competition and the erosion of traditional markets due to the availability of low-cost computers. They package and sell their software for in-house use and provide public and private data communications networks, such as GTE Telenet Communications Corp.'s Telenet and Tymshare Inc.'s Tymnet. Some have established on-line information database services, such as SDC's Orbit and Lockheed's Dialog. Most have become turnkey systems suppliers, selling hardware with their own and with third-party software, while others have become software publishers.

Some services companies have been acquired by large companies such as National CSS by Dun & Bradstreet, resulting in a new generation of comprehensive information services. ADP and McDonnell Douglas Automation Co. (McAuto) have extended and diversified their services and products through numerous acquisitions, as exemplified by McAuto's pending acquisition of Tymshare.

*System houses* also appeared in the 1950s, providing on-site contract personnel and creating operating systems, languages and development tools for manufacturers as well as application software for end users. Informatik General's early success was largely based on sales of its



# STATE OF THE MARKET REPORT:

## DISTRIBUTION CHANNELS

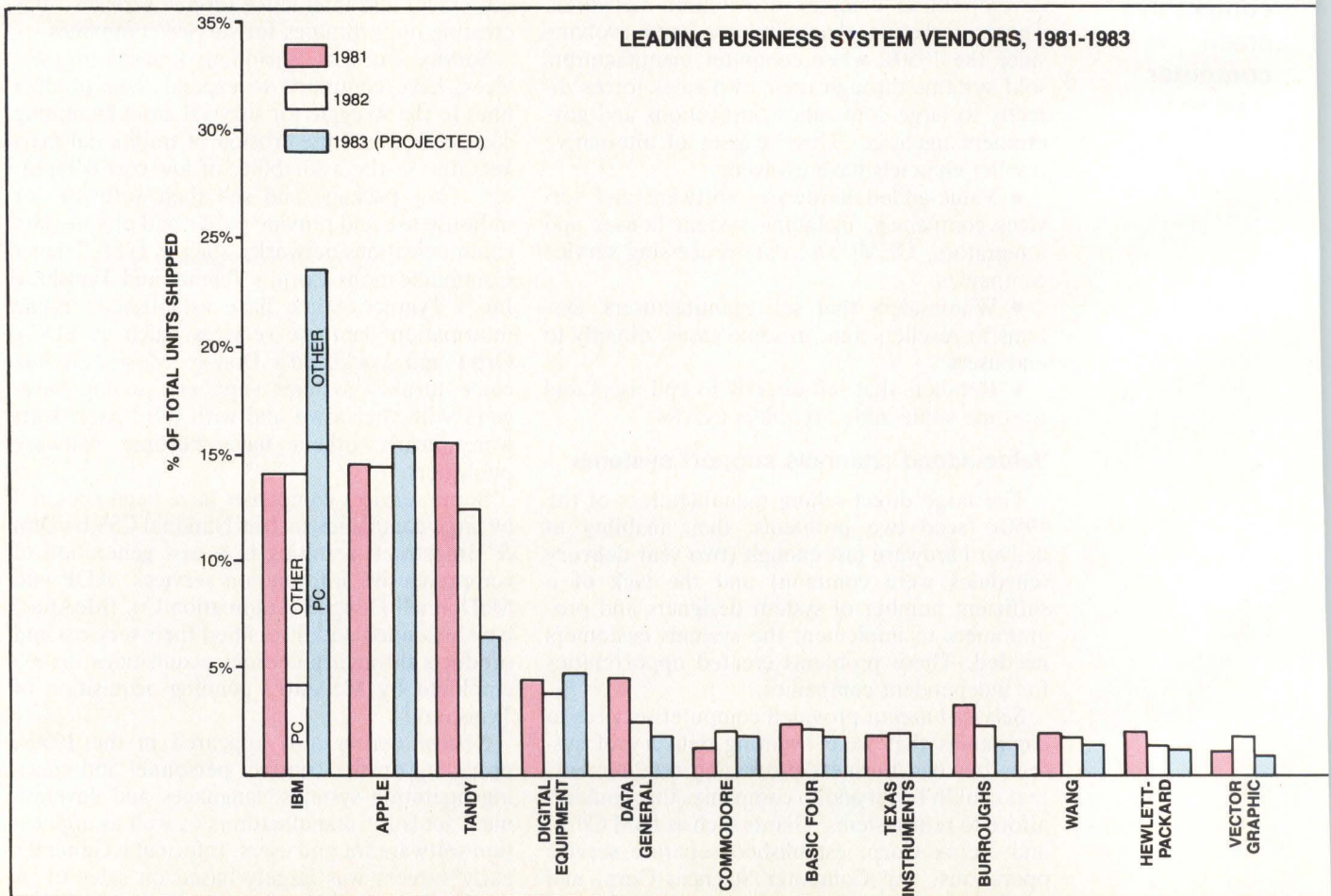
Mark IV product. Planning Research Corp., Logicon Inc. and others specialize in government markets. Monchik-Weber Corp. and Insurance Systems of America are larger examples of the many system houses that serve specialized markets, providing software products, custom development and on-site contract personnel to banking, insurance, brokerage and other industries. Management Science America Inc. provides packaged application software for mainframe operations and, through its acquisition of Peachtree Software Inc., is addressing microcomputer markets. System houses continue to grow and diversify as products become available, opening new markets.

The appearance of minicomputers in the late 1960s triggered an explosion in the number of regional system houses, some of which—by bundling their software with discounted hardware—became OEMs. Their numbers continue to grow, keeping pace with escalating microcomputer sales. Originally, many of these companies were started by system integrators who had developed systems for their employers and then implemented these systems on contract to other

companies. The technical and narrow vertical-market orientation of these system houses, coupled with limited financial resources, usually restricted them to regional operations. Now, with a market potential of more than 3 million small businesses, technically oriented entrepreneurs are starting system houses to provide general business systems for a variety of industries. These system houses license software from manufacturers and publishers, integrating and customizing products to meet customers' needs.

### Wholesalers target resellers

Computer distributors started out by selling terminals to large mainframe users and later added printers and other peripherals. They now handle complete computer systems and software. As distributors started stocking and marketing computer systems to retailers and other resellers, they discovered that it was difficult, if not impossible, to operate profitably on the 10 percent to 15 percent margins available to them in a two-tier distribution structure. Profit margins on low-priced microcomputers do not cover the cost of maintaining large inventories; sup-





porting dealers with technical, marketing, financing and other support programs; and carrying dealers' receivables. Dealers, in turn, need 30 percent to 35 percent minimum discounts, regardless of their volume commitments. Those distributors that have survived have usually obtained outside capital; others have been forced into bankruptcy.

*Software distributors*, such as Softsel Computer Products Inc., work on manufacturers' discounts of as much as 55 percent. Softsel had \$80 million in revenues in 1983 and handled 3,500 products through 6,000 dealers. The company's dealers earned volume discounts as high as 50 percent. Softsel's success is based on its ability to stock and quickly deliver popular software. Although software distributors must inventory many lines of products, their investment, which grows as their business grows, is not as great as that of hardware distributors. In addition, software manufacturers are not as likely to develop their own competitive sales forces for selling to dealers because of the low cost of their products and the low volumes most dealers purchase at any one time.

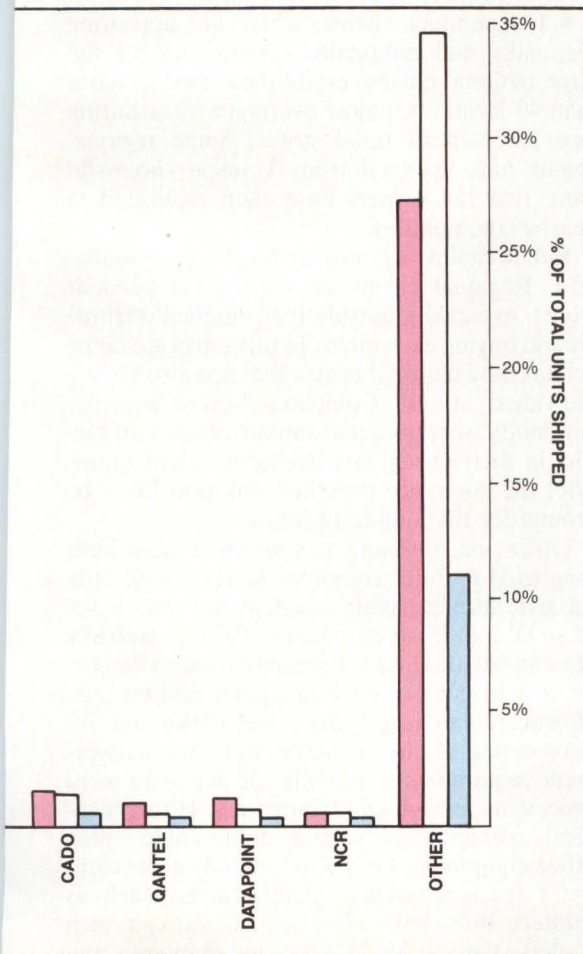
*Industrial electronics distributors* entered the computer field later with sufficient financial resources, seasoned management, experienced marketing organizations and established industrial customer bases. Some acquired computer distributors to gain product lines, technical expertise and new customer bases. Others formed divisions or separate companies to address computer products and markets. They face the same challenges as do computer specialty distributors, but their experience and assets afford them a better chance of success.

There are several classes of distributors, including national and regional operations. Some plan to open or have opened company-owned dealerships, which might compete with the distributors' independent dealers. Others sell directly to end users—high-volume accounts and specialized markets such as OEMs, science, engineering and education. However, their sales forces eventually come into competition with dealers.

Historically, distributors have expanded manufacturers' marketing scope and offered them early revenue through volume purchases. But, with computer systems, distributors frequently experienced delivery and reliability problems, technological obsolescence, manufacturers' financial instability, low-volume dealer purchases, delayed collections and dealer bankruptcies. Such risks have forced them to minimize inventory levels, in turn reducing their value to cash-starved manufacturers. The rapid growth of computer chains also threatens distributors. In addition to opening their own dealerships, the chains are acquiring the independent dealers and small chains that constitute the distributors' markets. Franchisors are also pursuing the conversion of independents to franchises, further shrinking distributor markets.

As retail prices continue to fall due to competitive pressure, hardware manufacturers are finding it more difficult to offer the 40 percent to 50

**Retail chain stores operate in a manner similar to franchises except that management and purchasing are centralized.**



**IBM, Apple and Tandy lead the small business system market.** IBM is rapidly expanding its share, Apple is holding its own, and Tandy is losing market share despite increasing sales and profits. DEC appears to be gaining ground, while market share for DG, Texas Instruments, Wang, HP and others is eroding. Although market share may be shrinking, sales volumes may be increasing due to expanding markets. The widely predicted 1984 fallout will primarily affect the companies that fall in the "other" column.



## STATE OF THE MARKET REPORT:

### DISTRIBUTION CHANNELS

**As retail prices continue to fall due to competitive pressure, hardware manufacturers are finding it more difficult to offer the 40 percent to 50 percent discounts required to support two-tiered distribution.**

percent discounts required to support two-tier distribution. And, if VisiCorp's price reduction for Visi<sup>On</sup> to \$95 is indicative of the effect of growing competition for each market segment, software manufacturers may be facing the same dilemma. Although the marketing needs of start-up hardware and software manufacturers and of peripheral and communications equipment manufacturers assure near-term survival of distributors, their long-range survival will depend on their ability to manage inventories and receivables, the value they add to manufacturers' marketing efforts and the level of support they can offer dealers.

*Manufacturers' representatives* play a major role in the distribution of peripherals, components and accessories, selling to distributors, dealers, OEMs and large-volume end users. The representatives obtain orders from buyers and place them with the manufacturers, for which they earn a small commission. Their underlying value is their customer base. Although they do not provide support or service, they do maintain face-to-face contact with customers on behalf of manufacturers. Although Apple Computer Inc. initially sold its products successfully through manufacturers' representatives—primarily because there were at the time few, if any, computer distributors—representatives have not been effective in selling computers or software. The economies of multiple-tier distribution also work against them. While manufacturers' representatives continue to fill a need, they are even more threatened by the same economic and competitive realities facing distributors.

*Franchisors* typically operate both as distributors to their franchisees and as chain stores supporting company-owned retail outlets. ComputerLand, with revenues of \$963 million from 620 franchised stores in 25 countries, is by far the largest computer franchisor. Its sales of large territorial franchises has led to the development of regional chains with multiple locations established by single franchisees, such as ComputerLand Connecticut with more than nine locations. *Computer Retail News* rated six of ComputerLand's franchised territories among the 25 top-grossing retailers.

In addition to new retailers, franchisors also contract with established independent dealers, offering them access to product lines previously denied them, such as IBM PCs, and better discounts on hardware and software than they could negotiate based on their low-volume operation. Affiliation with a franchisor also gives dealers a stronger market image in their communities because of the franchisor's financial stability and the publicity franchisors generate. In most cases, franchisees also handle products not of-

fered by the franchisor. Specialty franchisor chains, such as the Valmont group of 115 company-owned and -franchised locations, are now springing up. Valmont is concentrating on farm and rural markets, capitalizing on its established distribution network for irrigation equipment in 38 states.

#### **Computer retailers sell directly**

*Computer retail chains* are similar to franchises except that management and purchasing are centralized and the stores are more standardized in appearance and operation than are franchisees. The three types of retail chains competing for national markets are:

- Manufacturer-owned chains, the largest of which is Tandy Corp.'s Radio Shack stores with several thousand locations. IBM, Control Data Corp., Digital Equipment Corp. and other manufacturers are also opening storefront locations.

- Mass-merchandising chains of department and discount stores, such as Macy's, which are opening computer sales departments in their stores or standalone operations, such as Sears Roebuck and Co., which has Business Systems Centers in more than 50 locations.

- Independent chains, which are appearing regionally and nationally. Genra, one of the large national chains, established itself in more than 40 locations almost overnight by acquiring most of Xerox's retail stores. Some regional chains have evolved from a single successful store that the owners have then replicated in nearby communities.

Retail chains are now undergoing consolidation. Regional chains are buying independent stores, expanding outside their original territories and buying each other. In turn, they are being acquired by national chains that are also buying individual stores. Computer buyers consider continuity of service and support important factors in their purchasing decisions. Chain stores offer the assurance that they will most likely be around for the long-term future.

*Office machine and equipment dealers* have long tried to enter computer markets with little success, despite having excellent customer bases of small and large businesses. Dealers typically have strong ties and high credibility with department managers, purchasing agents and owners. However, they lack technical expertise and understanding of clients' accounting and management requirements. Initially, dealers sold word processors as high-end typewriters. Hiring technical computer personnel didn't help most office equipment dealers successfully enter computer markets. Many manufacturers, such as Infotecs Inc., have tried to sell through such dealers. Value-added OEMs, system houses and



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## STATE OF THE MARKET REPORT:

### DISTRIBUTION CHANNELS

**The rapid expansion of computer markets** has stimulated unprecedented growth in the number of hardware and software manufacturers and marketing channels. Consolidation through merger and acquisition is increasing, as is the number of new entrants in each category.

EVERYONE WANTS TO SELL COMPUTERS			
The sellers	No. of companies	No. of systems	Notes, sources
Computer system manufacturers	600	2,064	
• Mainframes	21	174	<i>Data Sources</i> , Jan. 1984 (some companies manufacture more than one type of system)
• Minicomputers	79	280	
• Microcomputers	311	666	
• Others	372	944	
Software manufacturers and publishers	3,500		
• operating/development/DBMS/utilities		4,531	<i>Data Sources</i> , Jan. 1984
• business applications		14,363	
Wholesale distributors	150-200		estimated major national and regional distributors
Specialty computer dealers			
• manufacturer-owned locations	633		<i>Future Computing Inc.</i> , Jan. 23, 1984 (excludes Tandy/Radio Shack stores)
• retail-chain locations	383		
• franchised locations	797		
• independent computer dealers			
multiple-location dealer sites	599		
single-location dealer sites	740		
Mass merchandisers			
• department and discount-store sites	25,000-30,000		<i>Future Computing Inc.</i> , July 1983
Office-equipment dealers	6,000-10,000		Office-equipment and supplies dealers
Value-added system houses/OEMs	3,000-6,000		
Mail-order operations	150-200		

retailers have also established working relationships and joint ventures with these dealers with limited success. However, they remain one of the best sources of qualified leads for computer system sales. The National Office Machines Dealers Association estimates that 40 percent of its members sold computer products in 1983, and it projects that percentage to increase to 50 percent to 60 percent in 1984.

*Independent retail stores* have proven successful for a few entrepreneurs. For others, profits have proved elusive, and many stores have gone out of business. Product lines are key to a store's volume. IBM and Apple product lines assure a continuing stream of sales of systems, add-ons and upgrades. Other product lines are easier to obtain but don't sell nearly as well. Manufacturers' and distributors' discounts are based on a store's volume and must be 30 percent to 35 percent to assure sufficient profit margins to support operations and to maintain enough inventory to deliver products at the time of sale or shortly thereafter.

Independent retail stores must provide customers with sufficient education, training and support and must maintain and support a customer base while attracting new prospects through referral. Salespeople frequently lack the knowledge and experience to help prospects understand how an inventory system they see

demonstrated meets their business requirements. Frequently, they cannot help customers convert manual accounting records or customize software. Competition from other independents, retail chains, franchises, distributors and discount houses increases independents' challenge and decreases their profit margins.

Location, product lines and service are the main ingredients of a successful independent computer retail store. With all the pressures these stores face, many are selling out to chains and converting to franchisees. Others are joining associations that provide access to better product lines, larger discounts through group volume purchases and cost reductions through group insurance and other programs. In spite of these options, the independent single-location retailer is an endangered species.

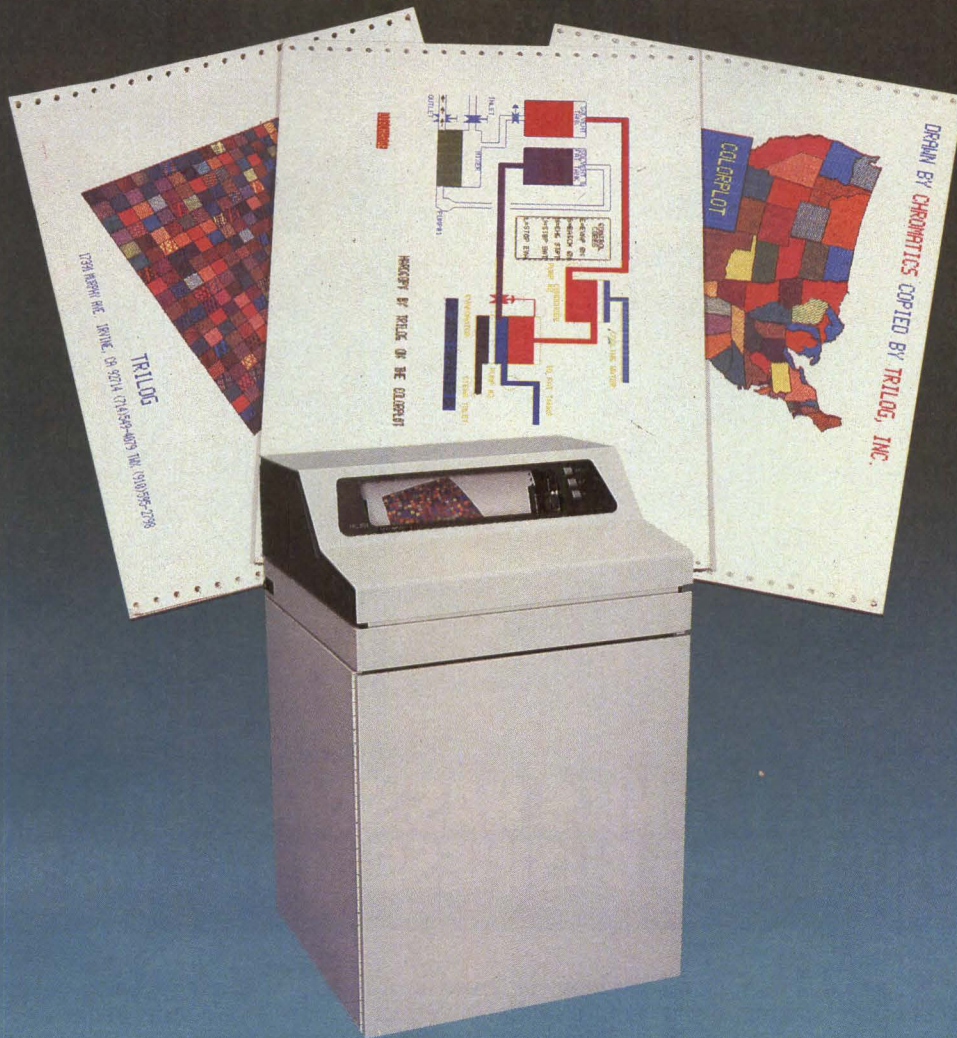
*Discounters* include stores such as 47th Street Photo, New York, and the several hundred regional and national mail-order houses. Discounters are the bane of most manufacturers and resellers. Even closely policed products can appear in discounters' ads as a result of bargain purchases from distributors or other dealers with excess inventory or cash-flow difficulties.

When purchasing from discounters, buyers must know exactly what they want and make sure their order is complete and correct. They should make no assumptions regarding model



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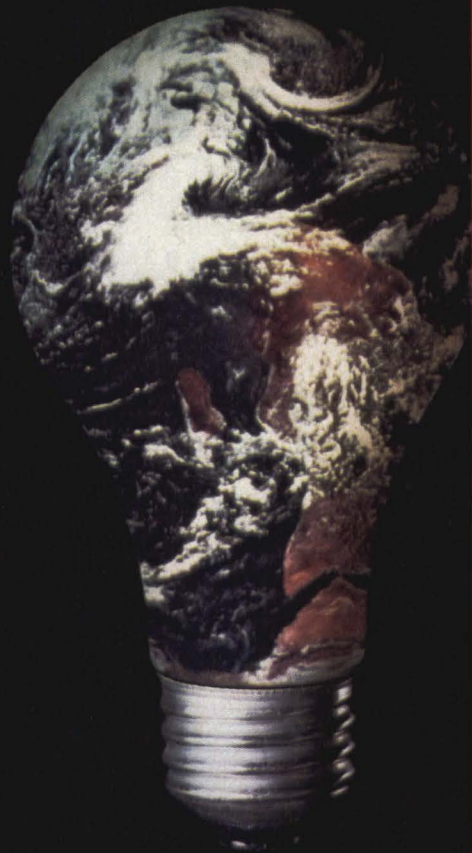
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# STATE OF THE MARKET REPORT:

## DISTRIBUTION CHANNELS

numbers, peripherals, cables or software. Discounters offer virtually no product support. By publicizing discounted prices of even the most current products, they disrupt manufacturers' relations with dealers and have a negative impact on dealer margins by offering lower prices to the public. However, to manufacturers that have excess inventory or are introducing a model and want to sell large quantities of current inventory fast, discounters can be very helpful.

### New marketing channels emerge

*In-house stores*, established by some large companies and institutions, offer employees a limited variety of computer systems for personal use. The stores usually pass on to the employees the discounts the company has negotiated with vendors. Companies usually set up a small showroom in an office and assign staff members to assist employees. The computers offered are typically those the company has approved for in-house departmental use. Staff members can assist in the selection of appropriate hardware and software for personal use and in-house business applications and provide training for in-house users. The federal government contracted an independent dealer to set up such a retail operation for individual departmental purchases. That operation sold several million dollars worth of computer systems in its first year.

Some companies stop short of setting up stores; instead, they arrange for their employees to purchase hardware and software from their vendors at the corporate discounts. Apple has established an aggressive marketing program for educational institutions, offering them better discounts than it offers its highest-volume deal-

ers for school, faculty and student purchases. Apple provided Drexel University students and faculty with nearly 3,000 Macintosh computers at \$1,000 each—less than one-third the retail price. These arrangements sometimes backfire because resellers have started advertising to buy systems purchased by students. This allows students to make a profit and dealers to obtain systems at a greater-than-normal discount.

*Telemarketing*, as implemented by Interactive Telemarketing (ITM), is one of the newest distribution channels. ITM evaluates microcomputer software and products, provides its evaluations and sells products from its catalog through an on-line service. The company addresses corporate markets as well as individuals. For example, it has "preferred vendor" status with Pepsico Inc. By combining realistic and meaningful evaluations, a broad line of quality products and responsive support, telemarketing could have a major impact on sales of peripherals, software, accessories and supplies.

*Cross-licensing clearinghouse operations*, which have the potential of becoming one of the most important marketing channels, are best exemplified by The Office Manager (TOM), Seattle. Originally a consulting and software company, TOM began licensing its general business and vertical application packages to other system houses for resale. Now, it no longer sells directly to end users but has an international network of more than 300 licensees, providing them with support programs usually offered by only large manufacturers.

TOM offers licensees its Speed proprietary development language for Wang Laboratories Inc.'s 2200 and VS systems, plus general busi-

**Discount-schedule complexities** are compounded by the number and different types of marketing channels competing for the same business while buying from and selling to each other.

THE ECONOMICS OF DISTRIBUTION										
% DISCOUNT TO: FROM:										
	Hardware Mfr.	Private-label OEM	Publisher	Distributor	Retail chain	Franchisor	Retail dealer	Value-added systems house/OEM	Discount store/mail order	Volume end user
Hardware manufacturer		50-60		35-50	35-50	35-50	10-40	5-35	35-75	5-35
Software manufacturer	50-85	50-85	50-85	40-60	40-60	40-60	35-50	35-50	40-85	5-50
Private-label OEM				35-50	35-50	35-50	10-40	5-35	35-75	5-35
Publisher	50-85	50-85	50-85	40-60	40-60	40-60	35-50	35-50	40-85	5-50
Distributor					25-50	25-50	15-40	5-35	15-40	5-35
Retail chain								5-15	50-?	5-35
Franchisor							15-40	5-25	50-?	5-25
Retail dealer								5-25	50-?	5-25
Value-added system house/OEM										5-25
Discount house/mail order										10-75



## STATE OF THE MARKET REPORT:

### DISTRIBUTION CHANNELS

**System houses appeared in the 1950s providing on-site contract personnel and creating operating systems, languages and development tools for manufacturers, as well as application software for end users.**

ness software and several vertical packages, including a restaurant system, a construction accounting and management system, a property-management package and an office-automation/word-processing package. It trains licensees in all business and technical aspects, participates in computer industry and vertical market trade shows, sponsors cooperative advertising in addition to its own national advertising campaign and provides all the support and services needed to assure the success of licensees.

TOM became a cross-licensing clearinghouse by selling software written by its licensees and other authors through its licensee networks, thus creating a two-way stream of revenue for its licensees. The first revenue stream is generated when a licensee sells TOM software, which is bundled with customization and support, to end users. The second source of revenue is created when a licensee distributes its proprietary package through the TOM network. To qualify, developers must conform to TOM's stringent development and documentation standards, which include implementing the developer's program in Speed and obtaining enough installation references to verify that the system works and meets user needs. This two-way path for products to and from qualified licensees distinguishes clearinghouses from software publishers and other marketing channels.

TOM has expanded the marketing horizons of its licensees by developing TOMBASIC software, which enables products developed under Speed to be ported without conversion or modification to UNIX and C-based minicomputers and microcomputers. The software runs on systems from Fortune Systems Corp., Altos Computer Systems, Prime Computer Inc., Perkin-Elmer Corp., Hewlett-Packard Co., Apple and a growing list of other manufacturers. With this capability, manufacturers can acquire the proven application software they have been missing, and licensees can sell to a larger market because of expanded hardware environments.

The clearinghouse approach not only provides a large distribution network for software but also places the software in the hands of well-qualified resellers experienced in dealing with the corporate market and who understand accounting and business. Through TOM's training, these resellers can learn the aspects of the vertical markets they will be addressing and the software they will be customizing, installing and supporting to meet customer needs.

Other established software vendors are moving toward the clearinghouse approach, but none have TOM's combination of products, support and cross-licensing distribution capabilities. Dealers trying to meet the needs of small- and

medium-sized businesses could profit from establishing joint ventures with licensees in such networks or by becoming licensees themselves.

#### Short-term marketing trends

Even with phenomenal computer market growth projections, the rapidly growing, complex, intertwined and overlapping networks—all competing for the same markets—would justify forecasts of fallout this year. The 2,000 largest U.S. companies purchased more than \$1.4 billion worth of microcomputers in 1983; smaller companies bought \$6.7 billion worth of hardware and software. Future Computing Inc., a market research concern, predicts that the 2,000 largest companies will buy \$3.8 billion worth of microcomputer hardware and software in 1985. However, the small business market potential is much greater. Studies by Focus Research Systems, based on interviews with more than 35,000 business owners and managers, indicate that only 16 percent of the more than 3 million companies with fewer than 500 employees and less than \$25 million in revenues had installed computers in mid-1983, and that 900,000 more companies will buy more than 1 million additional computers by mid-1985. Even with a projected 15 percent decline in prices, Focus forecasts, small businesses will spend \$8.8 billion on computer systems in 1984.

Marketing channels continue to evolve and grow to meet the needs of these runaway markets. However, they face the same challenges confronting manufacturers—how to deal profitably in a highly competitive environment. □

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**Gene R. Talsky** is president of Professional Marketing Management Inc. (PROMARK), Old Lyme, Conn. PROMARK provides strategic planning, business development and marketing planning services for hardware, software and service companies. Talsky has served in management positions with IBM Corp., Computer Sciences Corp. and Informatics General and has started four successful data-processing companies. He is listed in *Who's Who of Finance and Industry* and *Who's Who of Corporate Acquisitions*.

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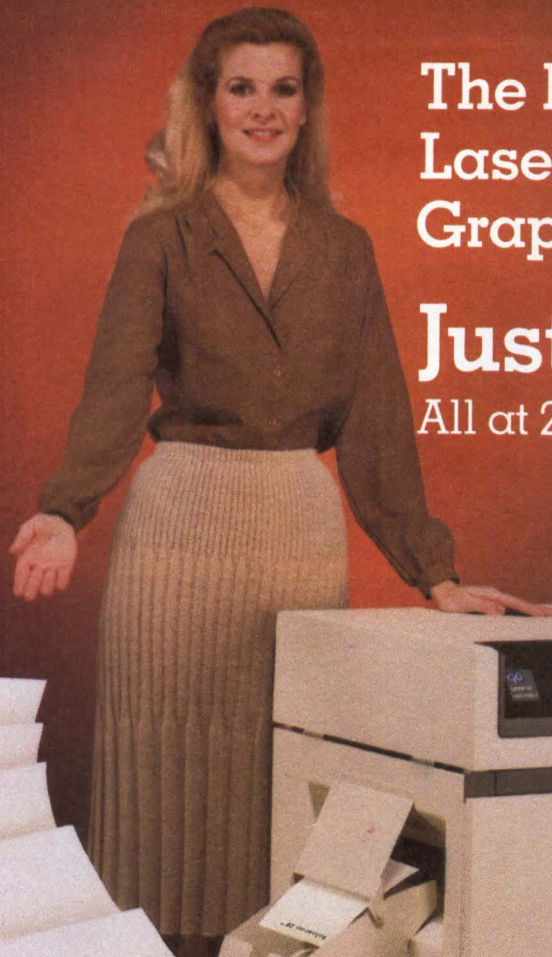
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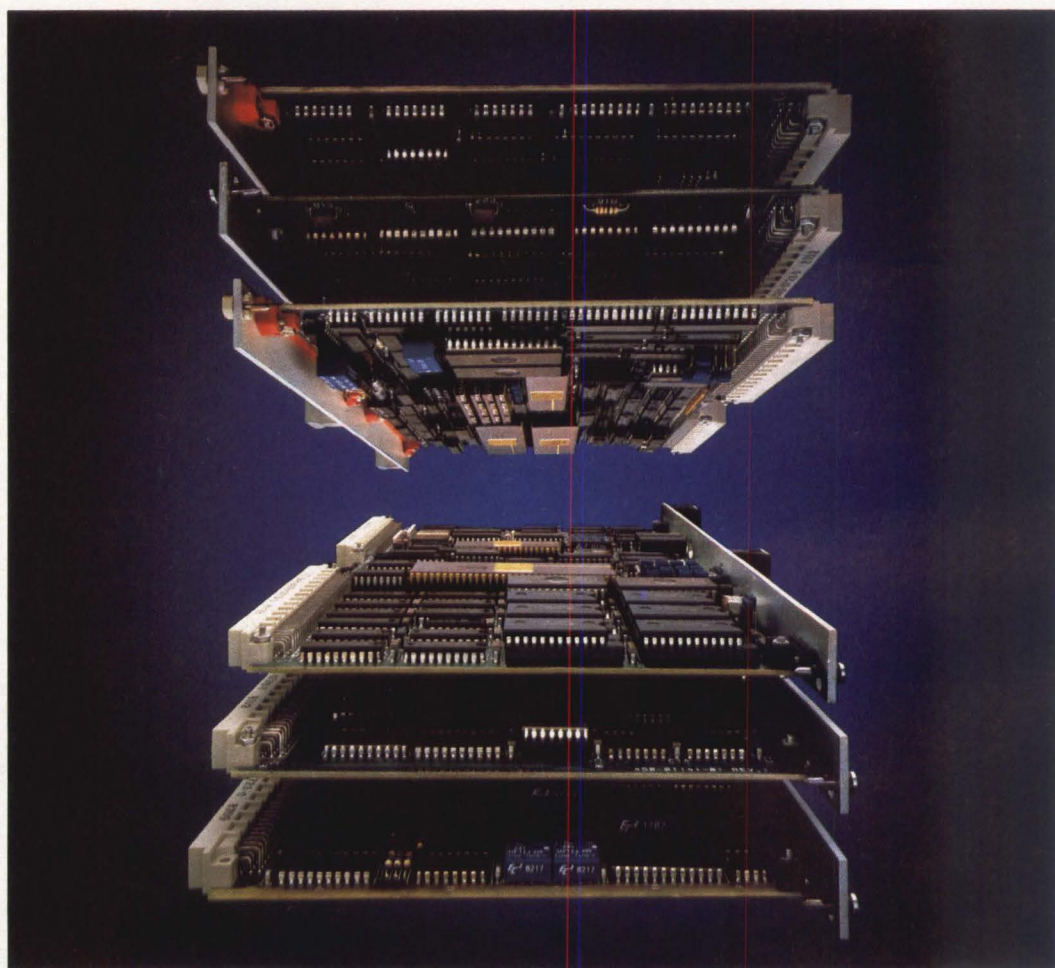
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# IT'S STILL FAST TIMES FOR A HOT INDUSTRY

**IBM and Apple have thrown down the gauntlet with de facto standards, powerful hardware and extensive software libraries**

**Dr. Egil Juliussen, Future Computing Inc.**

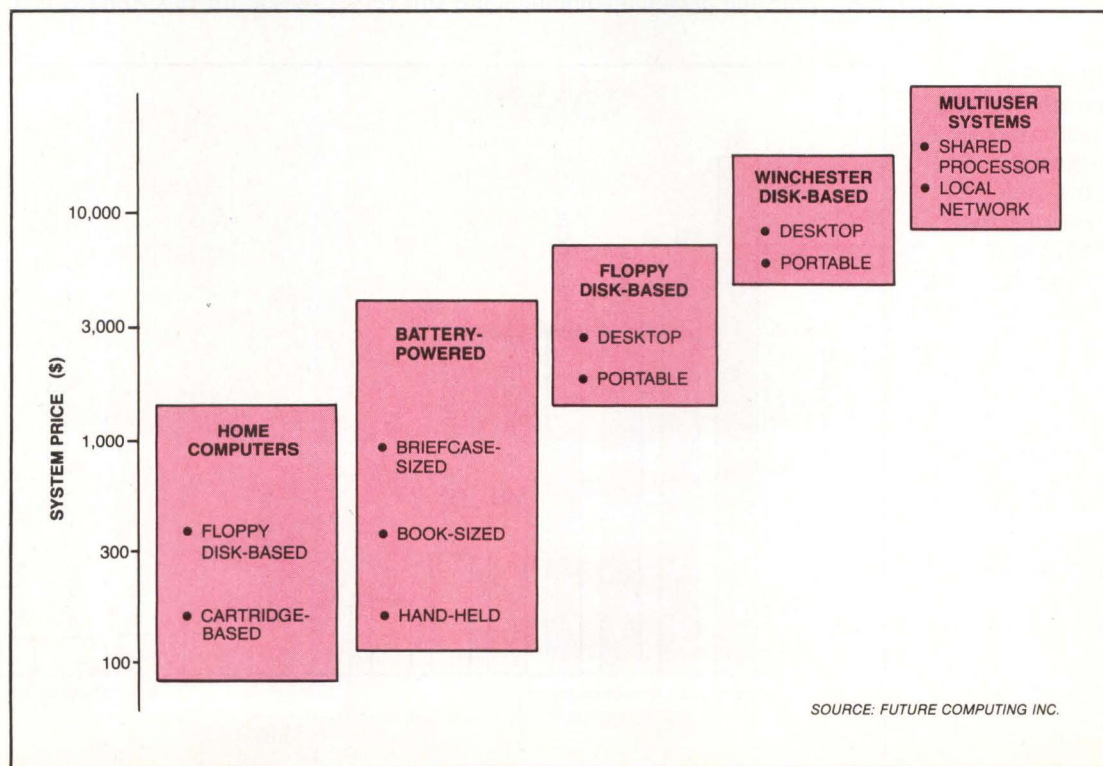
The personal computer industry is less than 10 years old but is already larger than the minicomputer industry and should surpass the mainframe industry by the late 1980s. With such a steep growth pattern, it is understandable that a large number of companies continue to enter the personal computer business, which includes office personal computers and home computers.

There is no exact definition of a personal computer, but Future Computing Inc. defines it as a processing unit with an entry-level price of

less than \$10,000. Personal computer hardware and software products usually incorporate de facto industry standards, even though some start out as proprietary systems. Personal computers are sold via independent third-party distribution channels.

### Product segments simplify market

From simple beginnings as hobby computer kits, personal computers have grown to encompass a complex spectrum of products (Fig. 1). Home computers, which comprise the least expensive product segment, are disk- or cartridge-



SOURCE: FUTURE COMPUTING INC.

**Fig. 1. Personal computer product classes range from cartridge-based home computers selling for approximately \$100 each to multiuser systems selling for more than \$10,000 each.**



## STATE OF THE MARKET REPORT:

### PERSONAL COMPUTERS

based. Most floppy disk-based home computers also have a cartridge, and most cartridge-based home computers can be expanded by adding a floppy disk. Hence, the two categories overlap. Atari's 600 XL is an example of a cartridge-based home computer. IBM Corp.'s PCjr has both a cartridge and a floppy disk model. Growth in the home computer market is shifting toward the high end, and portable home computers should appear soon.

Battery-powered products are the newest category of personal computers. Hand-held or pocket computers, which evolved from programmable calculators, were the first battery-powered personal computers. They have a single-line display, limited peripheral expansion and are priced at a few hundred dollars or less. Radio Shack's TRS-80 pocket computer is an example of this type of product.

Book-sized personal computers, such as Radio Shack's TRS-80 model 100, have multiple lines of display, more sophisticated peripheral expansion and sell for approximately \$1,000 each. Briefcase-sized computers, such as Gavilan Computer Corp.'s microcomputer, also have multiple display lines—usually eight—a removable mass-storage device, a microfloppy disk or a bubble-memory cartridge.

Floppy disk-based personal computers come in desktop and portable versions. Some portable products have external battery packs that allow a few hours of battery-powered operation. However, portable personal computers are still very

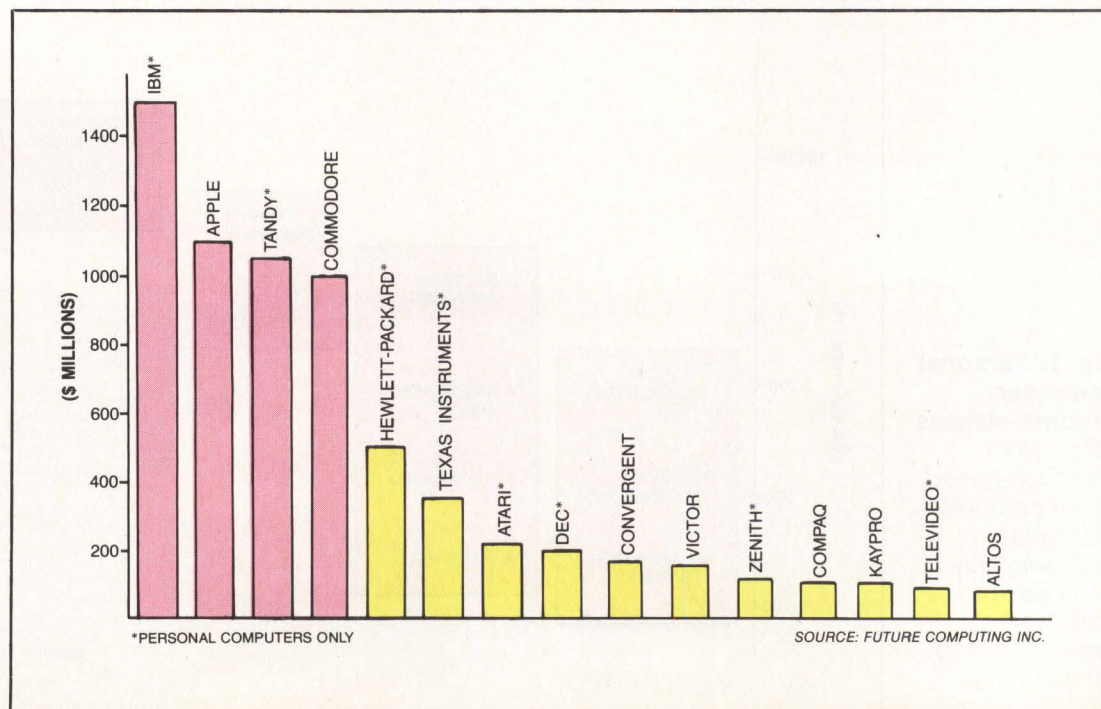
different from battery-powered products in specifications, capabilities, software base and market dynamics. As the technology evolves, the line between portable and briefcase personal computers will blur. The IBM PC is a desktop floppy disk-based personal computer, and Compaq Computer Corp.'s Compaq is a portable floppy disk-based personal computer.

Personal computers that use Winchester disks usually come in desktop versions, as does the IBM PC XT. Winchester disk-based personal computers have seen steep price declines in the last year. The first portable models of these systems, such as the Kaypro 10, appeared last year.

Multiuser personal computers come in two configurations: shared-processor systems and local-area networks (LANs). Shared-processor systems are based on Winchester disk-based personal computers. They are similar to multiuser minicomputers, but they rely on a personal computer software base. Shared-processor systems and minicomputers overlap, and the distinction will continue to blur if the UNIX operating system becomes a major factor in the industry.

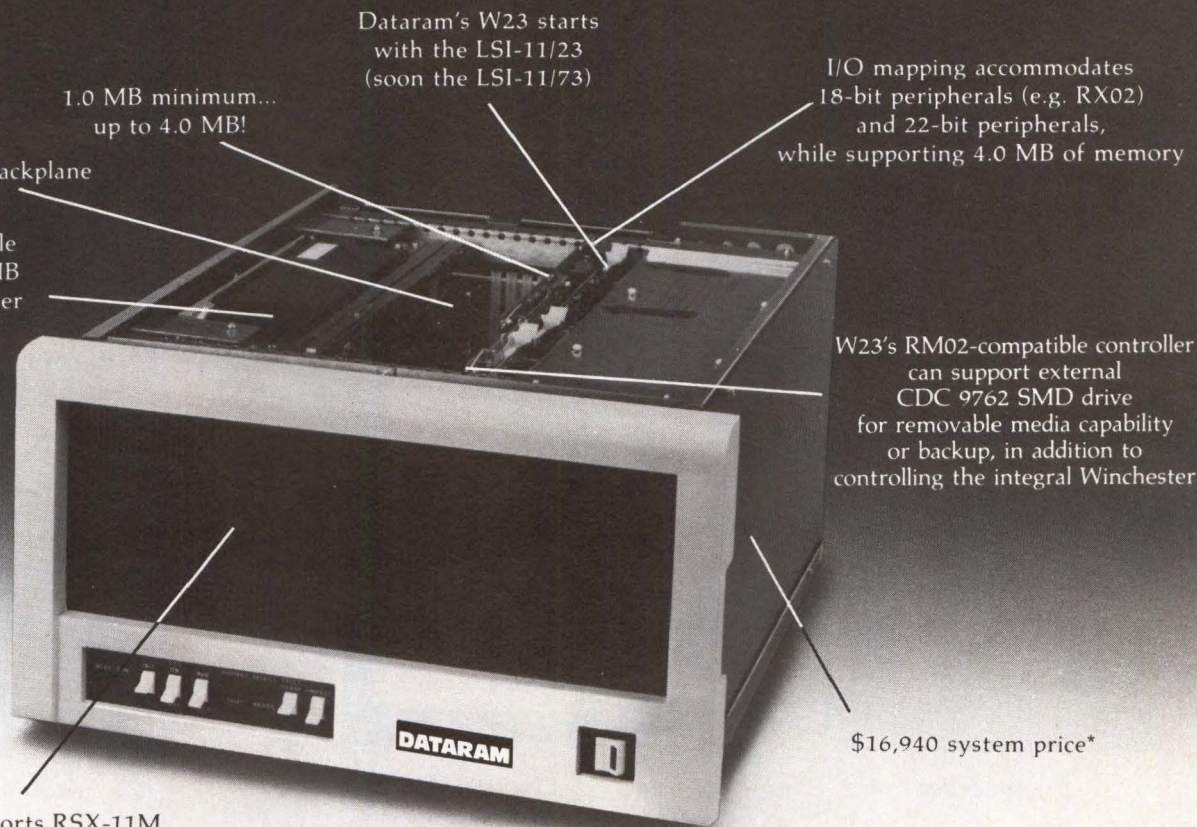
In LANs of personal computers, a user has all the advantages of the personal computer with the information- and cost-sharing benefits of multiuser systems. Future Computing believes that LANs will grow in importance, stunting the growth of shared-processor systems. The main reason for this trend is that LANs are an after-

**Fig. 2. Four manufacturers dominated U. S. personal computer revenues in 1983.** On a worldwide basis, companies such as NEC, Fujitsu and Sharp would make the list. NEC, for example, is the fifth-largest personal computer manufacturer.





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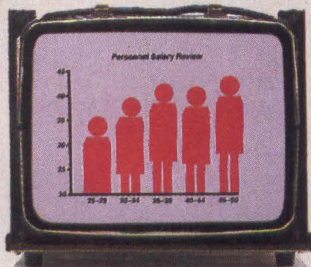
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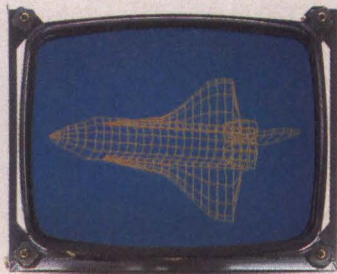
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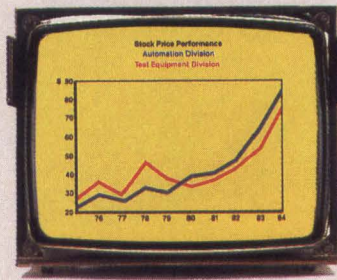
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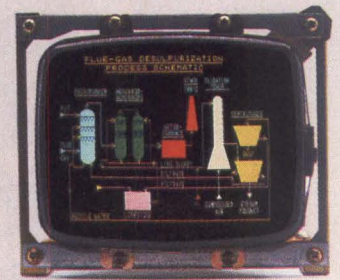
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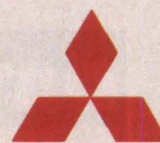
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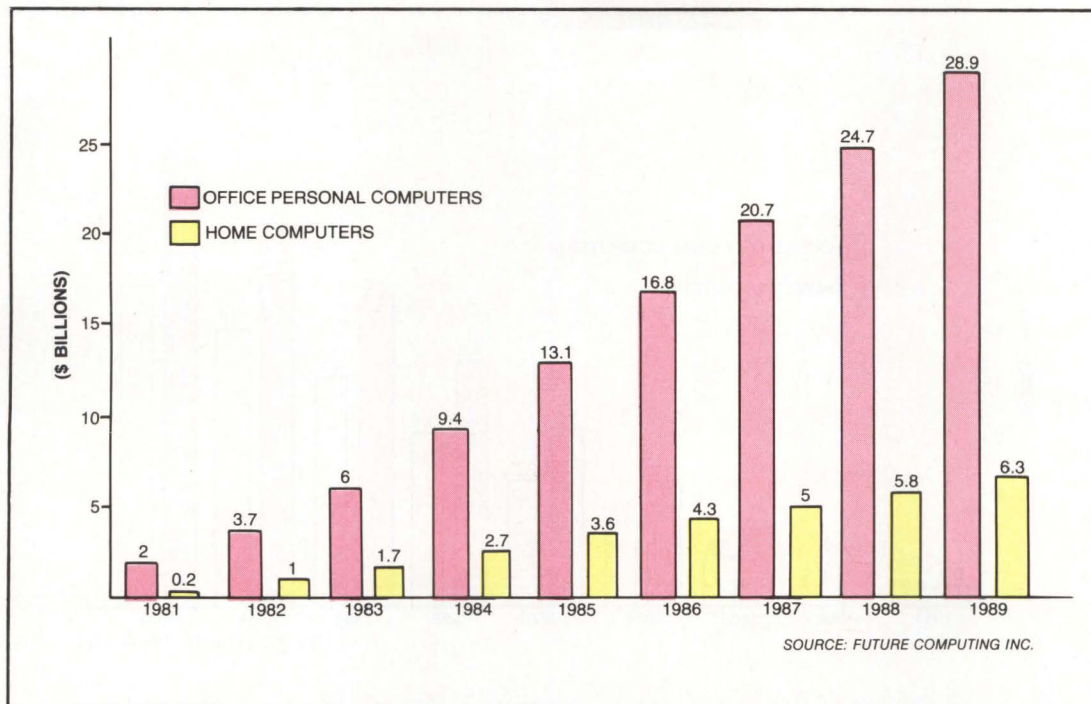
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## STATE OF THE MARKET REPORT:

### PERSONAL COMPUTERS



**Fig. 3. U.S. revenues for office personal computers and home computers, excluding software revenues, will have 30 percent and 24 percent compound annual growth rates, respectively, between 1983 and 1989.**

market solution to information sharing for users of personal computers.

#### IBM dominates the market

IBM had the largest personal computer revenues—\$1.5 billion—in 1983 (Fig. 2). The company's personal computer revenues tripled from 1982 to 1983. Future Computing estimates that 8 percent of IBM's 1983 revenues came from software and that only about 12 percent to 15 percent of its personal computer revenues came from international sales—a percentage expected to increase this year. Future Computing also predicts that IBM's personal computer revenues will double in 1984, while unit shipments will more than triple from about 500,000 PC and XT units shipped in 1983.

Apple Computer Inc. was the second-largest personal computer manufacturer last year with sales of \$1.085 billion—a 70 percent increase over 1982. Apple's software revenues were about 7 percent of sales, and international sales accounted for approximately 22 percent of revenues. Future Computing projects a revenue increase of 55 percent to 60 percent for Apple in 1984.

Radio Shack had the third-largest personal computer revenues—nearly \$1 billion—in 1983. However, its revenues are at the end-user spending level, while IBM's and Apple's revenues are at the factory level. The difference is in the margin that goes to the various distribution channels. The result is that Tandy's manufactur-

er-level market share is overstated. Its software revenues accounted for nearly 9 percent of its personal computer revenue in 1983; international revenues were about 15 percent.

The success of Commodore Business Machines Inc. in the home computer and international markets brought it revenues of nearly \$1 billion in 1983, up from \$350 million in 1982. Commodore had the strongest international presence with more than half of its sales going to non-U.S. customers.

Hewlett-Packard Co.'s many personal computers contributed more than \$500 million to its revenues. Personal computers include the HP75/HP80 family and the HP100 family, which includes the recently announced HP150. HP also had very strong international sales that accounted for nearly 50 percent of its total revenues.

Texas Instruments Inc. had more than \$300 million in revenues from the 99/4A home computer and the TI Professional business computer. Although its home computer sales were very unprofitable, the TI Professional's contribution of nearly \$100 million was a very strong showing for a first-year product.

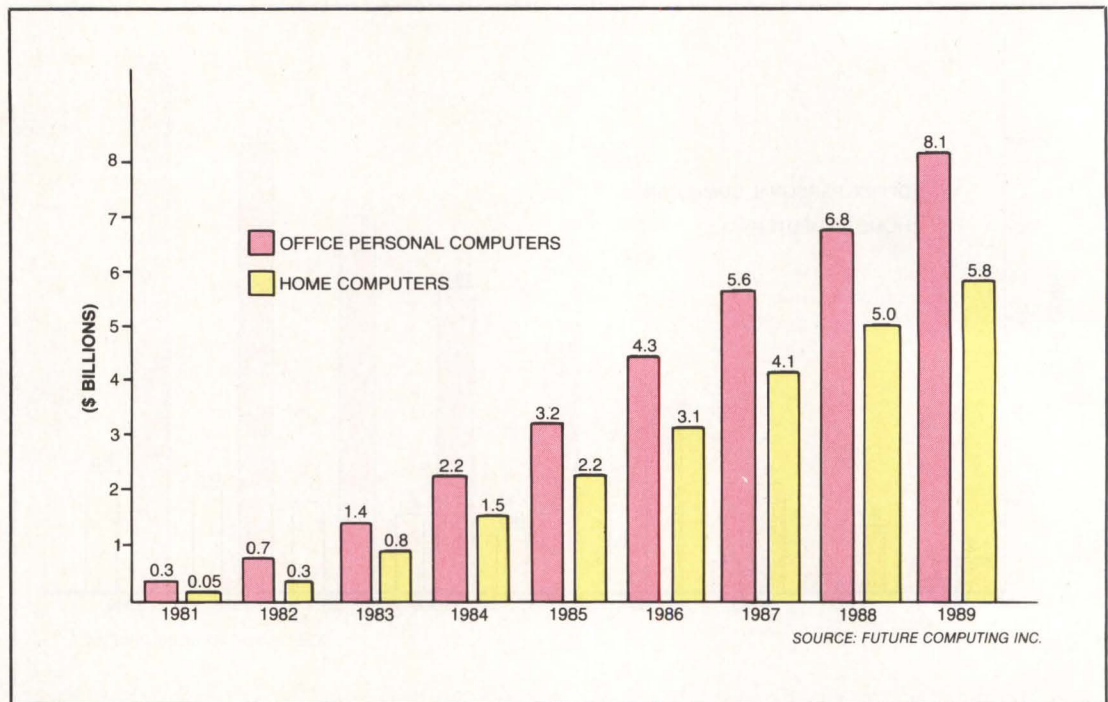
The remaining nine companies out of the top 15 had revenues in the \$80 million to \$200 million range. However, the list will probably change considerably in 1984. For example, Victor Technologies Inc. has filed for protection under Chapter 11 of the federal bankruptcy law, and TI will not have any home computer revenues this year because it has discontinued production of the 99/4A.



## STATE OF THE MARKET REPORT:

### PERSONAL COMPUTERS

**Fig. 4. The U.S. software market for office personal computers and home computers will have 34 percent and 39 percent compound annual growth rates, respectively, between 1983 and 1989.**



If worldwide manufacturers were considered, several Japanese personal computer companies, such as NEC Corp., Fujitsu Ltd. and Sharp Electronics Corp., as well as a few European companies, would have made the list of the top 15. For example, NEC was the fifth-largest personal computer company in the world in 1983.

#### Hardware market explodes

The hardware market for personal computers grew substantially in 1983 (Fig. 3). The hardware market for office personal computers increased from \$3.7 billion in 1982 to \$6 billion in 1983—a growth rate of 61 percent. By 1989, the U.S. office personal computer hardware market is expected to grow to nearly \$29 billion at the end-user spending level, with a compound annual growth rate of 30 percent between 1983 and 1989. Despite this strong showing, the after-market stemming from the installed base will probably grow faster than the market itself. In 1984, the after-market will account for 20 percent of the market, increasing to 30 percent in 1989.

The home computer hardware market grew from \$1 billion in 1982 to \$1.7 billion in 1983. In the same time, the number of units shipped more than doubled, going from 2.3 million units in 1982 to 5 million in 1983. Future Computing expects the growth rate of home computer hardware to slow in 1984, especially in units sold. About 6.5 million home computers will be sold in the United States this year at 30 percent growth over 1983. Most of that growth will occur at the high end. Given smaller price decreases at

the low end, Future Computing projects an increase in the average system price. Thus, the home computer hardware market will grow 64 percent to \$2.7 billion in 1984. The after-market is even more important in home computers. In 1984, 22 percent of the market will be from after-market sales, and the after-market share will increase to nearly 36 percent by 1989.

The home computer hardware market will grow more slowly than the office personal computer hardware market. By 1989, the home computer hardware market will be nearly \$6.3 billion, with an estimated compound annual growth rate of 24 percent between 1983 and 1989.

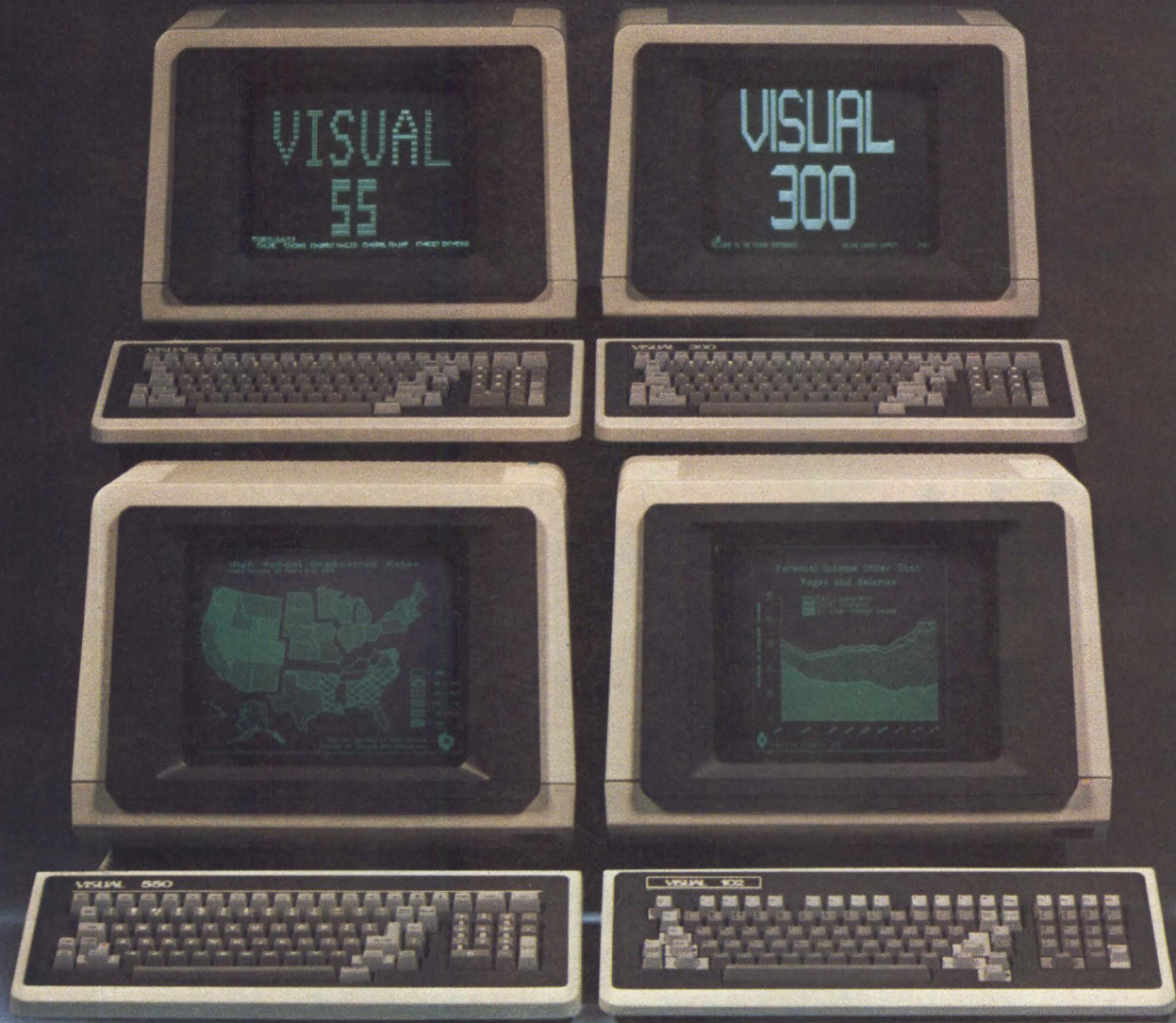
#### Tools highlight software market

A large variety of software is available for personal computers, including business, productivity, education, scientific/engineering, entertainment and system software. Productivity software, the most important application segment, includes spreadsheet, word-processing and database-management packages. Graphics and data communications are growing in importance, and there is a market trend toward combining productivity applications into single products, as in Lotus Development Corp.'s 1-2-3 integrated package.

The office personal computer software market doubled from 1982 to 1983, from \$0.7 billion to \$1.4 billion (Fig. 4). Future Computing projects growth of 57 percent this year to \$2.2 billion and a nearly sixfold increase in 1983 to 1989, to \$8.1



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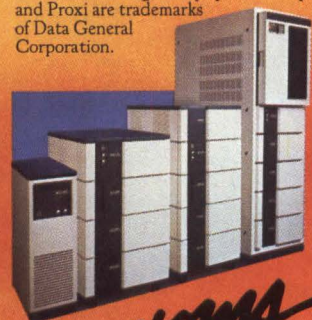
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## STATE OF THE MARKET REPORT:

### PERSONAL COMPUTERS

billion. The compound annual growth rate for the six-year span will be 34 percent. Software will increase as a percentage of the total office personal computer market. In 1983, software constituted 19 percent of the \$7.4 billion office personal computer market. By 1989, it will constitute 22 percent of the \$37 billion U.S. office personal computer market.

The home computer software market grew from \$0.3 billion in 1982 to \$0.8 billion in 1983, a 167 percent rate. The 1984 growth rate will slow considerably but will still show an impressive 88 percent increase to \$1.5 billion. Home computer software will continue to grow faster than hardware and, by 1989, will be a \$5.8 billion business. Compound annual growth rate is projected at 39 percent between 1983 and 1989. Software constituted only 32 percent of the total home computer market in 1983, but that percentage should increase to 48 percent in 1984. By 1989, the software market will be almost as large as the hardware market.

Home computer software is growing as a portion of the personal computer software market. In 1983, home computer software constituted 36 percent of the personal computer market, and office software had the remaining 64 percent. In 1984, home computer software will have 40 percent of the market and office personal computer software will have 60 percent, and by 1989 home computer software will increase its share to 42 percent.

#### Standards haze begins to clear

The drive for standards is one of the strongest forces in the personal computer industry. De facto standards are not frozen and will continue to evolve with advancing technology. There will also be multiple standards—usually a primary and a secondary standard.

One standard, based on the CP/M-80 operating system and the Z80 microprocessor, is still alive but slowly declining in importance for office personal computers. However, the CP/M operating system, available on a ROM chip, is a good candidate for a home computer standard. The Apple II/Ie is another standard, despite Apple's effort to keep it proprietary. The Apple IIe is a hardware- and software-system standard, not just an operating-system standard. The IIe is well-positioned to become a home computer standard. The most important standard is the IBM PC, which is a hardware- and software-system standard.

The UNIX operating system, especially in combination with the 68000 microprocessor, is receiving attention as the next possible personal computer standard. UNIX will undoubtedly be very important in the minicomputer industry

and at the high end of the microcomputer market. But the characteristics of today's UNIX do not fit the personal computer market. Although UNIX has strengths as a shared-processor, multiuser system, LANs will dominate multiuser personal computer systems. Furthermore, UNIX is only an operating-system standard, but the personal computer industry needs hardware- and software-system standards that can take advantage of integrated, window-oriented, user-friendly application software. Can UNIX evolve to fill personal computer requirements? It is possible, but the probability is low.

For Winchester- and floppy disk-based personal computers, the primary standard is the IBM PC and XT architecture, which will continue to evolve and will be considerably more powerful by the end of 1984. There is room for another standard in this area, and the Apple 32 family, consisting of the Macintosh and Lisa, is a well-positioned contestant. However, Apple first must be willing to have a second source before it can become a standard.

The home computer industry has no standards. Contestants include the IBM PCjr, Apple IIe and CP/M.

The proliferation of personal computer products is having an impact on many other segments of the electronics and computer industry. Entertainment home computers are rapidly replacing or merging with video game machines and stunting the growth of dedicated videotex terminals. Videotex is expected to become an application of home computers.

Battery-powered personal computers are slowly penetrating dedicated and programmable terminal applications. Pocket, or hand-held, computers will replace hand-held terminals, or data-collection devices, and programmable calculators. Dumb terminals will lose market share to battery-powered and floppy disk-based personal computers. These personal computers have affected dedicated word-processing systems and have made inroads into the low-end minicomputer and small business computer markets. In the next few years, personal computer LANs will start eroding the popularity of multiuser minicomputers and small business computers.

The success of the personal computer industry relative to computer industry segments is due to a variety of factors, including the availability of application software, investment in manufacturing and technology and the efficiency of distribution channels. □

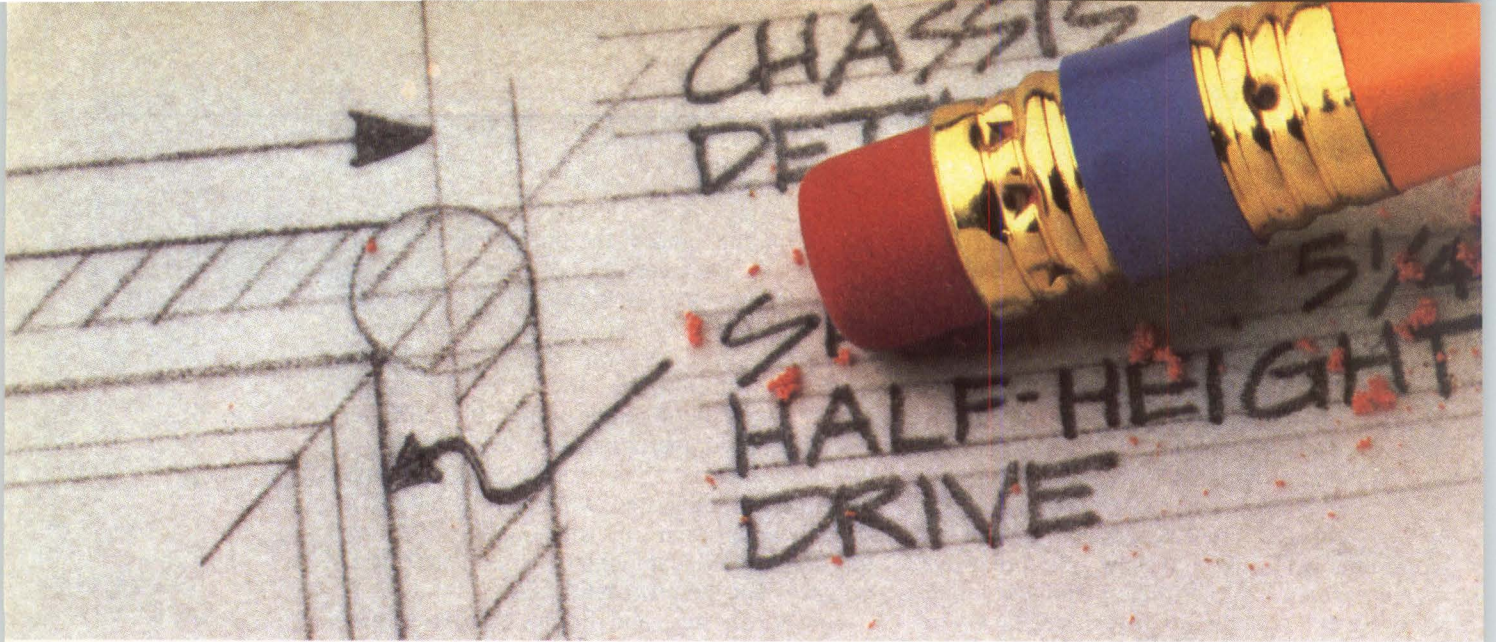
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Interest Quotient (Circle One)  
High 813 Medium 814 Low 815

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**Dr. Egil Juliusen** is chairman of Future Computing Inc., Richardson, Texas, which specializes in market research and business seminars for the office personal and home computer industry. Juliusen is co-author of Future Computing's newsletter, *FutureViews*, and market research reports. Previously, he was product planner for microprocessors, minicomputers and personal computers at Texas Instruments Inc.





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# INTEGRATED SOFTWARE MOVES UP FAST

**Packages such as 1-2-3 and MBA have advanced the state of the art, but true integration lies in exploratory environments such as Smalltalk and with AI-based homogeneous environments**

Todd L. Corenson, Enlon Associates

Most software packages handle one type of application, which requires a user to divide a multiapplication job into different tasks, each of which is performed by a different package. The user must conform to the limitations of the packages, which restricts creativity and lowers efficiency. Integrated software, on the other hand, combines frequently used applications, enabling users to perform jobs more naturally.

The current generation of integrated software, although a significant improvement over individual application packages, has neither completely removed the distinction between functions nor has it become flexible enough to adapt easily to individual needs. However, software developers are experimenting with new approaches that will overcome these drawbacks. As integrated software continues to improve, users are becoming more aware of its benefits. As a result, the integrated-software market is growing rapidly, with unit shipments expected to grow from 630,000 in 1983 to more than 8.5 million in 1987.

## What is integrated software?

Integrated software consists of applications or functions that possess user-interface and data integration (Fig. 1). User-interface integration means that a user can view and manipulate applications in a similar manner. Data integration means that the user can employ the same information in more than one application by transferring or sharing data.

User-interface commonalities, such as a standard menu format and screen layout, let the user concentrate on a task rather than on interface mechanics. This decreases learning time for new applications because the user has only to learn the functions that are specific to an application.

An example of user-interface integration is Apple Computer Inc.'s Lisa microcomputer, which uses menus in a consistent manner, always presenting them across the top of the screen. Viewing and selecting from a menu requires the same user actions, regardless of the application. Furthermore, the contents of the menus for different applications are as similar as possible.

An interface that allows a user to view or work

## USER-INTERFACE INTEGRATION

### Attributes

- Common commands and data entry
- Uniform screen layout
- Concurrent application processing
- Multiple-application display
- Application interaction
- Composite documents
- Homogeneous environment

### Possible application commonalities

(can include one or more of above attributes)  
Help facilities, menu facilities, programming facilities, property sheets, input and output device handling, forms management, formatting, report generation, graphics, type styles, database management, documenting, user profiling, archiving, window management

## DATA INTEGRATION

- Translation of file formats
- Common file formats
- Cut and paste
- Linking

**Fig. 1. Integrated software includes user-interface and data integration between applications, or functions. A variety of attributes can exist within these two categories.**



on several applications at once prevents lengthy start-up and exit sequences that are normally required when a user switches between applications. The most common method of multiple-application display is windowing. Some systems present multiple applications simultaneously but allow only one active application at a time. Others, such as Concurrent CP/M 3.1 from Digital Research Inc., provide true multitasking through multiple active windows.

Data integration occurs in a variety of ways. The least sophisticated—translation of file formats and common file formats—requires a user to write data to an external file, run a translation utility if necessary and read the data into the destination application. The cut-and-paste technique is more convenient. With this technique, the user selects the data to be transferred, issues a cut (or copy) command and then executes a paste command at the desired location in the destination application.

Data transfer can be unlinked or linked. Unlinked data transfer requires that the source and the destination be explicitly specified for each

transfer. With linked data transfer, the source and destination are connected so that changes in the source are reflected automatically in the destination. The changes in the destination can be immediate (dynamic linking) or can occur later (latent linking), such as when the destination is next accessed or when the user requests an update. Packages such as Lotus Development Corp.'s Symphony provide dynamic linking.

### Four product types dominate

Integrated software can be divided into six segments (Fig. 2), of which exploratory environments are available only on a limited basis and homogeneous environments are still experimental.

Application families, the first form of integrated software, typically provide a low level of integration because they were developed as vendors began to extend product lines. Because each package in a family is independent, application families do not allow multiple applications to be displayed concurrently. Achieving user-interface commonality requires programmers to adhere to the interface standards developed for a family. Users typically perform data transfer via external files. Application families are popular for use on portable computers such as Kaypro Corp.'s microcomputer, which comes bundled with the Perfect series by Perfect Software.

Uniform paradigms came on the scene with the introduction of Context MBA from Context Management Systems, followed by 1-2-3 from Lotus. The primary problem with this type of software is that the model chosen as the paradigm may not be appropriate for all applications. For example, a spreadsheet model is not the best way to represent a complex database. However, uniform paradigms are relatively compact and efficient because they have large amounts of shared code and data. Paradigms are prevalent on machines ranging from portables to Winchester-based microcomputers.

Cluster managers meet the needs of users who have built a library of software packages but still want integration. Cluster managers provide data integration and multiple-application display but do not offer a uniform interface across packages. Another problem results from applications that bypass the operating system to reference the hardware directly. Such applications may not operate under a cluster manager or may be only partially operational. Cluster managers will be popular on diskette-based systems because of the large installed base of application software on these systems.

Environment managers offer a high degree of integration because all applications use a common set of facilities for user interaction and data

**Fig. 2. Of the six segments, or product types, of integrated software, application families and uniform paradigms are currently most prevalent, but environment managers are expected to dominate the market by 1987.**

INTEGRATED-SOFTWARE PRODUCT SEGMENTS		
Segment	Characteristics	Examples
Application family	a group of integrated applications usually provided by one vendor	Perfect series by Perfect Software, pfs series by Software Publishing Corp.
Uniform paradigm	a package that can perform various functions using a single model or paradigm	1-2-3 by Lotus Development Corp., MBA by Context Management Systems
Cluster manager	a program that integrates existing unmodified applications	DesQ by Quarterdeck Office Systems
Environment manager	system software that provides integration capabilities to modified or possibly unmodified applications	Visi <sup>On</sup> by VisiCorp, MS-Windows by Microsoft Corp., Apple Computer Inc.'s Lisa and Macintosh micros
Exploratory environment	integration of operating system, applications, programming language and data	Smalltalk-80 by Xerox Computer Services
Homogeneous environment	an environment in which objects are not constrained to have a fixed set of properties or operations that can be performed on them and in which meaning is inferred from context and perceived user intention	will require artificial-intelligence concepts for implementation; products are expected at the end of the decade



## Smalltalk-80 highlights object-oriented software

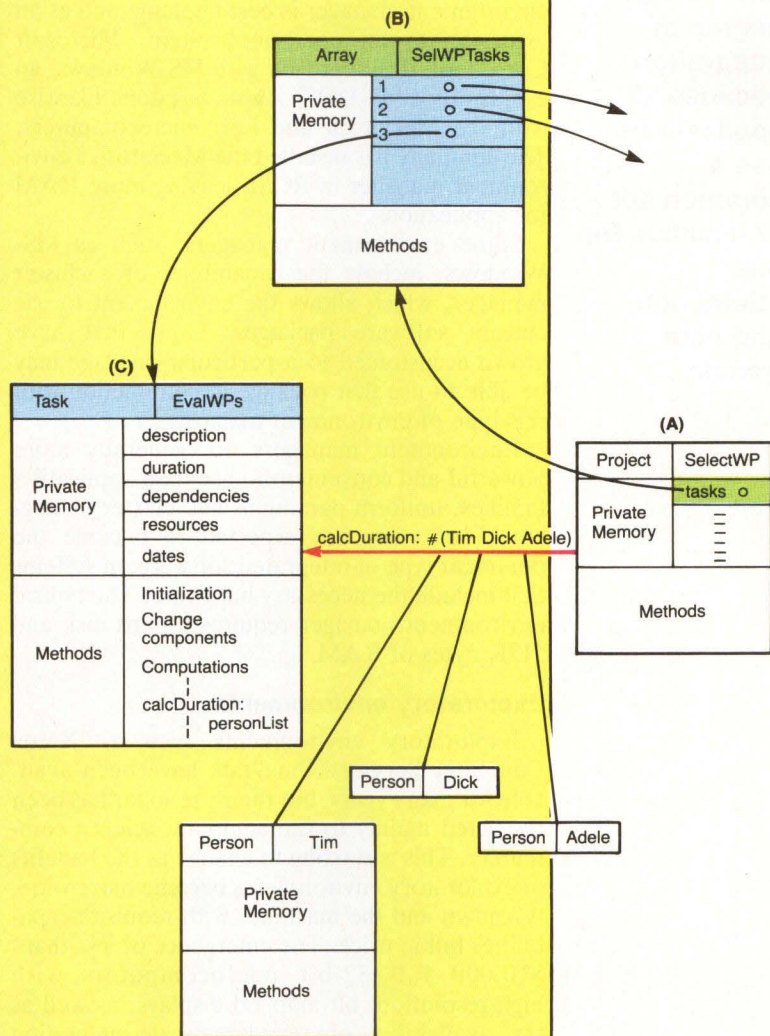
Xerox Corp.'s Smalltalk-80 consists of a virtual image and a virtual machine. The virtual image is a collection of objects that defines the language compiler, the user interface, the basic data structures and the utilities. The virtual machine implements the architecture of the object world.

An object is an entity that consists of private memory and methods. The contents of the private memory determine the state of an object. Methods specify the operations that can be performed on an object. A method is similar to a procedure in conventional languages.

Objects send messages to other objects (analogous to procedure calls in standard languages) in the course of executing their methods (see Figure). A message consists of the name of a receiver (EvalWPs in the figure), the selection of a method to invoke (calcDuration) and parameter objects (Tim, Dick, Adele). The recipient of a message returns an answer object when it completes execution of the requested method. Some messages are not sent to other objects but are executed directly by the virtual machine.

Object-oriented software is suitable for a wide range applications. The figure shows a project-scheduling application in which the goal is to select the most appropriate personal computer word-processing program for a company department. To start, a project, SelectWP, is instantiated from class Project (A). The project consists of a number of tasks (B) such as those to list the available packages, determine the selection criteria and evaluate the word processors (EvalWPs). Each of the tasks can be represented by an instance of class Task. SelectWP points to the array SelWPTasks, which contains the individual tasks.

Private memory for Task EvalWPs consists of five variables, which are pointers to other objects (C). The variables are description (a description of the task), duration (the time required to complete the task given the allocation of certain resources, or persons), dependencies (other tasks that must be com-



pleted before this one can begin), resources (a list of people to be assigned to the task) and dates (begin and end dates for the task). The task also implements three categories of methods: initialization, change components and computations.

In the figure, SelectWP is sending a message to EvalWPs to calculate the duration of the task, assuming that three people are to be assigned to the task. SelectWP might, for example, use the result of the calculation to help determine if these are the most appropriate people for this task.



# STATE OF THE MARKET REPORT:

## SOFTWARE

**Environment managers offer a high degree of integration because all applications use a common set of facilities for user interaction and data transfer.**

transfer. Application developers use the environment facilities to keep programs compact and to avoid unnecessary development work. An environment manager is best implemented as an extension to an operating system. Microsoft Corp. took this approach with MS-Windows, an extension of MS-DOS. Apple has done likewise with the Macintosh and Lisa microcomputers. The company has installed the Macintosh's environment manager in ROM, leaving more RAM for applications.

Some environment managers, such as MS-Windows, include the capabilities of a cluster manager, which allows the environment to use current software packages. Users that have grown accustomed to a particular package may be able to use that package in conjunction with this type of environment manager.

Environment managers are generally more powerful and convenient to use than application families, uniform paradigms and cluster managers. Thus, they are expected to become the dominant type of integrated software on systems that include the necessary hardware. The typical environment manager requires a hard disk and 512K bytes of RAM.

### Exploratory environments

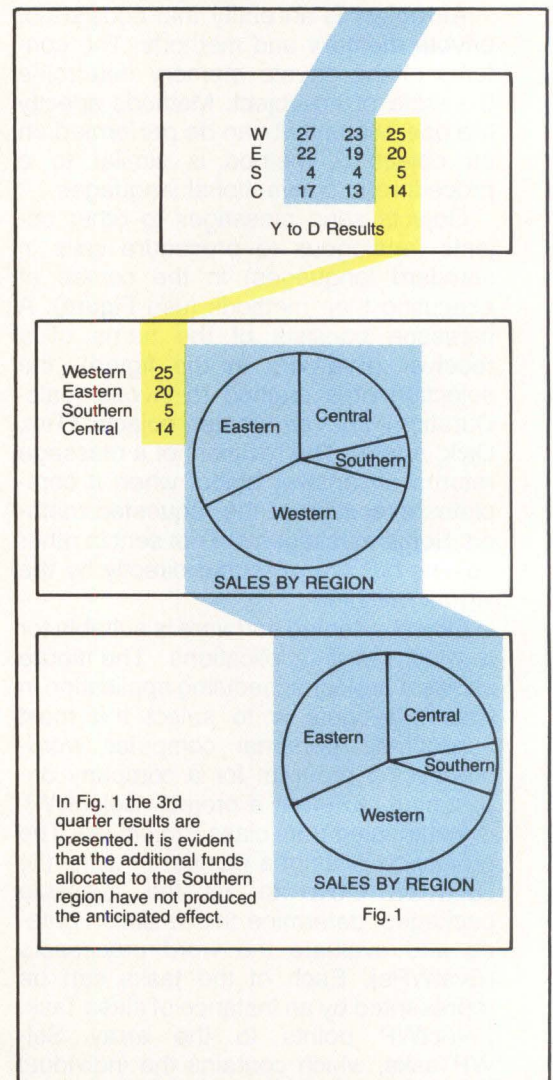
Exploratory environments such as Xerox Computer Services' Smalltalk have been available for many years, but their use so far has been restricted mainly to the computer science community. This is starting to change as the benefits of exploratory environments become more widely known and the machines with requisite capabilities fall in price. The emergence of less-than-\$10,000 full 32-bit microcomputers with high-resolution, bit-mapped displays, as well as the availability of very-large-scale-integration hardware, will spur acceptance of the exploratory environment.

Smalltalk-80, which is based on the concept of interacting objects, is an exploratory environment expected to become more popular in future years. Object-oriented software is very flexible, allowing all facets of the environment to be modified or extended to develop new applications (see "Smalltalk-80 highlights object-oriented software," Page 179).

Environment managers such as VisiCorp's Visi<sup>On</sup> require a separate tool kit distinct from the end-user environment. With object-oriented software, the developer works within the standard end-user environment. The result is that application-development time is reduced, ad hoc development and minor modifications to applications are easier, and applications are improved because the developer has a better appreciation for the end-user environment.

Object-oriented software facilitates system enhancement because of its modularity. The programmer can modify the internal algorithms and variables of an object without disrupting the rest of the system. Object-oriented software also facilitates application customization because the capabilities of existing objects can be used to construct new objects.

Another benefit of object-oriented software is that it has a high degree of data sharing. All objects can reside in one address space and be



**Fig. 3. A composite document** consists of a combination of objects. One way to display a composite document is with overlapping windows. If a user changes the data in one window, any linked windows will be dynamically updated whether or not the windows are in the same document. For example, changing "25" to "30" in the middle document would update the two pie charts as well as the "25" in the top document.



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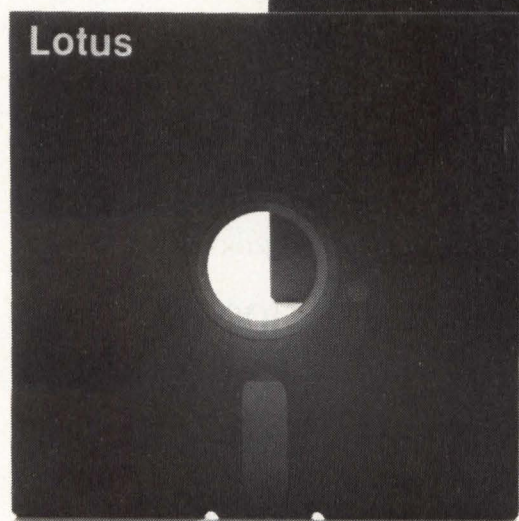
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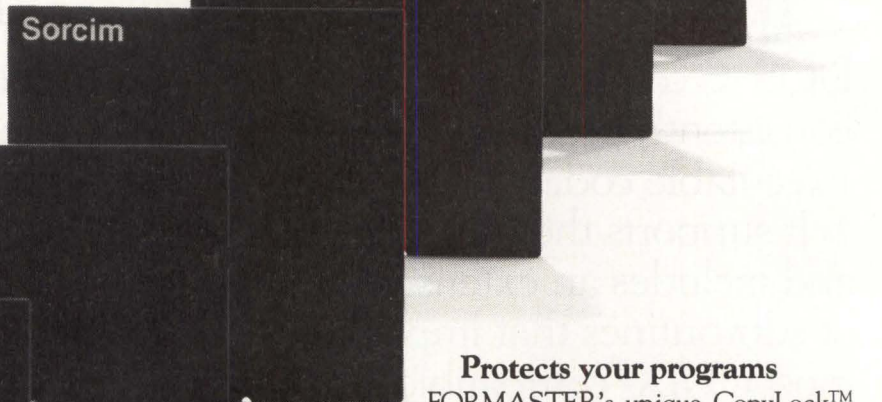
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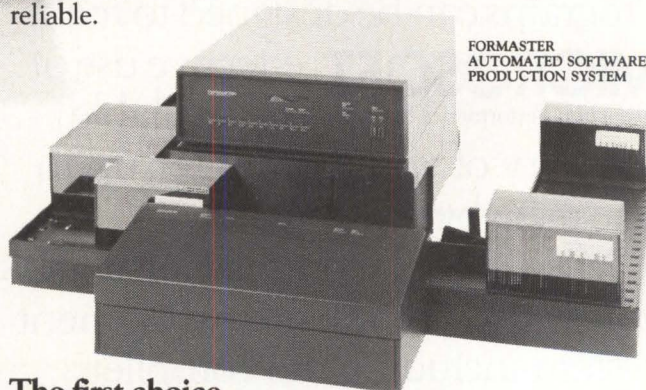


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## STATE OF THE MARKET REPORT:

### SOFTWARE

accessed from all other objects. When a user performs a cut-and-paste operation between applications, data may seem to move from one place to another, but it may be necessary only to move a pointer.

#### Homogeneous environments

The ultimate in integrated software would be a system that merges application packages without sacrificing capability or flexibility. One goal of such a homogeneous environment is to provide for the use of composite documents—documents that may contain more than one kind of structure (Fig. 3). For example, a composite document could include a portion of a spreadsheet in one location and different varieties of text in other locations without window boundaries between them. Each kind of structure has data and properties associated with it and responds to certain operations. Text, for example, has a character string as its data and properties such as font style and size. Text responds to editing commands like "insert" and "search."

Object-oriented software is a natural way to implement composite documents. Two commercial products that use composite documents are Xerox Corp.'s Star workstation and Gavilan Computer Corp.'s portable microcomputer running the company's proprietary operating system.

The problem with current implementations of composite documents is that the component objects have a rigid set of properties. Objects cannot behave intelligently based on context. As artificial-intelligence research advances, homogeneous-environment software will become available. Homogeneous environments will then be able to understand natural language, perceive user intentions and perform intuitively.

Integrated-software packages for personal computers were introduced in 1982, and approxi-

mately 50,000 units were sold worldwide that year. One year later, sales leaped to 630,000 units. Lotus' 1-2-3 accounted for close to 200,000 units shipped. Application families such as those from Perfect Software, Software Publishing Corp. and Chang Laboratories Inc., as well as integrated solutions from Japanese hardware vendors such as Epson also showed rapid sales growth. By 1987, shipments of integrated-software packages are expected to reach 8.5 million units (Fig. 4).

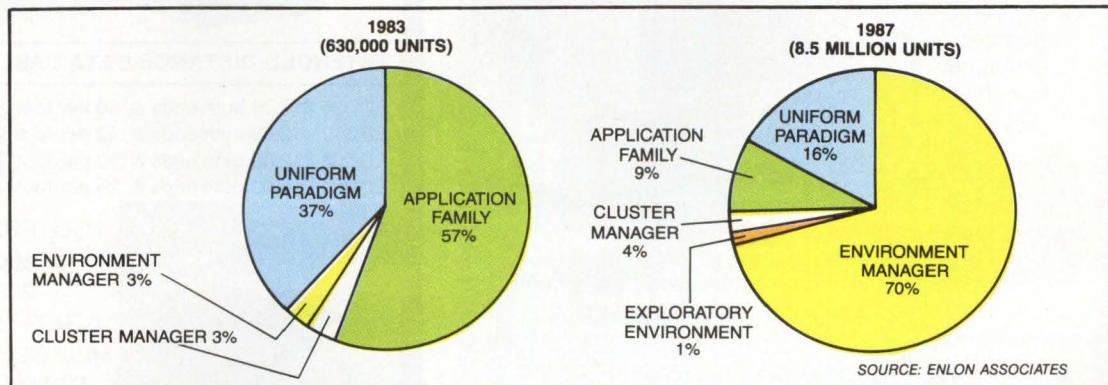
Approximately 30 percent of integrated software sold in 1983 was bundled with hardware. By 1987, that figure should rise to nearly 70 percent, much of which will be "extended" operating systems. Major players following this trend will probably include Microsoft, Apple and IBM Corp. Microsoft's MS-Windows runs with MS-DOS, and future implementations of MS-DOS will probably include MS-Windows.

Future versions of Apple's Macintosh and Lisa families will also follow the trend toward extended operating systems. Macintosh applications can run only under the Macintosh environment, but Lisa users have the choice of using the Macintosh or Lisa environments or UNIX. Models of IBM's soon-to-be-announced high-end personal computer, which is based on the Intel 286 processor, are also expected to be sold with an environment-manager/operating-system combination.

Since an increasing percentage of integrated software will be bundled, revenues will not rise as fast as unit shipments. Integrated-software developers collected approximately \$120 million in 1983, almost half of which—\$53 million—went to Lotus. By 1987, integrated software is expected to account for almost \$700 million in sales, representing a 55 percent compounded annual growth rate.

In 1983, sales of application families and uni-

Unit shipments of integrated-software packages went from 50,000 in 1982 to 630,000 in 1983 and are expected to top 8.5 million in 1987.



**Fig. 4. Worldwide integrated-software unit shipments** are expected to grow at a compounded annual rate of more than 90 percent between 1983 and 1987. Propelled by prod-

ucts from Microsoft, Apple, IBM and Lotus, environment-manager packages are expected to capture 70 percent of the market by 1987.



# STATE OF THE MARKET REPORT:

## SOFTWARE

**Object-oriented software facilitates enhancement because of its modularity.**

form paradigms dominated the market. The bundling of the Perfect Software series on Kaypro systems represented a large share of application-family sales while Lotus sold more than 80 percent of the uniform paradigms. Apple's Lisa represented the bulk of environment-manager shipments. By 1987, market shares for the integrated-software product segments will have shifted dramatically. Propelled by sales from Microsoft, Apple, IBM and Lotus, environment managers are expected to capture 70 percent of integrated-software shipments. Exploratory environments, although expected to represent only 1 percent of the market in 1987, are expected to show significant sales growth by the end of the decade.

The next few years should see the announcement of integrated-software packages for high-end personal computers running UNIX and commercial exploratory environments, particularly Smalltalk-based products. Homogeneous environments, which should be available by the end of the decade, will probably be a result of fifth-generation computer research. As such, the first introductions may come from Japanese vendors trying to leapfrog American manufacturers.

In the U.S. market, exploratory environments are expected to gain a significant foothold initially among OEMs and system integrators. These distribution channels will be strongly attracted to environments such as Smalltalk because the object-oriented nature of systems like Smalltalk permits rapid customization. An accounting system, for example, could be easily modified for a business or geographical region. Using a set of core applications, a value-added reseller could customize a system for a user.

**Todd L. Corenson** is a principal at Enlon Associates, a Cupertino, Calif., marketing research and software development company. Mr. Corenson was previously with Tymshare Inc., where he served as a manager of operating systems development.

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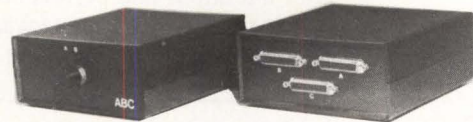
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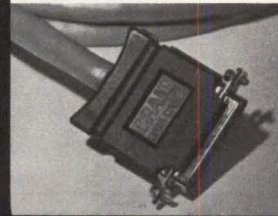


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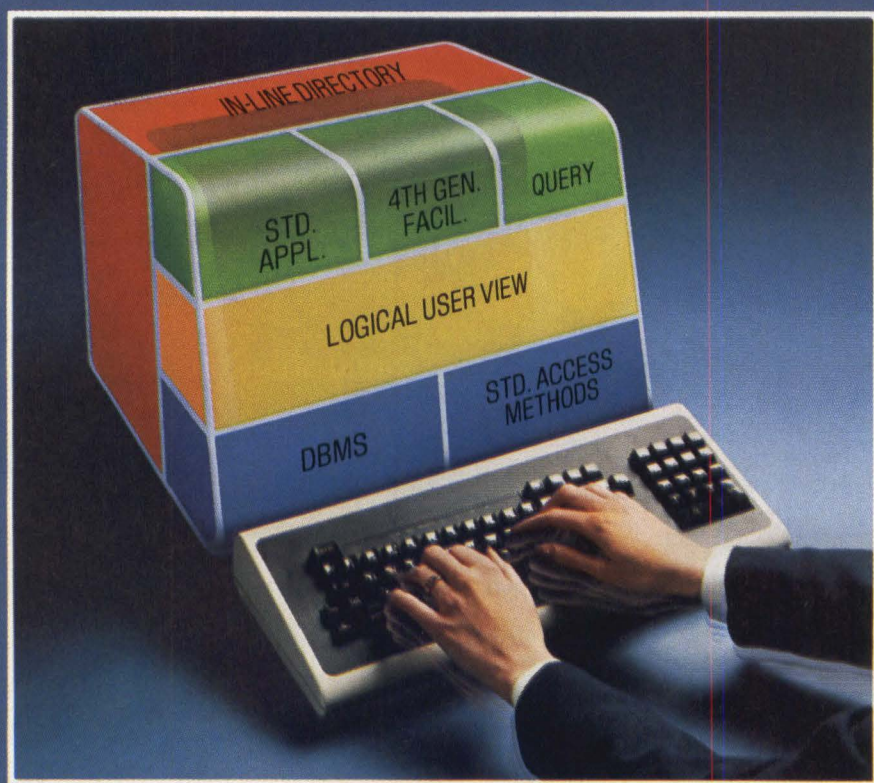
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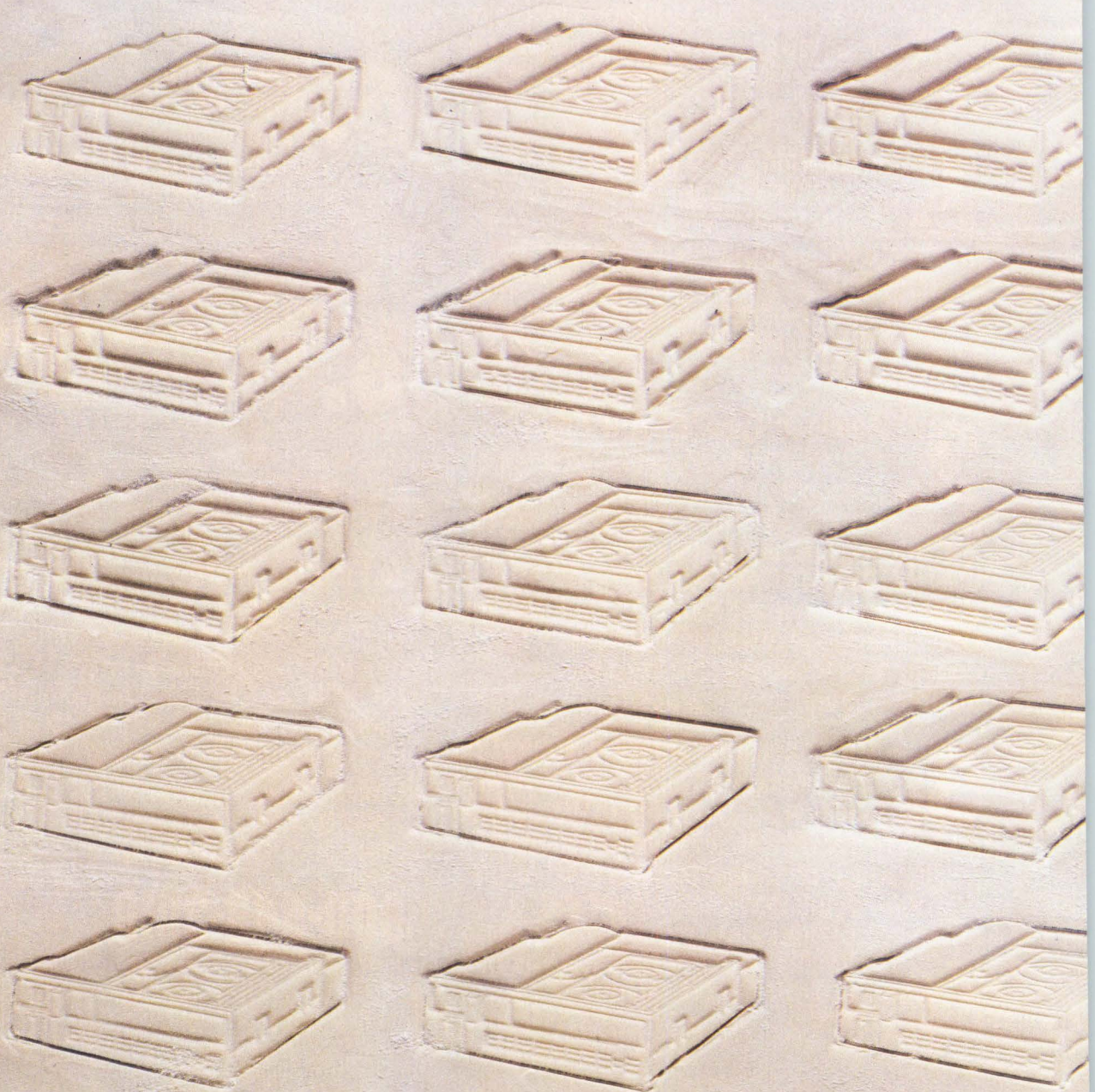
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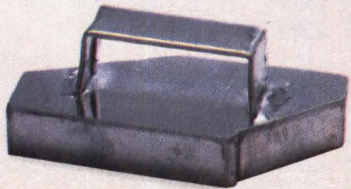


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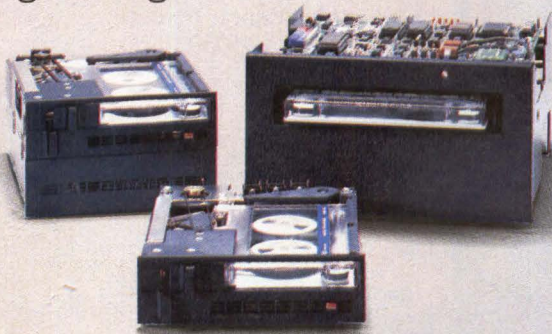
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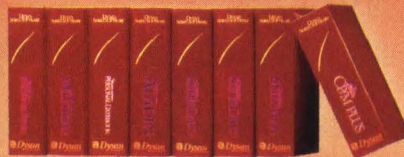
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# UNIX ESTABLISHES A GROWTH PATTERN

Thanks to AT&T, IBM and 20 other manufacturers, the UNIX market should double this year

James R. Groff, Plexus Computers Inc.

This year may well go down in the record books as the year UNIX finally shifted from a quiet, sandlot ballgame into the major leagues. The two biggest players, American Telephone and Telegraph Co. and IBM Corp., have entered the market with their first UNIX offerings, while nearly 20 other manufacturers are shipping UNIX-based systems in volume. UNIX-based software is becoming more widely available, with the AT&T and IBM announcements stimulating even more development. And the search for a UNIX standard seems to be near an end.

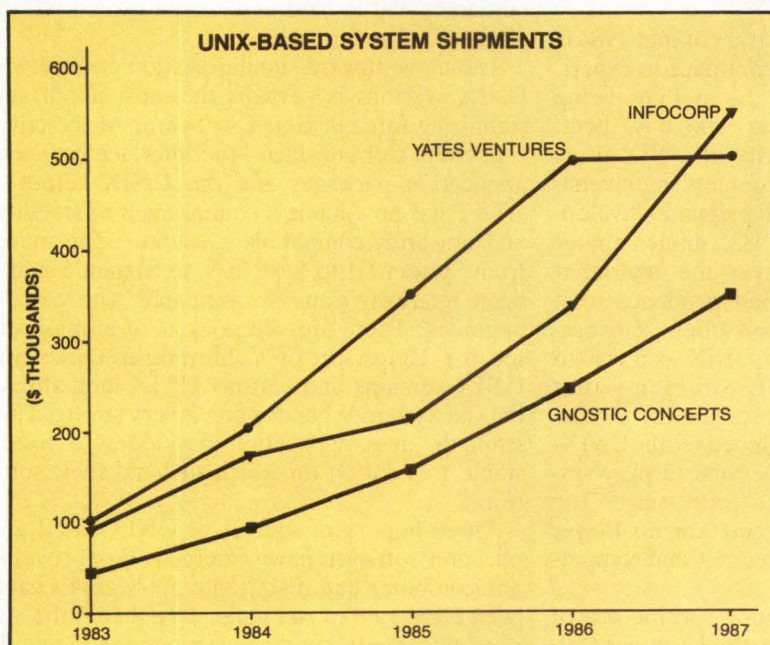
Industry analysts differ widely in their estimates of the size of the "UNIX market" (see

figure, below). The most conservative forecasts call for shipments of nearly 100,000 UNIX-based systems in 1984, and nearly all agree that 1984 shipments will be roughly double 1983's.

Part of the difficulty in sizing the UNIX market is in knowing just what to count. UNIX now runs on systems ranging from IBM PCs to VAX-11/780s and mainframes. Within this range, today's UNIX systems tend to group themselves into five segments, based on the number of users they support (see table, Page 192).

UNIX-based personal computers form the low end of the market. In addition to IBM's Personal Computer Interactive Executive (PC-IX), there are third-party versions of UNIX available for the IBM PC, Apple Computer Inc.'s Lisa, Radio Shack's TRS-80 model 16 and others. Despite these inroads, though, UNIX still plays a minor role in the personal computer market, which is dominated by MS-DOS-based systems. However, UNIX does play a major role in the crowded "four-user" market segment. These entry-level multiuser systems feature a single-board-computer design with a 16-bit microprocessor, 5¼-inch peripherals and a UNIX port from such vendors as Microsoft Corp. or Unisoft Systems Corp. Systems from Fortune Systems Corp., Altos Computer Systems and Onyx Systems Inc. appear in this segment.

Heavier multiuser work loads demand the more complex systems that comprise the "eight-user" market segment. These systems offload character I/O onto hardware with direct-memory access capability and use higher-performance



Industry analysts differ in their forecasts of the size of the UNIX market, but all agree on rapid growth for the next several years.



## STATE OF THE MARKET REPORT:

### SOFTWARE

Market segment	Typical no. of users	Architecture	Peripherals	Main memory (K bytes)	List price (\$000)	Dominant operating system
"1-user"	1	personal computer	5¼-in. disk, floppy backup	256-512	5-8	MS-DOS
"4-user"	2-6	single-board computer	5¼-in. disk, floppy backup	512-1,024	8-15	UNIX
"8-user"	6-10	separate I/O processor with DMA	5¼-or 8-in. disk, cartridge tape backup	512-1,536	15-25	UNIX
"16-user"	12-20	multiple processors, buses	8-in. disk, cartridge or 9-track backup	1,024-4,096	40-80	UNIX
"32-user"	24-100	minicomputer	14-in. disk, 9-track backup	2,048 +	100 +	vendor-specific

**UNIX aims at five market segments, based on the typical number of users per system. It is the dominant operating system in all segments except the extreme low and high ends.**

8-inch Winchester disk drives. At approximately \$20,000 per system, these systems are popular with OEMs and value-added resellers. A few vendors, pursuing minicomputer-level performance in a UNIX-based microcomputer, have moved to more complex, multiprocessor architectures. These systems constitute the "16-user" segment and compete with the PDP-11/70 and VAX-11/730. Prominent vendors in this category include Plexus Computers Inc., Convergent Technologies Inc. and several start-up companies with fault-tolerant multiprocessor systems.

The high end of the UNIX market is the province of the superminicomputers. The VAX-11/780, Eclipse MV series, AT&T's 3B20 and systems from Pyramid Technology Corp., Gould Inc. and Perkin-Elmer Corp. constitute this segment. In contrast to microprocessor-based systems, these machines use custom processors to achieve high performance. UNIX plays an important but secondary role in this market segment, which is dominated by vendor-specific operating systems such as VMS and AOS.

#### UNIX users undergo change

The five-segment UNIX market of mid-1984 is a snapshot of a market that continues to experience rapid change both in the systems being offered and in the customers who buy them. Until about 1982, the majority of UNIX users were UNIX veterans—programmers in universities, research concerns and software-development companies. By mid-1982, minicomputer OEMs had begun to discover the per-dollar performance and vendor independence that UNIX-based microcomputers offer. Government agencies also seized on UNIX as a way to minimize the compatibility problems that plagued their multivendor installations. UNIX-based microcomputers combined with UNIX-based application software became turnkey systems for commercial data processing. The ultimate users of these systems are no longer programmers but clerks, secretaries and computer operators.

The trend toward application-specific use of UNIX systems is continuing, and the general-

purpose UNIX-systems market is fragmenting into specialty markets. The four-user segment is fast becoming a commodity market, with emphasis on price and availability. Higher-performance microcomputer-based systems are targeted at commercial data processors with a focus on multiuser performance and OEM resellers. Other vendors, such as Masscomp, have tuned their systems for real-time performance and targeted the engineering/scientific market. Still others have added graphics support to UNIX to create a UNIX-based computer-aided-design/computer-aided-manufacturing workstation market. As the trend toward specialization continues, successful UNIX system vendors will likely be those that target their machines to specialty markets.

#### UNIX trends imply standardization

One of the brightest developments in the UNIX market is the growing availability of UNIX-based application software. UNIX software packages listed in the */usr/group* catalog, for example, have grown from 300 in the 1982 edition to 450 in 1983 and should exceed 700 in 1984.

The move toward standardization on AT&T's UNIX versions is perhaps the most important stabilizing force in UNIX software. At the critical system-call interface—the interface between application packages and the UNIX kernel—AT&T has now made a commitment to stability and upwardly-compatible evolution. The move from System III to System V to System 5.2 has been relatively painless compared with earlier upgrades. There are still pockets of enthusiasm for the University of California at Berkeley's UNIX versions and various UNIX look-alikes, but the System V bandwagon is very strong. This strength gives application developers a fixed, stable foundation on which to build their software.

Three important sources of UNIX-based application software have emerged. First, several minicomputer and mainframe applications have been converted to run under UNIX with the aid of cross compilers and conversion tools. Second,



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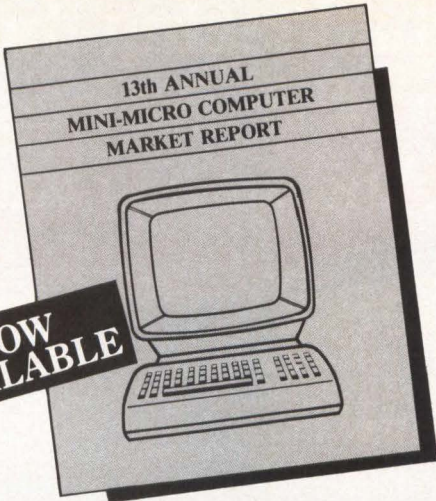
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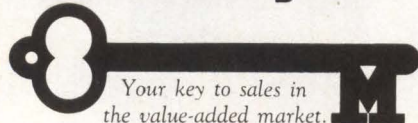
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- 1984 Estimated Expenditures for minicomputers, microcomputers, peripherals, and software.
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  - Units acquired
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\$100,000-249,999.....	3,582
\$250,000-499,999.....	2,218
\$500,000 or more.....	1,403
■ Sites planning to install integrated electronic office functions in 1984.....	1,642
■ HOT PROSPECTS... Sites planning to change major vendors in 1984.....	1,085
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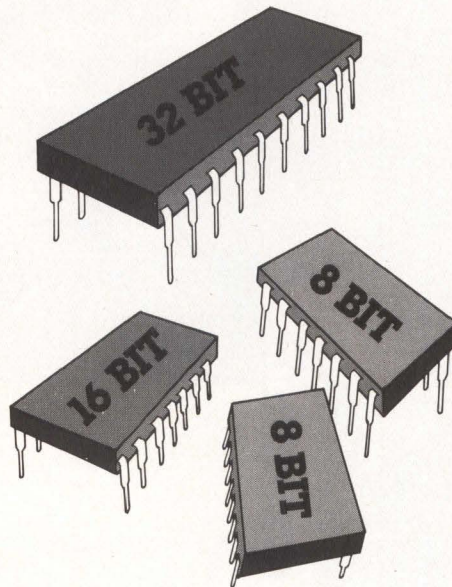
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## STATE OF THE MARKET REPORT:

### SOFTWARE

there is a great rush of new UNIX software development under way in small software companies, particularly for business data-processing and office-automation applications. Third, a few personal computer software packages have been converted for multiuser operation under UNIX, and this trend should accelerate.

UNIX-based database-management packages offer an excellent example of these trends. Two of the available packages—Oracle Corp.'s Oracle and Relational Technology Inc.'s INGRES—are converted versions of IBM mainframe and VAX supermini packages, respectively. Other excellent packages that have been developed specifically for UNIX-based supermicros include Informix from Relational Database Systems Inc. and Unify from Unify Corp. One of the newest entries is a multiuser version of the popular dBase II package for personal computers. Announced in February, it will be available both for PC-based local-area networks and for multiuser systems.

Venture-capital support of UNIX-oriented companies has been critically important. More than \$100 million has been invested, and much more will be invested this year and next. Volume

purchases by government agencies and the Bell operating companies have been another stimulating force, attracting more competitors and investment.

The major new factor in the market is the debut of AT&T's 3B computer family, accompanied by IBM's slow but steady entry into the market on the Series/1, the CS9000 and the IBM PC. The AT&T and IBM presence introduces new levels of competition but also vastly broadens the market. Fortune 1,000 data-processing departments that have been slow to accept UNIX-based systems could become large-volume purchasers.

The development of true 32-bit microprocessors, such as the Motorola 68020 and the National 32032, should also boost the popularity of UNIX. UNIX's proven portability means that it can be quickly moved to the new processors. Further, UNIX's built-in multiuser and multitasking features are a natural fit for the sophisticated systems and workstations that will be built from these microprocessors. □

Interest Quotient (Circle One)  
High 819 Medium 820 Low 821

**James R. Groff** is director of marketing for Plexus Computers Inc., Santa Clara, Calif., and co-author of *Understanding UNIX—A Conceptual Guide*, (QUE Corp., 1983). His previous employment includes seven years with Hewlett-Packard Co. He holds a bachelor of science degree in mathematics from the Massachusetts Institute of Technology and a master's in business administration from Harvard University.

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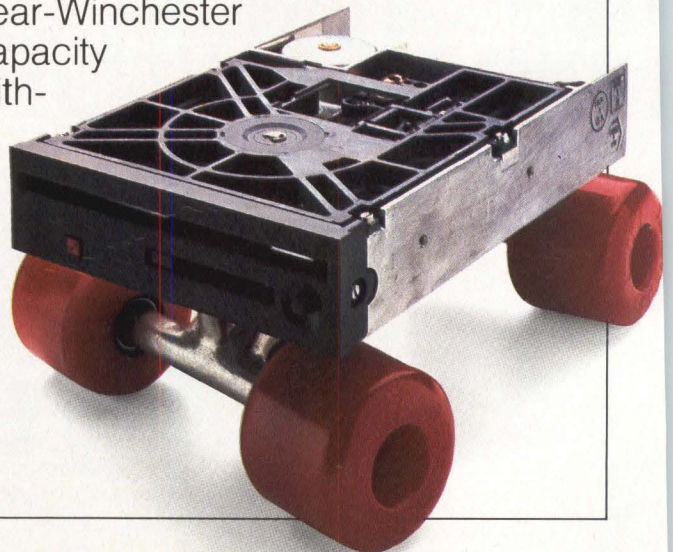
The SuperMinifloppy also reads 48tpi or 96tpi diskettes, and uses a standard floppy interface and 500 Kbit/second transfer rate. So

integrating the new standard in flexible disk drive technology will seem like old hat.

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The 3.33MB SuperMinifloppy is much more cost-effective than multiple floppies or low-end Winchesters, as well. And since flexible drive technology is designed for head-to-media contact, you get near-Winchester capacity with-





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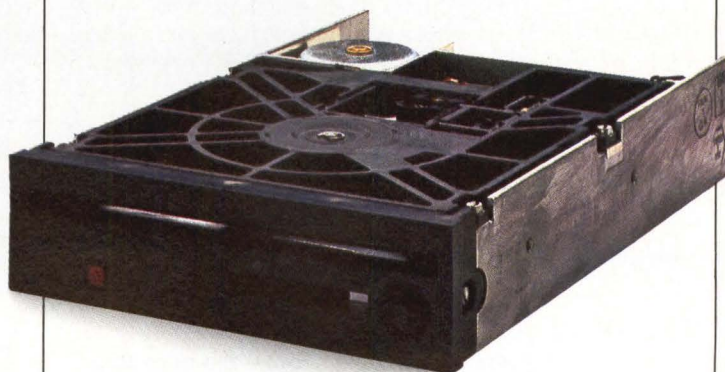
So put life into your system today.

Call us at (408) 946-2222. Or write Drivetec, Marketing Dept., 2140 Bering Drive, San Jose, CA 95131.

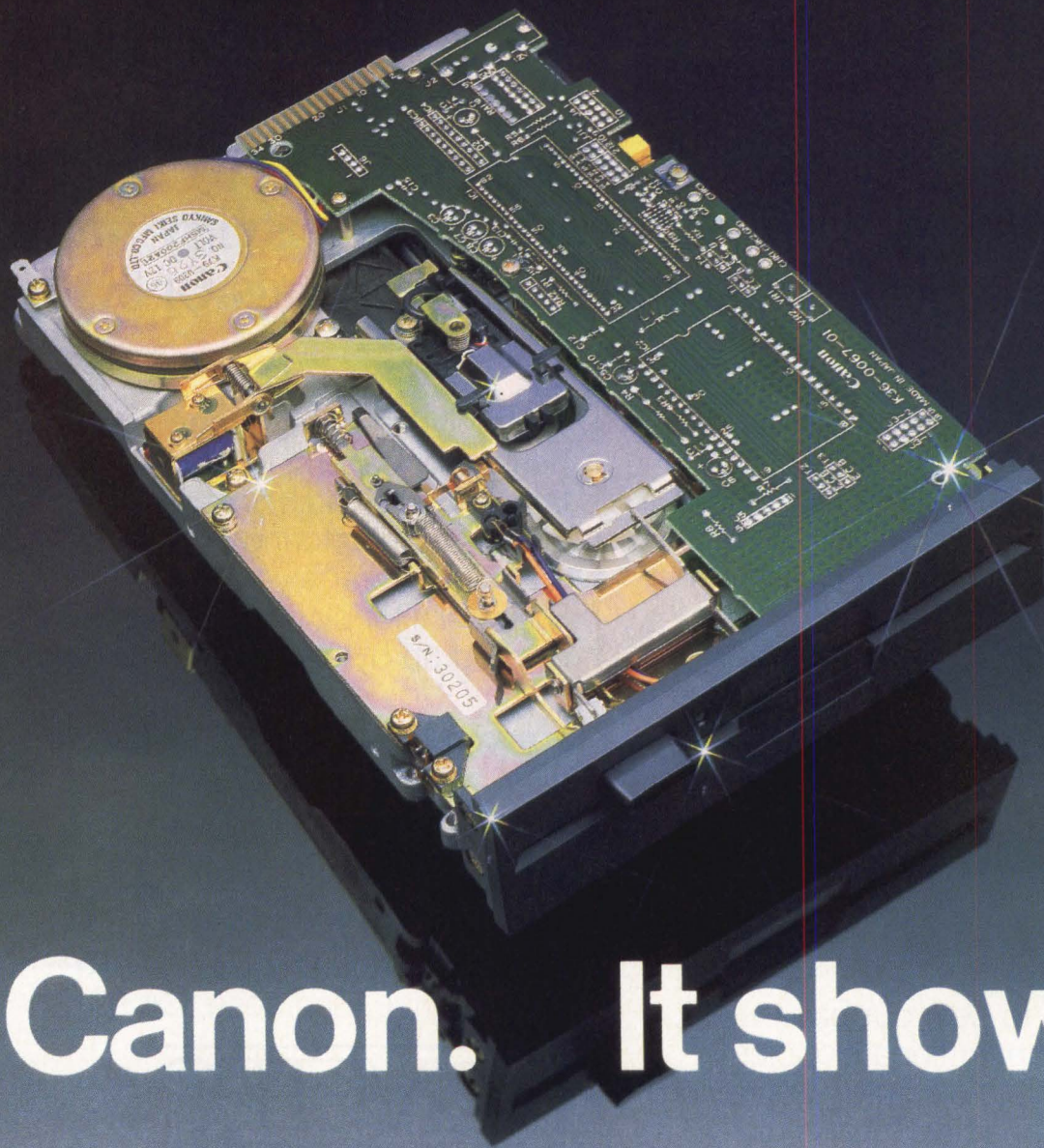


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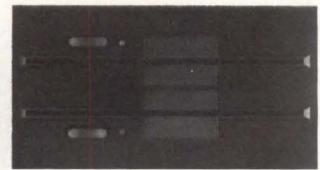
33.5 mm bezel



Standard half-height bezel



Dual drive:  
Standard 2/3 height (57.5 mm) bezel



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# WINCHESTER MARKET EXPANDS UNABATED

**Catalyzed by insatiable user demand for higher storage capacities and smaller form factors, small-Winchester disk drive shipments should triple over the next three years**

**John Klonick, Maxtor Corp.**

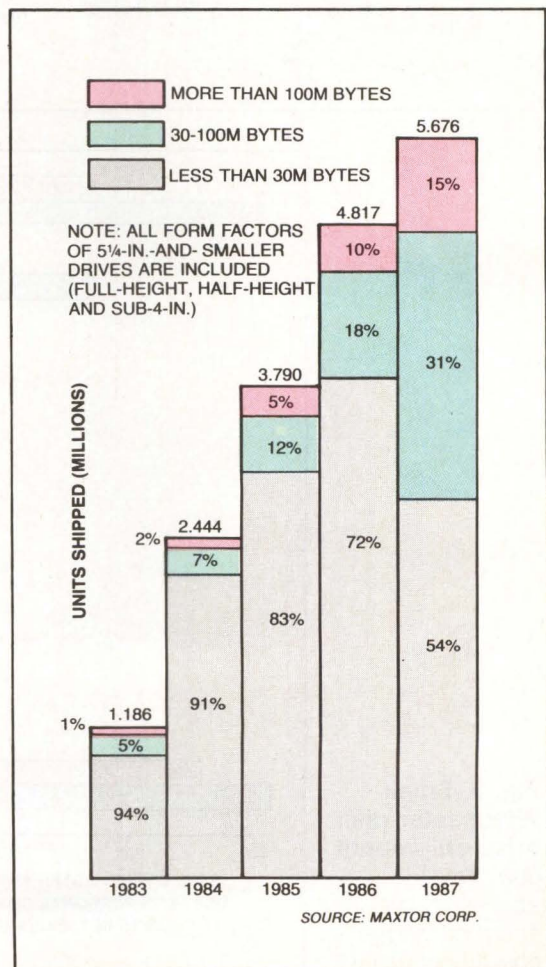
The rapid expansion of the small Winchester disk drive market shows no signs of slowing. Worldwide shipments of 5¼-inch and smaller drives, including half-height and sub-4-inch units, are expected to climb from 1.2 million in 1983 to over 5.6 million in 1987 (Fig. 1). Spurred by an ever-growing demand for drives with higher capacities and smaller form factors, new companies continue to enter the market. While more than 40 suppliers jockey for market share, buyers are enjoying the benefits of lower prices, improved quality and a widening variety of rotating mass-storage solutions (Fig. 2).

### Small drives compete with larger units

Small disk drives have made significant progress in squeezing more bits into less space. In the early days, products offering 6M to 12M bytes were sufficient for most needs, but rapid developments in the computer market have led to applications that require more storage capacity in a small desktop system. To meet these demands, Winchester manufacturers have used advanced recording technologies to create products

**Fig. 1. Worldwide shipments of 5¼-inch and smaller Winchester disk drives are expected to grow rapidly in the next three years in response to growing demand for small mass-storage units. Although less-than-30M-byte drives will continue to have the highest unit shipments, substantial growth is expected in the 30M- to 100M-byte range due to increasing demand for more powerful, higher-capacity, higher-performance desktop computer systems.**

with greater capacities and higher performance. By the end of 1984, drives in the 5¼-inch form factor will offer capacities similar to those of 8-inch Winchesters, while sub-4-inch drives will





# STATE OF THE MARKET REPORT:

## DISK DRIVES

handle the demand for lower-capacity storage previously filled by 5¼-inch drives.

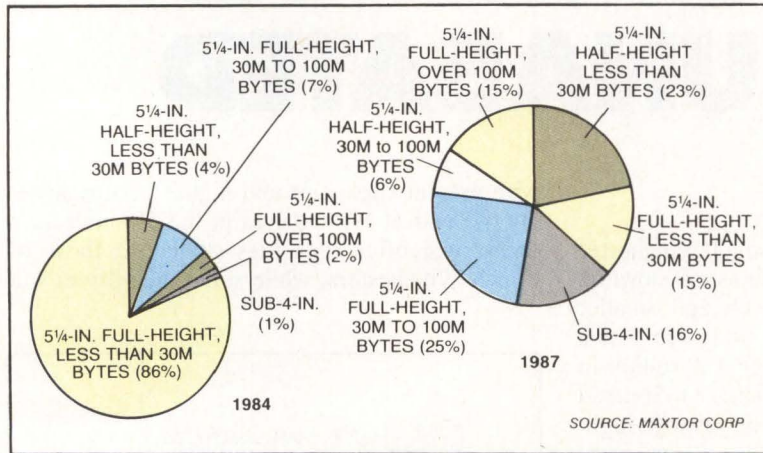
Several design elements will contribute to increased capacity in small Winchester drives. They include making more disk surface area available for storage, increasing linear recording

density, increasing the number of tracks per inch (tpi) and using data-encoding schemes that increase the bits per inch (bpi), such as 2,7 run-length-limited (RLL) encoding.

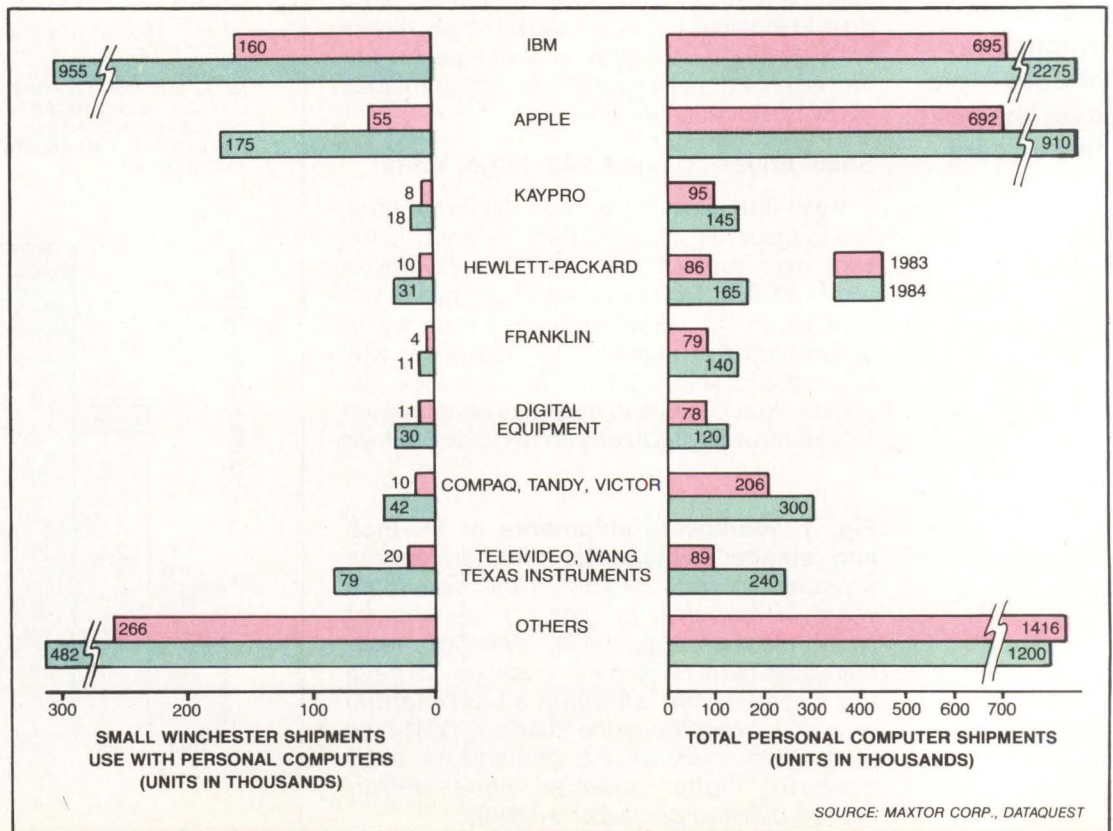
The physical limits of the 5¼-inch form factor and the need to place the drive motor below the disk spindle previously limited most drives to four platters. In 1982, Maxtor Corp. introduced a drive with an integral spindle motor built inside the hub of the disk stack, allowing the entire height of the drive to be used for media—as many as eight platters in Maxtor's case. Several other companies have subsequently used this approach. For example, Fujitsu Ltd. demonstrated a full-height spindle motor design in late 1983, and Tulin Corp. has shown a four-platter, half-height drive using an integrated spindle motor.

Increasing the linear bit density of a disk drive provides greater capacity, but there are two constraints: the interface transfer rate and the magnetic characteristics of the heads and disks. For example, the ST-506 interface standard defines a 5M-bps data-transfer rate, which limits linear bit densities to approximately 10,417 bytes per track, or 10,000 bpi for a 5¼-inch disk drive. Conventional ferrite heads and particulate media allow linear densities in this range, but their physical characteristics prevent them from

**Fig. 2. In 1984, the majority of small Winchesters shipped will be full-height, 5¼-inch drives, but by 1987 market share for the various form factors will change considerably.**



**Fig. 3. Small Winchester disk drive shipments (left) are spurred by personal computer shipments (right).**

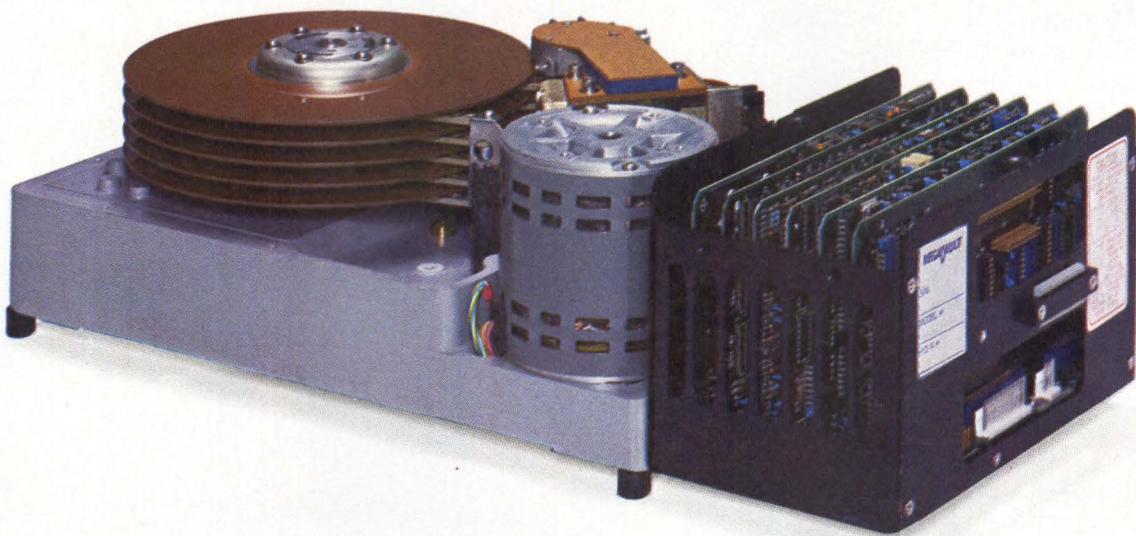




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The DART-130 offers for SMD and SCSI interfaces capacities of 129.27 and 133.57 Mbytes, respectively.

A crate of eight drives tied together in a single string—offers the host more than a billion bytes of storage space.

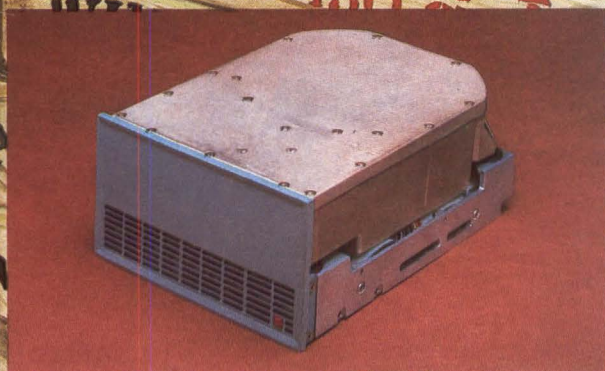
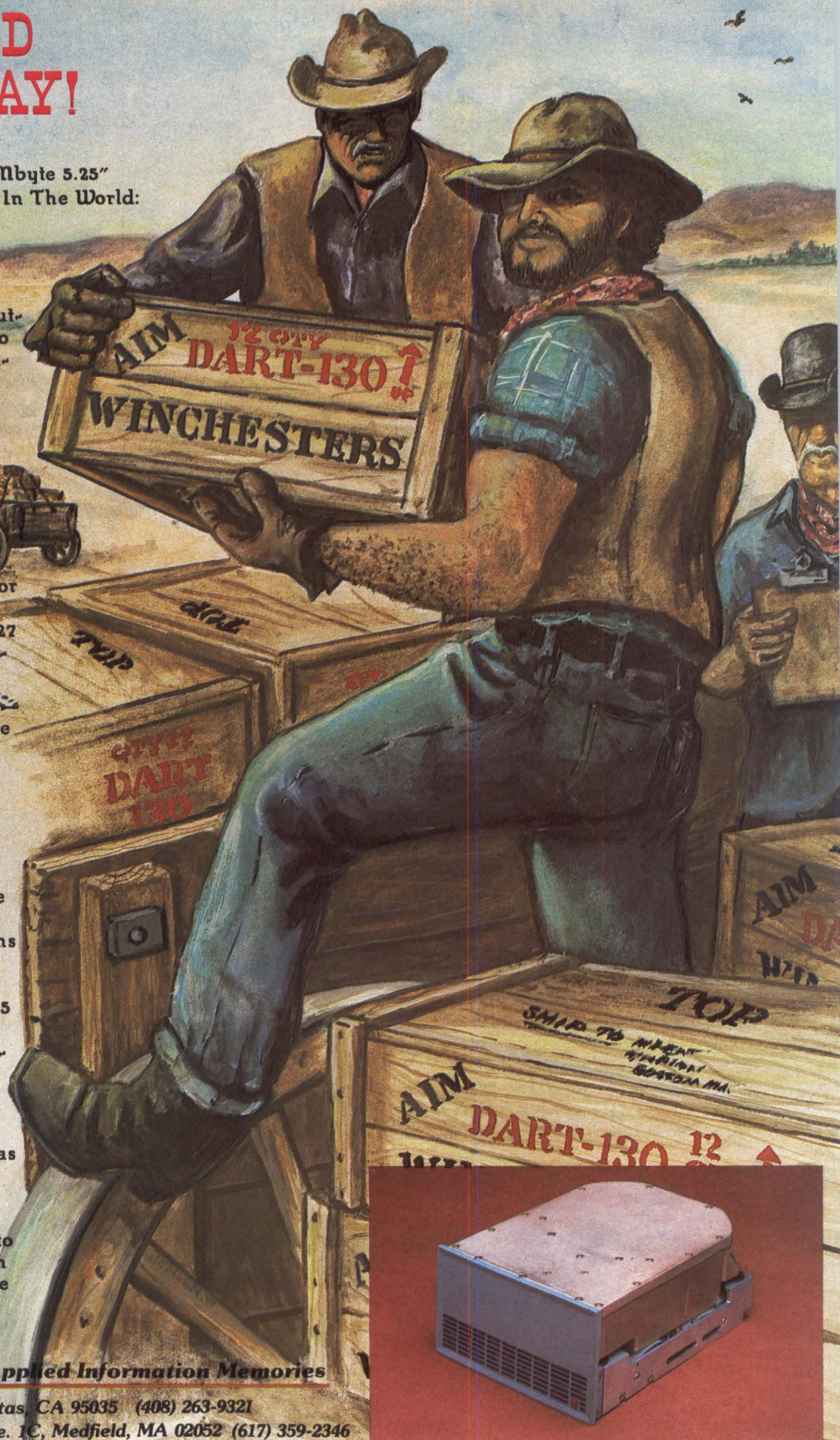
And performance over 18,000 power-on hours of reliable operation provides 18-ms average positioning time (including settling), 8.3 ms average latency, and data transfer at 1.209 Mbytes (SMD) and 1.25 Mbytes (SCSI) per second—with a large array of other advanced operational features.

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## STATE OF THE MARKET REPORT:

### DISK DRIVES

going much higher. Using composite or thin-film heads with thin-film metallic media extends the achievable bit density to more than 25,000 bpi.

The main factor influencing increases in track density is head-positioning technology. Because of cost considerations, early small Winchester drives used stepper motors, which permitted densities to approach 400 tpi. (The exception is Miniscribe Corp.'s unique rack-and-pinion stepper, which allows 588 tpi.) A number of drives shipped in 1983 use a variation of the stepper-motor design, such as a feedback loop, to improve positioning accuracy. For example, Quantum Corp., Syquest Technology and Microscience International Corp. manufacture drives with this approach that offer up to 650-tpi densities. Another approach is to use a voice-coil head positioner with a track-following, closed-loop servo-positioning system, allowing track densities approaching 1,000 tpi. In 1983, a variety of companies shipped drives employing this technology, including Atasi Corp., Control Data Corp., Maxtor, Quantum, Micropolis Corp. and Vertex Peripherals.

By implementing a data-encoding scheme that compresses information, manufacturers can

squeeze additional data capacity into the same physical area. One technique employs 2,7 RLL encoding, which provides a 50 percent capacity increase. The first 5¼-inch drives using this technology will appear in quantity shipments this summer.

The performance of small disk drives continues to improve. For example, track-following, closed-loop servo designs and voice-coil actuators enable average access times to reach 30 msec. More sophisticated disk drive controllers will provide even better performance in the near future. Some proposed designs offer solid-state cache memory, firmware to keep frequently used data centrally located on the disk and "look-ahead" buffering.

#### Interface standards encourage growth

One of the reasons for the success of the 5¼-inch Winchester product is the adoption of the ST-506 device-level interface. This de facto standard permits users to integrate drives into their systems without the risk of being saddled with a unique interface. The ST-506 remains the interface standard for the low end of the market, but technological developments in the small

**Shipments of 5¼-inch and smaller Winchester disk drives are expected to climb from 1.2 million in 1983 to more than 5.6 million by 1987.**

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Our new V2100 100MB 5¼" Winchester is an extension of this design philosophy. The V2100 family is based upon our V100 family. By increasing bit density and implementing the ST412HP interface (with 10Mbit/second transfer rate) we've maintained our four-platter, eight-head configuration. So you get lower cost and higher reliability.

And since few changes were made to upgrade the V100 family to the V2100, we'll be able to get up the high volume production ramp faster.

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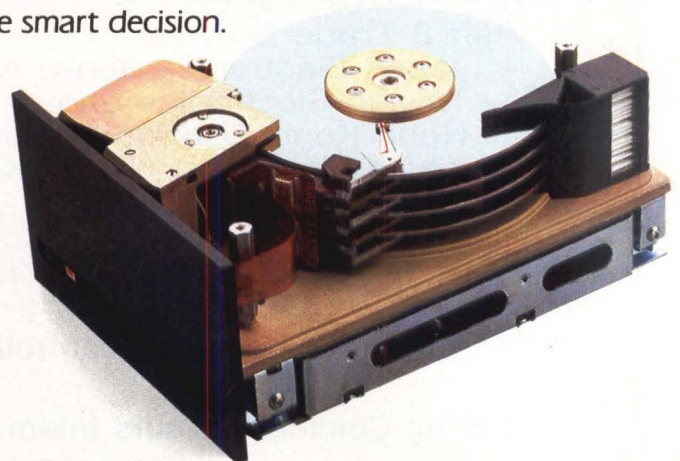
Every VERTEX drive is backed by the best Winchester engineering and manufacturing team in the business. So get your system and sub-system plans going now. Call us at (408) 942-0606. Or write VERTEX, 2150 Bering Drive, San Jose, CA 95131.

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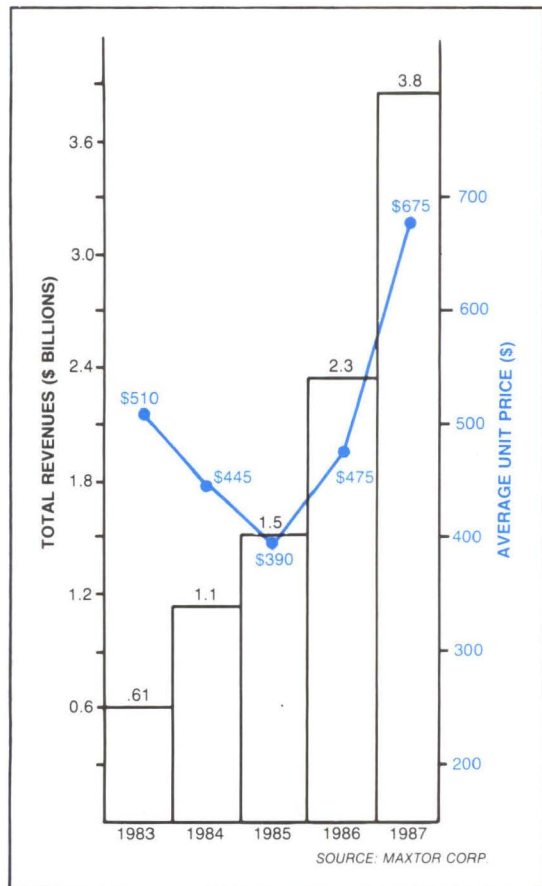
You Can Plan On Us . . .





## STATE OF THE MARKET REPORT:

### DISK DRIVES



drive market during the past year have created demands for a higher-performance device-level interface.

Two high-performance interfaces are vying for acceptance in the high-end Winchester market: the enhanced small disk interface (ESDI) and Seagate Technology's proposed ST-412HP. The leading contender appears to be the ESDI, with more than 40 companies favoring its use. It provides several enhancements to the ST-506 standard, including:

- a fourth head-select line so that disk drives with more than eight heads can be used,
- data-transfer rates from 5M to 25M bps,
- improved data integrity by locating the data separator chip on the drive,
- specific status/configuration lines that enable the controller to identify the features of the connected device.

Sample ESDI-based drives were delivered in late 1983, and this year should see the shipment of production quantities. Final market acceptance of a new high-performance interface standard will be an additional spur to market growth.

**Fig. 4. The average unit price of a small Winchester disk drive will drop between 1983 and 1985 but will rise in 1985 to 1987 due to increasing capacities. From 1983 to 1987, worldwide revenues should steadily increase.**

#### Market grows, prices fall

The needs of the expanding desktop systems market are contributing to the growth of the small Winchester market (Fig. 3). Because of their large shipment volumes, several drive manufacturers, including Seagate, Tandon Corp., Miniscribe and Computer Memories Inc., have been able to gain substantial cost benefits, which they have partially passed on as price reductions. As demand for desktop systems grows, disk drive manufacturers are able to lower prices still further, resulting in a highly competitive market. Competitive pressures from the sheer number of participants provide a strong downward push to the pricing structure. Technological improvements also play a part, allowing some manufacturers to offer higher-capacity, higher-performance products at only small price increases. As a result, although the average cost per drive will begin to increase again after 1984, the per-megabyte prices for 5¼-inch Winchester disk drives have been decreasing at around 20 percent per year.

The jostling for market share will continue, with the next arena in the 20M- to 60M-byte-per-box range. Cost per megabyte will continue to decline as manufacturers turn to a variety of cost-saving methods including offshore parts sourcing and manufacturing; increased automation; increased use of large-scale-integration (LSI) electronics; and backward integration into motors, media and/or recording heads. Although the average cost of a small Winchester disk drive will decrease between 1983 and 1985, costs will rise between 1985 and 1987 due to higher capacities. Worldwide revenues should steadily increase (Fig. 4). □

**John Klonick**, product manager for Maxtor Corp., San Jose, Calif., is responsible for directing product planning and development. Klonick previously directed market research and consulting activities as manager of the Computer Memory Industry Service at Dataquest Inc.

Interest Quotient (Circle One)  
High 822 Medium 823 Low 824

**Track-following, closed-loop servo designs and voice-coil actuators enable average access times to reach 30 msec.**



1974

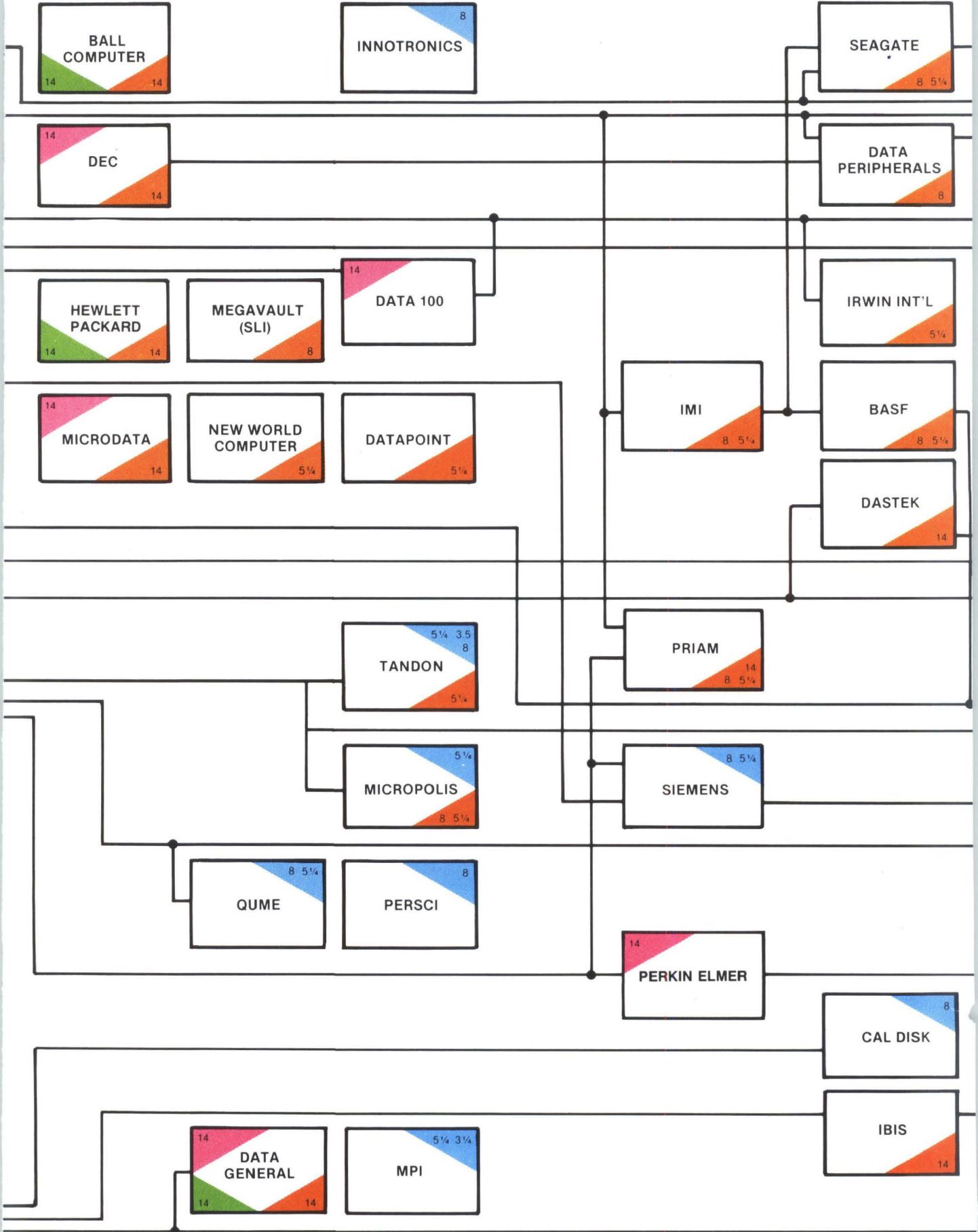
1975

1976

1977

1978

1979





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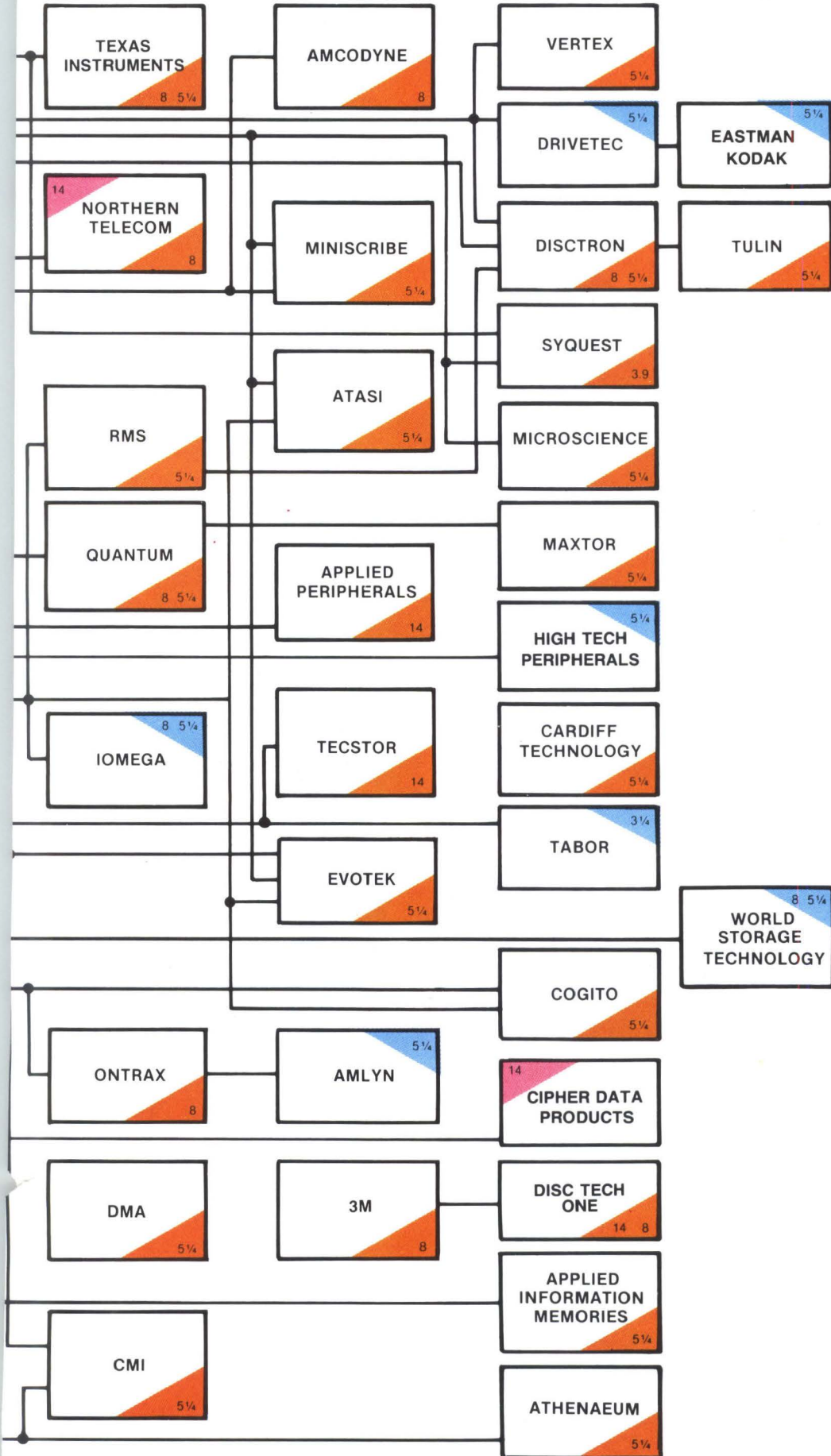
1980





1981

1982

1983

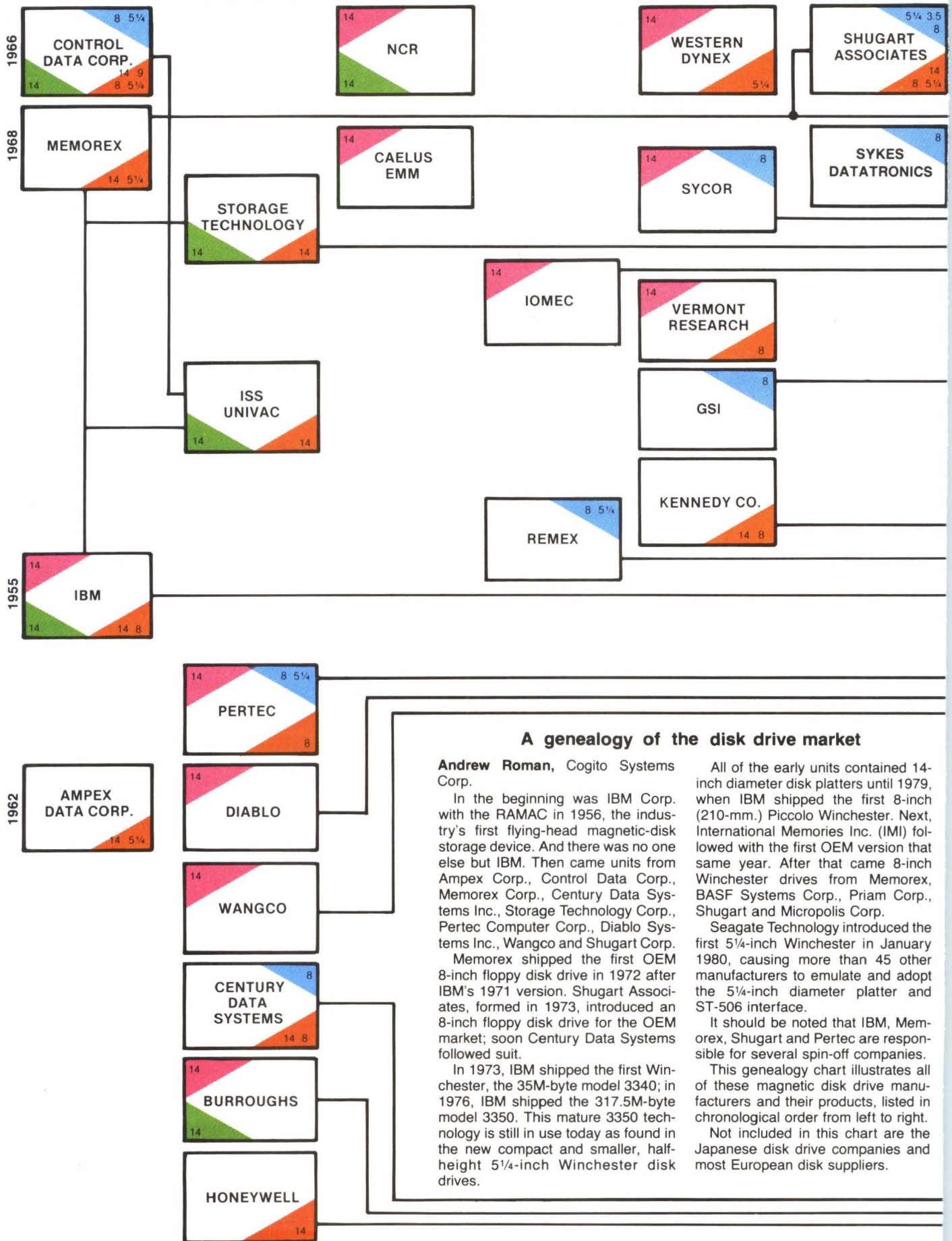
1984



-  CARTRIDGE DISK DRIVE
-  FLOPPY DISK DRIVE
-  WINCHESTER DISK DRIVE
-  PACK DISK DRIVE



# 1969 1970 1971 1972 1973



## A genealogy of the disk drive market

**Andrew Roman**, Cogito Systems Corp.

In the beginning was IBM Corp. with the RAMAC in 1956, the industry's first flying-head magnetic-disk storage device. And there was no one else but IBM. Then came units from Ampex Corp., Control Data Corp., Memorex Corp., Century Data Systems Inc., Storage Technology Corp., Pertec Computer Corp., Diablo Systems Inc., Wangco and Shugart Corp.

Memorex shipped the first OEM 8-inch floppy disk drive in 1972 after IBM's 1971 version. Shugart Associates, formed in 1973, introduced an 8-inch floppy disk drive for the OEM market; soon Century Data Systems followed suit.

In 1973, IBM shipped the first Winchester, the 35M-byte model 3340; in 1976, IBM shipped the 317.5M-byte model 3350. This mature 3350 technology is still in use today as found in the new compact and smaller, half-height 5 1/4-inch Winchester disk drives.

All of the early units contained 14-inch diameter disk platters until 1979, when IBM shipped the first 8-inch (210-mm.) Piccolo Winchester. Next, International Memories Inc. (IMI) followed with the first OEM version that same year. After that came 8-inch Winchester drives from Memorex, BASF Systems Corp., Priam Corp., Shugart and Micropolis Corp.

Seagate Technology introduced the first 5 1/4-inch Winchester in January 1980, causing more than 45 other manufacturers to emulate and adopt the 5 1/4-inch diameter platter and ST-506 interface.

It should be noted that IBM, Memorex, Shugart and Pertec are responsible for several spin-off companies.

This genealogy chart illustrates all of these magnetic disk drive manufacturers and their products, listed in chronological order from left to right.

Not included in this chart are the Japanese disk drive companies and most European disk suppliers.



# VALUE-ADDERS WILL PLAY KEY ROLE

**Operating systems, application packages and high-performance hardware propel the market, causing manufacturers to restructure distribution channels**

**Brian D. Wiltshire**  
Applied Digital Data Systems Inc.

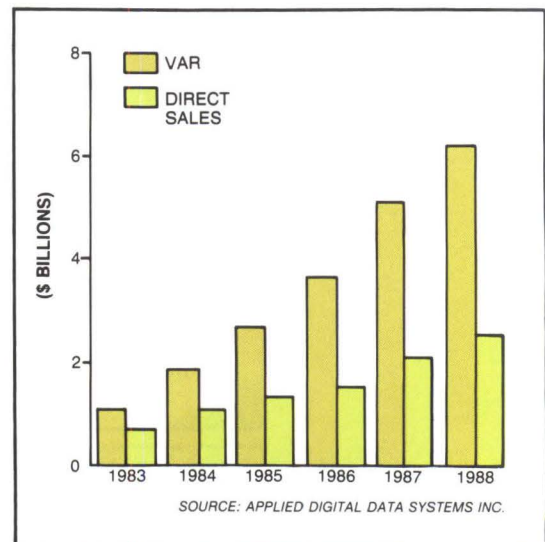
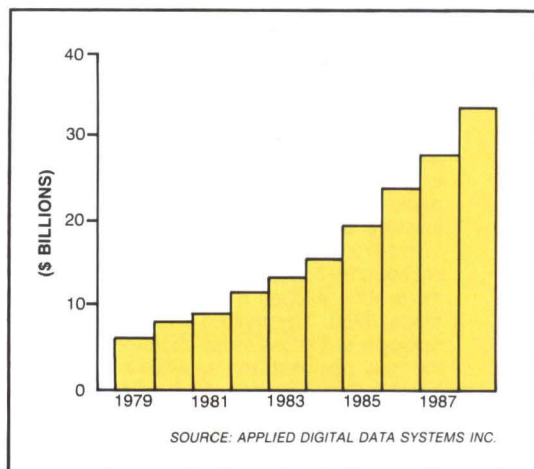
In 1979, the worldwide market for multiuser computer systems in the \$30,000 to \$50,000 range was worth \$6.7 billion. In 1983, this figure topped \$11 billion. The most dramatic growth in the multiuser system market, however, will be in the less-than-\$30,000 bracket. This market niche is expected to increase at a 32 percent compound annual growth rate in revenues and a 38 percent compound annual growth rate in units shipped between 1984 and 1988, compared to a 19 percent compound annual growth rate in revenues for the overall market for \$15,000 to \$50,000 systems. Applied Digital Data Systems (ADDS) Inc. defines a small multiuser system as one that sells for less than \$50,000 and that can grow to support at least 32 users.

There are approximately 15 million businesses in the United States with annual revenues of less than \$5 million. Medium-sized businesses and decentralized units of large businesses and government also

provide huge market potential for manufacturers of small multiuser systems. Even faster growth rates are predicted for overseas markets, which mirror domestic markets. But manufacturers have been slow to capitalize on the multiuser system market because of a lack of sufficient profit margins. Several elements affect the success of this market, including hardware availability, efficiency of multiuser operating systems and application packages and adequate distribution channels.

**Fig. 1. Sales to value-added remarketers (VARs) in 1983 accounted for approximately 60 percent of sales of multiuser systems in the \$15,000 to \$30,000 range. By 1988, VARs are expected to account for over 70 percent of sales, while revenue from direct sales channels will drop from 40 percent to 30 percent of the market during the same period.**

**Worldwide revenues for multiuser systems in the \$15,000 to \$50,000 range are expected to increase more than fivefold between 1979 and 1988.**





The most significant hardware improvements include high-performance, 10-MHz 16-bit CPUs, high-performance 5¼-inch Winchester drives with capacities of 30M bytes or more and 32-msec. average access times, faster and higher-capacity RAM chips, built-in uninterruptible power supplies and ¼- and ½-inch streaming-tape cartridge drives. The recent availability of high-capacity backup devices has virtually removed the need for diskettes, which are inadequate for large database applications, either as primary storage or as backup devices.

Next in line in ensuring growth potential for multiuser systems are the availability of true multiuser operating systems for microcomputers. The big step forward was the transfer of operating systems such as UNIX and Pick to microprocessor environments.

A consideration in configuring a multiuser environment is the trade-off between local-area networks (LANs) and timesharing configurations. A timesharing configuration provides a single system with multiple ports and generally offers higher performance and lower cost per station. Sharing databases is more difficult in LAN systems because it requires complex software to organize and police a distributed database-management environment. Mainframe and minicomputer manufacturers have struggled with this problem for more than a decade with few results.

Many systems termed "multiuser" are constrained by software based on the systems' floppy drive origins. If three or four users access one file, the system often responds too slowly for a true

multiuser environment. This slowdown complicates record protection and file locking, which are critical functions in a multiuser environment. To assure data integrity, records must be protected from simultaneous user access. If one user is executing a write access while another user is writing, data at the record level as well as at the file level must be protected.

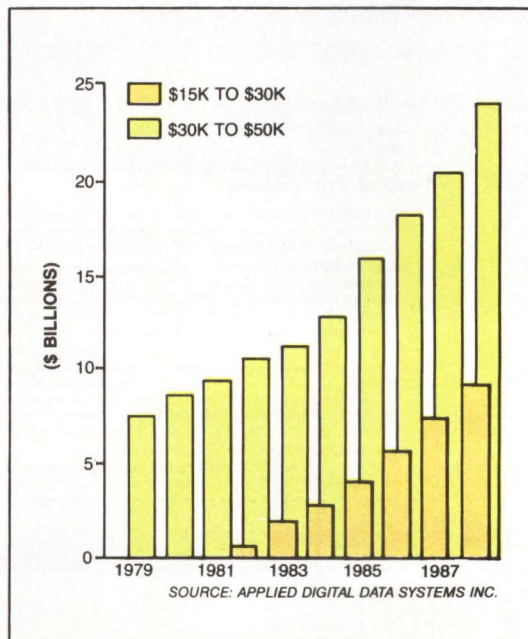
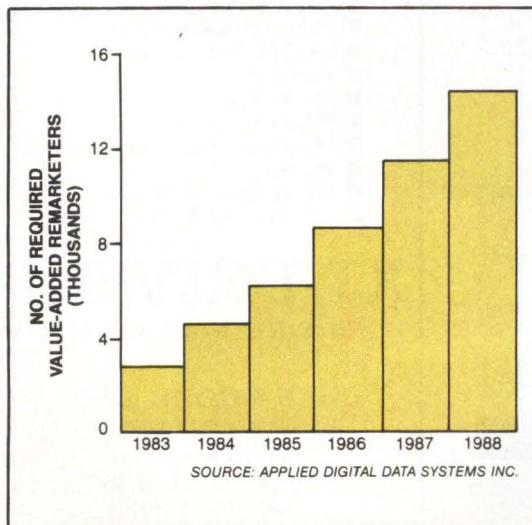
A relatively new and powerful phenomenon is software that can effectively link personal computers to multiuser central systems. For example, the ADDS-enhanced Pick operating system allows an MS-DOS-based workstation—running, say, Lotus Development Corp.'s 1-2-3 integrated software—to link to the Pick database-management system environment for retrieval and update. The software makes this link transparent to end users.

With hardware and operating systems in place, the next ingredient necessary to spur market growth is availability of application-generation products. Until recently, application packages were too rigid for multiuser environments. Because application generators produce clean code and self-documentation, they facilitate the building and modification of application packages as well as the reduction of development costs.

An increasingly important application area is the database-management system. Operating systems now integrate a variety of database-management system functions, such as relational systems with variable-length records, modification tools that allow simple additions of forgotten or overlooked fields or records and user-selectable retrieval and reporting.

**To meet the demand for multiuser systems, the current worldwide population of 3,000 value-added remarketers will have to increase to over 14,000 by 1988.**

**Fig. 2. The number of VARs will have to jump from 3,000 in 1983 to over 14,000 in 1988 to meet the expected demand for small multiuser systems.**



**Low-cost multiuser systems will increase their market share between 1982 and 1988 with a 31 percent compound annual growth rate in revenues.**



## STATE OF THE MARKET REPORT:

### MULTIUSER SYSTEMS

**The key distribution channel is the value-added remarketer.**

The final ingredient for success in the multiuser system market is adequate distribution channels to the end user. The key channel is the value-added remarketer (VAR). The VAR provides a combination of hardware, operating-system, application-software and vertical-market expertise to serve end users with what has recently been termed "warmware."

The VAR, however, often encounters a profit problem based on selling and support costs. The amount a user will pay for a multiuser system is often not enough to allow for a long sales cycle, numerous installation and service calls and prolonged customization. All of these factors can erode profit margins. VARs therefore must have a high degree of vertical-sales focus and the right tools, such as application software that can be easily customized to meet end-user requirements.

Sales through VARS are expected to increase at a 35 percent compound annual growth rate, while sales through direct sales forces will increase at a 25 percent compound annual growth rate. The most significant challenge facing manufacturers of small multiuser systems is creating enough remarketers or direct sales entities to handle the projected growth. The current base of more than 3,000

remarketers worldwide is handling about 60 percent of the multiuser system market, but this figure is expected to top 70 percent by 1988 (Fig. 1). To meet the demand, the number of VARs would have to increase to over 14,000 by 1988 (Fig. 2). Moreover, their average productivity would have to increase from about 15 systems sold per year to more than 25 systems. An alternative for manufacturers of small multiuser systems is to reorganize and retrain direct sales forces. □

**Brian D. Wiltshire** is vice president and general manager of the Systems Division at Applied Digital Data Systems Inc., Hauppauge, N.Y. The Systems Division develops, manufactures and markets the Mentor line of multiuser business systems. Wiltshire has held marketing and general management positions in the mainframe, computer service, minicomputer and microcomputer industries over the last 22 years.

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PF in VT100 Mode	0	64
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Non-Volatile Function Memory	NO	YES
Four-Page Memory	NO	YES
Eight-Page Memory Option	N/A**	YES
Bi-Directional Printer Port	NO	YES
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Dual Host Support	NO	YES
Compose Key	YES	YES
Graphics Option	NO	YES
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\* Based on latest information supplied by manufacturer. \*\* Not applicable.

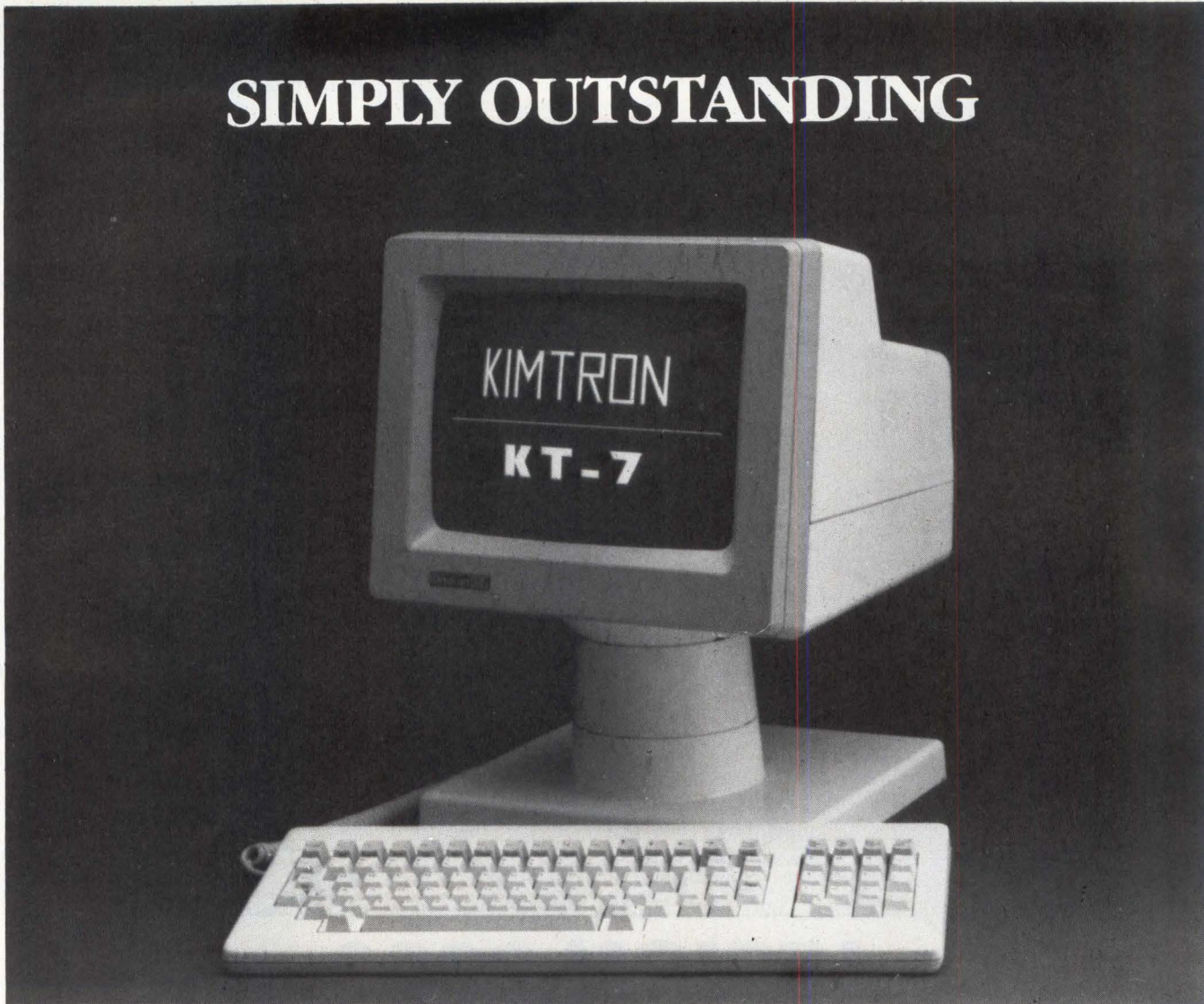
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# COMPETITION FORCES COST-CUTTING EFFORTS

**Manufacturers of conversational CRTs are moving to offshore production to lower costs and stave off competition from intelligent terminals**

**Marc H. Rudov**, Venture Development Corp.

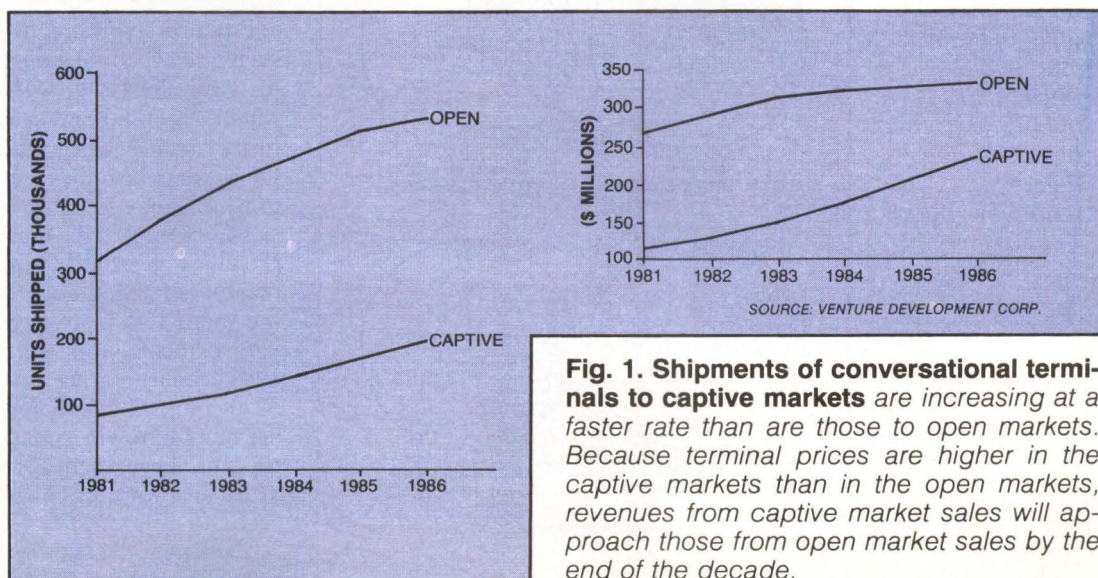
With the advent of inexpensive intelligent terminals, low-cost alphanumeric terminals are losing market share despite drastic price reductions. These conversational, or dumb, terminals generally have no local intelligence and rely on a host computer for control. They are non-programmable, have no editing features (except for retyping or character strikeover) or text buffers and converse with the computer one character at a time.

Recently, microprocessor technology enabled these terminals to perform tasks formerly controlled by a host computer, such as cursor control, uppercase and lowercase letters, single-page buffering and tab setting. These functions are sometimes "hard-wired" into a terminal rather than implemented by a microprocessor. A

terminal can contain a microprocessor and still be considered dumb if it acts primarily as a slave to the host computer.

The dumb-terminal market has approximately 20 major manufacturers with total 1983 revenues of \$513 million. This is 50 percent lower than the average revenues of smart-terminal manufacturers. The current leader in the dumb-terminal market is Digital Equipment Corp.

In the past few years, many dumb-terminal manufacturers, such as Teleray and Soroc Technology Inc., have left this market because of declining prices and low profit margins. Venture Development Corp. (VDC) expects to see more computer manufacturers enter this market as the independent companies leave. Most independent start-up companies entering the terminal market will manufacture smart terminals or personal computers.



**Fig. 1. Shipments of conversational terminals to captive markets are increasing at a faster rate than are those to open markets. Because terminal prices are higher in the captive markets than in the open markets, revenues from captive market sales will approach those from open market sales by the end of the decade.**



# STATE OF THE MARKET REPORT:

## TERMINALS

A recent trend among CRT manufacturers is to use offshore production because labor is cheaper in Taiwan, Korea and Japan. TeleVideo Systems Inc., for example, manufactures terminals in Korea. The company entered the CRT terminal market in 1979 and now commands a leading 25 percent of the overall market.

One company affected by TeleVideo's offshore strategy is Hazeltine, which has since adopted a similar strategy. In 1981, Hazeltine introduced the Esprit, a dumb terminal manufactured in Taiwan by Disco Electronics. The price of the terminal was so attractive that Hazeltine contracted to become its exclusive worldwide distributor. The Esprit is now Hazeltine's most popular terminal.

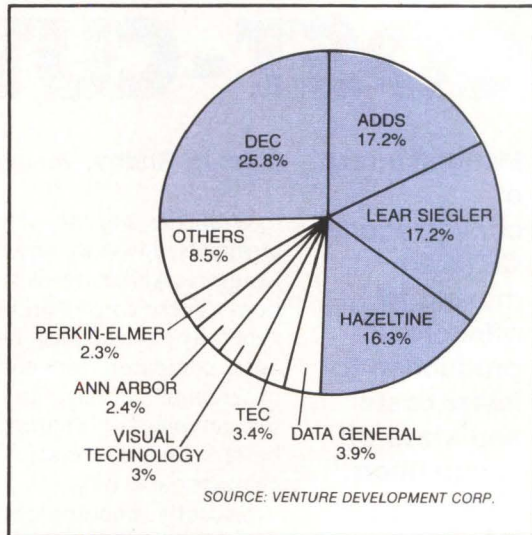
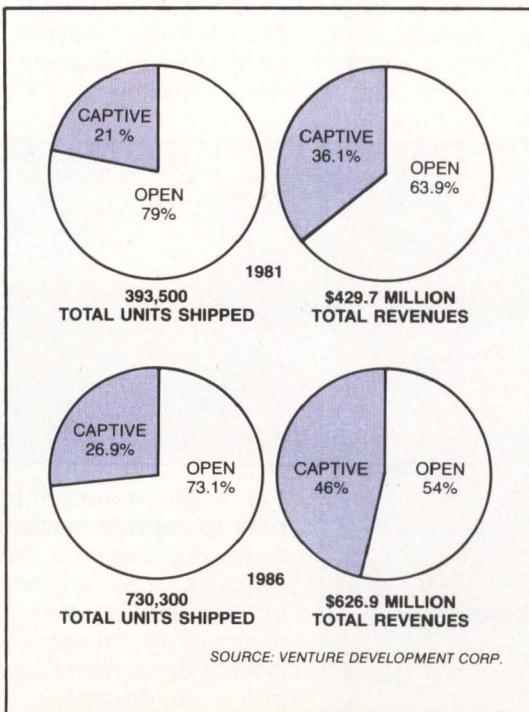
Other industry leaders, such as Lear Siegler Inc., sell monitors made in Korea and keyboards made in Japan. VDC expects the offshore manufacturing trend to continue. As prices fall below \$400, manufacturers will have to find less expensive ways of manufacturing terminals to remain competitive and profitable.

One source of competition for conversational terminals comes from intelligent CRTs, which have taken market share away from dumb terminals because of their local processing abilities and declining prices. Teleprinters are another keen competitor. The main difference between CRTs and teleprinters is the form of output. One advantage of a CRT is that its output appears quickly. The disadvantage is that it requires a separate printer for hard copy. However, it is

sometimes less expensive to buy a dumb terminal and slave printer than to purchase a teleprinter. This is particularly true of multiterminal installations that can share one printer. The competition between teleprinters and CRT terminals occurs more frequently at the intelligent-model level.

Graphics terminals also compete with alphanumeric terminals. This competition occurs more often in statistical and business applications, in which a pie chart or graph can display information better than a list of numbers can. In applications such as word processing, there is little or no need for graphics.

**Fig. 2. Captive market shipments of conversational terminals will gain increasing market share between 1981 and 1986 both in units shipped (left) and revenues (right).**



**Fig. 3. Of the total installed base of conversational terminals in 1981, four companies accounted for more than 75 percent.**

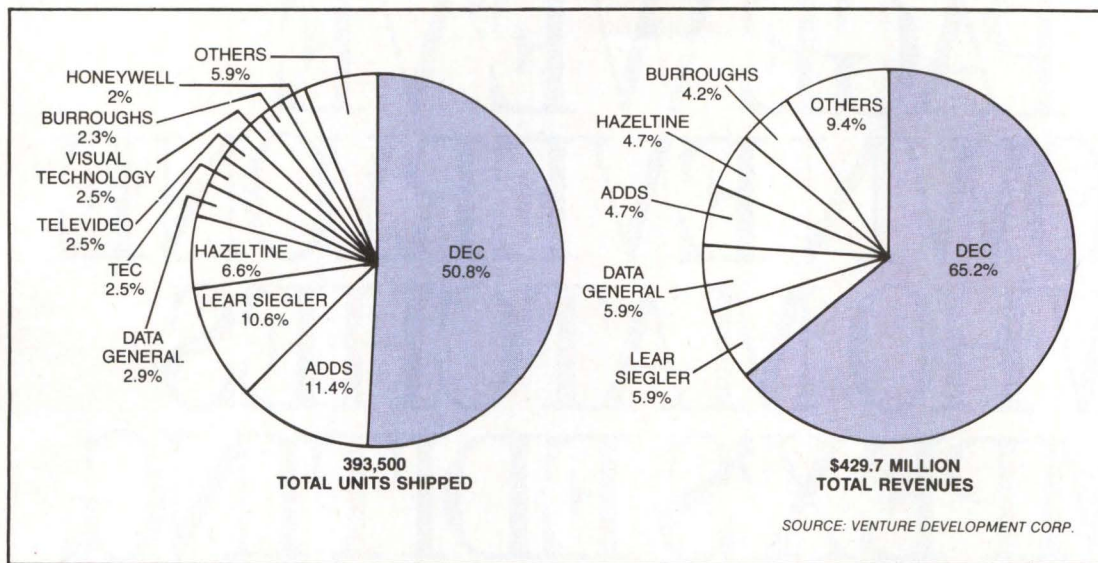
### Product cycle approaches maturity

Products typically progress through a four-stage life cycle: introduction, during which sales increase slowly; growth, when the product is widely accepted and sales increase rapidly; maturity, during which sales growth levels off and the product becomes a commodity; and decline, in which sales decrease steadily.

The overall CRT-terminal industry is in the growth stage of its life cycle. The dumb-terminal market is further along in the growth stage than the smart-terminal and personal-computer market segments and will approach maturity by 1986. Smart/editing terminals, including IBM 3270-compatible and non-3270-compatible units, are in mid-growth. Smart terminals will continue to experience high growth over the next five years and will not become mature products for seven to 10 years.

VDC pegs the average market life of an alphanumeric terminal at 4½ years. In other words,





**Fig. 4. DEC leads the conversational, or "dumb," terminal market.**

SOURCE: VENTURE DEVELOPMENT CORP.

terminals are sold actively for 4½ years before vendors replace or upgrade them with new products or models. Of the terminals introduced in 1981, most will be replaced or upgraded by 1985. It is also likely that many dumb terminals introduced in 1981 will be replaced by smart terminals by 1985.

When new technology and advanced manufacturing processes lead to reduced prices, thereby creating commodity-like products, the resulting features and functions provided by more powerful, but less expensive, products become necessities rather than luxuries. Just as 32-bit microprocessors will replace 8- and 16-bit CPUs, intelligent terminals will replace dumb terminals. To remain competitive, terminal vendors will replace dumb terminals with smart or intelligent terminals or with personal computers.

Unit shipments of dumb terminals to captive markets are lower than those to the open market but are growing at a faster rate (Fig. 1). Captive shipments of dumb terminals were 82,500 units in 1981. At a compounded annual growth rate of 19 percent, captive shipments will reach 196,700 units by 1986. Open market shipments were 311,000 units in 1981 and will grow at a compounded annual growth rate of 11.4 percent, reaching 533,600 units by 1986.

As with unit shipments, dollar shipments of conversational terminals are growing faster in the captive market segment. Dollar shipments of dumb terminals to the captive market were \$155.1 million in 1981. With a projected 13.2 percent compounded annual growth rate, shipments to the captive market will reach \$288.5 million by 1986. Dollar shipments to the open market have been increasing at a compounded annual growth rate of only 4.3 percent since 1981. This is a direct result of falling prices.

Shipments of conversational terminals to the open market in 1981 constituted 79 percent of total unit shipments. Open market shipments are expected to decrease to 73.1 percent of the conversational-terminal market by 1986. Likewise, dollar shipments to the open market will decrease from a 63.9 percent share in 1981 to 54 percent in 1986 (Fig. 2).

DEC had the largest part of the 1981 installed base of conversational terminals with a 25.8 percent share. Applied Digital Data Systems Inc. (ADDS) and Lear Siegler each had 17.2 percent, and Hazeltine earned a 16.3 percent share (Fig. 3). DEC also had the overwhelming lead in 1981 unit shipments with a 50.8 percent share, followed by ADDS with 11.4 percent, Lear Siegler with 10.6 percent and Hazeltine with 6.6 percent. DEC had an even larger share of dollar shipments, with 65.2 percent, because the company sold terminals to the captive market at prices higher than those common to the open market. Lear Siegler and Data General Corp. were tied for second place with 5.9 percent each (Fig. 4). Although DG had only 2.9 percent of unit shipments, its prices were higher than those of the independents because the company sells predominantly to the captive market.

Most conversational terminals are sold through dealers or distributors, which accounted for 39.4 percent of 1981 unit shipments. Captive end-user shipments represented 28.8 percent of shipments, OEM/system houses had 14 percent, and open-market shipments to the end user comprised 13.7 percent. □

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**Marc H. Rudov** is a senior consultant with Venture Development Corp., a Wellesley, Mass., management consulting company serving the electronics industry.



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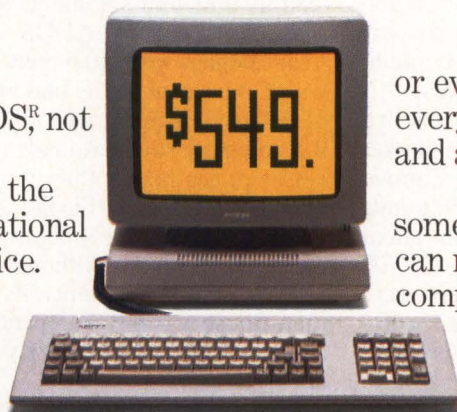
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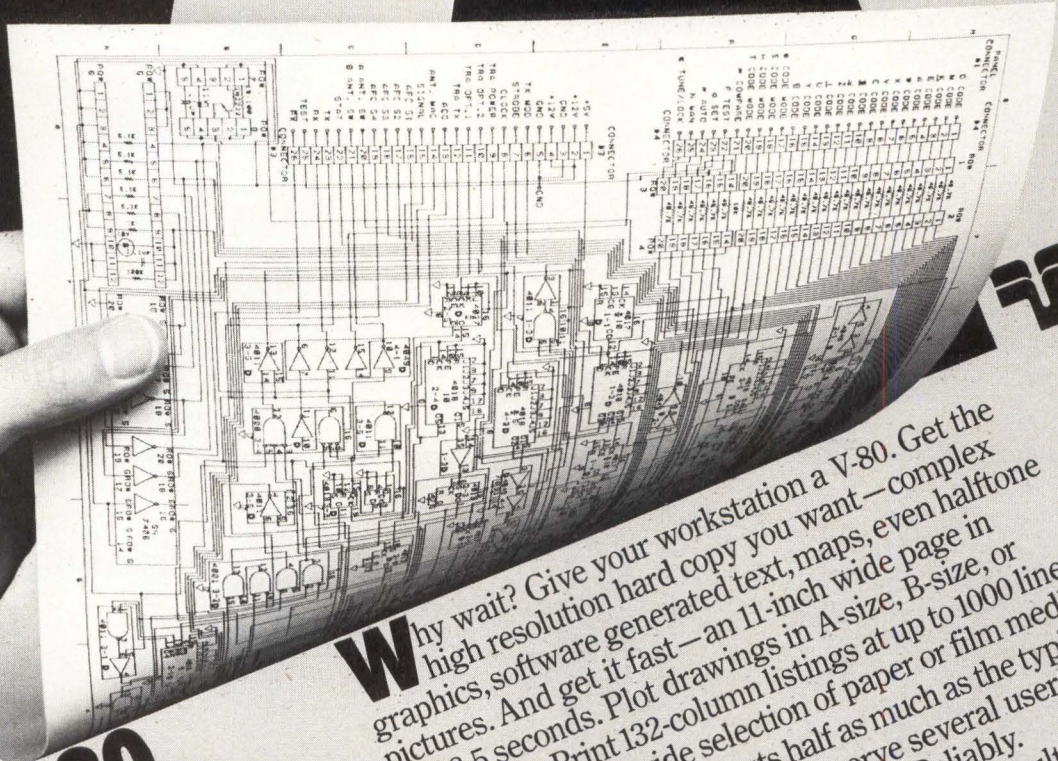






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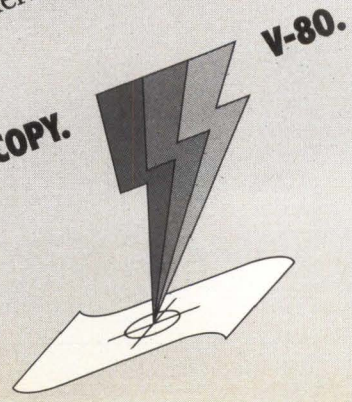
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# A PICTURE'S WORTH A THOUSAND BYTES

**As desktop computers multiply, the need for quick, accurate presentation of data has escalated the business graphics market**

**Mary Owen**  
Advanced Resources Development

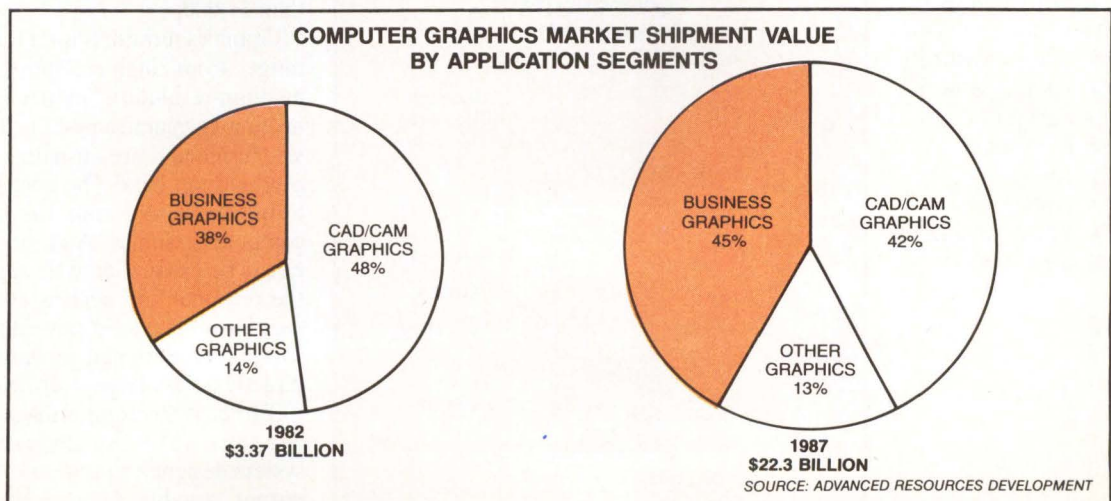
Computing power is coming into the hands of a wider category of users and is serving a broader range of applications than ever before. Whereas 10 years ago computer access was restricted mainly to data-processing personnel for specialized departmental applications, today a new kind of end user, commonly called a "knowledge worker," is using computers to assist in analyzing day-to-day business problems. As the quick, accurate presentation of data has become a crucial feature in this type of application, computer-generated graphics for business applications have emerged as a growing market segment.

Computer-generated graphics are not a new development. High-quality, high-resolution graphics have been used in design, manufacturing, engineering and military applications. For example,

in computer-aided design/computer-aided manufacturing (CAD/CAM) applications, design details are collected and processed to generate a pictorial representation of the object being designed or complex circuitry is pictured on a screen for easy analysis. The largest application markets for CAD/CAM today are mechanical design and printed-circuit-board layouts, with architecture, drafting and engineering design as other important market segments. Architectural planning, process control and imaging in fields such as medicine, land-resource planning and space exploration are other traditional applications for computer-generated graphics.

The use of computer-generated graphics in general business applications is a recent trend. Apple Computer Inc.'s Apple II computer, introduced around 1978, brought easy-to-use, low-cost graphics to personal computer users. The development in the late 1970s of improved display devices

**Fig. 1. Business graphics will constitute the lion's share of computer graphics shipments by 1987.**





## STATE OF THE MARKET REPORT:

### BUSINESS GRAPHICS

for computer/terminal installations reduced the cost of computer graphics enough to make graphics feasible for business applications. Now, graphics capability is finding its way into distributed workstations, in which more intelligent terminals and local graphics-processing capability are unburdening host computers and speeding interactive response.

#### Business graphics use expands

At the end of 1982, CAD/CAM and other applications, including process control and imaging, dominated computer graphics shipments with 48 percent and 14 percent shares of the market, respectively. By year-end 1987, healthy growth in the business graphics sector will have changed this picture. Business graphics will then account for 45 percent of total graphics market shipments, up from 1982's 38 percent share. CAD/CAM applications will drop to a 42 percent market share, down from 1982's 48 percent share. The total computer graphics market will mushroom into a \$22.3 billion market by 1987, with business graphics alone accounting for roughly \$10 billion of the 1987 total. By then, graphics capability will be a necessity for workstations, microcomputers and terminals sold for business applications.

Graphics displays, hard-copy output devices, input devices and software constitute the graphics market. The graphics display segment includes all the hardware directly associated with the display, including the graphics processor, the display memory, the internal memory dedicated to graphics and the monitor. Hard-copy output devices include color and monochrome printers based on matrix impact, ink-jet and thermal technologies. Development of hard-copy output devices based on electro-

static and laser color technologies promise faster color output at a lower cost per copy. Input devices include keyboards, mouse-like cursor-control devices and digitizer tablets. Finally, graphics software encompasses all microcomputer and host software graphics generation.

Graphics displays will continue to account for the largest dollar volume in the graphics market (Fig. 2), with hard-copy output devices and software coming in second and third, respectively. Through 1987, displays will show the most dramatic growth in revenues, followed by hard-copy output devices.

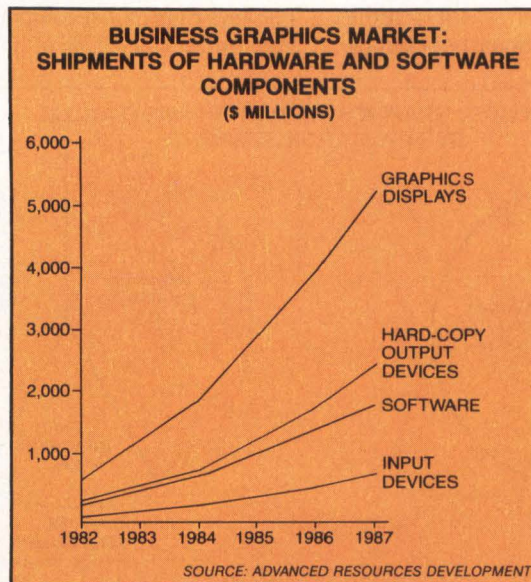
Business graphics function with four broad types of computer devices: workstations, business microcomputers, graphics terminals and turnkey presentation systems. Workstations, as defined in Advanced Resources Development's market study, "Management Workstations: Markets and Strategies," offer multifunction support to managers, professionals and support-staff workers and include personal desktop computers, intelligent terminals, multifunction word processors and workstation systems. These devices are usually part of larger integrated office systems using shared data files and peripherals and providing communications with other workstations. Communications are via a central computer system, a local-area network or a telephone line.

Business microcomputers include single-user and multiuser, 8-, 16- and 32-bit microcomputers with graphics software as well as hard-copy devices supporting general business applications. Software-based graphics can be added to most microcomputers at a very low incremental cost, stimulating the demand for graphics. Many low-end microcomputers support graphics software using their main processors and standard displays, thus requiring no additional investment in hardware to implement monochrome graphics displays. Some microcomputers, however, require the use of an optional graphics display processor, usually selling for less than \$1,000.

Graphics terminals used for business applications range from high-resolution color terminals to medium-resolution monochrome displays. Connecting to mainframes or minicomputers, graphics terminals are usually used for generating presentation data. The declining prices of graphics terminals should spur the use of host-generated computer graphics. And, because hard-copy devices can be easily shared through a central computer, the terminal approach is attractive on a cost-per-user basis. The most powerful and flexible graphics software is designed for large computers that can directly access large statistical databases.

Turnkey presentation systems bundle hardware and software into an integrated standalone graphics system designed to generate high-quality hard-copy output suitable for presentations. Such systems

**Fig. 2. Graphics displays** will continue to outpace hard-copy output devices in terms of the value of device shipments. Graphics software, however, will be close behind.







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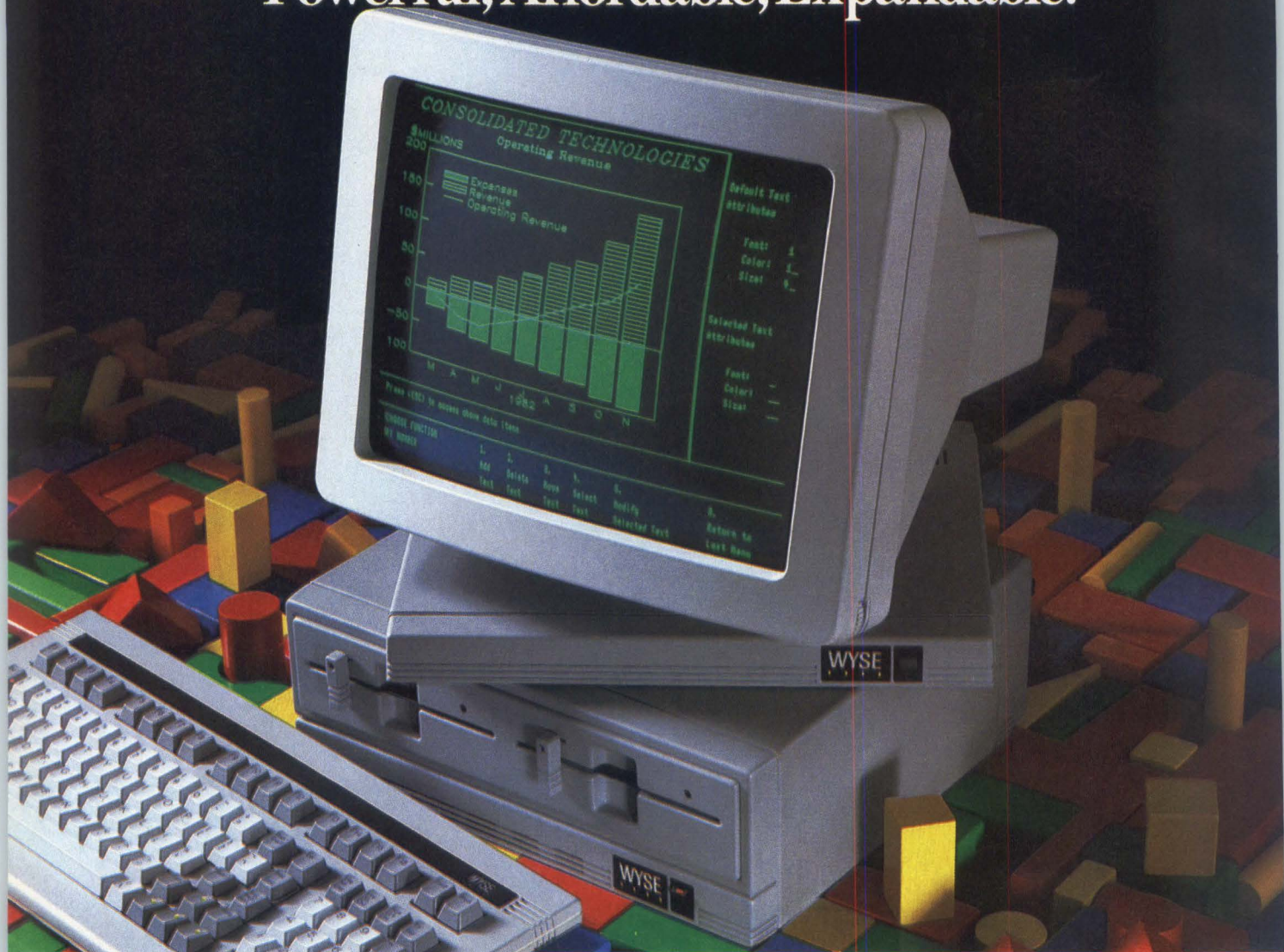
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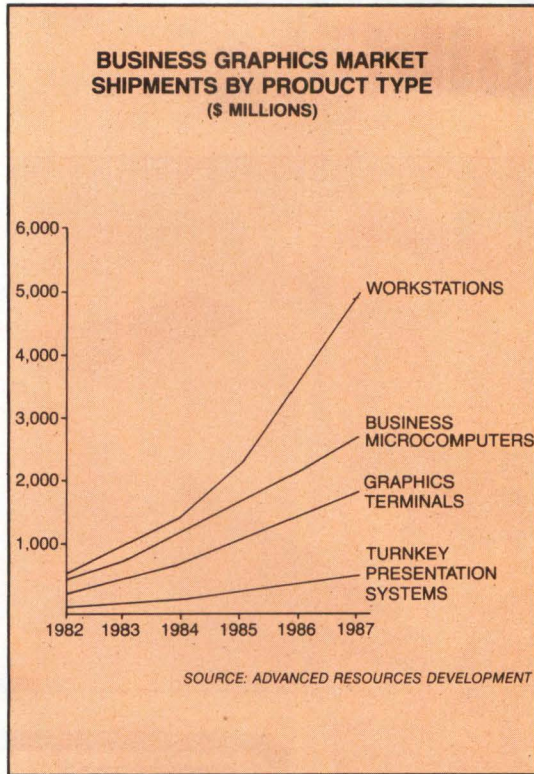
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# STATE OF THE MARKET REPORT:

## BUSINESS GRAPHICS



**Fig. 3.** Workstations account for the largest dollar volume in the business graphics market and will exhibit the most dramatic growth in revenues through 1987.

offer sophisticated graphics software with flexible formatting options, color support and high-quality hard-copy output devices.

Workstations account for the largest dollar volume in the business graphics market and will show the most dramatic growth in revenues through 1987 (Fig. 3). Business microcomputers will exhibit the next-best growth pattern—although the increased demand for workstation systems will hamper the revenue growth of business microcomputers. Graphics terminals will continue to show growth through 1987, but their market share in dollars will decrease in favor of workstations and microcomputers. Although shipments of turnkey presentation systems will continue to grow, this type of system will continue to be a relatively minor market segment. □

**Mary Owen** is a consultant and director of terminals research at Advanced Resources Development, Medfield, Mass.

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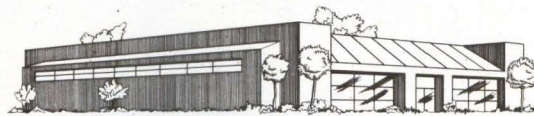
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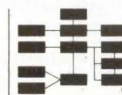
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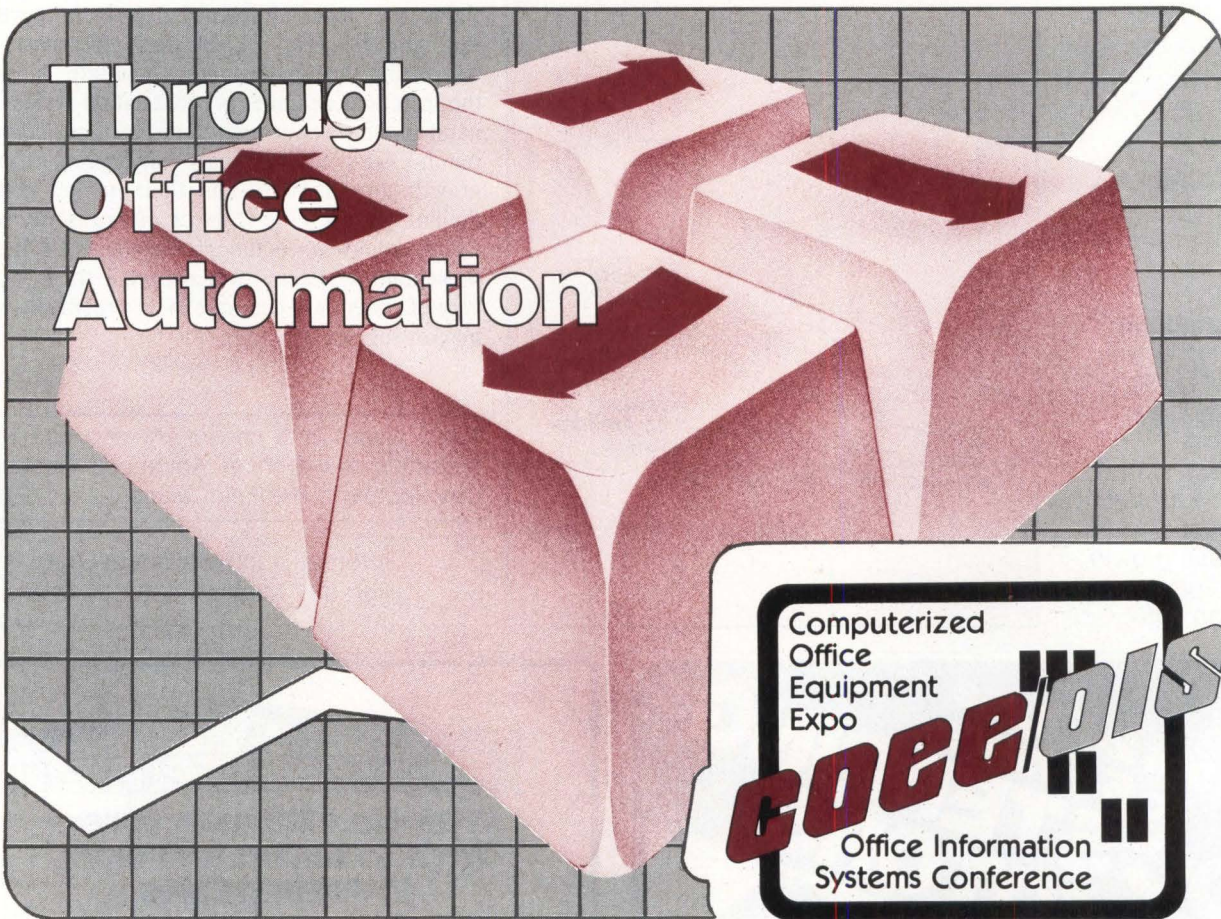
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# MAILMEN SUPPLY COMPUTER BOOM

**Computer proliferation in small business applications has spurred the emergence of direct-mail specialists as dominant computer-supply vendors**

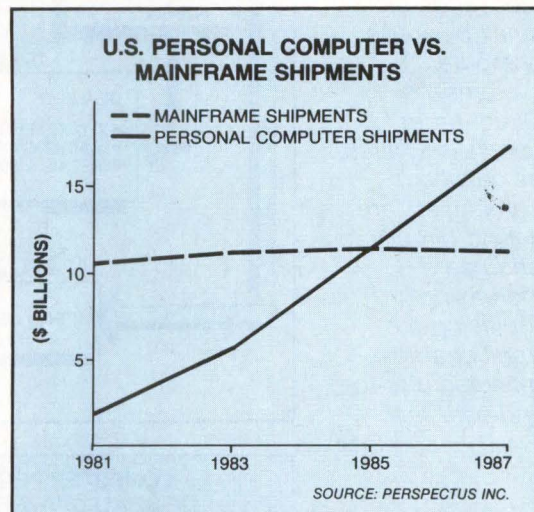
**Joseph V. Popolo, MISCO Inc.**

As recently as 20 years ago, computers were exotic pieces of equipment that were sequestered in computer rooms, pampered with air conditioning and tended by specialists. Today, business people who never dreamed they'd be able to afford the advantages of electronic budget forecasting, inventory control or sales projections have discovered they can have such benefits on their desktops for a few thousand dollars. The demand for computers has triggered a rising demand for computer supplies of all kinds—from floppy disks to print wheels, paper and magnetic tape. The demand has also significantly affected the computer-supplies market, spurring the growth of the direct-order computer-supplies industry and altering traditional distribution patterns.

A \$20,000 computer uses about \$3,000 worth of consumable supplies a year. The market for floppy disks is predicted to increase to more than \$730 million by 1987, up from 1981's \$128 million total. The dramatic penetration of computers into small business applications—which is emerging as the most important segment of the business-supply market—is one of the main factors fueling the growing demand for computer supplies. The market increased 130 percent from 1979 to 1982, and 1 million computers are expected to be installed in businesses with fewer than 500 employees by 1985.

## Changing distribution patterns

This market growth has altered the traditional distribution patterns of the computer-supplies market, which has had to change from supplying a few dozen industrial giants to supporting and servicing thousands of small systems. The sudden growth of the direct-order computer supplies market is a consequence of this changing supply pattern. End users are increasingly buying computer supplies



**The dramatic increase in personal computer shipments, expected to surpass mainframe sales by next year, has forced the computer-supply industry to restructure to supply this new demand.**

from direct-mail companies instead of ordering directly from supplies manufacturers. Yearly sales from direct-order companies are estimated at \$420 million.

Catalogs of computer supplies offer the most efficient means of reaching the greatest number of customers. With the cost of an average sales call now pegged at \$250, many companies cannot afford to send salespeople to potential customers. In addition, many end users prefer the advantages of shopping from a catalog. Without waiting for a salesperson to call, they can use the catalog as a reference tool to what's available for their computer systems and get valuable insights into ways of optimizing their operation. Charts and diagrams aid in matching disk drive filters with disk drives



# STATE OF THE MARKET REPORT:

## COMPUTER SUPPLIES

and the right cables and connections for adding peripherals to systems. End users can discover equipment they did not know was available to solve business problems—from ergonomic furniture to boost computer operator performance to surge suppressors to protect vital equipment.

### Direct-order serves end-user needs

Direct-order specialists can help meet critical end-user needs. Business computer users must have a reliable source for their supplies and one that furnishes the right product for an application. No retail outlet has the shelf space to stock thousands of computer supplies. In addition, some products, such as printer ribbons and diskettes, deteriorate over time. The direct-order supply specialist has the volume turnover to ensure that a product has not been sitting on the shelf for too long; the retailer may not have the inventory turnover to ensure product freshness.

Because they stock all leading brands of computer supplies and have no particular axe to grind, supply specialists can usually recommend the best product for an end user's application. They can offer pre- and post-sale technical assistance over the phone at the end user's convenience. Furthermore, they can stop problems before they begin by recommending products completely compatible with a user's equipment.

Dealing directly with all major computer-supply product manufacturers, supply specialists know what products are about to be introduced. By comparing customers' needs with advance knowledge of product features, they can offer expert recommendations.

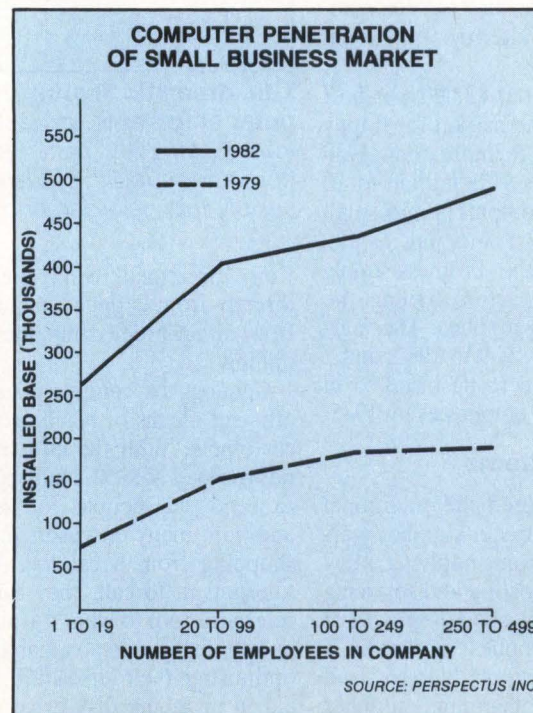
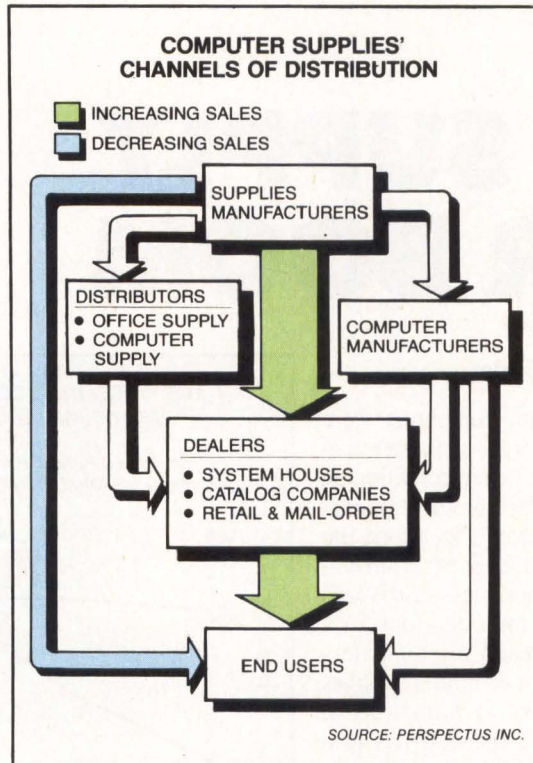
End users concerned about quality will be well-served by supply specialists. They carry top-quality brand names and products whose reliability and performance consistency has been proven over a number of years. The specialist knows that a product is not a bargain if it fails in use and causes costly downtime for end users.

Finally, using a single specialized source for computer supplies assures end users that they can pinpoint responsibility for malfunctioning products. The shipper, in addition, is responsible for proper packing to prevent goods from being damaged en route to the end user.

These and other advantages have spurred the growth of the direct-order computer-supplies market and will continue to do so as the catalog of tomorrow moves into electronic mail and onto videotex screens. □

**Joseph V. Popolo** is president of MISCO Inc., Holmdel, N.J. Active in the Direct Marketing Association, Popolo was formerly director of sales at Perkin-Elmer Corp., Oceanport, N.J.

**Traditional methods of computer-supply distribution are eroding as a result of the requirements of thousands of small business computer systems. Direct-order specialists, such as catalog companies, are selling directly to end users, increasingly replacing the traditional manufacturer-to-end-user link.**

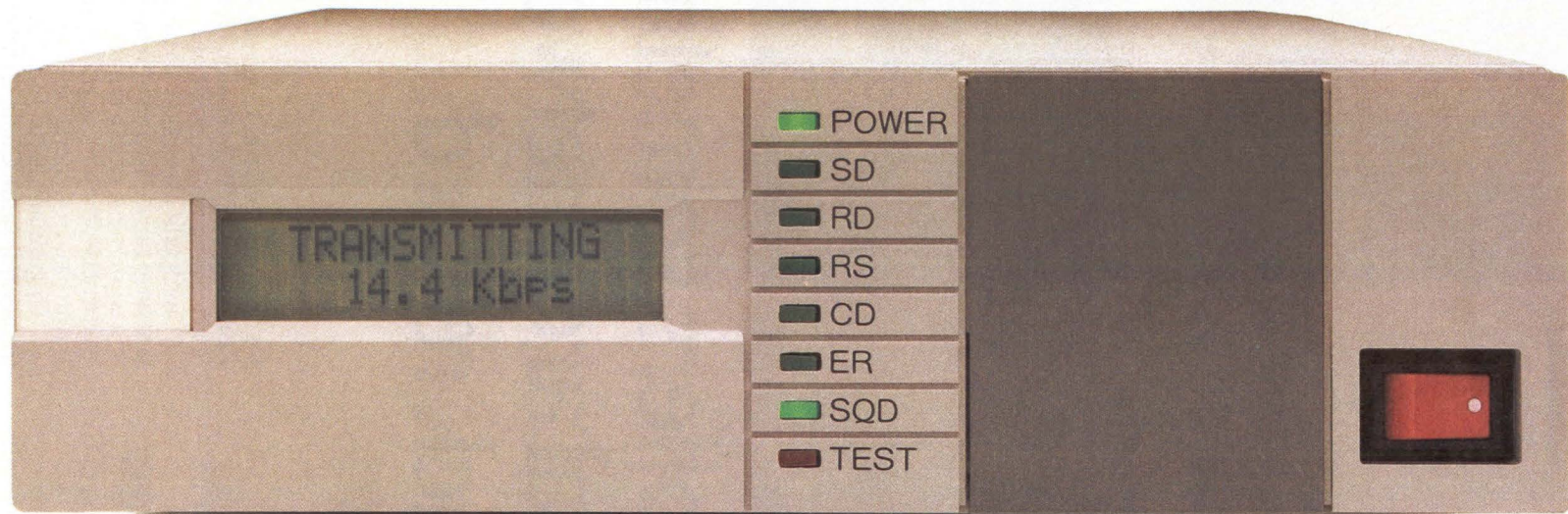


**Computer penetration of the small business market has risen dramatically over the last few years, producing opportunities for direct-order computer-supply companies.**

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# Disk subsystem makers lure OEMs with integrated backup, higher performance

*OEMs look to subsystem manufacturers for ready-to-run, value-added disk drives. Meanwhile, drive manufacturers enter the subsystem market*

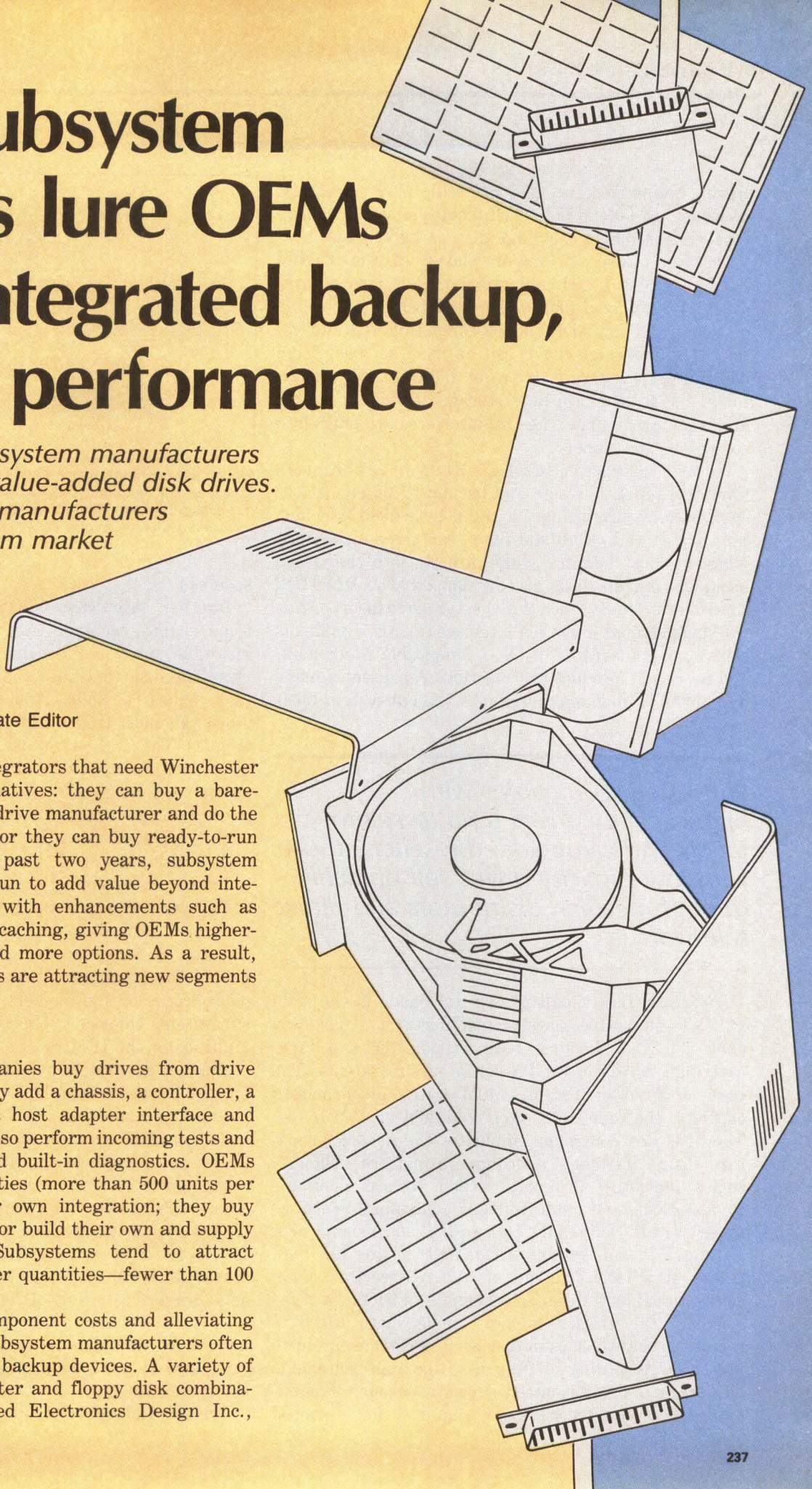
**David Simpson**, Associate Editor

OEMs and system integrators that need Winchester storage have two alternatives: they can buy a bare-bones disk drive from a drive manufacturer and do the integration themselves, or they can buy ready-to-run subsystems. Over the past two years, subsystem manufacturers have begun to add value beyond integration and packaging with enhancements such as backup devices and disk caching, giving OEMs higher-performance systems and more options. As a result, subsystem manufacturers are attracting new segments of the OEM market.

## Why buy a subsystem?

Disk subsystem companies buy drives from drive manufacturers and usually add a chassis, a controller, a power supply, cables, a host adapter interface and software utilities. They also perform incoming tests and debugging and often add built-in diagnostics. OEMs that ship in large quantities (more than 500 units per year) generally do their own integration; they buy off-the-shelf components or build their own and supply appropriate software. Subsystems tend to attract OEMs that ship in smaller quantities—fewer than 100 units per year.

Aside from cutting component costs and alleviating integration headaches, subsystem manufacturers often add value by integrating backup devices. A variety of companies offer Winchester and floppy disk combinations, including Advanced Electronics Design Inc.,





Bering Industries Inc. and Scientific Micro Systems. However, the trend is toward fixed/removable subsystems that include a cartridge-disk or -tape drive.

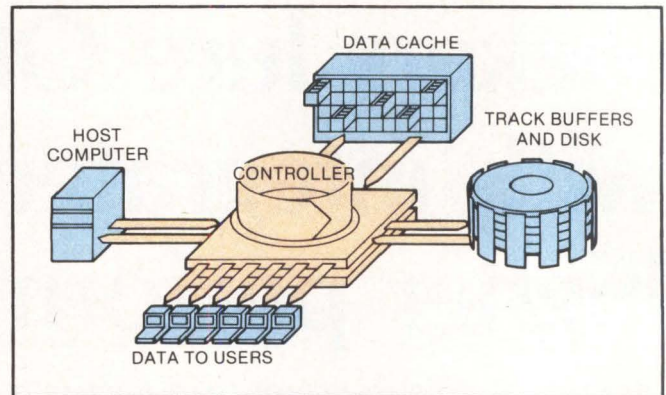
Dataram Corp., a major player in the Digital Equipment Corp. LSI-compatible market, incorporates a 31.2M-byte fixed disk and a 10.4M-byte removable disk cartridge in its DEC RL02-compatible D22 subsystem. The cartridge drive can be used as fixed-drive backup, as a separate drive for file-oriented applications, as a user-program storage device or as an archival storage unit. The D22 interface card plugs into the Q-bus backplane.

Another alternative to DEC's RL02 drive is Emulex Corp.'s SABRE (storage and backup/RL02 emulation) subsystem, which includes a 31.2M-byte fixed Winchester drive and a 10.4M-byte cartridge-disk unit. Emulex's host adapter plugs directly into the Q-bus backplane and emulates two overlapped DEC RLV11/12 controllers. The 5¼-inch Winchester drive incorporates the small computer system interface (SCSI). Emulex is a major manufacturer of DEC-compatible controllers, and its recent product introductions represent a move by controller manufacturers into the subsystem business.

### *Subsystem companies with high-capacity drives tend to sell to OEMs and value-added resellers; those with low-capacity drives sell primarily through dealers, distributors and direct sales forces.*

Tallgrass Technologies Corp., a leader in the IBM PC-/XT-compatible market, manufactures a disk/tape controller that handles both Winchester and tape-cartridge drives in its TG series of subsystems. The hard disks offer 6M to 140M bytes of formatted capacity; the tape cartridges hold 20M or 45M bytes. The disk/tape controller eliminates the need for separate disk controllers and tape formatters. The TG series indicates a general trend toward disk/tape combinations and multifunction controllers, such as those from Data Systems Design Inc. and Priam Corp.

Tallgrass' subsystems read and write 10K-byte tracks at a time, instead of 512-byte sectors as in conventional hard disks. The company's BIOS software converts the track's memory image into 512-byte sectors so that the lack of disk sectors is transparent to MS-DOS. According to Tallgrass, this approach yields 20 percent more formatted capacity because it eliminates the inter-record gaps required for sectored



**Fig. 1. Disk caching** reduces access times by storing most-frequency-accessed data records in RAM cache. In U.S. Design Corp.'s CSS-800 disk subsystem, the controller includes a Z80A that manages all I/O functions and cache operations, as well as "look-ahead" track buffering.

schemes.

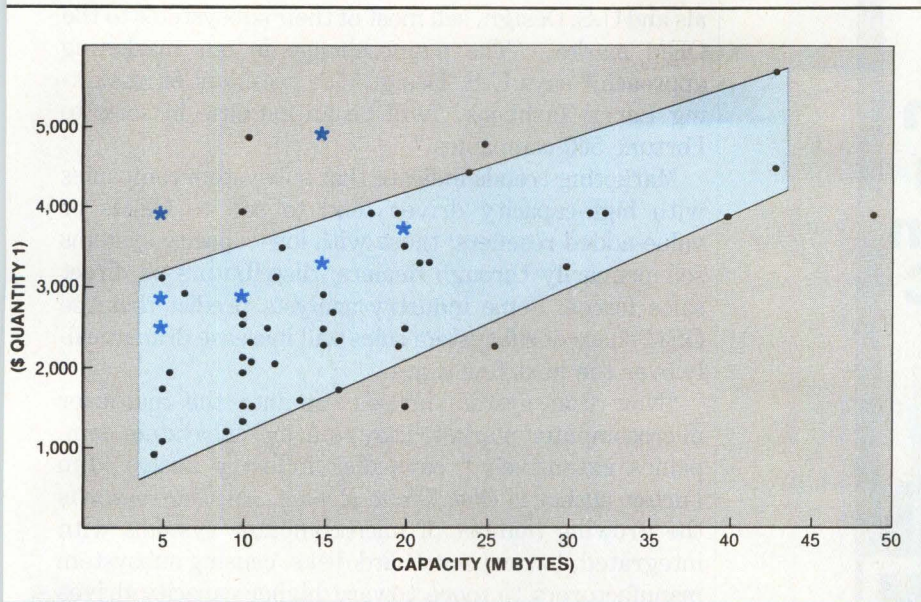
Another significant enhancement in some subsystems is disk caching. U.S. Design Corp.'s CSS-800 disk/tape subsystems include 64K-byte cache memories. The disk controller contains the RAM cache and four dedicated Z80As that execute algorithms that store the most-frequently-used disk sectors in cache (Fig. 1). The CSS-800 transfers data from disk at 800K bytes per second and from cache at 2M bytes per second. Cache access time is 1.5 msec.; the disk's average access time is 20 msec.

U.S. Design recently announced the 620M-byte VIP/X disk subsystem, bringing mainframe storage to multiuser microcomputers. The VIP/X includes a 512K-byte cache that gives the subsystem a 10-msec. average access time with a disk that normally has a 35-msec. average access time. The cache is tripleported for concurrent transfers between disk, host, microprocessor and memory. The CSS-800 and VIP/X subsystems connect to the DEC Q-bus or Unibus, the Multibus or the IBM PC.

Another subsystem manufacturer offering disk caching is Eicon Research Ltd. Recently available in production quantities, the DCH series of Winchesters includes 128K or 256K bytes of RAM cache and a dedicated microprocessor. When the processor loads a requested sector into the cache, it also loads the adjacent 31 sectors, which are the ones the host is most likely to request next. The subsystem typically returns 75 percent of all sector requests from the RAM cache. Maximum RAM access time is 100  $\mu$ sec., compared to an average access time of 200 msec. from the Winchester. The subsystem backs up 10M bytes in less than 1 minute. Eicon's disk drives are compatible with Apple Computer Inc., IBM Corp. and NEC Corp. microcomputers.

System Industries' multiple-access control system





Disk subsystem prices show an uneven cost-per-megabyte distribution. Stars indicate subsystems that include backup devices.

(SIMACS) is another subsystem product incorporating performance improvements. Via its 9900 disk subsystems, SIMACS allows as many as eight VAXs to share one to eight storage-module drive (SMD)-compatible disk drives. The control unit combines hardware, firmware and software that manages dynamic shared-disk access and performs load balancing.

Capitalizing on a recent advance in drive technology, some subsystem manufacturers are incorporating into their systems Amcodyne Inc.'s Arapahoe 7110 drive, which uses Whitney technology read/write heads (Fig. 2). The drive provides 22.5M bytes of removable cartridge storage and 22.5M bytes of fixed storage. Subsystem manufacturers using the Amcodyne drive include Plessey Peripheral Systems and Interphase Corp., a leader in the Multibus-compatible market.

*Responding to the high-capacity requirements of multiuser systems, subsystem manufacturers are offering more storage and are abandoning 5M- and 10M-byte drives.*

In response to the high-capacity requirements of multiuser systems, subsystem manufacturers are now offering products with more storage than the conventional 5M to 10M bytes. As more microcomputer manufacturers furnish systems with integrated 5M- and 10M-byte Winchesters, end users and OEMs will be less apt to buy low-capacity add-ons. For example,

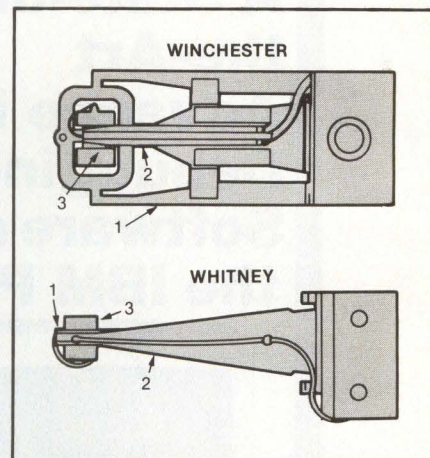


Fig. 2. Whitney technology read/write head assemblies offer improved head suspension—a function of the stability of the read/write platform—which improves recording-signal reliability. The reduced mass of the head assembly contributes to stability, as does the geometry of the side rails (1), load beam (2) and slider (3).

Tallgrass has stopped manufacturing the 6M-byte TG-3006 subsystem and is phasing out the 12M-byte TG-3012, according to vice president of marketing Steve Volk. The company is instead focusing marketing attention on the 20M-byte TG-3020 and is ramping up production lines for its recently announced 70M- and 140M-byte subsystems.

Likewise, Davong Systems Inc. recently announced 43M-byte drives for the IBM PC and Apple Macintosh computers. Dubbed the I0011-040 and AM12-040, respectively, the drives represent a move away from Davong's established 5M- and 10M-byte subsystems. Other PC-compatible subsystem manufacturers, such as Corona Data Systems Inc., Corvus Systems Inc. and Tecmar Inc. are also following this trend.

**Marketing channels are changing**

Subsystem manufacturers traditionally sell to end users (via distributors, dealers and direct sales) or to specific OEM markets such as the DEC-compatible market. Now, however, the marketing mix appears to be in a state of flux as subsystem companies look for new markets and distribution methods.

Some subsystem manufacturers, such as Polymorphic Systems, market solely through dealers and distributors. Polymorphic's disk drives are targeted for the company's microcomputers but are also compatible with systems from Vector Graphics Inc. and North Star Computers Inc., among others. Although the company does not currently market to OEMs, sales to value-added resellers will probably pick up over the next year, predicts Ken Gudis, vice president of operations. Other companies, such as Dataram, Plessey Peripher-



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## WINCHESTER DISK DRIVES

als and U.S. Design, sell most of their subsystems to the OEM market. "The major change in our marketing approach," says U.S. Design vice president of marketing Larry Tashbook, "will be an increase in sales to Fortune 500 companies."

Marketing trends indicate that subsystem companies with high-capacity drives tend to sell to OEMs or value-added resellers; those with low-capacity systems sell primarily through dealers, distributors or direct sales forces. Some industry analysts predict that the OEM share of subsystem sales will increase dramatically over the next few years.

"Now that system houses are into the multiuser microcomputer market, they're using subsystem companies extensively," says disk industry analyst Jim Porter, author of *Disk/Trend Report*. Another reason is the growing number of microcomputer systems with integrated, low-capacity hard disks, causing subsystem manufacturers to move toward higher-capacity drives and thus toward the OEM market. The major growth area for subsystems is the multiuser environment where added performance is a major requirement.

### Drive manufacturers enter the market

In what may presage another general trend in the subsystem market, drive manufacturers are throwing their hats into the ring. Drive manufacturers with plans to sell subsystems include Control Data Corp., Priam, Quantum Corp., Seagate Technology and Tandon Corp.

Priam is shipping production quantities of a subsystem based on its 86M-byte 803 drive. The subsystem includes a 45M-byte, 1/4-inch tape-cartridge drive manufactured by Archive Corp. Priam manufactures all the other components, including the controller. "This originally was not a planned product as much as a logical solution to a customer problem," says Dal Allan, product manager of storage systems.

Over the next year, OEMs can expect more drive manufacturers to offer disk subsystems. The only impediments are lack of software expertise and inexperience in supporting controllers. Drive manufacturers often cannot tailor subsystems to specific OEM applications, but they can provide inexpensive general-purpose solutions. As Priam's Allan puts it, "A lot of OEMs believe that they could do the job better than could a subsystem manufacturer, but a general solution is always cheaper."

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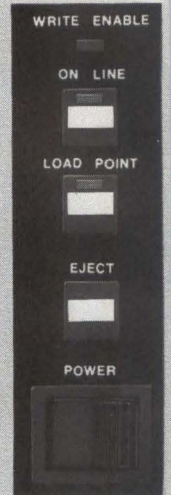
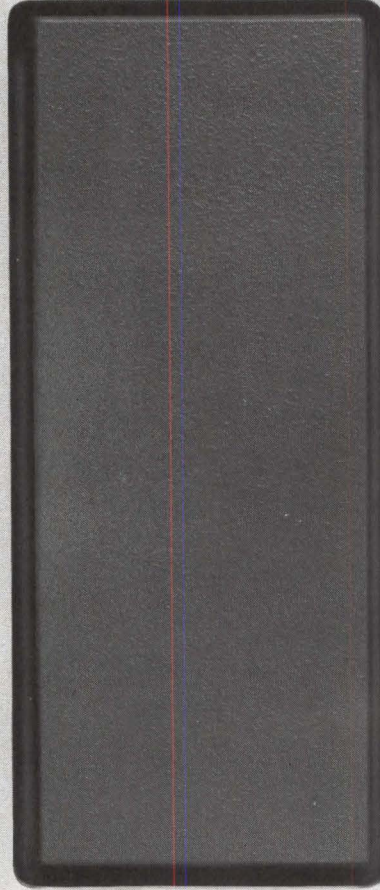
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CIRCLE NO. 129 ON INQUIRY CARD



# CDC, MEET YOUR MATCH!

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## 9715 FSD DRIVE

The "half-wide" Winchesters from Control Data offer a great combination of convenience and capacity.

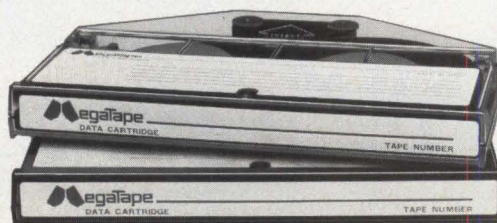
Finally, there's a low-cost backup device that's a perfect match: the new MT-1220 cartridge tape drive from MegaTape. 330 MB of reliable backup—in a single book-size cartridge.

The MT-1220 drive has the same form factor as the CDC 9715 disk drive—so the two fit perfectly side-by-side in just 10½ inches of rack space.

In 200 ips streaming mode, the MegaTape system dumps 330

MB in just 24 minutes. Start/stop mode is great for network archive servers, high-volume transaction journal logging, digital image storage, and similar applications. Average access to any record on a cartridge takes only 30 seconds.

330 MB in each book-size cartridge



CIRCLE NO. 130 ON INQUIRY CARD

## 330 MB BACKUP DRIVE

MegaTape is an easy design-in, too—it uses standard off-the-shelf controllers. The same transport is also available in a horizontal full-rack configuration. With extremely attractive OEM prices, it's no wonder MegaTape is fast becoming the new industry standard for high-capacity backup.

**Call Gary Webb, Vice President, Marketing at (213) 357-9921**

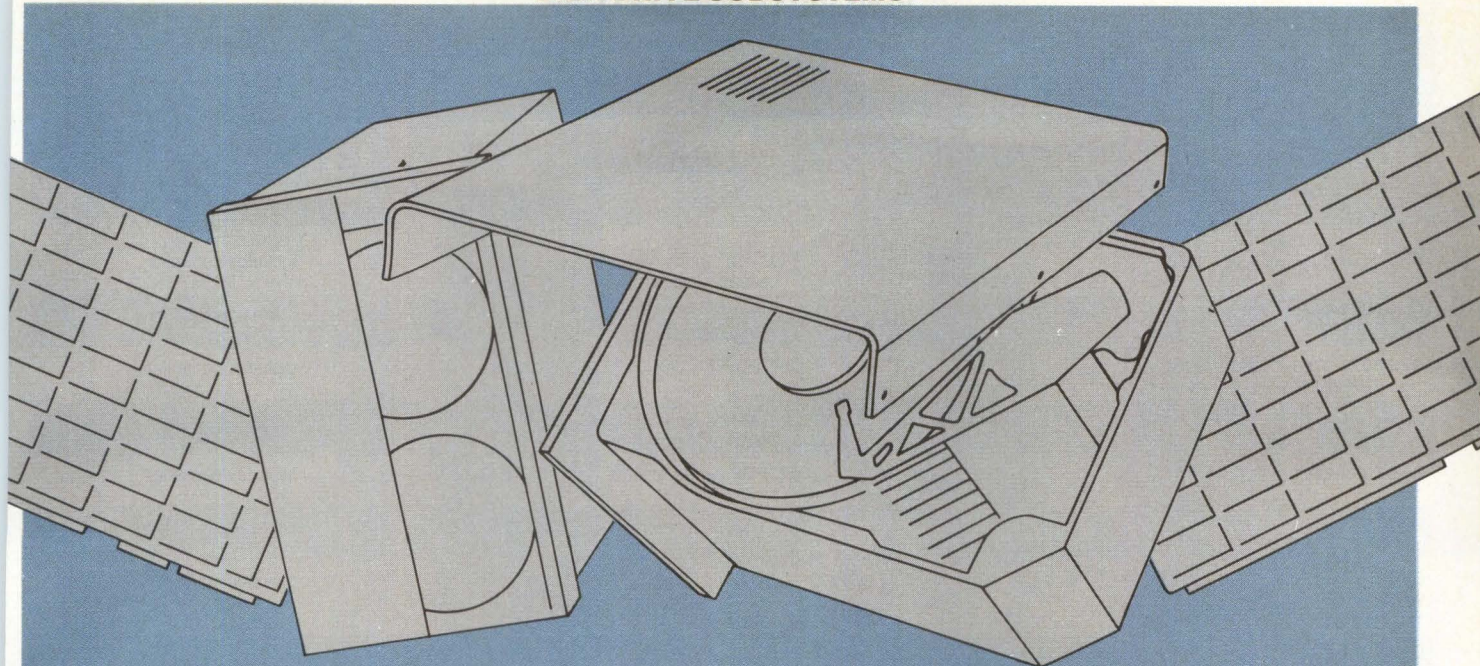
MegaTape Corporation, P.O. Box 317  
1041 Hamilton Road, Duarte, CA 91010



The great leap forward in backup.  
Demos at NCC/Booth C-4362.



## DISK DRIVE SUBSYSTEMS



Company Subsystem Model	Formatted capacity (M bytes)	Disk size (inches)	Disk drive manufacturer and model number	Computer Bus compatibility	Price (\$)	Notes, features, options
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### ADVANCED ELECTRONICS DESIGN INC. (AED)

WINC-05/5	10(fixed)/.5(removable)	5.25	Seagate Technology/Qume	DEC RL01, RL02, RX02, Q-bus	5,033	5.25-inch floppy backup, single dual-wide controller
WINC-05/8	10(fixed)/1(removable)	5.25/8	Seagate Technology/Qume	DEC RL01, RL02, RX02, Q-bus	6,740	8-inch floppy backup, single dual-wide controller, includes power supply
WINC-08	40(fixed)	8	Fujitsu	DEC RL01, RL02, Q-bus, Unibus	9,400	includes power supply, software transparency, on-board bootstrap, self-test diagnostics

### AMCODYNE INC.

Arapahoe 7110	22.5(fixed)/22.5(removable)	8	Amcodyne	IBM PC	4,550	uses Whitney-technology read/write heads
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### APPARAT INC.

Hard disk subsystem	30(fixed)	5.25	CDC	IBM PC, Radio Shack	3,395	
Hard disk subsystem	15(fixed)	5.25	Tandon	IBM PC, Radio Shack	2,495	
Hard disk subsystem	10(fixed)	5.25	Miniscribe	Radio Shack, IBM PC	1,995	

### AVIV CORP.

DFS 607A-9710	67(removable)	9	CDC 9710	DEC RM02, VAX series; Computer Memories bus	16,800	includes power supply
DFS 607A-9766	256(removable)		CDC 9766	DEC VAX series, Computer Memories bus	24,100	includes controller
DFS 907A-2312	67(fixed)	8	Fujitsu America M2312K	DEC LSI series, Q-bus	9,765	includes controller
DFS 607A-2312	67(fixed)	8	Fujitsu America M2312K	DEC VAX series, Computer Memories bus	15,100	includes controller
DFS 607A-9715/160, 340, 515	134, 268, 402 (fixed)	9	CDC 9715-160, -340, -515	DEC VAX series, Computer Memories bus	16,415; 18,165; 19,165	includes controller
DFS 607A-9775	512(fixed)	14	CDC 9775	DEC VAX series, Computer Memories bus	31,000	
DFS 607B-2351	349(fixed)		Fujitsu America M2351A	DEC VAX series, Computer Memories bus	22,100	includes controller



## DISK DRIVE SUBSYSTEMS

Company Subsystem Model	Formatted capacity (M bytes)	Disk size (inches)	Disk drive manufacturer and model number	Computer/Bus compatibility	Price (\$)	Notes, features, options
DFS 807A-2312	67(fixed)	8	Fujitsu America M2312K	DEC PDP series, VAX series, Unibus	9,765	includes controller
DFS 807A-9710	67(removable)	9	CDC 9710	DEC RM02, PDP series, VAX series, Unibus	11,465	includes power supply
DFS 807A-9766	256(removable)		CDC 9766	DEC PDP-11, VAX-11, Unibus	18,700	includes controller
DFS 807A-9775	512(fixed)	14	CDC 9775	DEC PDP series, VAX series, Unibus	25,765	
DFS 808A-2351	349(fixed)		Fujitsu America M2351A	DEC PDP series, Unibus	17,500	includes controller
DFS 907A-9710	67(removable)	9	CDC 9710	DEC RM02, LSI series, Q-bus	11,465	includes power supply
DFS 907A-9715/160, 340, 515	134, 268, 402 (fixed)	9	CDC 9715-160, -340, -515	DEC LSI-11, Q-bus	11,065; 12,500; 13,815	includes controller
DFS 907A-9775	512(fixed)	14	CDC 9775	DEC LSI series, Q-bus	25,765	
DFS 907A-9766	256(removable)		CDC 9766	DEC LSI series, Q-bus	18,700	includes controller
<b>BERING INDUSTRIES INC.</b>						
3000	5, 10, 15(fixed)	5.25	Computer Memories 5000	HB-IB, IEEE-488	2,540	multiport disk sharing, includes power supply; opt. rackmount
3300	5, 10, 15(fixed)	5.25	Computer Memories 5000	HP-IB, IEEE-488	2,840	multiport disk sharing; includes power supply, 280K-byte, 3.5-inch floppy disk drive backup; opt. rackmount
3500	5, 10, 15(fixed)	5.25	Computer Memories 5000	HP-IB, IEEE-488	3,250	multiport disk sharing, includes power supply, 280K-byte, 5.25-inch floppy disk drive backup; opt. rackmount
3800	5, 10, 15(fixed)	5.25	Computer Memories 5000	HP-IB, IEEE-488	4,260	multiport disk sharing, includes power supply, 1.2M-byte, 8-inch floppy disk drive backup; opt. rackmount
<b>THE BRAEGEN CORP.</b>						
DSL 160W	134.8(fixed)	9	CDC 9715	DEC PDP 11/70, VAX 11/780		
DSL 302	256.2(removable)	14	CDC 9766	DEC PDP 11/70, VAX 11/780		
DSL 302W	256.2(fixed)	14	Tecstor 315	DEC PDP 11/70, VAX 11/780		
DSL 400W	405.2(fixed)	10.5	Fujitsu	DEC PDP 11/70, VAX 11/780		
DSL 602W	512.4(fixed)	14	CDC 9775	DEC PDP 11/70, VAX 11/780		
DSL 82	67.4(removable)	14	CDC 9762	DEC PDP 11/70, VAX 11/780		
DSV 160W	134.8(fixed)	9	CDC 9715	DEC VAX 11/750		
DSV 302	256.2(removable)	14	CDC 9766	DEC VAX 11/750		
DSV 302W	256.2(fixed)	14	Tecstor 315	DEC VAX 11/750		
DSV 400W	405.2(fixed)	10.5	Fujitsu America Inc.	DEC VAX 11/750		
DSV 602W	512.4(fixed)	14	CDC 9775	DEC VAX 11/750		
DSV 82	67.4(removable)	14	CDC 9762	DEC VAX 11/750		
<b>CAMEO ELECTRONICS</b>						
Series 1000	40(fixed)/10(removable)	8	Disctron	IBM PC, NEC APC, Victor 9000, Epson, Sanyo, Xerox	6,995	
Series 500	12, 24(fixed)	5.25	Rodime	IBM PC, NEC APC, Victor 9000, Epson, Sanyo, Xerox	3,195; 4,495	
<b>CMI INTERNATIONAL</b>						
Targa I	5, 10, 15, 31.2 (fixed)	5.25	CMI 5206, 5412, 5619, 6640; Syquest SQ306R	IBM PC and compatibles; Kaypro II; Osborne I, II; Televideo 803	1,945	single-drive box, linear power supply



## DISK DRIVE SUBSYSTEMS

Company Subsystem Model	Formatted capacity (M bytes)	Disk size (inches)	Disk drive manufacturer and model number	Computer/Bus compatibility	Price (\$)	Notes, features, options
Targa II	5, 10, 15, 31.2 (fixed/removable)	5.25	CMI 5206, 5412, 5619, 6640; Syquest SQ306R	IBM PC and compatibles; Kaypro II; Osborne I, II; Televideo 803, 802		2-drive box, includes linear power supply
Targa III	5, 10, 15, 31.2 (fixed/removable)	5.25	CMI 5206, 5412, 5619, 6640; Syquest SQ306R	IBM PC and compatibles		2-drive box, includes linear power supply, 5 PC-compatible expansion slots
<b>COMPUPRO</b>						
Hard disk subsystem	40(fixed)	5.25	Quantum	S-100 bus	5,495	includes CP/M-80, -86 operating systems
<b>COMPUTER DYNAMICS INC.</b>						
WIN-5	4.5(fixed)	8	Shugart	IBM, Heath, Apple IIe, S-100 Bus	950	
WIN-10	9(fixed)	8	Shugart	IBM, Heath, Apple IIe, S-100 Bus	1,200	
WIN-15	13.5(fixed)	8	Shugart	IBM, Heath, Apple IIe, S-100 Bus	1,600	
<b>COMPUTER PRODUCTS INT'L.</b>						
CPI hard disk drive subsystem	8, 16, 25, 40, 65, 92(fixed)	5.25	Miniscribe	IBM PC; DEC Rainbow, North Star, Xerox 820, Zenith, Radio Shack, Victor 9000, NEC PC8000; Apple II, III	1,675; 2,095; 2,495; 3,675; 4,195; 5,250	
<b>COMREX INTERNATIONAL INC.</b>						
ComFiler CR-1510	10 (fixed)	5.25	Tandon	Epson QX-10	2,295	
<b>CONTROL DATA CORP.</b>						
33501 A2	635 (fixed)	14	CDC 33501	IBM System 370, 4300 Series	40,000	field upgradable to 33502, attachment of up to three 33501 B2 models; opt. dual access, zero seek
33501 B2	635 (fixed)	14	CDC 33501	IBM System 370, 4300 Series	31,680	field upgradable to 33502; opt. dual access, zero seek
33502 B2	1270 (fixed)	14	CDC 33502	IBM System 370, 4300 Series	41,680	opt. dual access feature, zero seek storage
33502 A2	1270 (fixed)	14	CDC 33502	IBM System 370, 4300 Series	50,000	attachment of up to three 33502 B2 models; opt. dual access feature, zero seek storage
33750 AD4	1630 (fixed)	14	CDC 33750	IBM 303X, 308X, 4300 Series, System 370	83,555	separate and independent HDA, independent interface logic, separate power interface, field upgradable to 33800 AA4, includes DPS/E, attachment of up to three 33750 B4 models
33750 AB4	1630 (fixed)	14	CDC 33750	IBM 303X, 308X, 4300 Series, System 370	73,115	separate and independent HDA, independent interface logic, separate power interface, field upgradable to 33800 A4, attachment of up to three 33750 B4 models
33750 B4	1630 (fixed)	14	CDC 33750	IBM 303X, 308X, 4300 Series, System 370	60,650	separate and independent HDA, independent interface logic, separate power interface, field upgradable to 33800 B4
33800 A4	2520 (fixed)	14	CDC 33800	IBM 303X, 308X, 4300 Series, System 370	81,995	separate and independent HDA, independent interface logic, separate power interface, attachment of up to three 33800 B4 models
33800 AA4	2520 (fixed)	14	CDC 33800	IBM 303X, 308X, 4300 Series, System 370	93,710	separate and independent HDA, independent interface logic, separate power interface, attachment of up to three 33800 B4 models, includes DPS; opt. DPS/E
33800 B4	2520 (fixed)	14	CDC 33800	IBM 303X, 308X, 4300 Series, System 370	68,020	separate and independent HDA, independent interface logic, separate power interface, field upgradable to A4 or AA4
<b>CORONA DATA SYSTEMS</b>						
Personal hard disk (external)	10(fixed)	5.25	Seagate Technology, Miniscribe	IBM PC	2,695	includes operating system software
Personal hard disk (internal)	10(fixed)	5.25	Seagate Technology, Miniscribe	IBM PC	2,295	includes operating system software



## DISK DRIVE SUBSYSTEMS

Company Subsystem Model	Formatted capacity (M bytes)	Disk size (inches)	Disk drive manufacturer and model number	Computer/Bus compatibility	Price (\$)	Notes, features, options
<b>CORVUS SYSTEMS INC.</b>						
6, 11, 20	5.9, 12.1, 18.4(fixed)	5.25	IMI 5007-H, 5014-H, 5021-H	Apple II, IIe, III; Radio Shack TRS-80 models II, III, 12; Xerox 820, 820-II; IBM PC, DEC VT80, NEC PC8000	2,195; 2,995; 3,995	
<b>CROMEMCO INC.</b>						
HD-20	18(fixed)	5.25	International Memories	S-100 bus	3,995	includes WDI-II HD interface card
<b>CVM SYSTEMS</b>						
M80-F	80 (fixed)	8		DEC Unibus, Q-bus	3,315(Q1); 2,680(Q100)	tape back-up, dual-function controller, DEC Unibus or DEC Q-bus meets specifications for CDC 9762
M40-F	40 (fixed)	8		DEC Unibus, Q-bus	2,600(Q1); 2,100(Q100)	tape backup, dual-function controller, DEC Unibus or DEC Q-bus meets specifications for CDC 9760
<b>DATA GENERAL CORP.</b>						
6060, 6061, 6122	96, 192, 277(removable)	14	Data General	Data General	32,500; 35,900; 43,350	
6160, 6161, 6214	73, 147, 602(fixed)	14		Data General	18,000; 24,000; 50,000	
6236	354(fixed)	14	Data General	Data General	25,000	opt. tape drives
<b>DATAPoint CORP.</b>						
9313	5(fixed)/1(removable)	5.25		Datapoint 1560	3,950	
9315	10(fixed)/1(removable)	5.25		Datapoint 8600	3,950	
9325	40(fixed)/10(removable)	8		Datapoint 8605	17,750	
<b>DATARAM CORP.</b>						
D22	31.2(fixed)/10.4(removable)	8	Quantum/Disctron	DEC RL02, Q-bus	11,950	D33 equivalent version available for VAX and PDP-11
<b>DAVONG SYSTEMS</b>						
AE012-005	5.2(fixed)	5.25	Computer Memories, Disctron, Tandon, Rodime	Apple IIe	1,995	
A2012-005	5.2(fixed)	5.25	Computer Memories, Disctron, Tandon, Rodime	Apple II	1,995	
A2012-010	10.4(fixed)	5.25	Computer Memories, Tandon, Disctron, Rodime	Apple II	2,395	
A2012-015	15.6(fixed)	5.25	Computer Memories, Tandon, Disctron, Rodime	Apple II	2,795	
AE012-010	10.4(fixed)	5.25	Computer Memories, Tandon, Disctron, Rodime	Apple IIe	2,395	
AE012-015	15.6(fixed)	5.25	Computer Memories, Tandon, Disctron, Rodime	Apple IIe	2,795	
AM012-010	10.4(fixed)	5.25	Computer Memories, Tandon, Disctron, Rodime	Apple Macintosh	2,395	
AM012-015	15.6(fixed)	5.25	Computer Memories, Tandon, Disctron, Rodime	Apple Macintosh	2,795	
AM012-021	21.8(fixed)	5.25	Computer Memories, Tandon, Disctron, Rodime	Apple Macintosh	3,295	
AM012-032	32.6(fixed)	5.25	Computer Memories, Tandon, Disctron, Rodime	Apple Macintosh	3,995	



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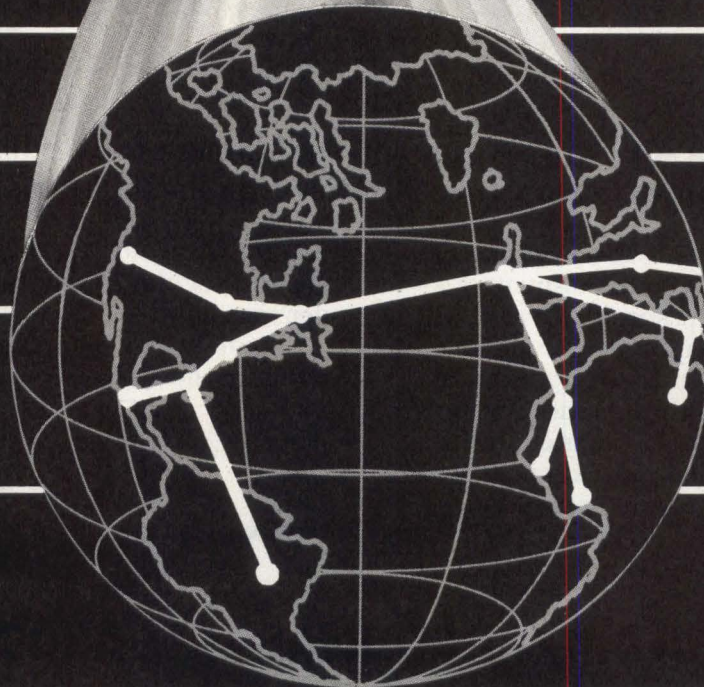
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**RIXON** INC.

CIRCLE NO. 131 ON INQUIRY CARD



## DISK DRIVE SUBSYSTEMS

Company Subsystem Model	Formatted capacity (M bytes)	Disk size (inches)	Disk drive manufacturer and model number	Computer/Bus compatibility	Price (\$)	Notes, features, options
AM012-040	43(fixed)	5.25	Computer Memories, Tandon, Discron, Rodime	Apple Macintosh	4,495	
AM014-005	5.2(fixed)	5.25	Computer Memories, Tandon, Discron, Rodime	Apple Macintosh	1,995	
I0011-032	32.6(fixed)	5.25	Computer Memories, Tandon, Discron, Rodime	IBM PC	3,695	
I0011-005	5.2(fixed)	5.25	Computer Memories, Tandon, Discron, Rodime	IBM PC	1,845	
I0011-010	10.4(fixed)	5.25	Computer Memories, Tandon, Discron, Rodime	IBM PC	2,095	
I0011-015	15.6(fixed)	5.25	Computer Memories, Tandon, Discron, Rodime	IBM PC	2,695	
I0011-021	21.8(fixed)	5.25	Computer Memories, Tandon, Discron, Rodime	IBM PC	3,095	
I0011-040	43(fixed)	5.25	Computer Memories, Tandon, Discron, Rodime	IBM PC	4,495	
<b>DIGITAL EQUIPMENT CORP.</b>						
RUA60-AA	205 (removable)	14	DEC	DEC Unibus	20,000	
RUA80-AA	121 (fixed)	14	DEC	DEC Unibus	19,000	
RUA81-AA	456 (fixed)	14	DEC	DEC Unibus	24,000	
RCD50-BB	5 (fixed)	5.25	DEC	DEC PRO 350, Rainbow, DECmate	1,495	
RCD51-BB	10 (fixed)	5.25	DEC	DEC PRO 350, Rainbow, DECmate	2,995	
RL211-AK	10 (removable)	14	DEC	DEC Q-bus, Unibus	6,900	
<b>EICON RESEARCH INC.</b>						
DisCache 10, 20, 40	10.5, 20, 40(fixed)	5.25		NEC, Apple, IBM PC	3,000	includes 128K-byte RAM cache; max. access time for a sector from RAM is 100 microseconds
<b>EMULEX CORP.</b>						
Sabre	31.2(fixed)/ 10.4(removable)	5.25/8		DEC RL01, RL02	8,550(Q1); 5,815(Q100)	
<b>GENIE COMPUTER CORP.</b>						
Genie 5 + 5	5(fixed)/ 5(removable)	5.25	DMA Systems	Apple II, Ile; IBM PC, TI Professional	3,995	
Genie 5, 10, 15, 20	5, 10, 15, 20(fixed)	5.25	Discron	Apple II, Ile; IBM PC, TI Professional	2,295; 2,595; 2,895; 3,195	
X5A	5(removable)	5.25	DMA Systems	Apple II, Ile; IBM PC, TI Professional	3,295	
<b>HARRIS CORP.</b>						
5330, 5350	80, 160(fixed)	14		Harris 600, 700, 800, 1000	19,900; 23,700	
5360	474(fixed)	10.5	Fujitsu America	Harris 600, 700, 800, 1000	26,000	
5630	80(removable)	14		Harris 600, 700, 800, 1000	20,900	includes controller
5650	300(removable)	14		Harris 600, 700, 800, 1000	26,500	includes controller
5660	675(fixed)	14		Harris 600, 700, 800, 1000	44,500	includes controller
<b>HEWLETT-PACKARD CO.</b>						
9133V	4, 8(fixed)	5.25			3,040	includes 270K-byte, 3.5-inch floppy disk drive
9133XV	14.5(fixed)	5.25			3,650	includes 270K-byte, 3.5-inch floppy disk drive
9133XV opt. 010	9.6(fixed)	5.25			3,650	includes 270K-byte, 3.5-inch floppy disk drive



## DISK DRIVE SUBSYSTEMS

Company Subsystem Model	Formatted capacity (M bytes)	Disk size (inches)	Disk drive manufacturer and model number	Computer/Bus compatibility	Price (\$)	Notes, features, options
9134XV	14.5(fixed)	5.25			3,345	
9134XV opt. 010	9.6(fixed)	5.25			3,345	
<b>HONEYWELL INC.</b>						
CDU 9640, 9641	20(fixed)/ 20(removable)	8		Honeywell DPS6	12,750	
<b>I2 INTERFACE INC.</b>						
I2BM10P	10.6(fixed)	5.25	Tandon 502	IBM PC, Compaq, Columbia, Eagle	1,495	includes case, power supply, controller, cable and host adapter
I2BM15P	15.9(fixed)	5.25	Tandon 503	IBM PC, Compaq, Columbia, Eagle	1,795	includes case, power supply, controller, cable and host adapter
I2BM25P	25.1(fixed)	5.25	Tandon 703	IBM PC, Compaq, Columbia, Eagle	2,245	includes case, power supply, controller, cable and host adapter
<b>INTERPHASE CORP.</b>						
RDS 300	21(fixed)/ 21(removable)	8	Amcodyne	Multibus, IBM PC	8,000	
RDS 300	6.5(fixed)/ 6.5(removable)	8	Control Data Lark	Multibus, IBM PC	7,000	
<b>KENNEDY CO.</b>						
4055/8055	33.67, 67.4	8	38.3	SMD, ANSI, Pico Bus	5,800; 6,600	includes .25-inch cartridge tape drive, rack mountable cabinet, power supply
<b>MICRO MAINFRAME</b>						
HD10	10(fixed)	5.25	Microscience Int'l.	IBM PC, Radio Shack models TRS-80 I, II, III, IV, 12, 16	1,595	
MF-HDS10	10(fixed)	5.25	Microscience Int'l.	IBM, Tandy, S-100 bus	1,695	
<b>MICRO-DESIGN</b>						
PRO-10	10(fixed)	5.25	NEC	IBM PC, Radio Shack TRS-80	1,399	
PRO-20	20(fixed)	5.25	NEC	IBM PC, Radio Shack TRS-80	1,549	
SQ-520	20(fixed)/ 5(removable)	5.25	Syquest Technology	IBM PC, Radio Shack TRS-80	3,795	
SQ-55B	5(fixed)/ 10(removable)	5.25	Syquest Technology	IBM PC, Radio Shack TRS-80	2,895	internal and external configurations available
SQ-5B	5(removable)	5.25	Syquest Technology	IBM PC, Radio Shack TRS-80	1,995	internal and external configurations available
<b>MOUNTAIN COMPUTER INC.</b>						
MCI 5 Mb	5.33 (IBM); 5.01 (Apple) (fixed)	5.25	Seagate ST-406	IBM PC/XT and compatibles, Apple and Apple compatibles	1,995(Q1); 1,397(Q100)	
MCI 10 Mb	10.66 (IBM), 10.02 (Apple) (fixed)	5.25	Seagate ST-412	IBM PC/XT and compatibles, Apple and Apple compatibles	2,495(Q1); 1,746(Q100)	
MCI 15 Mb	15.99 (IBM); 15.03 (Apple) (fixed)	5.25	Seagate ST-419	IBM PC/XT and compatibles, Apple and Apple compatibles	2,995(Q1); 2,097(Q100)	
MCI 20 Mb	21.32 (IBM); 20.04 (Apple) (fixed)	5.25	Seagate ST-425	IBM PC/XT and compatibles, Apple and Apple compatibles	3,495(Q1); 2,447(Q100)	
MCI 32 Mb	35.65 (fixed)	5.25	Quantum Q540	IBM PC/XT and compatibles, Apple and Apple compatibles	4,495(Q1); 3,147(Q100)	
MCI 10 Mb internal	10.66 (fixed)	5.25	Cogito CG912	IBM PC/XT	2,195(Q1); 1,536(Q100)	
MCI 10 Mb internal	10.66 (fixed)	5.25	Microscience HH612	IBM PC/XT	2,195(Q1); 1,536(Q100)	





# The only reason you're not using Pioneer's disk drive tester already.

If you still haven't seen the Pioneer hard disk drive tester in action, it's time to take a look. And judge for yourself.

Beginning with the price tag, every aspect of the Pioneer Qualifier™ is designed to meet your requirements for pocketbook *and* performance.

It's the only tester to interface with any and all SMD drives.

It's the only one with a hefty 20-megabit per second capability. Even at triple the price.

It's the only one that can read and transfer Fujitsu's error map right into your computer. In seconds.

It's the only one that will format to your custom specs. And it does it at one megabyte per second. Over five times faster than by computer.

It pinpoints your errors to a specific media sector. And separates the correctable from the uncorrectable. So you can detect and log either set.

Have you ever seen a tester that does all that?

And also checks the address mark capability of your drive? And isolates

intermittents in the output? And works with embedded servos? And can be multiplexed to test four drives at once?

The Pioneer Qualifier does all those things. And easily, at that.

It's almost turnkey. It's totally programmable through the simplified keyboard. And you can input a custom set of drive characteristics with no EPROMS to modify or boards to change.

Plus, there's even a standard RS232 port for remote operation, data print-out, uploading and downloading.

Call Pioneer for a demonstration today. It's an eye opener.

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(800) 233-1745  
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California). Rep opportunities available.



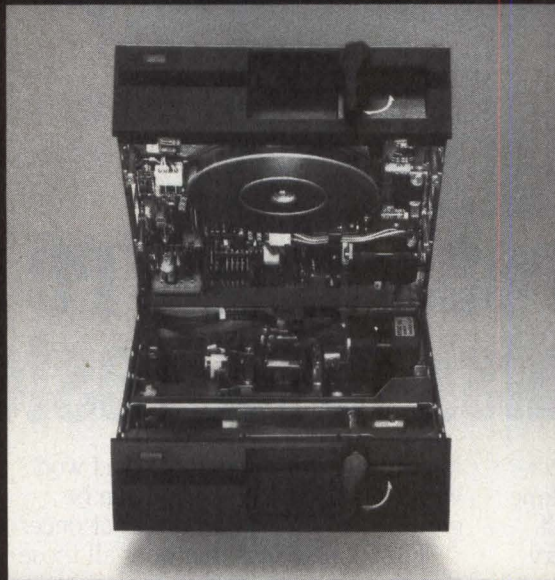
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**CIRCLE NO. 132 ON INQUIRY CARD**



# TAKE ONE FOR A TEST DRIVE.



Introducing the 1984 TEACS.

A full line of 5 1/4 inch half-high flexible disk drives. Available in single/double sided, 48 tracks per inch/96 tracks per inch, single/double density.

With Teac's exclusive system of half-high at half power you get less heat build-up, less media expansion and disk off-tracking problems. Which means more reliability plus more adaptability.

And, Teac's brushless DC direct drive motors are proven mileage champs with up to 10,000 hours MTBF. Which only goes to show, as always, Teac quality pays off down the road.

**TEAC** ICPD  
BUILT TO FANATICAL STANDARDS.

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CIRCLE NO. 133 ON INQUIRY CARD



## DISK DRIVE SUBSYSTEMS

Company Subsystem Model	Formatted capacity (M bytes)	Disk size (inches)	Disk drive manufacturer and model number	Computer/Bus compatibility	Price (\$)	Notes, features, options
<b>MYARC INC.</b>						
WDS/100	5, 10, 15(fixed)	5.25	Tandon 501, 502, 503	TI 99	1,899; 2,199; 2,499	includes power supply
WDS/200	10, 20(fixed)	5.25	Nippon Electric RD4127, RD4255	IBM PC, XT	2,199; 2,599	
<b>NATIONAL MEMORY SYSTEMS CORP.</b>						
2501, 2502	84, 168(fixed)	8		DEC LSI series	8,500; 10,800	
2503	335(fixed)	14		DEC LSI series	12,900	
2504	480(fixed)	10.5		DEC LSI series	14,900	
3084, 3168	84, 168(fixed)	8		TI 300	11,900; 12,500	
3500	480(fixed)	10.5		TI 300	15,500	
8001, 8002	84, 168(fixed)	8		IBM PC	8,900; 10,900	
8003	335(fixed)	14		IBM PC	12,900	
8004	480(fixed)	10.5		IBM PC	14,900	
<b>NCR CORP.</b>						
6097-4141	10 (fixed)	5.25	Seagate ST-412, Teac FD55F			power supply, SASI controller included
6097-6560	1 or 2 (removable)	8	NEC FD1165	industry standard		power supply included
<b>PERCOM DATA</b>						
PHD-10, -20	10, 20(fixed)	5.25	Tandon, Micro Peripherals Inc.	Apple, IBM, Radio Shack	2,295; 2,995	
<b>PLESSEY PERIPHERAL SYSTEMS</b>						
290, 292, 294	28(fixed)	8	Micropolis	DEC RK06, RK07, Q-bus	7,000; 8,350; 9,550	includes power supply, model 292 includes one 1M-byte, 8-inch floppy disk drive; model 294 includes a 20M-byte, .25-inch streaming tape drive
295	56(fixed)	8	Micropolis	DEC RK02, Q-bus	11,750	includes power supply, two 28M-byte Winchester disk drives
850	70(fixed)	8	Fujitsu America	DEC RK06, RK07, Q-bus	10,800	includes power supply
853	67.6(fixed)	8	Fujitsu America Inc.	DEC RM02, Q-bus	11,300	includes power supply
110, 112, 113, 114	10.4(fixed)	5.25	Computer Memories Inc.	DEC RL01, RL01, Q-bus	4,815; 5,985; 6,730; 7,065	model 112 includes one 1M-byte, 8-inch floppy disk drive; model 113 includes 2 floppy disk drives; model 114 includes a 20M-byte, .25-inch streaming tape drive
210, 212, 213, 214	20.8(fixed)	5.25	Computer Memories Inc.	DEC RL01, RL02, Q-bus	6,350; 7,650; 8,475; 8,850	all models include power supply; model 212 includes one 1M-byte, 8-inch floppy disk drive; model 213 includes two floppy disk drives; model 214 includes a 20M-byte, .25-inch streaming tape drive
215, 216, 217, 218	41.6(fixed)	5.25	Computer Memories Inc.	DEC RL02, Q-bus	8,750; 10,050; 10,875; 11,250	all models include two 20.8M-byte Winchester disk drives, model 216 includes one 1M-byte, 8-inch floppy disk drive; model 217 includes two floppy disk drives; model 218 includes a 20M-byte, .25-inch streaming tape drive
<b>POLYMORPHIC SYSTEMS</b>						
HD/18	15(fixed)	5.25	Seagate ST419	Polymorphic Systems, S-100 bus	2,995	includes chassis, power supply, controller, host adapter, cables and software; can be upgraded to model HD/18+
HD/18+	15(fixed)/5(removable)	5.25/3.9	Seagate ST419/Syquest SQ306	Polymorphic Systems, S-100 bus	4,995	includes chassis, power supply, controller, host adapter, cables and software
HD/40	40(fixed)	5.25	Craden Peripherals Corp.	Polymorphic Systems, S-100 bus	3,995	includes chassis, power supply, controller, host adapter, cables and software
<b>QDP COMPUTER SYSTEMS, QUASAR DATA PRODUCTS INC.</b>						
HD-10	10(fixed)	5.25	Miniscribe 2012	S-100, IEEE-696	3,995	includes power supply, controller, cables
HD-15	15(fixed)	5.25	Miniscribe 4020	S-100, IEEE-696	4,995	includes power supply, controller, cables
HD-30	30	5.25	Miniscribe 4020	S-100, IEEE-696	6,995	self-contained storage expansion unit contains two 15M-byte drives in one package



## DISK DRIVE SUBSYSTEMS

Company Subsystem Model	Formatted capacity (M bytes)	Disk size (inches)	Disk drive manufacturer and model number	Computer/Bus compatibility	Price (\$)	Notes, features, options
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### QUALITY COMPUTER SERVICES

DSK 62, DSK 63, DSK 65, DSK 67	10, 16, 20, 42(fixed)	5.25	Miniscribe, Ampex, Vertex, Rodime, Syquest, Western Dynex Corp.	Apple, Canon, Compaq, Digital, Epson, Heath/Zenith, IBM, TI, Radio Shack; S-100 bus	2,499; 2,799; 2,999; 4,999	
DSK 7X	5(removable)	5.25		Apple, Canon, Compaq, Digital, Epson, Heath/Zenith, IBM, TI, Radio Shack; S-100 bus	14,000	
BE V	10(fixed)	5.25	Miniscribe, Ampex, Vertex, Rodime, Syquest, Western Dynex Corp.	Apple, Canon, Compaq, Digital, Epson, Heath/Zenith, IBM, TI, Radio Shack; S-100 bus	1,999	

### QUENTIN RESEARCH CORP.

Q-505, Q-510, Q-515, Q-520	5, 10, 15, 20(fixed)	5.25	Nippon Electric	IBM PC, DEC Rainbow, Tandy 2000, Radio Shack TRS-80 model IV, Apple IIe, III	1,795; 1,995; 2,295; 2,495	opt. tape drive
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### RADIO SHACK/TANDY

15MB Hard disk	15(fixed)	5.25		Radio Shack TRS-80 models 12, 16	2,995	
5MB Hard disk	5(fixed)	5.25		Radio Shack TRS-80	1,999	
Tandy 2000 Hard disk	10(fixed)	5.25		Tandy 2000	1,699	includes power supply, controller

### SCIENTIFIC MICRO SYSTEMS

FWT 0100	71.2(fixed)	8	Quantum Q2000	DEC	6,600	includes power supply, controller, floppy disk drive backup
FWT 50000	71.4(fixed)	8	Quantum Q2000	general purpose SASI	6,100	
FWT 80000	75.4(fixed)	8	Quantum Q2000	Multibus	6,600	includes power supply, controller, floppy disk drive backup

### SYSGEN

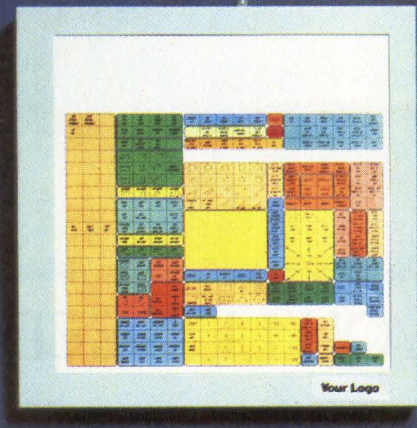
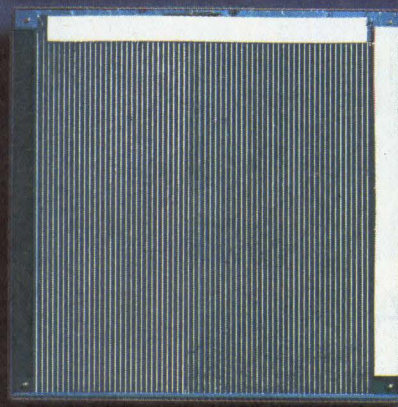
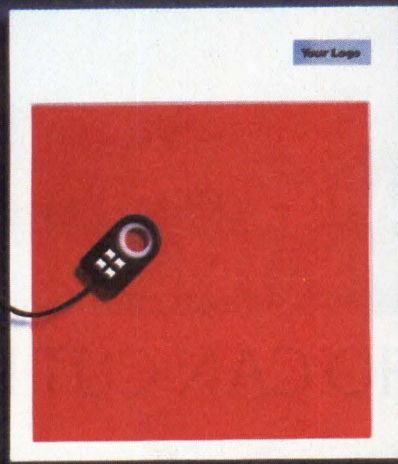
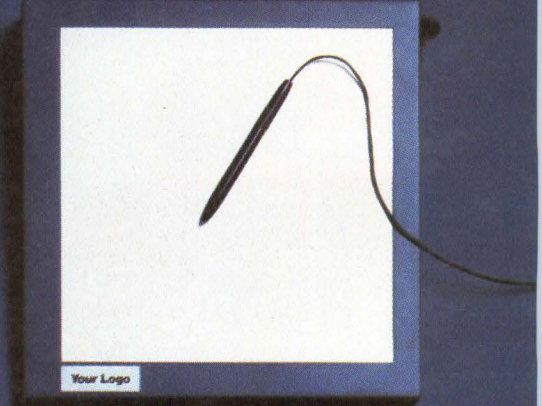
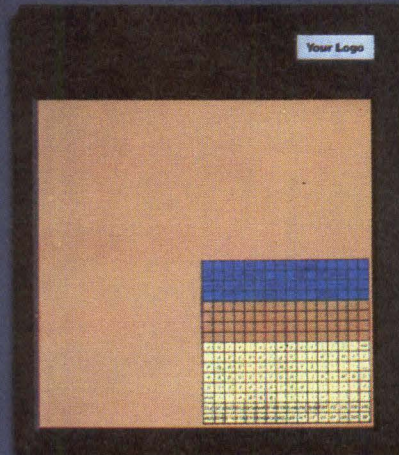
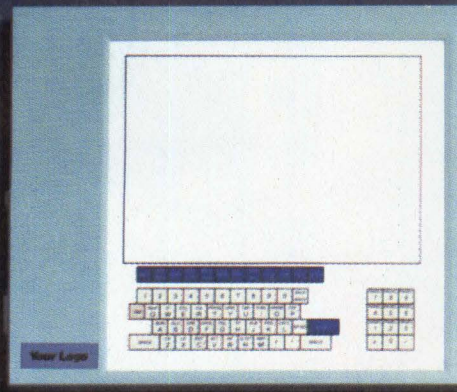
II-10	10(fixed)/10(removable)	5.25	Disctron, Fujitsu America Inc., Rodime, International Memories Inc., NEC	IBM PC, XT and compatibles	2,995	verifying on the fly
II-20	20(fixed)/10(removable)	5.25	Disctron, Fujitsu America Inc., Rodime, Int'l. Memories Inc., NEC	IBM PC, XT and compatibles	3,795	verifying on the fly
IIG-10	10(fixed)/20(removable)	5.25	Disctron, Fujitsu America Inc., Rodime, International Memories Inc., NEC	IBM PC, XT and compatibles	3,295	verifying on the fly
IIG-20	20(fixed)/20(removable)	5.25	Disctron, Fujitsu America Inc., Rodime, Int'l. Memories Inc., NEC	IBM PC, XT and compatibles	3,995	verifying on the fly
Image	10(removable)	5.25	Disctron, Fujitsu America Inc., Rodime, Int'l. Memories Inc., NEC	IBM PC, XT	995	verifying on the fly
Qicfile	20(removable)	5.25	Disctron, Fujitsu America Inc., Rodime, Int'l. Memories Inc., NEC	IBM PC, XT	1,495	

### SYSTEM INDUSTRIES

3400-51	380(fixed)	10.5		Data General		Zebra emulation
3400-62	74(removable)	14		Data General		Zebra and Kismet emulations, bad block forwarding, rack-mountable
3400-65	277(removable)	14		Data General		Zebra and Vulcan emulations
3400-66	277(removable)	14		Data General		Zebra and Vulcan emulations, bad block forwarding



# Not only will CalComp's digitizing tablet integrate with your equipment, it will look like it, too.



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competitive models. And with its flexible output format it will easily integrate with all your equipment.

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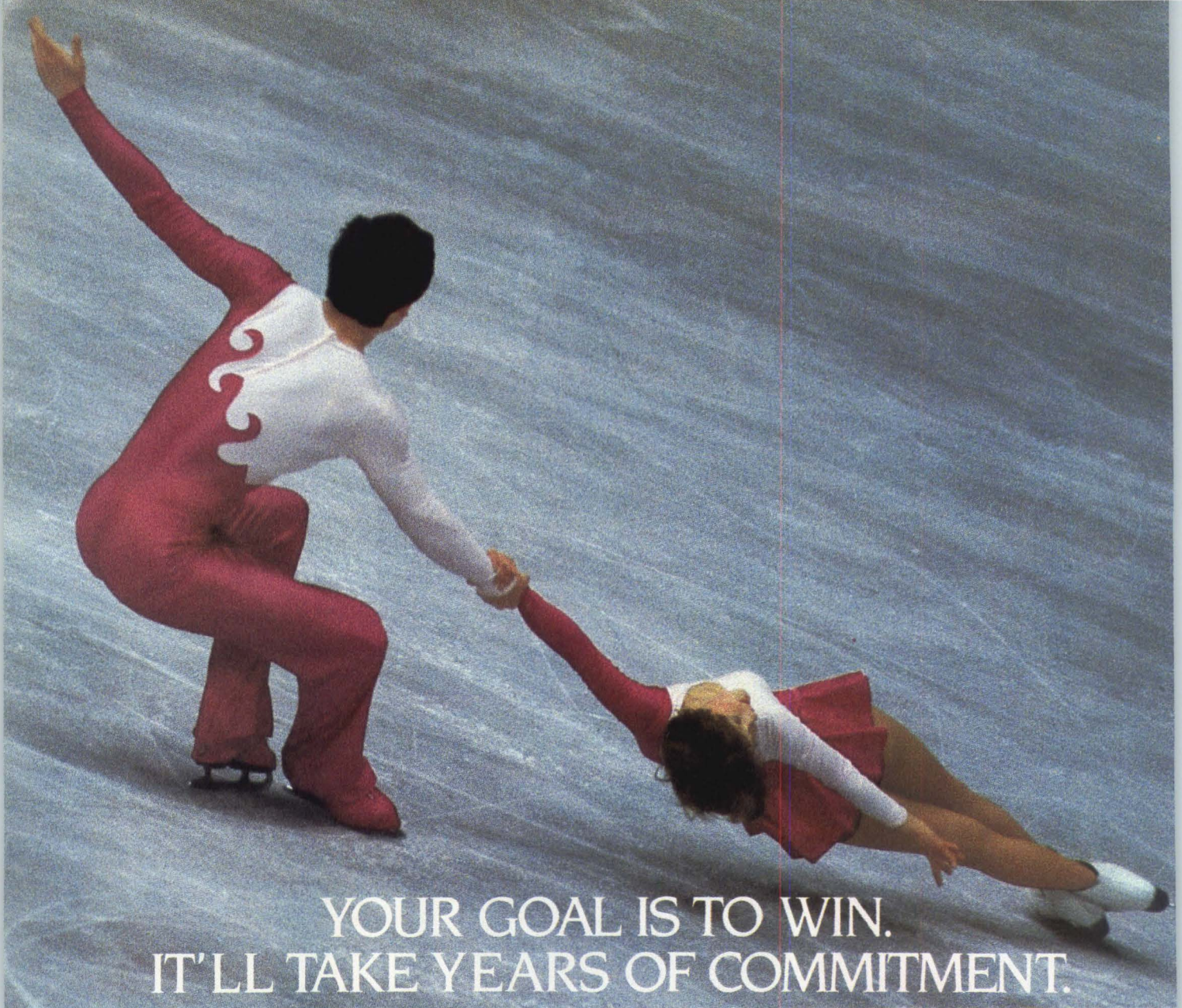
So if the other digitizer tablets on the market have been looking drab to you, take a look at CalComp's

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Choosing the right printer partner can be critical.

Are the same strong goals for success shared? Is the necessary talent, commitment, and dedication to meeting and exceeding those goals present?

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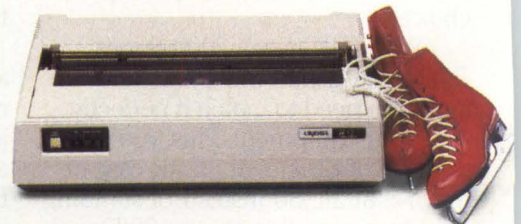
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**OKIDATA**  
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## DISK DRIVE SUBSYSTEMS

Company Subsystem Model	Formatted capacity (M bytes)	Disk size (inches)	Disk drive manufacturer and model number	Computer/Bus compatibility	Price (\$)	Notes, features, options
3400-75	380, 554(fixed)	14		Data General		Zebra and Vulcan emulations, bad block forwarding
3400-84	100, 147(fixed)	14		Data General		Zebra and Kismet emulations, bad block forwarding, rack-mountable
3400-94	277(fixed)	14		Data General		Zebra and Vulcan emulations, rack-mountable
6100-51	414(fixed)	10.5		DEC PDP-11, VAX Unibus		rack-mountable
6100-62	67(removable)	14		DEC PDP 11, VAX Unibus		rack-mountable
6100-65	256(removable)	14		DEC PDP-11, VAX Unibus		
6100-66	256(removable)	14		DEC PDP-11, VAX Unibus		
6100-75	512, 552(fixed)	14		DEC PDP-11, VAX Unibus		
6100-84	67, 134(fixed)	14		DEC PDP-11, VAX Unibus		rack-mountable
6100-94	256(fixed)	14		DEC PDP-11, VAX Unibus		rack-mountable
9900-51	405(fixed)	10.5		DEC PDP-11 Unibus, PDP-11/70 Cache bus, VAX 750 CMI, VAX 780 SBI		bad block forwarding, rack-mountable
9900-62	67(removable)	14		DEC PDP-11 Unibus, VAX 730, VAX 750 CMI, VAX 780 SBI, PDP-11/70 Cache bus		bad block forwarding, rack-mountable
9900-65	256(removable)	14		DEC PDP-11 Unibus, PDP-11/70 Cache bus, VAX 730, VAX 750 CMI, VAX 780 SBI		bad block forwarding
9900-66	256(removable)	14		DEC PDP-11 Unibus, PDP-11/70 Cache bus, VAX 730, VAX 750 CMI, VAX 780 SBI		bad block forwarding
9900-75	512, 552(fixed)	14		DEC PDP-11 Unibus, PDP-11/70 Cache bus, VAX 730, VAX 750 CMI, VAX 780 SBI		bad block forwarding
9900-84	67,134(fixed)	14		DEC PDP-11 Unibus, PDP-11/70 Cache bus, VAX 730, VAX 750 CMI, VAX 780 SBI		bad block forwarding, rack-mountable
9900-94	256(fixed)	14		DEC PDP-11 Unibus, PDP-11/70 Cache bus, VAX 730, VAX 750 CMI, VAX 780 SBI		bad block forwarding, rack-mountable

### SYSTEMS GROUP

HD2906	12.76(fixed)	5.25	Computer Memories	S-100 bus	2,060	
HD2907	19.6(fixed)	5.25	Computer Memories	S-100 bus	2,230	

### TALLGRASS TECHNOLOGIES

TG-3006	6.2(fixed)	5.25		IBM PC, XT and compatibles	2,995	includes 20M-byte cartridge tape backup
TG-3012	12.5(fixed)	5.25		IBM PC, XT and compatibles	3,495	includes 20M-byte cartridge tape backup
TG-3020	19.7(fixed)	5.25		IBM PC, XT and compatibles	3,995	includes 20M-byte cartridge tape backup
TG-3135	35(fixed)	5.25	Vertex Peripherals	IBM PC, XT and compatibles	5,595	includes 45M-byte cartridge tape backup
TG-3170	70(fixed)	5.25	Vertex Peripherals	IBM PC, XT and compatibles	7,495	includes 45M-byte cartridge tape backup



## DISK DRIVE SUBSYSTEMS

Company Subsystem Model	Formatted capacity (M bytes)	Disk size (inches)	Disk drive manufacturer and model number	Computer/Bus compatibility	Price (\$)	Notes/features, options
<b>TARBELL ELECTRONICS</b>						
HDS5-5, -10, -16, -28	5, 10, 16, 28(fixed)	5.25	CMI 19	S-100 bus	2,095 to 3,000	
<b>TECMAR</b>						
40200, 40300, 40400	10, 15, 33(fixed)	5.25	Computer Memories	IBM PC	2,795; 3,195; 4,295	
40210, 40310, 40410	10, 15, 33(fixed)/5(removable)	5.25	Computer Memories Inc./Syquest Technology	IBM PC	3,995; 4,395; 5,495	
<b>THOUGHT WORKS INC.</b>						
DataFile	5, 10, 20, 40(fixed)	5.25	Memorex, Fujitsu America Inc.	Sanyo models 1000, 1100/1150, 1200/1250, 3000, 500/550; IBM PC, Xerox 820, Zenith Z100	2,195; 2,595; 3,595; 4,995	
<b>U.S. DESIGN CORP.</b>						
CSS-800 model 835	22(fixed)	8	Priam 3450	IBM PC, Multibus, DEC Q-bus, Unibus	8,995	includes cartridge tape backup, controllers, host adapters, cables, power supply, 64K-byte cache memory
CSS-800 model 870	59(fixed)	8	Priam 7050	IBM PC, Multibus, DEC Q-bus, Unibus	9,995	includes cartridge tape backup, controllers, host adapters, cables, power supply, 64K-byte cache memory
VIP/X	620(fixed)	5.25	Maxtor XT2190	IBM PC, Multibus, DEC Q-bus, Unibus, SCSI	23,995	includes ASCII port, controller, host adapter, cables, power supply, 512K-byte cache memory; opt. cartridge tape, floppy disk backup
<b>UNITED PERIPHERALS</b>						
1696	480	14	CDC	Hewlett-Packard	29,500	
1698	480	14	CDC	Hewlett-Packard	29,500	
<b>WANG LABORATORIES INC.</b>						
2265V-1	75(removable)	14		Wang	12,000	
2265V-2	288(removable)	14		Wang	18,000	
2265V-3	620(fixed)	14		Wang	28,000	
2280N-3A	67(fixed)/13.4(removable)	14		Wang	13,000	
2280V-3	75(fixed)/15(removable)	14		Wang	13,000	
6580-3	67(fixed)/13.4(removable)	14		Wang	13,000	
<b>WINCHESTER SYSTEMS INC.</b>						
2xRL01	5.4(fixed)/5.4(removable)	5.25	DMA Systems	DEC RL01, Q-bus	7,000	
2xRL02	10.8(fixed)/10.8(removable)	5.25	DMA Systems	DEC RL02, Q-bus	9,000	
4xRL01	10.8(fixed)/10.8(removable)	5.25	DMA Systems	DEC RL01, Q-bus	10,000	includes two fixed/removable drives
4xRL02	21.6(fixed)/21.6(removable)	5.25	DMA Systems	DEC RL02, Q-bus	14,000	includes two fixed/removable drives
DataSafe-8 + 8R	5.4(fixed)/5.4(removable)	5.25	DMA Systems	ISIS-II	8,995	includes enclosure, controller, power supply, cables, host adapter
DataSafe-17R, -34AR	10.6, 21.2(removable)	8	Linx DP-100	ISIS-II	9,500; 11,995	includes enclosure, controller, power supply, cables, host adapter
DataSafe-8, -16, -24	5, 10, 15(fixed)	5.25		ISIS-II, Multibus	4,995; 6,500; 7,995	includes enclosure, controller, power supply, cables, host adapter
MB 10/10Rx2	21.6(fixed)/21.6(removable)	5.25	DMA Systems	Multibus	14,000	includes two fixed/removable drives
MB-10/10R	10.8(fixed)/10.8(removable)	5.25	DMA Systems	Multibus	9,000	same capacity as model MB-5/5Rx2 at lower cost in a smaller package
MB-5/5R	5.4(fixed)/5.4(removable)	5.25	DMA Systems	Multibus	7,000	
MB-5/5Rx2	10.8(fixed)/10.8(removable)	5.25	DMA Systems	Multibus	10,000	includes two fixed/removable drives



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CIRCLE NO. 135 ON INQUIRY CARD



## DISK DRIVE SUBSYSTEMS

Company Subsystem Model	Formatted capacity (M bytes)	Disk size (inches)	Disk drive manufacturer and model number	Computer/Bus compatibility	Price (\$)	Notes, features, options
<b>XCOMP</b>						
XF-10	10(fixed)	5.25	Miniscribe	S-100 bus	2,195	
XF-16	16(fixed)	5.25	Miniscribe		2,395	
XF-20	21(fixed)	5.25	Computer Memories Inc.	IBM PC	3,395	
XF-30	31.5(fixed)	5.25	Computer Memories Inc.	IBM PC	3,995	
10 Mb, 15 Mb	10, 15 (fixed)	5.25		S-100, Apple, IBM, and compatibles	2,195(10 Mb); 2,395(15 Mb)	write-protection, up to 5 year warranty
21 Mb, 31.5 Mb	21, 31.5 (fixed)	5.25		S-100, Apple, IBM and compatibles	3,395(21 Mb); 3,995(31.5 Mb)	write-protection, up to 5 year warranty
<b>ZOBEX</b>						
12.7M byte	10.6 (fixed)	5.25		IBM PC	1,295(Q1); 1,095(Q100)	power supply, controller, cables, software included
12.7M byte	10.6 (fixed)	5.25		IBM PCjr. Sanyo	1,595(Q1); 1,295(Q100)	power supply, controller, cables, software included

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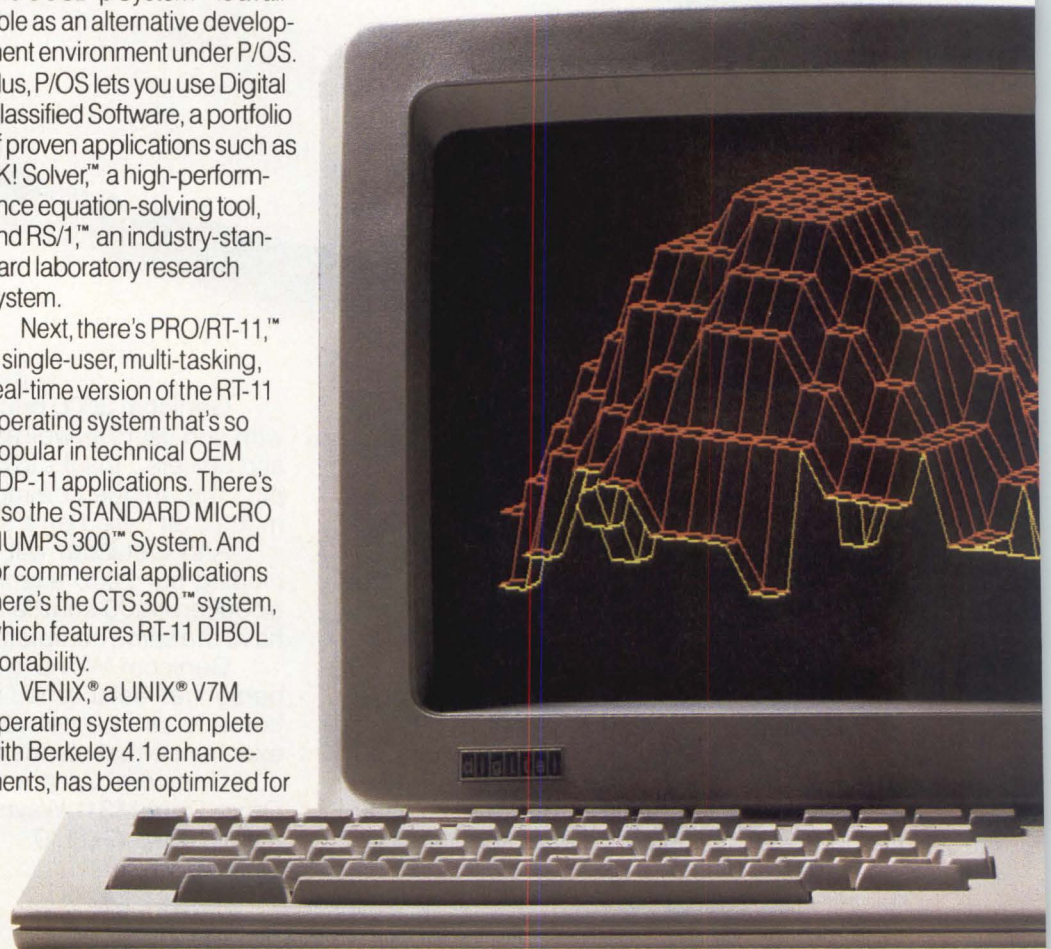
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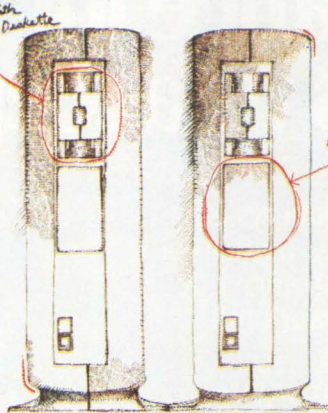
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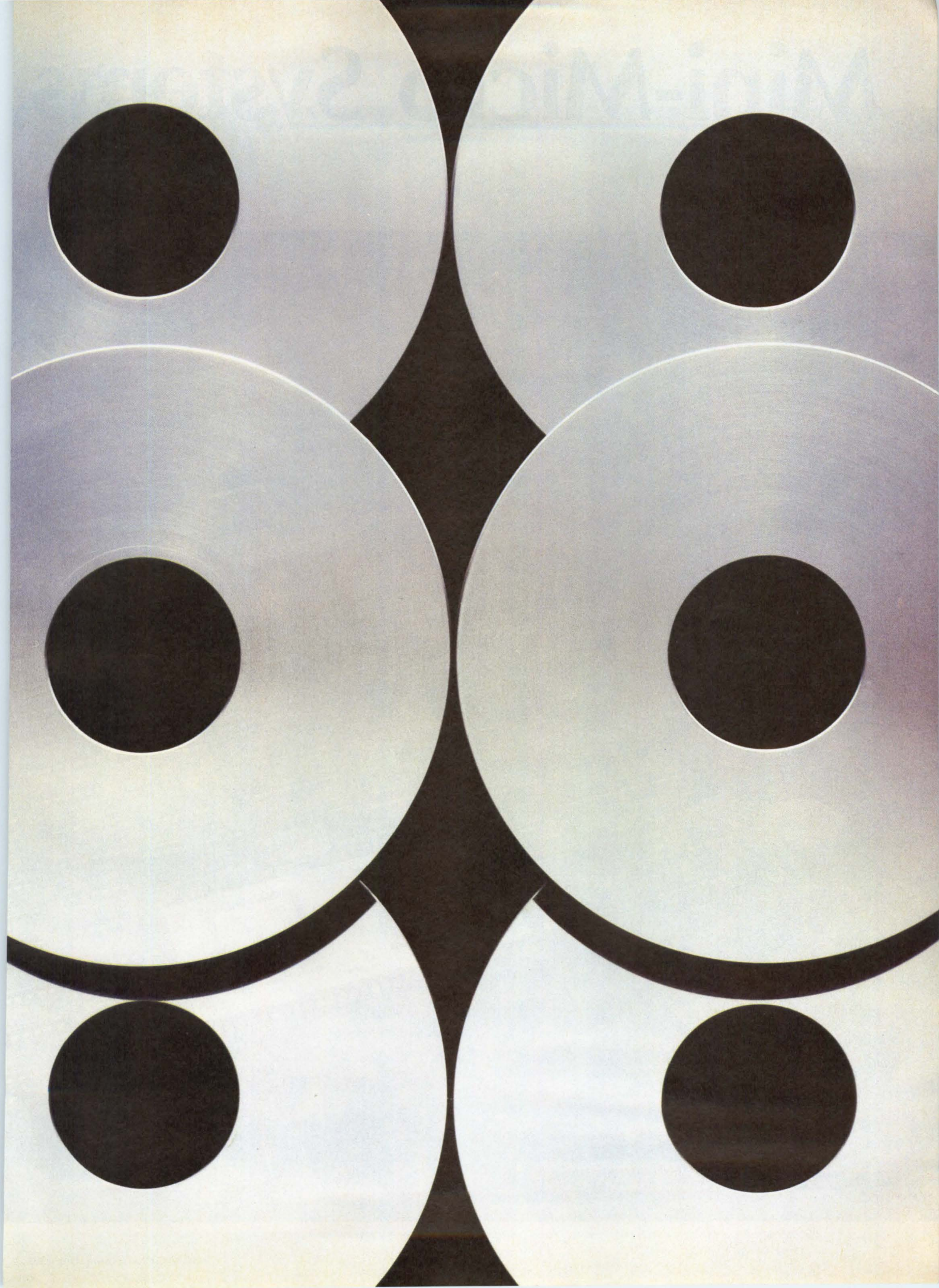
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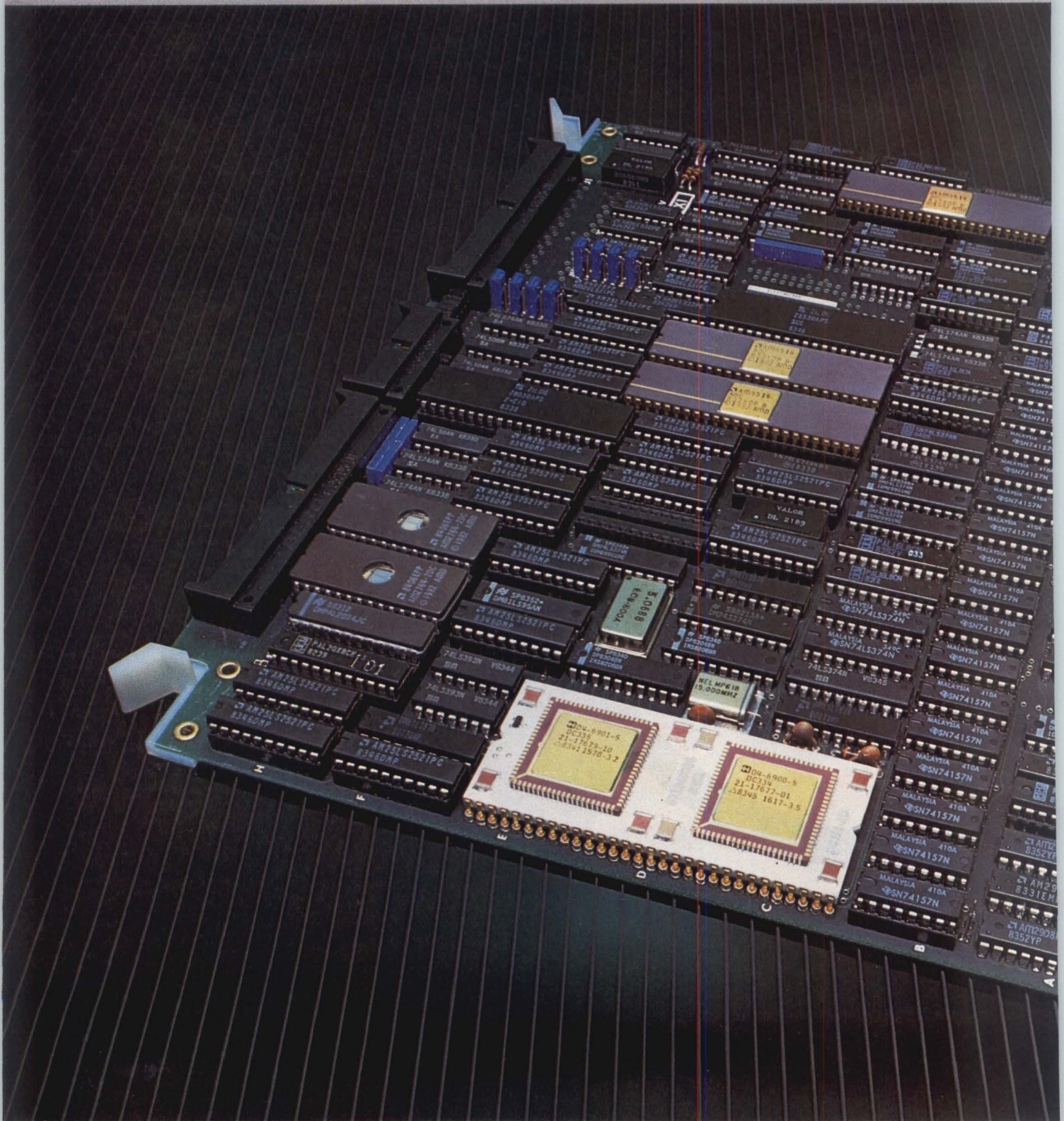
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# Mini-Micro Systems





# NCC '84 Preview

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The National Computer Conference preview from *Mini-Micro Systems* comprises three sections. There is a detailed article by senior editor Ron Shinn on a front-end processor board that will be introduced at the NCC by MDB Systems Inc. The board, shown on the opposite page, lets integrators use existing PDP-11 programs to boost system performance. Following that are shorter articles, compiled by assistant editor Steve Frann, on six more products that have introductions planned for NCC. Finally, associate editor Jesse Victor tells you what to look for in the various professional programs and seminars scheduled for the annual gathering of the computer industry this year in Las Vegas, Nev., July 9 to 12.

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## Front-end processor board combines J11 chip set, PDP-11 instructions

Ron Shinn, Senior Editor

By configuring Digital Equipment Corp.'s J11 chip set, two high-speed direct-memory-address (DMA) serial communications ports, 512K bytes of dual-ported memory and a parallel timer/counter port, a front-end processor board lets integrators use existing PDP-11 programs and instruction sets to boost the performance of compute-bound systems.

The JFEP11 board from MDB Systems Inc., Orange, Calif., although designed to solve multiprotocol communications throughput

problems, provides a wide range of general-purpose applications, including operation as an inter-processor link, a data compressor/decompressor, a dynamic memory reallocator, a terminal switcher and a terminal multiplexer.

The board operates in a Q-bus environment, furnishing an interface through its own external J11 bus for a variety of high-speed inputs and outputs. A key advantage of the board is that it boosts the power of systems based on relatively standard-performance host processors, such as the PDP-11/23, while providing a software migra-





# NCC '84 Preview

tion path for PDP-11 programming.

## Man-months to days

According to Sandra Traylor, senior design engineer at MDB, users can with minimal effort make PDP-11 software run in the JFEP11 environment. "It might take man-months to build a driver from scratch, but it literally takes only days and weeks to transfer programs using the JFEP11. Also, there are large numbers of PDP-11 programmers available as programming resources, which makes the product especially attractive."

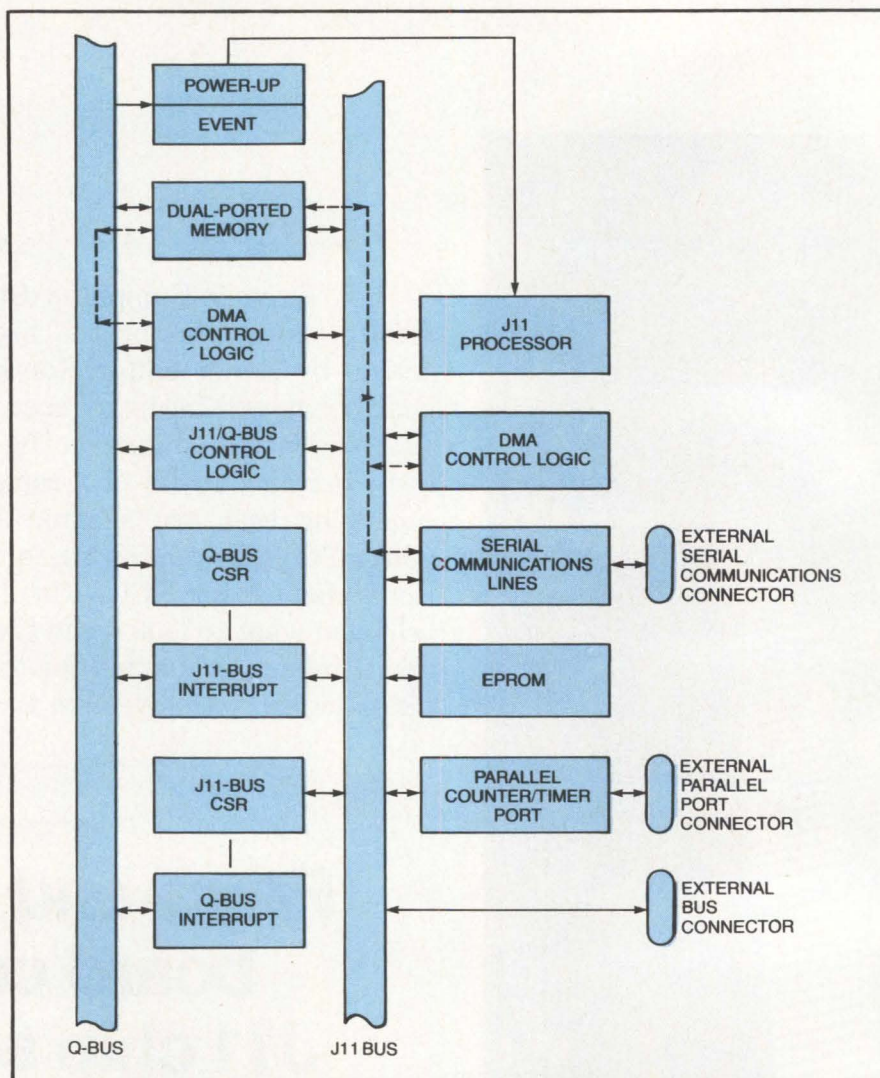
Traylor describes the software job as basically writing additions to the serial port drivers and programming the on-board devices. But, she points out, this can all be done in the PDP-11 instructions with which many programmers are familiar.

The quad-height JFEP11 board contains three connectors on one edge. It slides into any PDP-11 backplane without modification. The connectors link the J11 bus directly to external devices, connect the serial ports to a distribution panel and connect the parallel counter/timer port. Five light-emitting diodes mounted on the top board edge assist in troubleshooting and debugging. Boards are available now, and single-quantity price is approximately \$4,500.

## Raw power of a PDP-11/70

The J11 chip set generally rates at two to three times the processing power of a PDP-11/23 processor and, says Traylor, gives the JFEP11 board much of the raw power found in a PDP-11/70.

In the JFEP11 board, this processing power combines with a dual-ported memory to save Q-bus bandwidth. Typically, the main or host processor performs data transfers to memory under interrupts or DMA control, which ties up the main bus during the operation. With



The functional block diagram of the JFEP11 front-end processor board shows the relationship between the Q-bus and the J11 bus. The J11 bus communicates with devices outside the computer system. It performs high-speed data I/O while the J11 chip processes data for presentation to the host processor at the dual-ported memory.

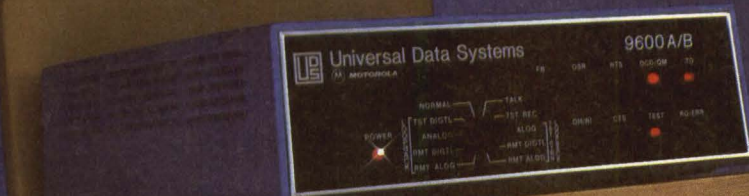
dual-ported memory, the front-end processor, or coprocessor, brings in the data, manipulates it, puts it into memory and then tells the host processor that the data is available at a given Q-bus address.

For example, 1,000 blocks of data transferred under DMA could take as long as 4  $\mu$ sec. per instruction cycle (or block) to transfer under host control. With the JFEP11 handling all the communications and placing the raw data in memory, which is then available to the host on the Q-bus, all of that time is saved by the main processor. This

setup thus delivers data into a system at rates as high as 1M bit per second (bps) over a high-speed port without loading the system bus.

Limited bus bandwidth is frequently a serious system problem, which is caused by significant bus activity from devices such as disks, terminals and magnetic tapes. Of the 512K bytes of memory on-board the JFEP11, 256K bytes can be selectively shared by the main processor. This sharing means that the data processed by the board can be put directly into system memory without detracting from the main





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CIRCLE NO. 141 ON INQUIRY CARD

Created by Dayner/Hall, Inc., Winter Park, Florida



# NCC '84 Preview

system bus bandwidth. The board can also generate an interrupt to notify the main processor that data is available.

## Board proves multifunctional

Because many different types of terminals are used to input and output data from the main computer system, the JFEP11 provides a solution to both data-transfer and data-manipulation problems. The board, under user programming, can compress/decompress data, handle data integrity, process data in synchronous or asynchronous protocols and search for special characters or messages.

It can also be used as a protocol emulator, emulating more than one protocol on a single channel or on more than one channel. What's more, the two on-board high-speed DMA or interrupt-driven ports are programmable in asynchronous or synchronous protocols.

The external, or JFEP11, bus can bring in additional serial channels directly to the J11 processor, or into the memory for later data processing. Therefore, the board can serve as a terminal server, handling various dumb terminals, intelligent terminals and personal computers.

As a terminal server, the board can be programmed to support features such as switching terminals, dynamic reallocating of terminals and varying terminal-cluster applications. It can also multiplex local terminals, remote terminals and workstations into the main system.

## Good for graphics

The JFEP11 especially suits applications requiring heavy throughput, such as for graphics. This application can load down the main processor with point-to-point computations and screen displays. The additional data handling and processing power of the JFEP11 significantly enhances such systems.

Another use of the board is as an

inter-processor link. This application proves useful when parallel inter-processor links are not possible or when higher-level protocols and assorted levels of error correction/detection are required. The advantage here is the JFEP11's high-speed (1M-bps) data rates, full modem-control capability, DMA and data manipulations. The programmable JFEP11 can also control satellite communications.

Because nearly all the board functions are under program control, the product resists obsolescence. As new protocols are implemented and changes are made to existing protocols, system integrators have merely to reprogram the board, not obtain new hardware.

For example, the JFEP11's on-board counter/timer works through a parallel port. The software-programmable, interrupt-driven counter/timer ports can help set event-timing constraints. The parallel port also accommodates modem signals or connects control lines from the J11 process to a user-specified device.

System programs or diagnostics can be down-loaded from the main processor into the JFEP11. Once the programs are down-loaded, board execution is started by booting up on power or via an on-line debugging tool console. This console finds primary use in the development environments and operates similar to a serial line unit interface device on the Q-bus.

The dual-ported memory is accessible to the J11 processor, on-board DMA devices and other devices via the Q-bus or the J11 bus. It has two separate addressing ranges. One address range relates to the Q-bus; the other, to the J11 bus. If the address range for the Q-bus starts at location 0, the addressing range for both buses is the same. If the address range for the Q-bus starts at location 256K bytes and the address range for the J11 bus starts at

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<b>Qume SPRINT 11/55 PLUS</b>	<b>55</b>	<b>5,500</b>	<b>YES</b>	<b>\$1990</b>

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SPRINT 11/55 PLUS™  
outperforms NEC\*\*  
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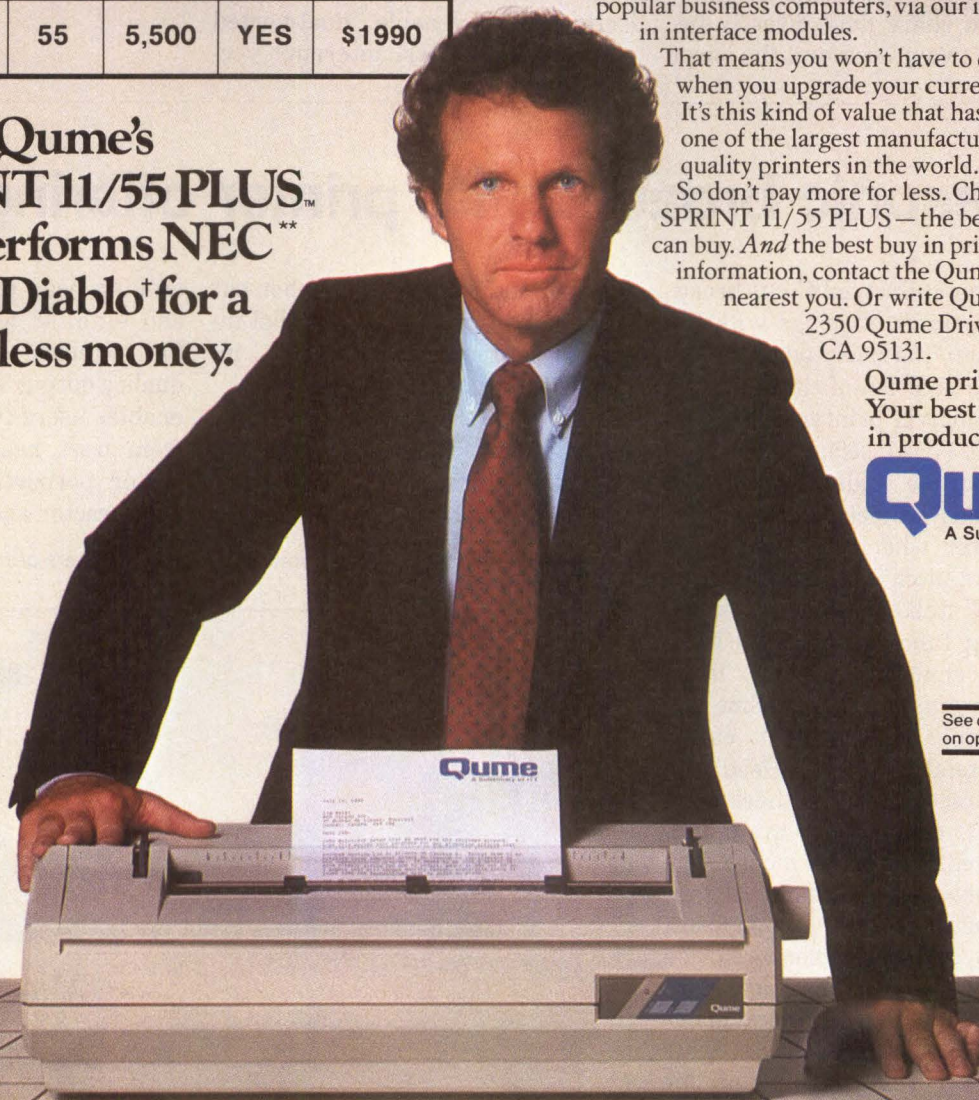
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\*Mean Time Before Failure at 25% duty (manufacturer's published data)

\*\*NEC is a registered trademark of Nippon Electric Company

†Diablo is a registered trademark of Xerox Corp.

CIRCLE NO. 142 ON INQUIRY CARD



# NCC '84 Preview

0, then the addresses are different. In this case, address 0 for the J11 bus correlates to address 256K bytes on the Q-bus.

Each additional address correlates with the next location for each range. Address locations 0 through 776 on the J11 bus are considered the vector address range for the J11 processor. When using the dual-ported memory, this section of memory must be protected from the Q-bus.

Making the memory look like two separate sections to the Q-bus helps reduce problems encountered by program collisions when using multiprocessors with common memory. Here, the upper memory can be used to share data directly between the two processors; the lower

memory, for J11 programs.

## Dual buses ease I/O operations

Furthermore, the JFEP11 can be programmed to perform I/O operations between the J11 bus and the Q-bus. To do this, the J11 takes over the Q-bus by initiating a DMA transfer. Once the board becomes the master, it can read or write to any address on the Q-bus until it releases the bus back to the main processor.

In addition, two registers on the JFEP11 regulate the control and status information for each bus. The Q-bus control-and-status register controls power-fail to the J11 processor, lower- and upper-memory selection, DMA enable, dual-ported memory enable, J11 interrupt vec-

tor address and J11 interrupt request.

The second register grabs the Q-bus for J11-to-Q-bus I/O transfers, sets single cycle or requests the number of DMA transfers for burst-mode operation, starts DMA mode and enables the BEVENT (60-Hz-clock) line to J11 from the Q-bus and the Q-bus interrupt vector address and the request for Q-bus interrupt.

The serial communication channels and certain modem signals connect to the 50-pin connector on the card edge. Only RS422 interfacing is supplied on the board; RS423 interfacing is available through the external distribution panel. □

## Panasonic broadens its printer offerings

Panasonic Industrial Co. is broadening its printer offerings with the introduction of a daisy-wheel printer and the addition of three models to its dot-matrix printer line.

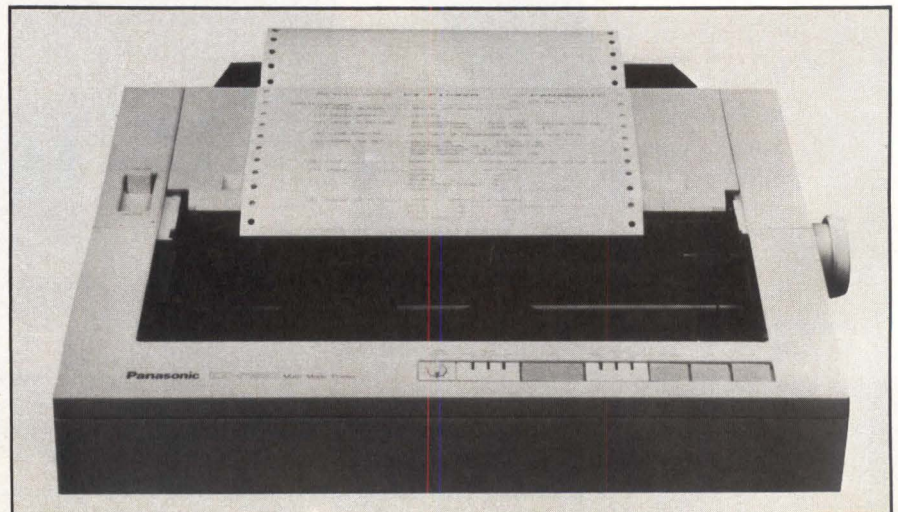
The KX-P3151 serial impact Diable-compatible, bidirectional logic-seeking daisy-wheel printer uses a 96-character wheel. It operates at 22 cps in 12-pitch Shannon text or 21 cps in 10-pitch. It performs word-processing functions such as bold-face and shadow lettering, backspace, margins, tabs, underline and justification. The product comes with a standard friction-feed and optional tractor and cut-sheet feeders. Usable form lengths are operator-variable from 3 to 16 inches. The printer produces as many as four copies at a time on non-carbon forms or as many as three copies on carbon paper with a maximum paper width of 15½ inches and a maximum printing width of 13½ inches. LED lights indicate power-on and on-line operation and error conditions such

as paper end, ribbon end, ribbon out and line error. An 8-bit parallel interface is standard; an RS232C interface is optional. \$700.

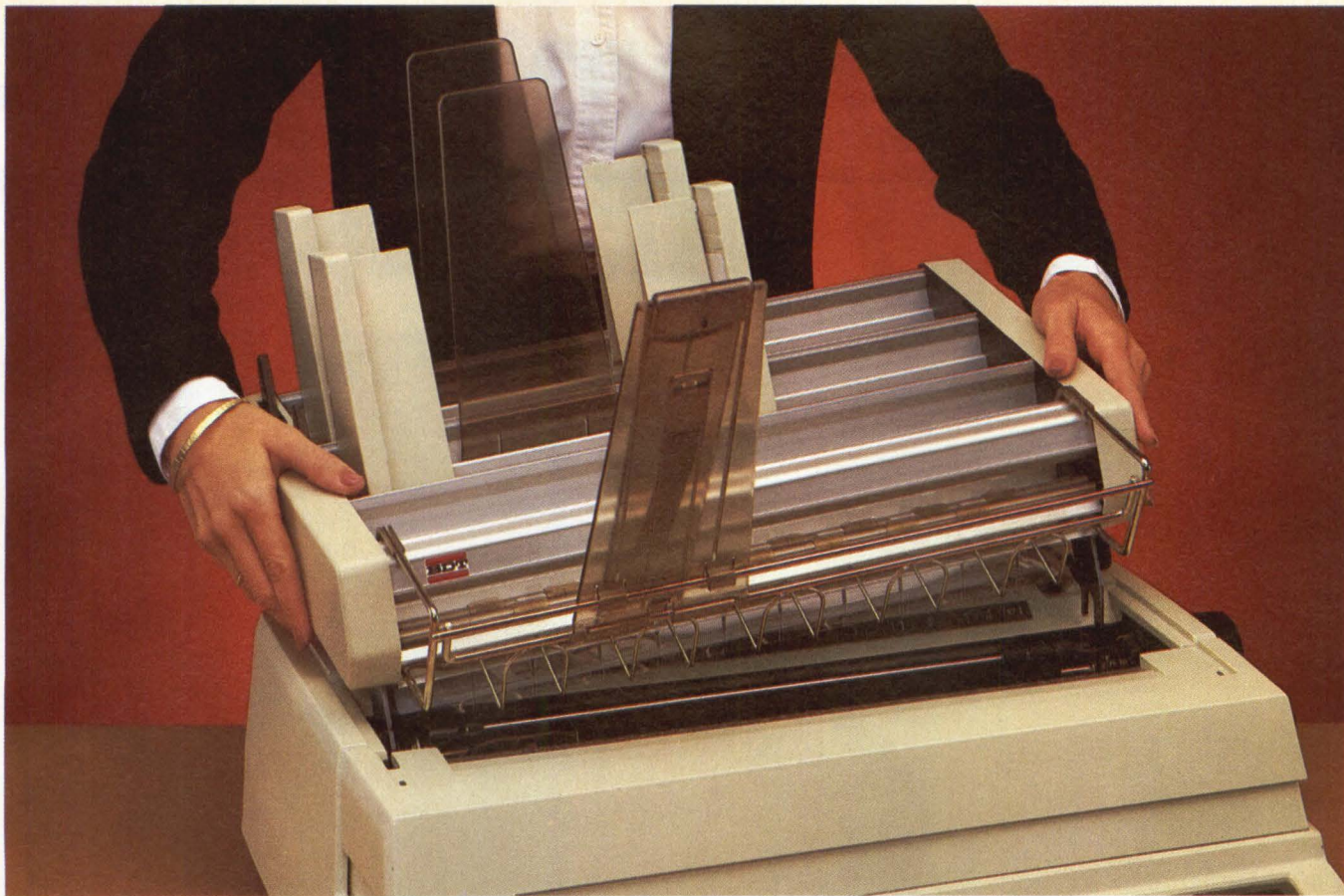
Models KX-P1092, KX-P1093 and KX-P1091 are nine-pin, serial dot-matrix printers. The KX-P1092 bidirectional printer with logic-

seeking head prints 180 cps in pica and elite. It features print modes for graphics, draft or near-letter-quality output with a touch pad that enables users to change print mode from draft, near-letter-quality, italics or proportional. The unit has both tractor and friction paper-feed

**Panasonic's model KX-P1092 dot-matrix printer lets users change form length and print mode from the front panel.**







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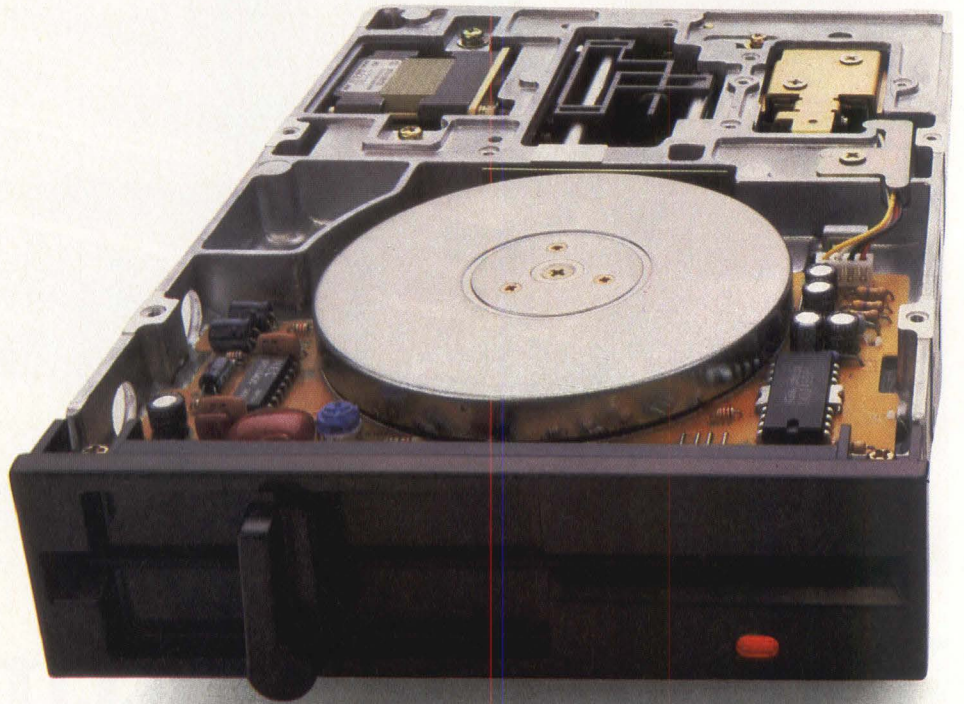
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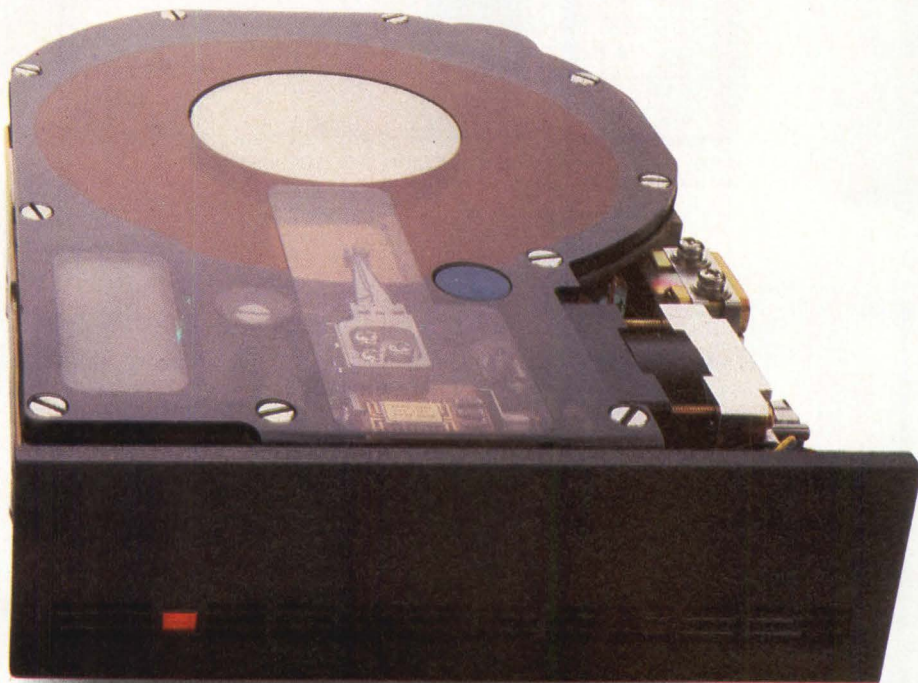
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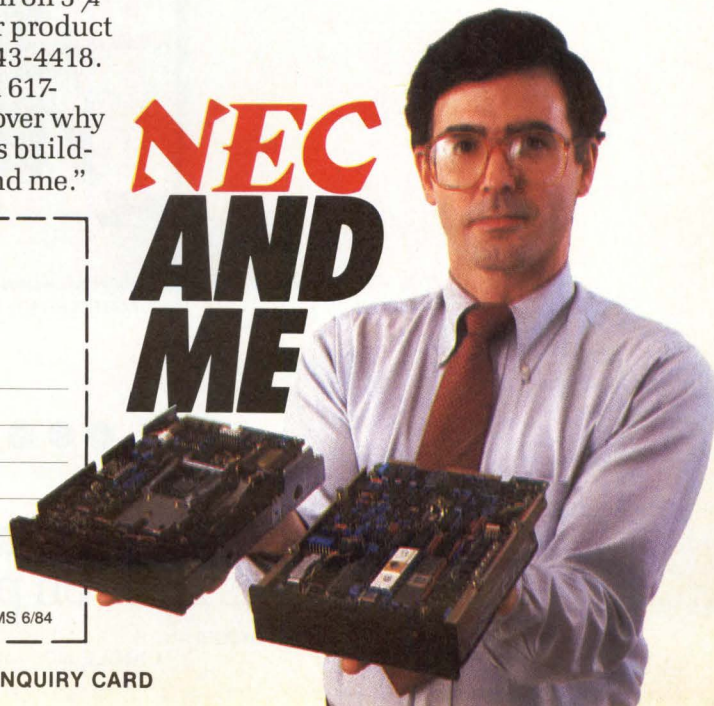
ments in electronics for almost 85 years. Today, we're a world-wide company with over \$6 billion a year in sales.

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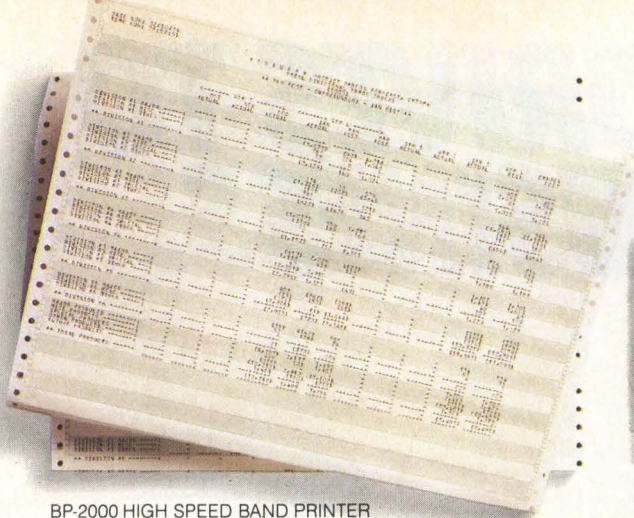
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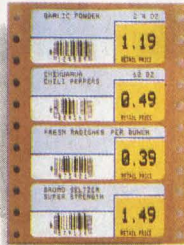
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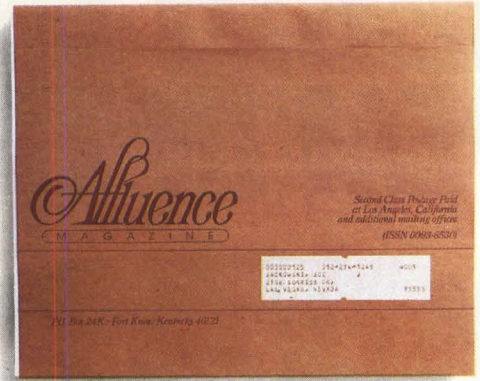




BP-2000 HIGH SPEED BAND PRINTER



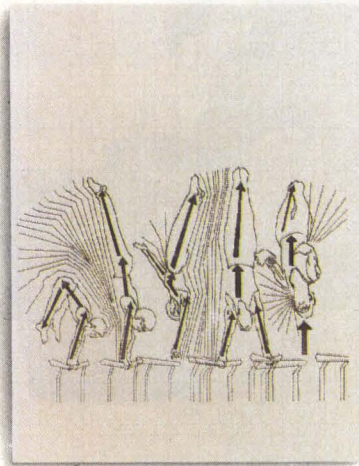
M-100L MATRIX PRINTER



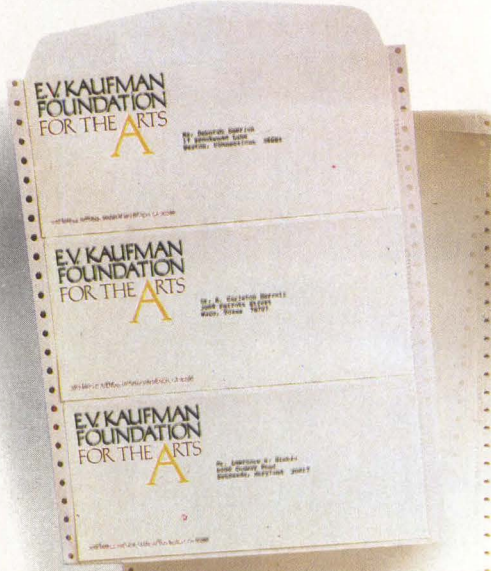
B-600 MEDIUM SPEED BAND PRINTER



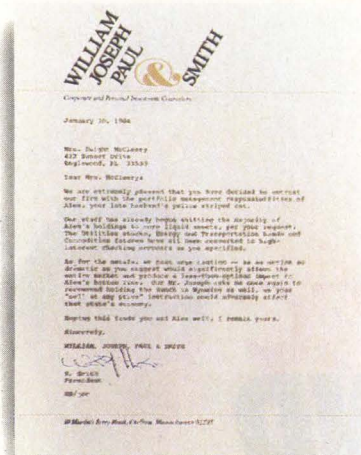
P-80 MATRIX PRINTER



MODEL 480 MATRIX PRINTER



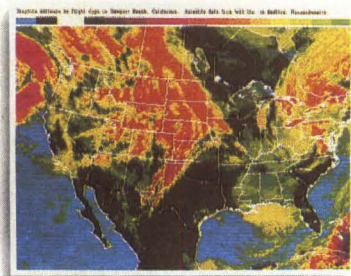
DP-55 DAISYWHEEL PRINTER



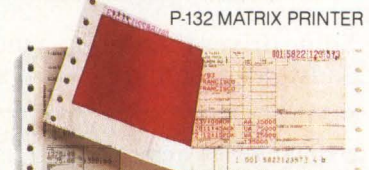
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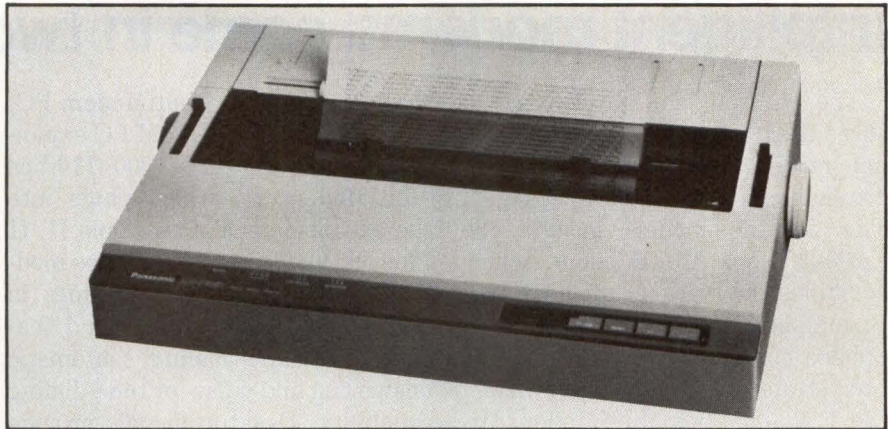


# NCC '84 Preview

mechanisms and can accommodate fan-fold or single-sheet paper from 4 to 10 inches wide. Communication is through an 8-bit parallel interface; an RS232C interface is optional. \$599.

The bidirectional model KX-P1093 with logic-seeking head prints at 160 cps in pica and at 135 cps in elite. The printer also features graphics, draft, near-letter-quality and proportional printing modes. It uses bottom paper feed and has adjustable tractor feed or friction paper feed. It accommodates 15-inch-wide paper. The product comes with 8-bit parallel and RS232C interfaces. \$899.

The KX-P1091 printer operates at 120 cps and offers switch-selectable graphics, draft, near-



Panasonic enters the solid-font printer market with its KX-P3151 daisy-wheel unit.

letter-quality and proportional modes. Featuring an adjustable tractor feed and friction feed, the printer accepts sprocket or single-sheet paper from 4 to 10 inches wide. The product has a standard

8-bit parallel interface with an optional RS232C interface. \$499. **Panasonic Industrial Co.**, One Panasonic Way, Secaucus, N.J. 07094, (201) 348-7183.

Circle No 743

## Subsystem provides 2.6G-byte write-once storage

Hitachi's 301 series optical-disk subsystem provides a maximum recording density of 19,500 bpi and a track density of 16,000 tpi for a storage capacity of 2.6G bytes per 12-inch disk. A proprietary Tellurium-Selenium photoelectric medium is air-sandwiched into the sealed glass envelope of the 301's disk.

Combined with read-after-write recording and an error-correction function, the medium reduces expected read errors to  $10^{-12}$ , permitting storage of image and encoded data. Average access time is 250 msec. Data-transfer rate is 440K bytes per second. The basic subsystem configuration combines a for-

matter controller with one to four disk units. The second, or library, configuration offers as much as 80G bytes of storage and incorporates a formatter controller with software, one or two disk units and an automatic changer for as many as 32 disk cartridges. The formatter controller interfaces with CPUs via the GP-IB interface. Contact vendor for prices. **Hitachi America Ltd.**, 950 Elm Ave., San Bruno, Calif. 94066, (415) 872-1902.

Circle No 744

## Selectable modes match varied applications

The multimode model MVP 150B dot-matrix line printer produces correspondence-quality documents at 80 lpm and data-processing-quality reports at 150 lpm. In the condensed-print mode, the product can print a 132-column report on an 8½-by-11-inch page. With the block graphics character set, an operator

can generate custom business forms from a variety of horizontal, vertical and diagonal lines. For scientific or industrial graphics applications, the device plots at 100-by-100 dpi. It handles continuous fan-fold, edge-perforated, 3- to 16-inch-wide, one- to six-part forms. A Centronics-compatible interface is standard.



\$3,745. **Printronix Inc.**, 17500 Cartwright Road, P.O. Box 19559, Irvine, Calif. 92713, (714) 863-1900.

Circle No 745



# NCC '84 Preview

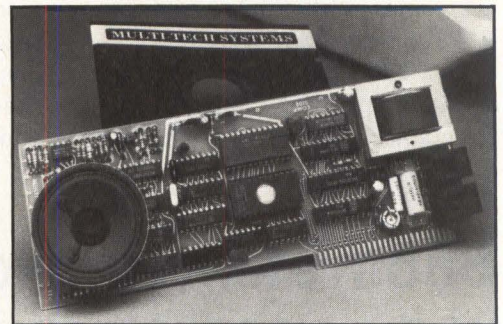
## Intelligent modems come in two configurations

The MultiModem line consists of three desktop models and two internal modem cards, which include communications software packages. The desktop models include the 1,200-/300-bps MultiModem, which combines the features of the Hayes Smartmodem 1200 with internal telephone-number storage and dial- or busy-tone-detection capabilities, the 1,200-/300-bps MultiModem HC and the 300-bps MultiModem HC3. The two internal modem cards are

the 1,200-/300-bps MultiModem PC, which plugs into the IBM PC expansion bus, and the 300-/110-bps MultiModem II, which plugs into the expansion bus of an Apple II, II Plus or IIe. The 1,200-/300-bps models operate over two-wire lines in half- or full-duplex mode and feature automatic dialing, automatic answering and pulse- or tone-dialing capability. Desktop models provide seven LED indicators for verification of phone-line and modem condi-

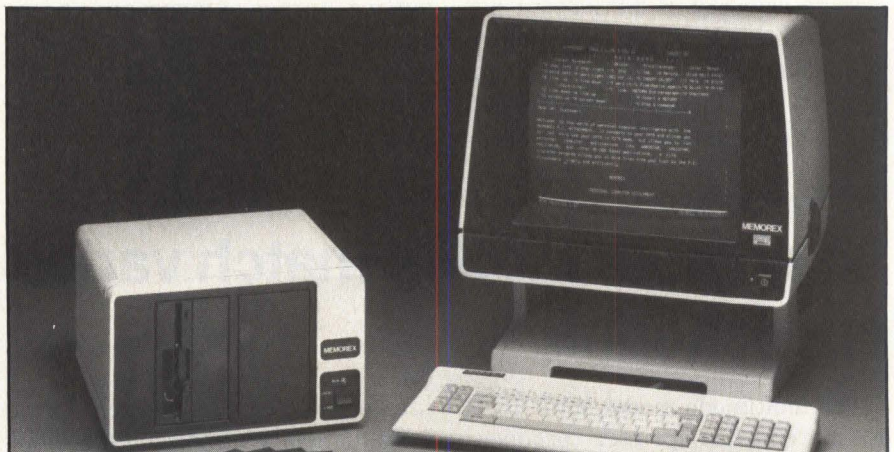
tions, such as receive data, transmit data, carrier detect, high speed, off hook, data terminal ready and modem ready. The 1,200-/300-bps MultiModems sell for \$549 each; the MultiModem IIe, for \$329; and the MultiModem HC, for \$289. **Multi-Tech Systems Inc.**, 82 Second Ave., S.E., New Brighton, Minn. 55112, (612) 631-3550.

Circle No 746



## Processor transforms terminal into personal computer

The Memorex PC Attach adds personal-computing capabilities to the company's line of IBM-compatible display stations. The product also attaches to the Memorex 2078 and 2079 display stations as well as to the IBM 3278, 3279 and 3178 displays. For host processing applications, the PC Attach connects to the Memorex 2074 and 2076 or the IBM 3274 and 3276 cluster controllers. PC Attach can transfer files to and receive files from an IBM host. The unit has 8088 and Z80A microprocessors, 128K bytes of memory, RS232C interfaces for asynchronous host communication and serial printer connection and includes MS-DOS and CP/M-80. Four system configurations are available: single-diskette drive,



dual-diskette drive and 10M- or 20M-byte hard disk drive with one diskette drive. All configurations use 5¼-inch diskettes formatted under MS-DOS to 320K bytes (IBM PC) or 360K bytes (IBM PC XT) or

under CP/M-80 to 410K bytes. Prices range from \$2,600 to \$6,000. **Memorex Corp.**, 18922 Forge Drive, Cupertino, Calif. 95014, (408) 996-9000.

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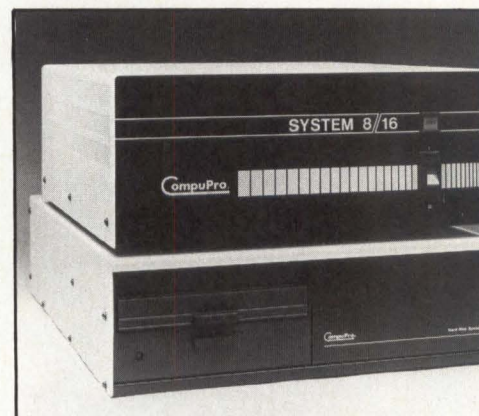
# NCC '84 Preview

## Multiuser system contains NS16032 CPU

The multiuser System 816/G uses National Semiconductor's 6-MHz NS16032 CPU with an NS16202 ICU and NS16082 MMU. The IEEE-696-compatible microcomputer also includes 512K bytes of 16-bit static memory, 12 serial ports, one Centronics printer port, one parallel port, 1.2M bytes of floppy disk storage, 40M bytes of hard

disk storage and 1.5M bytes of MDrive/H solid-state disk storage. UNIX Version 4.2 and the C and FORTRAN programming languages are standard. \$19,995. Deliveries begin in the third quarter. **CompuPro**, 3506 Breakwater Court, Hayward, Calif. 94545, (415) 786-0909.

Circle No 748



## NCC looks ahead to AI, emerging computer industry standards

*The NCC will target AI systems emerging from R&D labs and standards for graphics packages, LANs and microcomputers*

**Jesse Victor**, Associate Editor

The National Computer Conference (NCC), to be held July 9-12 in Las Vegas, Nev., will focus on artificial-intelligence (AI) systems and emerging standards for computer graphics, local-area networks (LANs) and microcomputers. AI is no longer merely a technical buzzword or a subject for lengthy articles in technical journals. AI-based computer systems are emerging from research and development labs into prototype and, in some cases, commercial products. This year's NCC will provide an in-depth look at this powerful and significant technology, devoting a professional program track and nearly a score of professional sessions to AI and associated expert and knowledge-based systems.

"We are going to look at what is really going on out there right now and not just work in a laboratory,"

explains AI-program-track chairman James Miller, director of sponsored research at Computer Thought Corp., Dallas. A Wednesday morning session, for example, "Expert Systems in the Computing Industry," will present an overview of practical expert systems that can in some sense reproduce experts' decision-making skills. Providing a designer/user perspective, the panel will feature joint presentations by companies that have developed expert systems and by users of the systems in the field. The companies will discuss the motivation for applying AI and problems in building the systems; the users will zero in on applications and performance parameters.

Speakers will describe an order-entry expert system built by Teknowledge for NCR Corp., a system for the design of very-large-scale-integration (VLSI) semiconductor chips developed by

Hewlett-Packard Co.'s Research Lab in Palo Alto, Calif., and an expert system for computer-controlled instrumentation developed by IntelliGenetics Inc., Palo Alto, Calif., for the Lawrence Livermore National Laboratory, Livermore, Calif.

Session chairman Peter Friedland, a research scientist in the heuristic programming project at Stanford University, Stanford, Calif., views AI and expert systems as supplying "an intelligent front-end to complicated machinery," making experts' jobs easier. "The operator will be able to talk to the computer or instrument in terms closer to [the operator's] language," Friedland says. "The expert system will translate what the expert knows into language the instrument can understand. One of the major functions of expert systems is to make tools smarter and easier to use."

Lawrence Livermore has devel-



## Video display offers Honeywell 7300 compatibility

The model 7-HNY terminal offers Honeywell VIP 7300 series and DEC VT102 compatibility. Unlike the VIP 7300, the model 7-HNY contains two bidirectional RS232 ports and expanded line-drawing and mosaic character sets, and its setup parameters are entered from the keyboard. The terminal has 12 pre-programmed function keys and

a 512-character, non-volatile function memory that accepts as many as 32 variable-length user-programmed functions. Its display attributes—low intensity, blink, underline, reverse and hide—are VIP7300-, VIP7200- and 7801-compatible. The model 7-HNY's display memory, consisting of one (or three) 24-line-by-80-column pages, can be

reformatted by logically redefining line length and page length in select mode. The terminal has seven area qualifiers, including zero fill, must fill and right justify, and characters can be displayed as large as double-height-by-quad-width. It is available in 9-, 12- and 15-inch CRT sizes and white, green and amber phosphors. The 12-inch model sells for \$1,695. **Teleray Division of Research Inc.**, 6425 Flying Cloud Drive, Eden Prairie, Minn. 55344, (612) 941-3300.

Circle No 749

oped an AI-based expert system to speed the calibration of a sophisticated triple-quadrupole mass spectrometer (TQMS). Developed with IntelliGenetics' knowledge-engineering environment (KEE) knowledge-representation language, the program, called TQMSTUNE, greatly speeds the complex coarse- and fine-tuning calibration process, claims Dr. John Kunz, manager of custom systems at IntelliGenetics.

"Because there is no good algorithm for doing the calibration, it takes a very good chemist nearly an hour to perform the task," Kunz observes. "One of the advantages of AI telling you what to do is that you can implement something and see specifically how the instrument behaves. In the process of doing the calibration, you are learning the algorithm for doing it well." Although Kunz says very few companies have triple-quadrupole mass spectrometers, he expects the technique to be applicable to other complex instruments.

Participants in a session called "AI Techniques for Signal Instruments" will discuss similar approaches to AI implementation. Signal processing, says Computer Thought's Miller, has been traditionally approached as a number-crunching problem, as in the analysis of complex seismic data, for

example. But recently, "people have been moving from a purely numerical approach to a more symbolic one," he says.

Systems like SRI International's Prospector, Miller explains, apply AI techniques to the seismic exploration for oil and other valuable materials, shifting more data analysis into the computer system itself. The system could then generate hypotheses about geological structures. For example, based on the collected seismic data, such a system could determine whether oil would likely be found at a specific location—in effect, giving an informed opinion with an associated probability of success.

A session called "Tools for Commercial AI" will explore practical AI systems from both hardware and software perspectives. Speakers at the Wednesday morning session will focus on new personal LISP machines that support AI, the AI operating-system environment and compatibility with traditional machines, ways in which AI can increase productivity and tools for improving application productivity.

"AI is essentially a scientific and engineering activity aimed at replicating or understanding human problem-solving skills," explains session chairman Thomas Kehler, executive vice president of technolo-

gy at IntelliGenetics. "From a product point of view, it is typically a program that supports an expert in decision making or in problem solving or a system that can supplement an expert when the expert is not around, allowing a less experienced person to substitute."

Kehler expects quite a few AI products to be introduced over the next few years and notes that Fortune 500 companies are developing AI products internally that could be developed for use in general applications. AI systems, Kehler says, can promote productivity by providing a set of highly relevant tools that permit designers to enhance the user-to-computer interface, do "some basic system design," customize computer systems for specific applications or create highly innovative graphics.

### Systems analyze for style errors

"Intelligent Aids to Document Preparation" will spotlight highly innovative AI-based systems that might someday replace secretaries and copy editors. In the Thursday morning session, IBM Corp. will unveil its Epistle document-enhancement and -editing system that can analyze text for word-level, grammatical and stylistic errors.

The difference between Epistle and other systems is that it has a



# NCC '84 Preview

parser of English text that understands grammatical structure, says Dr. Lance Miller, director of the Epistle project and manager of language and knowledge systems at IBM's Thomas Watson Research Center, Yorktown Heights, N.Y. Using standard style manuals, Epistle finds grammatical and stylistic errors and implements about 80 common style precepts. IBM will eventually customize Epistle to meet specific styles and user needs, Miller says.

Requiring 3M to 5M bytes of hard disk storage for its 130,000-word dictionary, Epistle uses a two-level cache memory. One level holds the

1,000 most frequently used words; the other holds the words most frequently written in creating a document. Epistle is in the research prototype stage and is undergoing field testing. It is currently a host-computer-based system, but Miller says it can be put into a small machine. Such a system, however, would need a performance level of 0.75 million instructions per second and 1M byte of memory. "Terminals now don't have those specs," Miller says, "but next year they probably will."

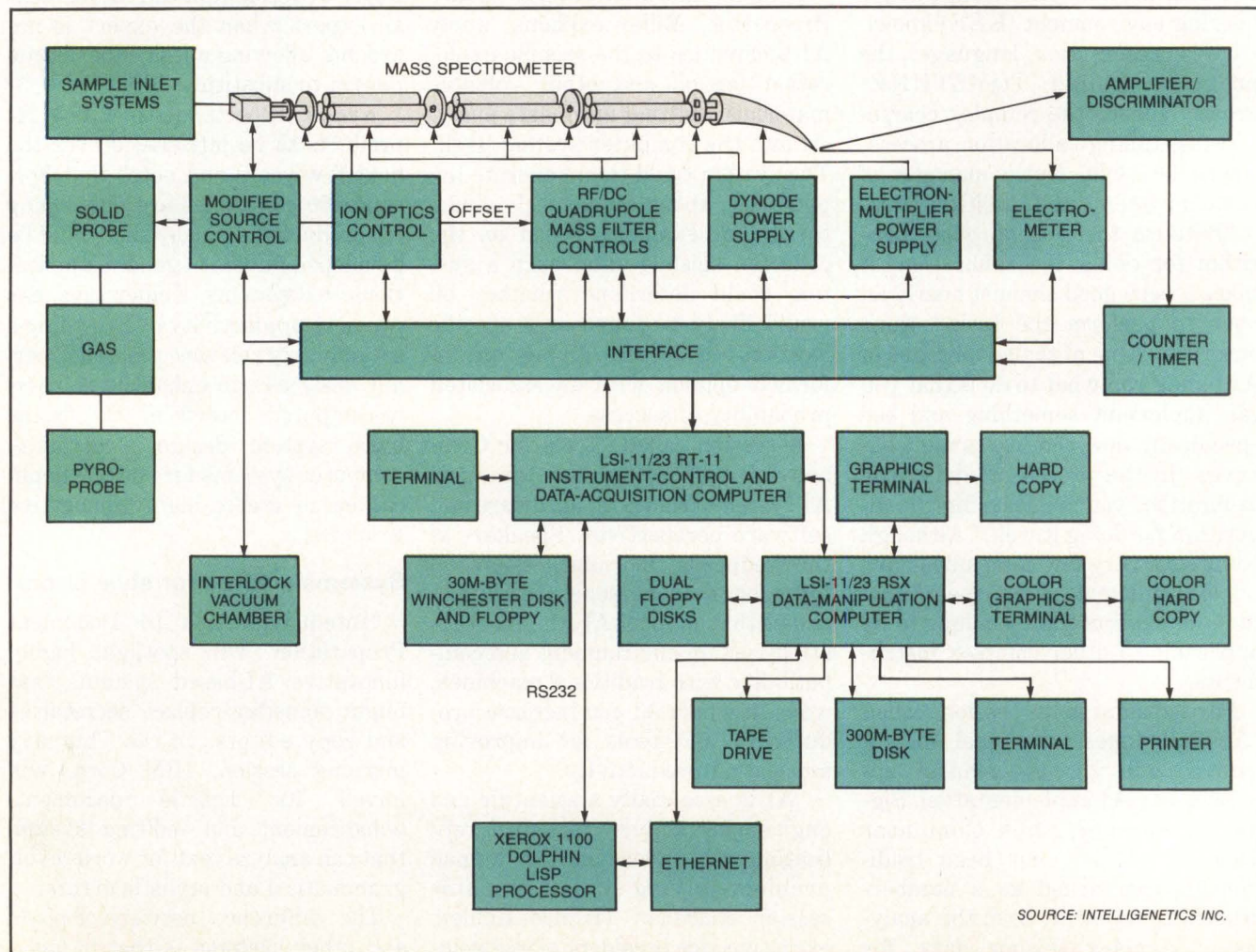
Also at NCC, Bell Laboratories, Summit, N.J., will spotlight its Writer's Workbench text-analysis

software. The package, produced by AT&T Technologies Inc., Greensboro, N.C., contains more than 25 programs designed to improve and clarify writing. The Writer's Workbench proofreading programs check for spelling and punctuation errors, consecutive occurrences of words, split infinitives and phrases classified by writing experts as poor or sexually biased. The style program provides statistical information about the text, including readability indexes, the average length of sentences and the percentage of passive verbs.

Running under most versions of UNIX and available with the re-

**Expert systems that encode human experts' knowledge and provide a logical decision-making process can control complex instruments or processes. The prototype triple-quadrupole mass spectrometer (TQMS) expert system, developed with IntelliGenetics'**

*knowledge-engineering environment software for Lawrence Livermore Laboratory uses an AI LISP processor, a Xerox 1100 Dolphin and two computers to calibrate and control a TQMS.*



SOURCE: INTELLIGENETICS INC.



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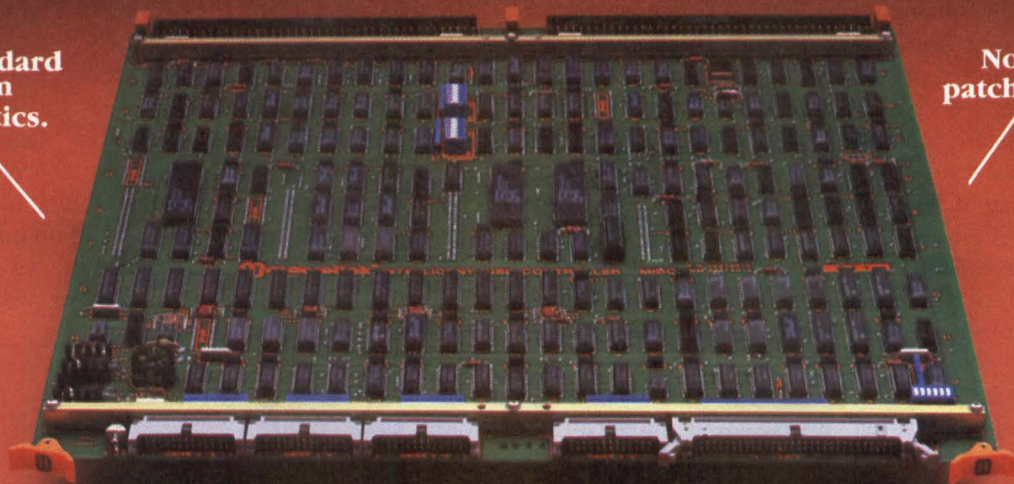
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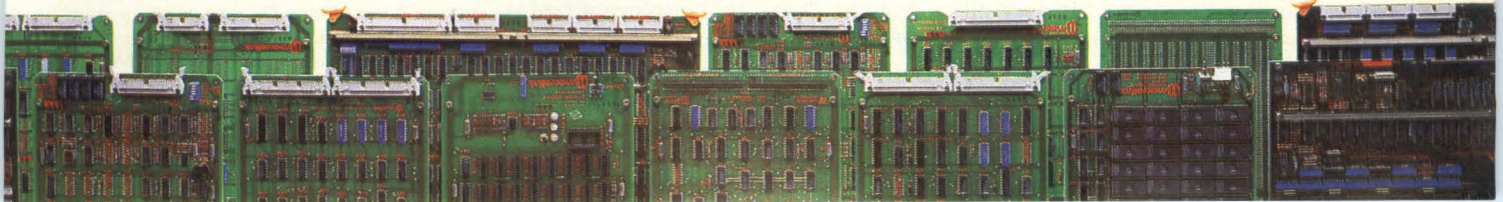
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# NCC '84 Preview

cently introduced AT&T 3B series computers, Writer's Workbench is written in C and is available in source code for other minicomputers. The compiled programs and libraries require approximately 550K bytes of disk storage.

## Document preparation

Epistle and Writer's Workbench, however, represent only one category of three types of AI-related document-preparation systems. Another session at NCC will describe a document-creation system for stylized documents, such as legal reports. The system will interview the user in standard English prose for the information needed to customize forms, says session chairman Bruce W. Ballard, assistant professor of computer science at Duke University, Durham, N.C.

Another presentation will highlight an AI system that, unlike most word processors, accommodates spoken, rather than typed, input. This permits an operator to use a touch-sensitive screen to move text from one part of a document to another under voice control. For example, a user could say, "Move this paragraph to here" as he touches the screen, Ballard explains. "You need AI [to do this] because you are not touching a paragraph but a horizontal and vertical screen coordinate and a letter, a word, a sentence or a paragraph. The system has to figure out which one."

Systems such as these will have a profound effect on the user/computer interface, Ballard asserts. Now, every step of editing or other computer-related processes must be specified at a very low level. "We are now talking about systems that can take over more of the tedious tasks, such as preparing legal documents," says Ballard. "Ultimately, we would like a system that does all of these things—document creation, improvement and editing. The system would automatically create styl-

ized documents with touch- and voice-based input and automatically catch grammatical and stylistic errors."

## Realizing the promise of CAI

A Monday afternoon NCC session will highlight knowledge-based training systems that effectively "realize the promise of computer-aided instruction (CAI)," says session chairman Eliot Soloway, assistant professor of computer science at Yale University, New Haven, Conn. "We are on the verge of being able to deliver effective CAI," he says, adding that CAI promises users a "high-powered teacher" at their beck and call. But providing such a teacher requires building experts into machines using AI techniques. "Traditional CAI is well-intentioned," says Soloway, "but the approach is insufficiently powerful to realize the goal."

Knowledge-based training systems, Soloway asserts, will revolutionize the man-machine interface and have an important place in schools and universities. "AI has been in the research part of the R&D stage for a long time. Now, we are about to enter the development stage."

Soloway's program will concentrate on systems for training medical students in diagnosis, teaching material in introductory psychology courses and aiding in the non-syntactic bugging of computer programs. The prototype medical-training program presents a case study containing medical symptoms. The student performs a diagnostic "interview," evaluates the "patient's" condition and reaches a diagnosis. The training system monitors the process and points out where mistakes are being made.

During the session, Computer Thought Corp. will explore a training system for Ada programmers that finds "the semantic and pragmatic bugs that prevent a program

from running correctly," according to Soloway.

## Are computers intelligent?

Computer Thought's Miller expects the term "knowledge-based system" to enjoy wider use because most people are uncomfortable with the idea of computers having "artificial intelligence." Says Miller, "Psychologists have trouble defining 'intelligence,' so it's difficult to say what 'artificial intelligence' is. Generally, however, [an AI system] must contain a lot of knowledge about the domain in which it is to be applied and [a lot of] general problem-solving ability."

Miller expects future systems to have "substantial" learning ability. However, some laboratory systems now have the ability to reconfigure themselves based on mistakes. "For VLSI chip design, we would like a system that could work with the

### Word level

Faulty abbreviations after first spelling  
Incorrect capitalization

### Stylistic level

Awkward double negatives  
Speaker shifts within sentences  
Tense shifts within sentences  
Unbalanced sentences—subject too long  
Wrong correlative conjunction  
Use of undesirable sentence construction

### Grammatical level

Subject and verb disagreement  
Wrong pronoun case  
Noun modifiers disagreement  
Non-standard verb forms  
Some punctuation errors

SOURCE: IBM CORP.

**The AI-based Epistle text-editing and -analysis system, under development at IBM, detects word, grammatical and stylistic errors. It can flag the disagreement of noun modifiers ("These valve must open"), non-standard verb forms ("That's all she writed") and undesirable sentence constructions, such as those using nominative absolutes ("The repair finished, reconnect the computer to peripherals").**



# NCC '84 Preview

VLSI engineer to build a circuit," Miller explains. "At some point, the system would suggest how the design might work. The engineer might say, 'No, it won't go,' and the machine would restructure the knowledge base to take this into account."

Miller views voice input as an "intriguing possibility" for AI systems and a very important area over the next few years. Stanford's

Friedland concurs, pointing out that, although considerable work is being done on voice input, "we are a long way from a system that can understand a large vocabulary. A lot of research needs to be done on spoken-language recognition on the AI side." A Thursday morning NCC session, "Natural Language Interfaces to Software Systems," will deal with problems of natural-language understanding in AI systems.

and sharing graphics instructions, notes session chairman Tom Wright, director of research at ISSCO. Graphics packages will use VDI to access devices; PHIGS is a more specialized standard for highly interactive packages.

Other NCC graphics coverage promising to be of high interest includes Wednesday afternoon sessions focusing on new techniques in 3-D presentations, including sophisticated simulation systems, and case studies in computer animation.

Standards are becoming increasingly important in LAN technology, claims William Zachmann, vice president of corporate research at International Data Corp., Framingham, Mass., and chairman of a session called "Update on LANs." Zachmann believes that emerging standards will play a very important role. "We will see users of LANs turning toward non-vendor-specific implementations when they are available," he says.

The relevant advisory committees and the American National Standards Institute have accepted three IEEE 802 LAN standards and submitted them to the International Standards Organization for acceptance as international standards. Other 802 standards are under review.

Zachmann's panel will feature speakers from 3Com Corp., Ungermann-Bass Inc., Concord Data Systems Inc. and Warner-Amex. The speakers will prognosticate on significant LAN developments over the next few years.

Zachmann sees three significant trends in LANs in addition to emerging standards:

- the use of baseband technologies to form "work-group networks" linking multiple microcomputers with shared file servers, Winchester disks, communications facilities and printers;
- the use of broadband, community antenna television- (CATV-)

INPUT: Our report, "The Basic Fundamentals of Computational Complexity", is enclosed. Please send any recommended changes at your earliest convenience. thanks.

PROOF: \*\*\*\*\* SPELLING \*\*\*\*\*

OUTPUT: Possible spelling errors are:

Computatnal recomended

\*\*\*\*\* PUNCTUATION \*\*\*\*\*

The punctuation is first described.

2 double quotes and 0 single quotes  
0 apostrophes  
0 left parentheses and 0 right ones

The program next prints any sentence that it thinks is incorrectly punctuated and follows it by its correction.

line 1

OLD: Our report, "The Basic Fundamentals of Computational Complexity",  
NEW: Our report, "The Basic Fundamentals of Computational Complexity,"

line 3

OLD: earliest convenience. thanks.  
NEW: earliest convenience. Thanks.

For more information about punctuation rules, type:

punctrules

\*\*\*\*\* DOUBLE WORDS\*\*\*\*\*

No double words found

\*\*\*\*\* WORD CHOICE\*\*\*\*\*

Sentences with possibly wordy or misused phrases are listed next, followed by suggested revisions.

beginning line 1

Our report, "The \*[Basic Fundamentals]\* of Computational Complexity", is enclosed.

beginning line 2

Please send any recommended changes  
\*[at your earliest convenience]\*

\*\*\*\*\* Table of Substitution\*\*\*\*\*

PHASE SUBSTITUTION

at your earliest convenience: use "soon" for "at your earliest convenience"  
basic fundamentals: use "fundamentals" for "basic fundamentals"

\*\*\*\*\* SPLIT INFINITIVES\*\*\*\*\*

No split infinitives found

Source: AT&T Bell Labs

## Standards prove important

As computer systems proliferate and computer-based applications multiply, standards for computer graphics, LANs and microcomputers become increasingly crucial for system integrators attempting to link disparate components and software. Several NCC professional sessions will deal with this important issue.

In "Emerging Standards in Computer Graphics," speakers from Integrated Software Systems Corp. (ISSCO), San Diego, Data General Corp., Austin, Texas, the National Center for Atmospheric Research, Boulder, Colo., and McDonnell Douglas Automation, St. Louis, will explore four key attempts at graphics standardization: the graphic kernel system (GKS), virtual device metafile (VDM), virtual device interface (VDI) and programmers hierarchical interactive graphics standard (PHIGS).

GKS applies to most passive and interactive applications and VDM serves graphics packages in storing

**Designed to improve and clarify writing,** AT&T Technologies' *Writer's Workbench* package comprises spelling, punctuation, style and text-analysis programs. This typical simplified printout from the proofreading (proof) program analyzes a two-line text (INPUT). It indicates spelling errors, correct punctuation (NEW:) for incorrect (OLD:), consecutive occurrences of a word (DOUBLE WORDS) and split infinitives. Sentences with wordy or faulty phrasing are surrounded with stars and brackets, and alternative phrasing is suggested (PHRASE SUBSTITUTION).



# NCC '84 Preview

based technology to create building-wide, inter-building and campus-wide LANs;

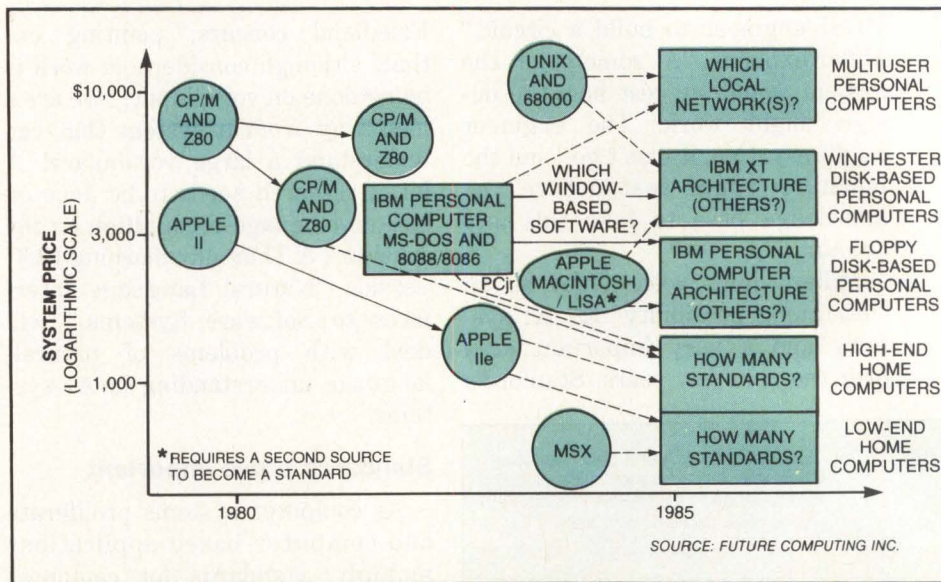
• The extension of these technologies in metropolitan areas as an important bypass alternative to local telephone company switching facilities.

## LANs improve videotex

Metropolitan LANs will initially be used primarily for transmitting business data, Zachmann says, but, ultimately, they have great potential for bringing videotex services into homes. If videotex is to be successful, Zachmann maintains, it is going to need more bandwidth than the telephone system can provide, and "CATV-based systems are the only way to get it." This type of videotex system, Zachmann points out, can furnish better graphics, quicker response and less cumbersome log-on procedures.

Zachmann is uncertain about the impact IBM's token-passing-ring-based LAN will have on the market: "It depends on how soon IBM rolls it out. We are seeing some evidence users are getting tired of waiting for it. It appears chip development has not gone as quickly as was hoped." Other potential problems with the LAN are that it has an extremely complicated protocol and, says Zachmann, there are "some fairly significant roadblocks" to getting it accepted as an 802 standard. "It was put together with a bit order different from that of other 802 standards," Zachmann observes, "and it won't be inexpensive to implement."

One of the best attended of all professional sessions at past NCC shows has been the presentation on the future of the personal computer industry, and this year promises to be no exception. In "The Personal Computer Industry; The Experts Forecast the Future," four leading industry analysts will take an intensive look at the current state and the future of personal computers.



Future Computing traces the evolution of de facto personal computer standards along actual or highly probable paths (solid lines) and possible future tracks (segmented lines). One LAN (IBM's approach) and possibly other products will dominate multiuser personal computer system standards. For Winchester- and floppy disk-based personal computers, the IBM PC and PC XT architecture constitutes the main standard, but the dominant window-based software application environment is still undetermined. IBM's PCjr, Apple Computer Inc.'s Apple IIe and Z80-based CP/M systems are the primary standard-setting candidates for high-end home personal computers.

"Two conflicting trends are at work in the industry today," asserts session chairman Dr. Portia Isaacson, president of Future Computing Inc., Richardson, Texas. On the one hand, "the customer, the consumer and the office worker want standards badly," Isaacson observes. "They can't understand why you can't run a diskette from one computer on another. But they know that you should be able to."

New technology, however, now being introduced to personal computers—whether new methods of user interfacing, liquid-crystal-display-based flat screens or new software-based application environments with windowing capabilities—work against standards. "Technology is almost the antithesis of standards," Isaacson comments. "A technological breakthrough necessitates pulling away from standards."

Whatever the outcome of the technology-vs.-standardization conflict, Isaacson foresees exciting days ahead for the personal computer industry. "The technology now being

incorporated in personal computers is very sophisticated. The most advanced user-interface work is being done in personal computers, led by the software companies, and that is the technology that benefits the user most directly. Personal computers are now delivering what the Xerox Corp. Star workstation technology promised us," Isaacson says. □

Interest Quotient (Circle One)  
High 840 Medium 841 Low 842

### LOOKING AHEAD IN MMS

The premier issue of Mini-Micro System's Computer Digest is coming soon. It is MMS' first ever guide to mini-computers and microcomputers featuring articles on:

- single-board micros
- single-user micros
- multiuser micros
- mini systems
- OEM computers

Each section includes a staff-written overview discussing market trends and issues and extensive product tables.



# New Products

## SYSTEMS

### Workstations support engineering applications

The Syte Series 3000 Micromainframe line of 32-bit engineering microcomputer systems features cache memory, an independent diagnostic processor and a floating-point processor. The workstations support CAD/CAM, engineering, robotics, graphics-arts, typesetting, office-automation and executive-administration applications.

The company's proprietary global environment manager system software permits the simultaneous use of different programs running on separate operating systems, with multiple windows displayed on the screen. For example, a user can write documentation in one window for a printed-circuit board layout displayed in another—even if the software for each application runs on different operating systems. The computers also support a proprietary implementation of System V UNIX, called /syte/UNIX, that offers demand



*Syte's Series 3000 model 300 engineering workstation provides floating-point capability, cache memory and separate processors for input/output, diagnostics and communications. The standalone station can be upgraded to local networking without software modifications.*

paging, pre-emptive scheduling and a forking algorithm.

The model 300, the first of the Series 3000, consists of a CPU with 1M byte of memory, a keyboard, and a 19-inch monochrome or color monitor. The monochrome monitor comes with high-resolution graphics (1,024 by 800 pixels); the color monitor has medium-resolution (640 by 480 by 4) bit-mapped graphics. Each CPU is a single board that includes an NS16032 microprocessor for executing code; an Intel 80186 microprocessor for DMA and network and disk interfacing and two Intel 8051 microprocessors—one for communications and another for diagnostic processing. Each workstation is equipped with Ethernet network capability. Monochrome version: \$21,900, color version: \$24,900. Both systems include the global environment manager, /syte/UNIX and the C, Pascal and FORTRAN programming languages. **Syte Information Technology Inc.**, 11339 Sorrento Valley Road, San Diego, Calif. 92121, (619) 457-2270.

Circle No 300



### Portable incorporates gas-plasma display

The PC Traveler portable computer for technical and business professionals features dual 16-bit Intel 80186 CPUs that are software-compatible with the Intel 8088 chip used in the IBM PC and other popular microcomputers. The PC Traveler includes an 80-cps impact

dot-matrix printer that prints 80 or 132 columns per line on letterhead or fan-fold paper. The printer also supports multiple print fonts, character sets and dot-addressable graphics. Incorporating AC gas-plasma technology, the computer's 9¼-inch diagonal amber screen displays 80 columns by 25 lines. The computer comes standard with 128K bytes of RAM, expandable to 256K bytes. A 6.2M-byte cartridge disk drive or two 360K-byte, half-height floppy disk drives provide mass storage. The system's lightweight, movable 88-key keyboard features a separate "enter" key on the numeric pad, 10 programmable function keys and additional function keys that initiate ROM-based diagnostics. \$4,495. **Strategic Technologies Inc.**, 7001 Peachtree Industrial Blvd., Building 3, Norcross, Ga. 30071, (404) 441-8070.

Circle No 301

### Portable computer suits OEMs

The C8/16 computer system features a 5-pound portable keyboard processor that can be linked to an optional low-profile coprocessor/mass-storage



unit. Keyboard-processor components consist of an 80-character-by-3-line LCD, a low-power 8-bit CMOS NSC-800 microprocessor, a standard typewriter keyboard and a microcassette recorder. The unit has a built-in 300-/1,200-baud modem, a real-time clock, RS232C and Centronics I/O ports, television and color-monitor ports, 64K bytes of dynamic RAM and 16K bytes of CMOS RAM for battery use. The coprocessor/mass-storage unit contains Z80A and 8088 microprocessors, 128K bytes of RAM and two 5¼-inch, 512K-byte floppy disk drives. Prices are available from the vendor. **Sunrise Systems Inc.**, 2209 Midway Rd., Carrollton, Texas 75006, (214) 934-0010.

Circle No 302



# New Products

## SYSTEMS

### Micros feature high performance

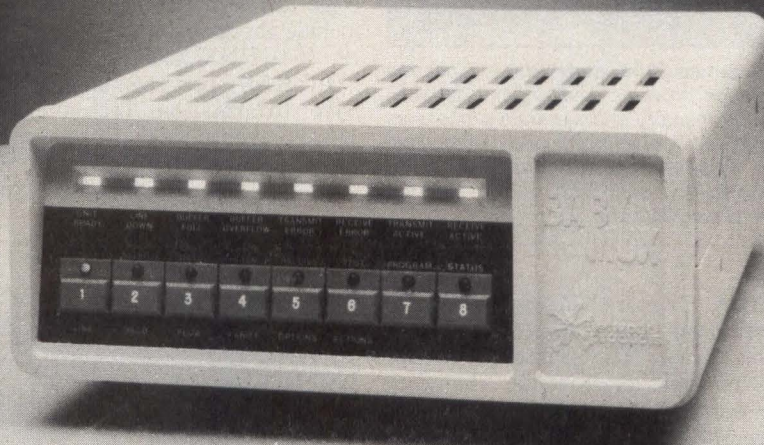
The Universe 68/35 and 68/67 microcomputers incorporate a 12.5-MHz MC68000 microprocessor, a 32-bit VERSAbus I/O bus, 32-bit main memories, 32-bit disk channels and a 32-bit, 4K-byte cache memory. The 68/35 features a 35M-byte, 5¼-inch



Winchester disk drive, 512K to 3M bytes of main memory and support of as many as 64 users. It uses an 8-inch, double-sided, double-density, 1.25M-byte floppy disk drive for program loading and backup storage. The 68/67 uses a 64M-byte, 8-inch Winchester disk drive. A built-in 45M-byte streaming-tape drive provides system backup. The 68/67 comes with 512K bytes of main memory with byte parity, expandable to 5M bytes. Both computers support UNIX and the UNOS real-time operating system. 68/35: \$14,900, 68/67: \$24,900. **Charles River Data Systems Inc.**, 983 Concord St., Framingham, Mass. 01701, (617) 626-1000.

Circle No 303

# BABYMUX



## TWO, FIVE OR EIGHT LINE VERSATILITY Network Products Dependability

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CIRCLE NO. 149 ON INQUIRY CARD



### Micro features color graphics

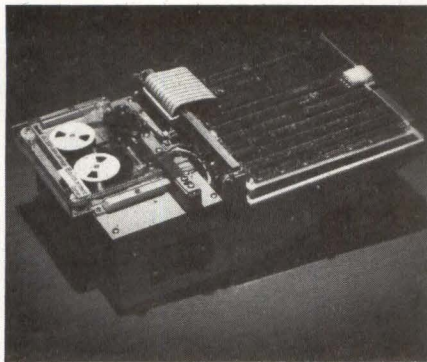
The IBM PC- and PC XT-compatible Sperry Personal Computer features a built-in asynchronous RS232 port, an automatic time-of-day clock, color graphics and a keyboard. The 16-bit 8088 microprocessor operates at switch-selectable speeds of 4.77 or 7.16 MHz, and the computer comes with 128K bytes of memory, expandable to 640K bytes. It offers a choice of three monitors, including a 12-inch, color monitor that supports 640-by-400-pixel resolution and simultaneously displays 16 colors. At 320-by-200-pixel resolution, the monitor simultaneously displays 256 colors. The keyboard has an IBM look-alike layout and features defined key captions, lock-key indicators, an enter key next to the numeric keypad and shift and return keys in typical typewriter locations. Mass-storage options include 320K- and 360K-byte floppy disk drives and 10M-byte hard disk drives. \$2,643 to \$5,753. **Sperry Corp., Computer Systems**, P.O. Box 500, Blue Bell, Pa. 19424, (215) 542-4213.

Circle No 304



# New Products

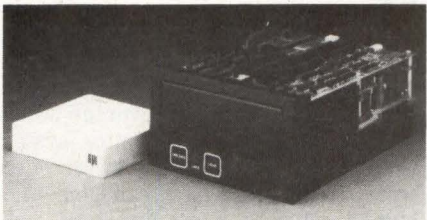
## DISK/TAPE



### Streamer uses nine-, 16-track tapes

The JetStream 16 1/4-inch streaming cartridge-tape drive reads and writes as a nine- and 16-track unit. The drive mechanism has a separate erase bar and uses a two-channel, bidirectional tape head to record data. It stores 80M bytes (formatted) on a DC300XL data cartridge. It is QIC-02 and -24 compatible. Burst transfer rate is 400K bytes per second, and average data-transfer rate is 72K bytes per second to maintain streaming. Microprocessors on the controller enable automatic-reference burst location, identification of cartridge type, error logging and diagnostic tests at power-up and cartridge insertion. \$925 (500 units). **Qantex Division of North Atlantic Industries Inc.**, 60 Plant Ave., Hauppauge, N.Y. 11788, (516) 582-6060.

Circle No 305

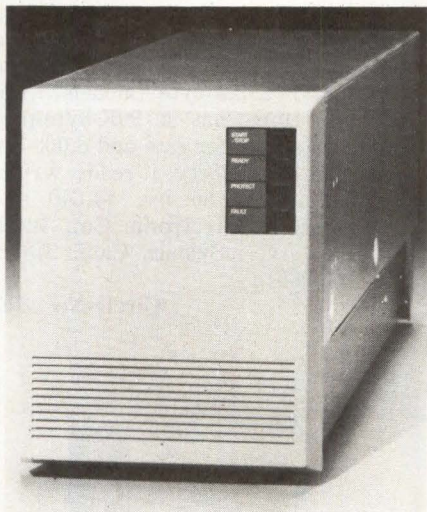


### Tape drive operates in two modes

The STR-Stream II model 130 dual-mode 1/2-inch cartridge-tape drive provides start/stop and streaming capabilities. Its streaming capacity is 130M bytes, and start/stop capacity is 83M bytes (formatted). The unit streams at 75 ips, runs start/stop at 50 ips and searches/rewinds at 150 ips. Data-transfer rate is 225K bytes per second in streaming mode. The drive has a 5 1/4-inch form factor and uses an Enhanced Small Tape Interface. MTBF is greater than 15,000 power-on hours,

and MTTR is less than 30 minutes. Approximately \$1,000 (10,000 units). **Electronic Processors Inc.**, 1265 W. Dartmouth Ave., P.O. Box 569, Englewood, Colo. 80110, (303) 761-8540.

Circle No 306



### Winchester employs 9-inch media

The NEC D2300 Winchester disk drive features 520M bytes of unformatted storage on 9-inch plated media, a 15-msec. average access time and a 1.859M-byte-per-second data-transfer rate. It is available with an Extended Storage Module Device interface. \$8,300 (100 units). **NEC Information Systems Inc.**, 1414 Massachusetts Ave., Boxborough, Mass. 01719, (617) 264-8000.

Circle No 307

### Winchester drives feature SCSI intelligence

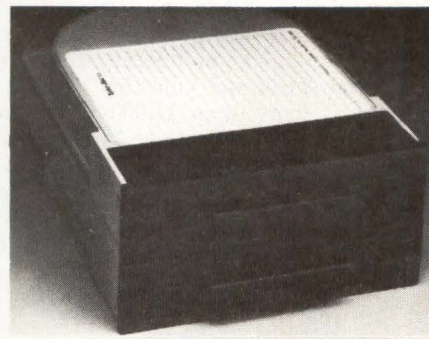
The 700S series of intelligent 5 1/4-inch rigid disk drives combines the performance of Winchester technology with the intelligence of SCSI controllers. The 706S and 712S pack 5M and 10M bytes of formatted data, respectively, on oxide-coated media. They provide device independence from the host CPU and easy integration with host CPUs through generic software programmed into the operating system. Incorporating the full SCSI function within the form factor of a full-height, 5 1/4-inch Winchester disk drive, the 700S series performs formatting, data-error detection and correction, data buffering and automatic retries functions. Data-protection features include four-point

shock mounts, a spindle lock and a dedicated head-landing/-shipping zone. MTBF is 18,000 power-on hours. Average access time is 85 msec. 706S: \$661 (OEM quantities), 712S: \$716 (OEM quantities). **Shugart Corp.**, 475 Oakmead Parkway, Sunnyvale, Calif. 94086, (408) 733-0100. Circle No 308

### Winchester aids multiuser systems

The half-height, 8-inch ST8100 Winchester disk drive stores 102.1M bytes (unformatted). Using a proprietary voice-coil linear-actuator design, the drive provides a 30-msec. average access time. Data-transfer rate is 10M bps. The unit uses three oxide-coated disks, a DC spindle motor and manganese-zinc ferrite, mini-slider read/write heads. Approximately \$1,500 in large quantities. **Seagate Technology**, 920 Disc Dr., Scotts Valley, Calif. 95066, (408) 438-6550.

Circle No 309



### Winchesters use 12 read/write heads per surface

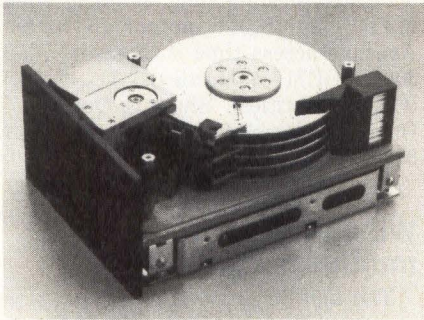
The Turbo-disc 5 1/4-inch Winchester disk drive subsystem uses 12 read/write heads per disk surface. In a 10M-byte configuration (5M bytes fixed/5M bytes removable), the Turbo-disc always maintains 425,000 characters of data under 48 heads. It provides an 8-msec. access time for data under the heads and a 16-msec. average access time for the remaining data. The heads are prevented from crashing onto the plated media by a head-lifting system that locks the heads above the disk surface. Data-transfer rate is 5M bps. OEM versions come with an ST506/412 interface. Prices start at \$1,800. **New World Computer Co.**, 6624 Owens Dr., Pleasanton, Calif. 94566, (415) 463-0330.

Circle No 310



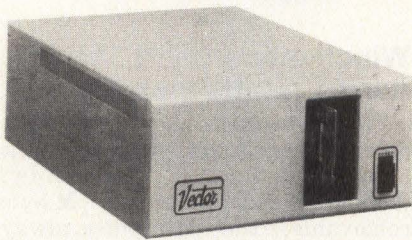
# New Products

## DISK/TAPE



### Winchester features 25-msec. access time

The model V2100 5 1/4-inch Winchester disk drive stores 78.7M bytes (formatted) on four thin-film disks. It offers a 25-msec. average access time and uses the ST412HP interface for a 10M-bps data-transfer rate. Other features include a 960-tpi track density and a dual-frequency, closed-loop servo system that allows continuous sampling and correction of head-to-track positioning as the disks rotate. An automatic actuator lock, which is activated on power-down, a dedicated landing zone and full shock mounting counter potential shock and vibration damage. MTBF is more than 11,000 power-on hours; MTTR is less than 30 minutes. Approximately \$1,750 in OEM quantities. **Vertex Peripherals**, 2150 Bering Drive, San Jose, Calif. 95131, (408) 942-0606. **Circle No 311**

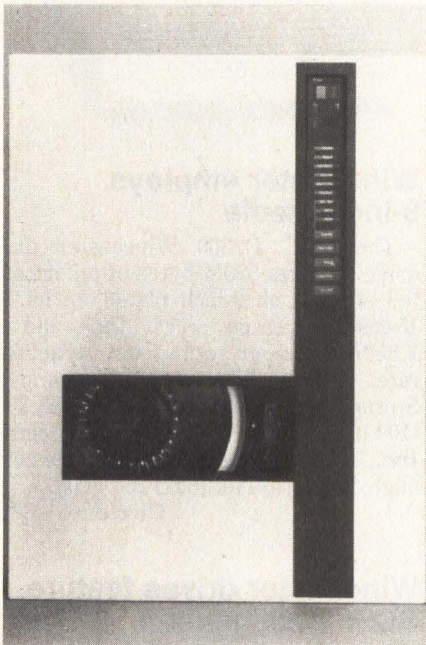


### Subsystem integrates hard disks, tape drives

The VectorSafe Series VS mass data storage system integrates an 83M-, 132M- or 212M-byte (unformatted) 8-inch Winchester disk drive with an optional 45M-byte formatted capacity, 1/4-inch, nine-track streaming tape-cartridge transport, interface cards, a power supply and a cooling fan. The subsystem attaches to computers ranging from the IBM PC to DG's Eclipse

and to system buses ranging from the Multibus to the STD bus. Interface options include SMD for the disk, QIC-02 for tape or SCSI for both devices. Winchester have an 11.5K-bpi recording density and a 1.2M-byte-per-second data-transfer rate. Average access times are 45 msec. for the 83M-byte model and 38 msec. for the 132M- and 212M-byte models. The streaming tape has a 90K-byte-per-second data-transfer rate and 8,000-bpi data-recording density. It reads, writes and rewinds at 90 ips. \$4,640 and \$8,610. **Vector Electronic Co.**, 12460 Gladstone Ave., Sylmar, Calif. 91342, (818) 365-9661.

**Circle No 312**

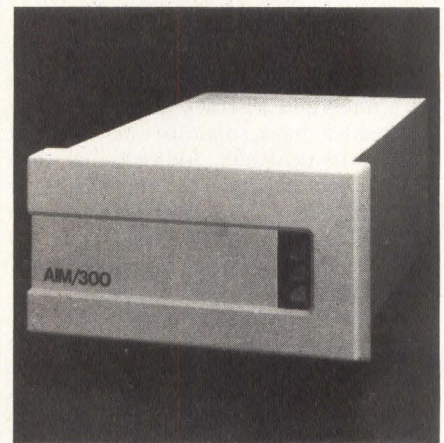


### Subsystem operates in start/stop, streaming modes

The model 2922 OEM tape subsystem operates at 50 ips in start/stop mode and at 100 ips in streaming mode. Both modes are software-selectable. The nine-track drive provides ANSI-compatible 1,600- and 6,250-bpi recording formats. In the 6,250-bpi recording mode, the drive can pack as much as 180M bytes of data on a 2,400-foot, 10 1/2-inch reel of 1/2-inch magnetic tape. Instantaneous transfer at 50 ips is as high as 312.5K bytes per second and 625K bytes per second at 100 ips. In start/stop mode, the drive has a 5-msec. average access time; in the streaming

mode, it has a 20-msec. nominal access time and a 50-msec. total reposition time. The subsystem includes a tape transport, a formatter/controller, a power supply and resident microdiagnostics. Evaluation units will be available in October. \$6,540 in 100-unit quantities. **Storage Technology Corp., OEM Marketing**, 2270 S. 88th St., Louisville, Colo. 80028 (303) 673-4066.

**Circle No 313**



### Disk subsystem improves access time

The AIM/300 Winchester disk drive subsystem attaches to the standard Massbus of the PDP-11 and VAX computers in the same manner as other DEC drives. It offers software and diagnostic compatibility with the DEC RM05 disk drive. The 300M-byte AIM/300 adaptively reorganizes its data structure to reduce the average access time during normal computer system operations. The drive also incorporates transparent media-flaw management, a high-speed data cache and read look-ahead buffering. The system can transfer single and multiple blocks of data at speeds as fast as 1.2M bytes per second from the magnetic media and at 1.6M bytes per second from the semiconductor memory. Using dynamic data relocation, caching and read look-ahead, the AIM/300 is said to achieve 10 times the access time of a conventional disk. Average seek time without dynamic data relocation is 29 msec., and average rotational latency is 8.33 msec. \$26,950. **Acceleron**, 2356 Walsh Ave., Santa Clara, Calif. 95051, (408) 727-9289.

**Circle No 314**



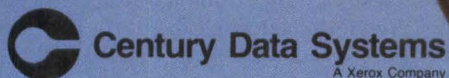
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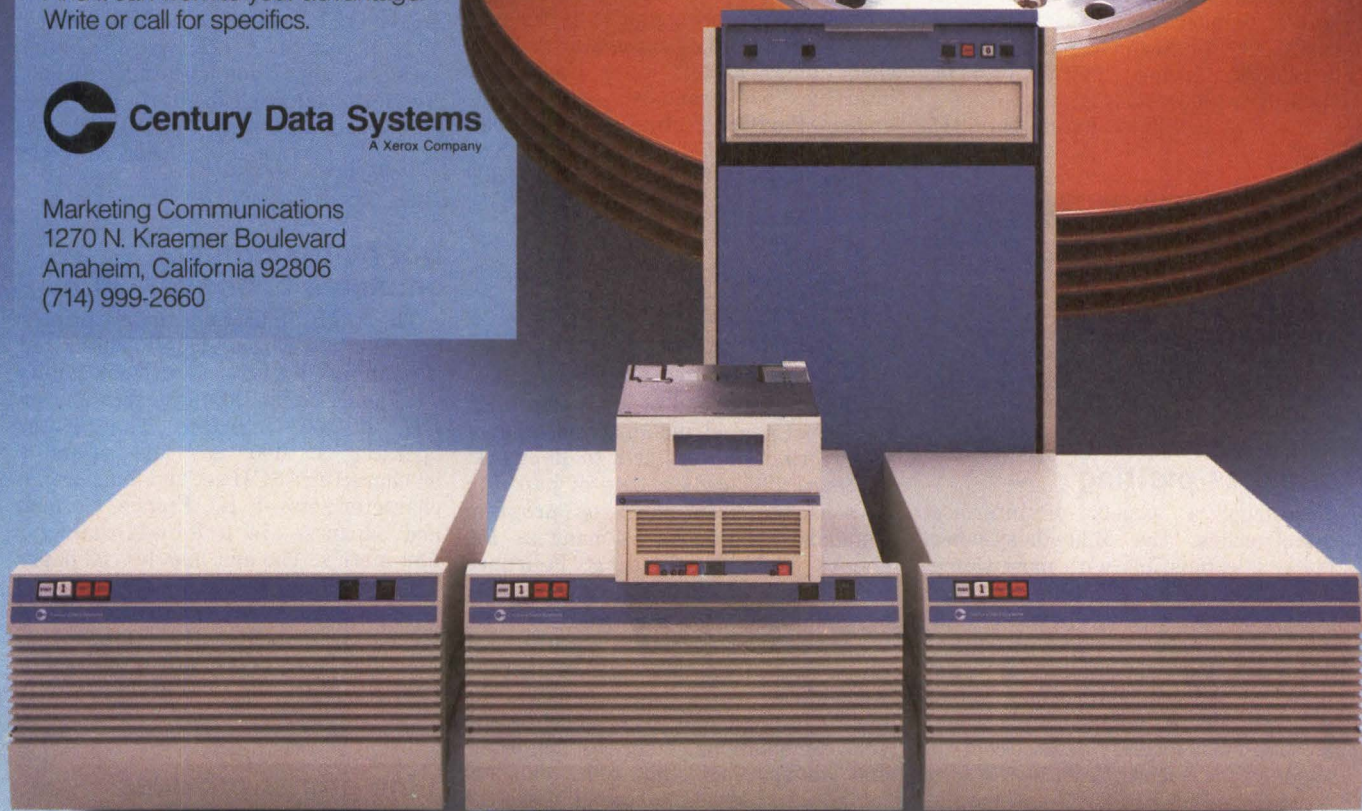
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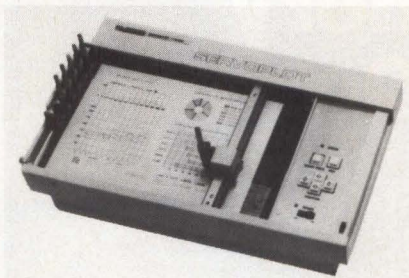
See us at NCC, Booth #A1144 and Presidential Suite, Las Vegas Hilton.

CIRCLE NO. 150 ON INQUIRY CARD



# New Products

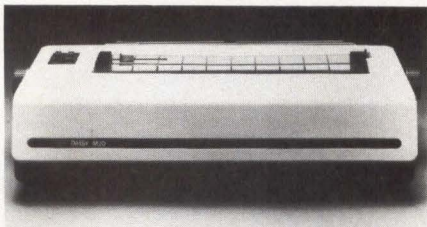
## PRINTERS



### Plotter comes in flatbed, roll-feed versions

The DA 8400 intelligent six-pen x-y plotter is directly compatible with RS232C, 8-bit parallel or GPIB/IEEE-488 interfaces. The plotter features a DC servo motor and a programmable 0.004-inch step size. Maximum plotting speed is 16 ips. The unit is available in flatbed or roll-feed models. The flatbed version employs electrostatic paper hold-down and accepts paper in sizes A3 (11 by 17 inches) and A4 (8½ by 11 inches). The plotter automatically selects water- or oil-based fiber-tip pens or water-based ball-point pens. Flatbed version: \$1,850, roll-feed version: \$2,350. **Western Graphtec Inc.**, 12 Chrysler St., Irvine, Calif. 92714, (714) 770-6010 or (800) 854-8385.

Circle No 315



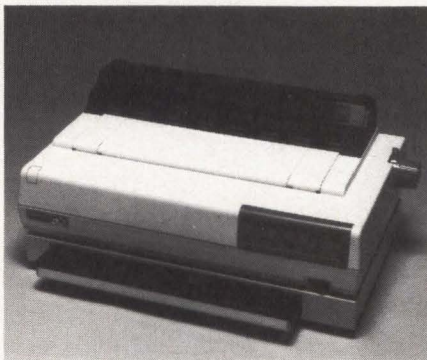
### Daisy-wheel printer furnishes plotting

Featuring a variety of interface-control codes, the M20 daisy-wheel printer is compatible with most Qume, Diablo and NEC printers. Printing speed is 20 cps. The unit prints lines as wide as 15.7 inches on paper as wide as 16.5 inches. The printer allows 6, 8 or 12 lpi. When plotting, it furnishes 23,040-dpi resolution. It handles single sheets and continuous forms. Operator controls include paper release, reset, top of form and paper adjust. RS232C and parallel interfaces are standard. \$999. **Daisy Systems Holland**, P.O. Box 1010, Torrance, Calif. 90505, (800) 423-2479 or (800) 441-5273.

Circle No 316

### Matrix printer features color graphics

The JDL 750 impact dot-matrix printer features letter-quality and color graphics printing. Using a 24-wire print head, it prints at 54 cps in letter-quality mode and 115 cps in draft-quality mode. It offers a graphics resolution of 180 by 180 dpi. Carriage width is 151 characters. The unit prints

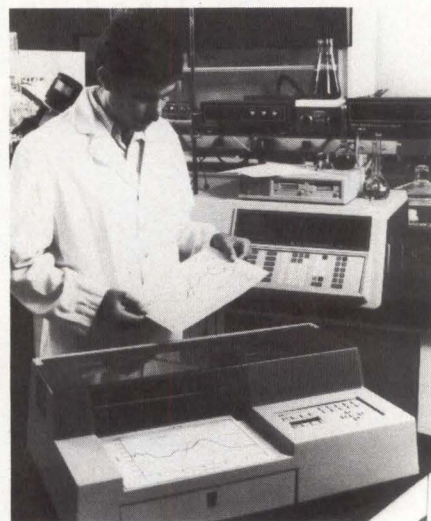


in six colors using a three-color ribbon, and users can select Courier, Gothic or italics print styles from a front-panel keypad. Paper movement is by friction feed, tractor feed or automatic cassette sheet feed. RS232C and Centronics interfaces are standard. \$1,788 (500 units). **Pacific Technology Services Inc.**, 332 Pine St., Suite 610, San Francisco, Calif. 94104, (415) 956-3926.

Circle No 317

### Graphics plotter features automatic paper feed

The HP7550A B-size eight-pen plotter has a pen speed of more than 31.5 inches per second and an acceleration of 6 gs, forming letters at 8 to 10 cps. It automatically loads sheets of paper in response to front-panel or program commands and feeds as many as 150 sheets without reloading. Features include an LCD with function keys for reporting plotter status and program messages and a re-plot feature that draws as many as 99 copies of a graph without rerunning the program. The plotter offers a wide array of colors and pen combinations—fiber-tip for paper and transparency film, roller ball and liquid ink. Pens are loaded onto the plotter in eight-pen carousels that provide automatic plotter settings by pen type for regulating pen speed and pressure. Additional features include 20



international character sets in two fonts, including Japanese katakana and most European languages, user-definable character-set capability, an-arc-and-circle generator, a line-pattern generator, polygon definition and area-fill commands, point digitizing and a built-in self-test. The plotter comes with HP-IB (IEEE-488) and RS232C/CCITT V.24 interfaces. A 12K-byte I/O buffer speeds system communications. \$3,900. **Hewlett-Packard Co.**, 1820 Embarcadero Road, Palo Alto, Calif. 94303.

Circle No 318

### Dot-matrix printer emulates Epson MX-80

The Esprit impact dot-matrix printer emulates the Epson MX-80 printer and is configured with a switch-selectable, Centronics-compatible interface and an EIA RS232C interface. The printer operates at 100 cps and offers a 96-character ASCII set and four foreign character sets—U.K., French, German and Japanese—in a 9-by-11-character font matrix. The unit handles roll paper and cut sheets using friction feed and fan-fold paper using tractor feed. \$399. **Esprit Systems Inc.**, 100 Marcus Dr., Melville, N.Y. 11747, (516) 293-5600 or (800) 645-4508.

Circle No 319

### Line printer provides dual modes

The multimode MVP 150B dot-matrix line printer for business, scientific and industrial graphics applications furnish-





es 80-lpm correspondence-quality printing. In condensed mode, it prints a 132-column report on an 8½-by-11-inch page. It handles one- to six-part continuous fan-fold forms as wide as 16 inches. Plotting resolution is 100 by 96 dpi. A Centronics-compatible interface is standard. \$3,745. **Printronic**, 17500 Cartwright Rd., P.O. Box 19559, Irvine, Calif. 92713, (714) 863-1900.

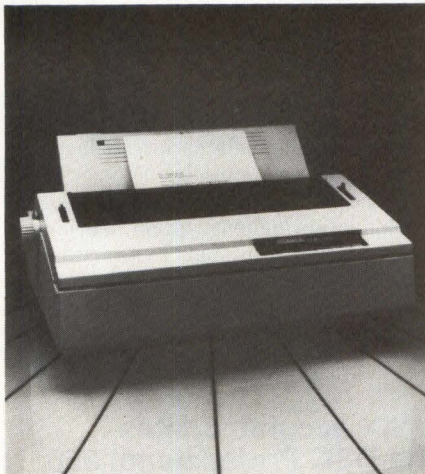
Circle No 320



### Letter-quality printer operates at 38 cps

Compatible with TeleVideo computer systems, the TP 740 daisy-wheel printer prints at 38 cps (Shannon text). The letter-quality printer has a 96-character print wheel and accepts paper as wide as 15 inches. It prints 132 characters at 10 cpi, 158 characters at 12 cpi and 197 characters at 15 cpi. With proportional spacing, the printer produces 113 to 263 cpl. The unit has a bidirectional carriage and uses HyType II cartridge ribbons. Interface options include Centronics, RS232C, Qume and IEEE-488. A cut-sheet feeder and a tractor feeder are optional. \$1,595. **TeleVideo Systems Inc.**, 1170 Morse Ave., Sunnyvale, Calif. 94086, (408) 745-7760.

Circle No 322



### Daisy-wheel printer has wide carriage

The ComRiter CR-III daisy-wheel printer operates at 23 cps and offers a 132-column carriage width, two-color printing and a 5K-byte buffer memory. The printer operates in word-processing mode with a Diablo 630 protocol. Word-processing features include superscript, subscript, backspace, underline, boldface, double strike and proportional spacing. Cut-sheet and tractor feed are available for automatic paper handling. The unit comes with a Centronics or RS232 interface. Approximately \$1,000. **Comrex International Inc.**, 3701 Skypark Dr., Torrance, Calif. 90505, (213) 373-0280.

Circle No 321



### Printer withstands industrial environments

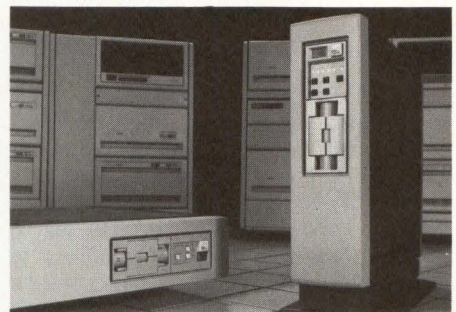
The 80-column SP-2000 printer, a rugged, industrial-quality unit, features a heavy, oil- and dirt-resistant aluminum cabinet. Printing method is impact dot matrix with or without a ribbon cartridge. The unit prints a 64-character ASCII subset in a 5-by-7-dot matrix at 100 cps on standard 8½-inch-wide or multiple-copy, carbonless paper from an internal paper supply. Other features include RS232 or 20-mA current loop input and a 256-character buffer. \$925. **Syntest Corp.**, 169 Millham St., Malboro, Mass. 01752, (617) 481-7827. Circle No 323

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CIRCLE NO. 143 ON INQUIRY CARD



# New Products

## SOFTWARE

### Tool speeds program development

The BSO symbolic debugger for testing and modifying Motorola 68000 microprocessor software supports assembly-language and Pascal programs as large as 16M bytes. It allows users to examine and modify variables and memory locations. Trace and breakpoints can be set upon modifications to variables and symbolic locations. The debugger works with the DEC VAX, PDP-11 and Micro-11 computers under the VMS, IAS, RSX and RSTS operating systems. \$5,000 when licensed with matching BSO/Pascal compiler or BSO/Assemble assembler. **Boston Systems Office**, 469 Moody St., Waltham, Mass. 02154, (617) 894-7800.

Circle No 324

### Software package works as cross assembler

The macro-oriented program interpreter (MOPI), an assembler/compiler for 8-bit microprocessors, converts assembly-language instructions into machine code. It also converts macro instructions into calling sequences to pre-defined subroutines that perform the required operations. MOPI contains only the syntax from which users can define their own instructions. Users can insert variable text data into a program when the program is assembled and can insert serial numbers for identification and to prevent unauthorized use. Available for use with the CP/M-80 operating system, MOPI sells for \$150. **Voice Operated Computer Systems**, P.O. Box 3705, Minneapolis, Minn. 55405, (612) 544-5712.

Circle No 325

### Program generator works under Microsoft COBOL

The COGEN program generator runs under Microsoft COBOL, a version of COBOL for microcomputers running under MS-DOS and PC-DOS. It generates COBOL source programs through a series of interactive steps using menus and prompts. Programmers can paint data-entry screens and forms for such standard business applications as file maintenance, inquiries and report writing. Occupying less than 30K bytes of memory, the generator features a data dictionary, data validation, arithmetic calculations

and conditional selection logic. Five skeletal source-code modules can be modified to tailor the generated code to installation standards. Less than \$1,000. **Bytel Corp.**, 1730 Solano Ave., Berkeley, Calif. 94707, (415) 527-1157.

Circle No 326

### p-System runs on DEC minicomputers

p-BRIDGE, an implementation of Softech Microsystems' p-System for DEC PDP-11 and VAX minicomputers, includes BRIDGE software, a p-System license, the vendor's z-Board, which contains four Z80A microprocessors, 256K bytes of memory and a bit-slice state machine. The p-BRIDGE software runs on the host minicomputer and maps all p-System output to the host's peripherals. It comprises the p-System editor, the UCSD Pascal compiler/linker and advanced programmer's tool kit. \$5,000 to \$7,500. **Virtual Microsystems Inc.**, 2150 Shattuck Ave., Suite 720, Berkeley, Calif. 94704, (415) 841-9594.

Circle No 327

### MegaBASIC addresses 1M byte of memory

MegaBASIC features direct addressing of 1M byte of memory and extensions for accessing custom packages from memory. Users can load libraries of programs, subroutines and functions into memory and execute them from the running program with one statement. The packages are user-written in MegaBASIC, providing custom tailoring to an application. MegaBASIC also features variable names as long as 255 characters, advanced trace and edit functions and BCD arithmetic. It works with the CP/M-86 and MS-DOS operating systems on 16-bit Intel microcomputers. \$400. **American Planning Corp.**, Suite 425, 4600 Duke St., Alexandria, Va. 22304, (703) 751-2574 or (800) 368-2248.

Circle No 328

### Database program features report writer

The Alphabase V relational database program runs on IBM personal computers and compatibles. The software provides 40 fields of 60 characters each per record and 32,767 records per file. It furnishes user-designed input screens,

full screen data editing, the linking of as many as four files when generating a report or entering data, database reconfiguration and keyboard macros. Its report writer offers unlimited length headers, titles, subgroup titles, footers and subgroup footers, printer control codes and the ability to define as many as 10 calculated report fields. \$425. **Alpha Software Corp.**, 30 B St., Burlington, Mass. 01803, (617) 229-2924.

Circle No 329

### Spreadsheet with graphics suits VAX/VMS

The Graphic Outlook electronic spreadsheet and graphics package for the VAX/VMS operating environment is available with interfaces to DISSPLA, DI/3000, SAS, MGSP graphics systems or with its own embedded graphics software. The package prepares black-and-white and color plots of spreadsheet data and produces vertical and horizontal bar graphs, pie charts and line drawings on most graphics terminals and plotters. A low-resolution graphics feature draws bar charts and line drawings on VT100-type terminals. The program accommodates spreadsheets as large as 500 columns by 999 rows and supports 3-D spreadsheets, spreadsheet consolidation and encryption, journaling and iteration to a goal. Prices start at \$2,950. **Stone Mountain Computing Corp.**, 1096 Cambridge Dr., Santa Barbara, Calif. 93111, (805) 964-9101.

Circle No 330

### UNIX accommodates the DEC Professional 350

PRO/V7M, a UNIX system for the vendor's Professional 350 microcomputer, includes all the standard features of UNIX V7, such as kernel routines, a tree-structured directory system, the V7 C compiler, the shell (Bourne) command language, pipes, background processing and more than 100 utility programs. The operating system also provides an error language and user diagnostics, the VI full screen editor from the University of California at Berkeley for program development and document preparation, a user overlay kernel scheme for large programs and communications with other PRO/V7M systems. \$695. **Digital Equipment Corp.**, Maynard, Mass. 01754.

Circle No 331



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BD02315



# New Products

## TERMINALS



### Variable display memory suits varied applications

The ADM 12 conversational/block mode video display terminal features 16 non-volatile, programmable function keys, six programmable edit and transmission keys and a variable-format display memory. The terminal can store data in a horizontal, 158-column-by-24-line format that can be scrolled horizontally across the screen. The vertical, 80-column-by-24-line page that can be scrolled vertically handles word-processing applications. The standard 80-column-by-24-line display memory suits general data-processing applications. Its 12-inch green or amber monitor is equipped with a tilt-and-swivel mechanism. \$895. **Lear Siegler Inc., Products Division**, 714 N. Brookhurst St., Anaheim, Calif. 92803, (714) 774-1010. **Circle No 332**



### Display terminal operates in two modes

The model 7-DEC dual-mode ANSI X3.64 terminal is software-compatible with DEC's VT102 in one mode and user-definable in the other. The unit performs all VT102 operating functions plus text-editing, programmable-function and block-transmission operations. It has two pages of volatile or non-volatile display memory that can be reformatted by redefining logical line and page lengths. In user-definable

mode, the terminal's controls can be changed to emulate DG, Datapoint, Honeywell and other asynchronous terminals. The unit has two buffered, bidirectional RS232 ports, a 256-character input buffer, a built-in calculator and a built-in clock. It has four resident character sets, including mosaic and line graphics. The terminal is available in three enclosure styles with 9-, 12- or 15-inch CRTs and three CRT phosphors (white, green or amber). \$1,370. **Teleray Division of Research Inc.**, P.O. Box 24064, Minneapolis, Minn. 55424, (612) 941-3300.

**Circle No 333**



### Hand-held terminal features expanded memory

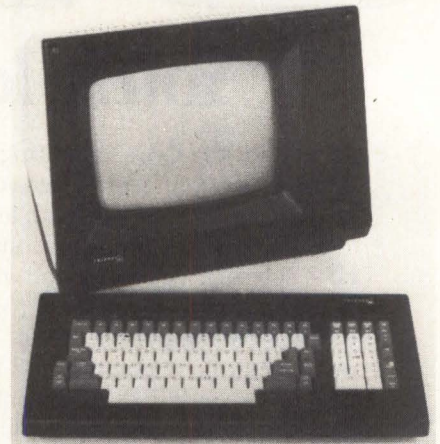
The HT/1000E LCD hand-held control/display terminal features a 24,000-character memory. The terminal can store data input from an outside source for review and analysis in a service application or transmit data to another device such as a printer in a machine data-collection application. The rugged, dust-proof unit operates on batteries or +4.75V to +28V DC supplies. Using the terminal's menu capability, operators can specify baud rate, parity, full-/half-duplex modes and function-key programming; selected options are stored in non-volatile memory. \$995. **Termiflex Corp.**, 18 Airport Road, Nashua, N.H. 03063, (603) 889-3883. **Circle No 334**

### Ergonomic terminal has 20 function keys

The KT-7 video display terminal has a tilt-and-swivel, height-adjustable, 12-inch, non-glare green or amber screen. It features menu setups and user-selectable hidden, or embedded, attributes. Setups, 20 programmable function keys and answer-back are set from the keyboard or the host and stored in



non-volatile memory. The screen displays 24 lines by 80 characters and a 25th status line. Character sets include 128 ASCII, 15 line graphics characters, three international character sets, 20 special and math symbols and 59 thick-line and bold graphics characters. The terminal is code compatible with TeleVideo models 910, 920 and 925. \$595. **Kimtron Corp.**, 2225-I Martin Ave., Santa Clara, Calif. 95050, (408) 727-1510. **Circle No 335**

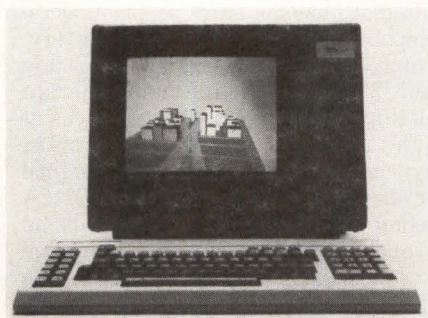


### Display terminal emulates DEC VT102, DG D200

The model 72 emulating terminal is software-compatible with the DEC VT102 and the DG D200. A user or the host computer can reformat the terminal's two- or four- page volatile or non-volatile memory to accommodate spreadsheets, tab listings or text varying from a single page of 255-column lines to 28 pages of 10-column lines or other line/page combinations within memory capacity. Users can program and store as many as 32 variable-length functions. The terminal features a 256-character input buffer



and two bidirectional, buffered RS232 ports. It offers five display attributes, including underscore and blank, and seven area qualifiers, including alpha only, numeric only and right justify. It contains 224 displayable characters, including mosaic and line graphics, any one of which can be used as a cursor. The CRT comes in three (9-, 12- and 15-inch) sizes and three phosphors (white, green and amber). 12-inch model: \$1,535. **Teleray**, 6425 Flying Cloud Dr., Eden Prairie, Minn. 55344, (612) 941-3300. **Circle No 336**



### Graphics terminal employs custom VLSI technology

The model One/10 desktop graphics terminal uses a 16-bit microprocessor and proprietary VLSI processor to achieve its vector-writing performance of more than 1 million pixels per second. VLSI hardware also generates image-memory refresh and timing, performs video refresh at 60 Hz non-interlaced and provides hardware vector clipping and picking. The terminal features 640-by-480 resolution, VT100 compatibility, eight planes of image memory and as much as 256K bytes of local display-list memory. The graphics database uses a nested-segment structure and supports CORE and GKS functionality. Prices start at \$6,000. **Raster Technologies Inc.**, 9 Executive Park Drive, North Billerica, Mass. 01862, (617) 667-8900. **Circle No 337**

### Graphics terminals draw vectors, circles, arcs

The ADM 11G and 12G graphics terminals offer the alphanumeric capabilities of the ADM 11 and 12 video display terminals plus Tektronix Plot 10 and 4010 compatibility. Graphics resolution is 512 by 250, and features include graph mode for drawing circles and arcs, polygon fill, multiple vector

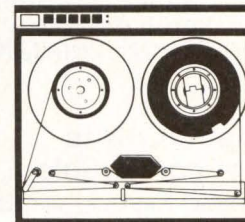
variations, point plot mode and selective erase. The conversational ADM 11G handles computer transmissions to 19.2K baud without handshaking. It has four visual attributes, four function keys and an 80-character-by-24-line display format with a 25th status line. In addition to all the features of the ADM 11G, the ADM 12G offers block

mode and has 16 programmable, non-volatile function keys, five selectable embedded or non-embedded visual attributes and a variable-format display memory. Model 11G: \$1,995, model 12G: \$2,195. **Lear Siegler Inc., Data Products Division**, 714 N. Brookhurst St., Anaheim, Calif. 92803, (714) 774-1010. **Circle No 338**

# MAG TAPE POWER FOR YOUR PC!

Microcomputer users and vendors can now add nine-track, main-frame-compatible tape drives to their single- and multi-user systems and reap the benefits of having the only TRUE STANDARD for DATA INTERCHANGE WORLD-WIDE. Choose from two drives: the hi-performance 75ips (non-vacuum coluum) drive, and the auto-loading 45ips drive. Both come with the following interfaces.

- RS-232C: supports full handshaking and async/bisync/isosync protocols.
- IEEE-488: supports subsets SH1, AH1, TE5, LE3, SR1, RL2, PP2, DC1, DT0 and CO.
- IBM-PC: DMA interface with DOS 2.0 driver and utilities, including hard-disk fast copy.



## TELEBYTE

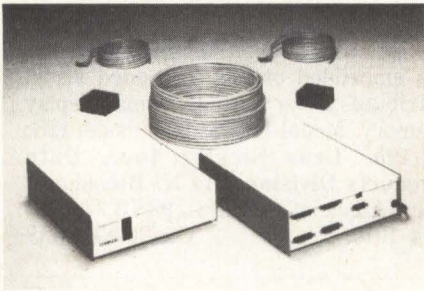
TDX Peripherals Division  
Telebyte Technology Inc., 148 New  
York Avenue, Halesite, NY 11743  
(516) 423-3232

CIRCLE NO. 153 ON INQUIRY CARD



# New Products

## DATACOMM



### Kit builds local-area network

The XLAN kit provides the tools to build a baseband, CSMA, 1M-bps LAN for as many as six devices. The kit includes two StationMate communication devices and 100 feet of twisted/shielded wire. Each StationMate interface unit contains three RS232C ports, a 300-baud, Bell 103J integral modem with auto-dial and auto-answer capabilities and an interconnect operating system in firmware. \$2,995. **Complex Systems Inc.**, 4930 Research Drive, Huntsville, Ala. 35805, (205) 830-4310.

Circle No 339

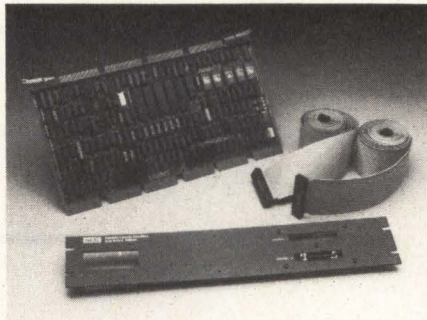
### Device transfers computer/printer data

The Macrolink data-control center can simultaneously transfer, share/buffer, access, hold, print and receive data to or from more than one computer, printer or modem. The Macrolink comes with Z80 processor, 64K bytes of memory, a clock with battery backup, two serial channels, four Centronics-compatible parallel channels and communications software. **Macrotech Computer Products Ltd.**, 1370 Marine Drive, North Vancouver, British Columbia V7P 1T4, Canada, (604) 984-9305. Circle No 340

### Fiber-optic LAN is Ethernet compatible

Fiber Optic Net/One, an Ethernet-compatible LAN, is available in single- or multiple-cable configurations and operates at 10M bps. Net/One network-interface units (NIUs) employ user-transparent electro-optical transceivers to provide the transmission interface to the fiber-optic medium. The interface meets all requirements of the Ethernet specification and employs access methods and collision-detection signals functionally identical to those used in Ethernet baseband systems. Star

couplers can connect as many as 62 NIUs per star, and the maximum distance between NIUs in single-star configurations is 2,800m. An entry-level system is approximately \$25,000, including NIUs, the network-management facility, transceivers, star couplers and the Network Operation System Software. Delivery is 60 days ARO. **Ungermann-Bass Inc.**, 2560 Mission College Blvd., Santa Clara, Calif. 95050, (408) 496-0111. Circle No 341



### Interface enables error-free communications

The IF-11/HDLC microprocessor-based communications front-end provides DMA support for PDP-11 and VAX applications that require HDLC capability. The system includes a processor board, a distribution panel, cabling and device drivers for RSX, VMS and IAS operating systems. The system supports user-selectable frame sizes as large as 131 bytes per frame. It also supports line speeds as high as 500K bps and data throughput rates as high as 400K bps. \$7,500. **Advanced Computer Communications**, 720 Santa Barbara St., Santa Barbara, Calif. 93101, (805) 963-9431. Circle No 342

### Product links personal computers to mainframes

The Attachmate-3270/OEM, a 3270 coaxial-processor subsystem, interfaces with IBM mainframes through the coaxial ports of an IBM 3270 control unit. It in turn interfaces with a non-IBM PC or other microprocessor-based product through shared memory. The Attachmate-3270/OEM emulates the functions of a 3270 coaxial terminal or printer device through the software operating in its proprietary microprocessor. It also emulates the functions of a 3270 control unit and drives 3270

devices. The product is available in an IBM PC- and PC XT-compatible version. It consists of two printed-circuit boards that fit into one I/O slot position of an IBM PC or XT. One board contains the Attachmate microprocessor and coaxial drivers and receivers. Prices start at \$910. **Attachmate Corp.**, 3241 118th St. S.E., Bellevue, Wash. 98005, (206) 644-4010. Circle No 343

### Plug-in modems feature auto-dial capability

The PC212A and R212A intelligent auto-dial modems store as many as 10 telephone numbers and feature battery-protected memory. Both modems are Bell 212A-compatible and operate full-duplex asynchronously at speeds as high as 300 bps and character asynchronously at 1,200 bps. Designed for use in the IBM PC, the PC212A modem features an RS232C port and an internal microprocessor for modem control from the IBM PC keyboard. The R212A intelligent modem also allows all option settings and test features to be controlled from the terminal keyboard. \$499. **Rixon Inc.**, 2120 Industrial Parkway, Silver Spring, Md. 20904, (301) 622-2121. Circle No 344

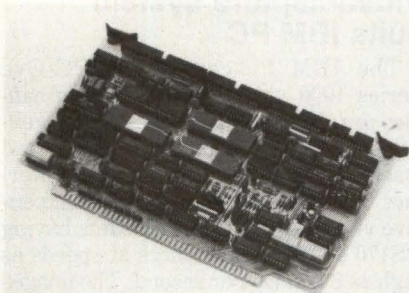
### Device translates codes, format commands

The Altexter Communicator screen-based protocol converter permits direct exchange of text, codes and commands between incompatible word processors, typesetting equipment and personal computers. In addition to its communications capabilities, the product is equipped with a CP/M operating system, so that when it is not being used as a conversion device, it can double as a standalone desktop personal computer. The system consists of a Z80 microprocessor with 64K bytes of memory, a 9-inch CRT that displays 24 lines of 80 characters each, a detachable keyboard, a proprietary communications program built around the company's "A" code, one 420K-byte, 5¼-inch floppy disk drive, four parallel ports and three RS232 ports. Both asynchronous and bisynchronous interfaces can be used with the unit. Users can select communications speeds between 300 and 19,600 bps. \$7,500. **Altexter Inc.**, 210 Lincoln St., Boston, Mass. 02111, (617) 426-0009. Circle No 345



# New Products

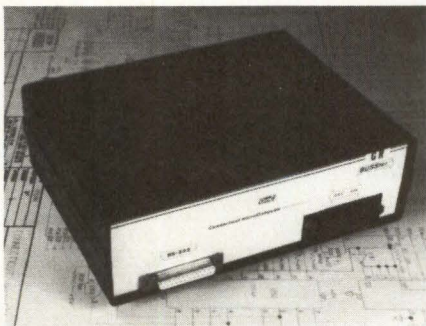
## SUBASSEMBLIES



### Intelligent board controls Winchester, floppies

The GMS6529 intelligent disk controller controls as many as four 8- or 5¼-inch, single- or double-density, single- or double-sided floppy disk drives and three 5¼-inch Winchester disk drives, one of which can be fixed/removable. Four processors are mounted on the 9¼-by-6-inch EXORbus board. A master processor operating at 10 MHz handles communication between the system and control processors. A second processor performs read/write to the hard disks, and a third, which controls the floppy disk drives, contains a built-in data separator, write pre-compensation and seek functions. A fourth processor, an error-correction/-detection device automatically generates ECC or CRC on the data stream. Upon error detection, it automatically corrects a 5-bit stream on a single burst of data, and, if data cannot be corrected, it automatically initiates a retry. \$387 (100 units). **General Micro Systems Inc.**, 1320 Chaffey Court, Ontario, Calif. 91762, (714) 621-7532.

Circle No 346

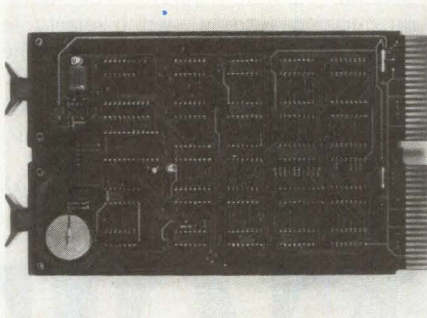


### Interface mates IEEE-488, RS232 devices

The CmC BUSSter GR microprocessor-based interface allows computers with an IEEE-488 interface to communicate with RS232 devices. The unit's

software-controlled features include selectable baud rates of 75 to 19.2K, a 110-character input buffer with X-on/X-off capability, parity and word-length selection, readable data-terminal-ready input and data-set-ready output. Special commands allow users to read input-buffer status. An eight-position DIP switch selects device address (0 to 31), startup baud rate (300 or 1,200), automatic line feed and automatic carriage return. The device comes with a case, a power supply and standard female GBIB and DB-25 connectors. \$495. **Connecticut MicroComputer Inc.**, 36 Del Mark Dr., Brookfield, Conn. 06804, (203) 775-4595.

Circle No 347



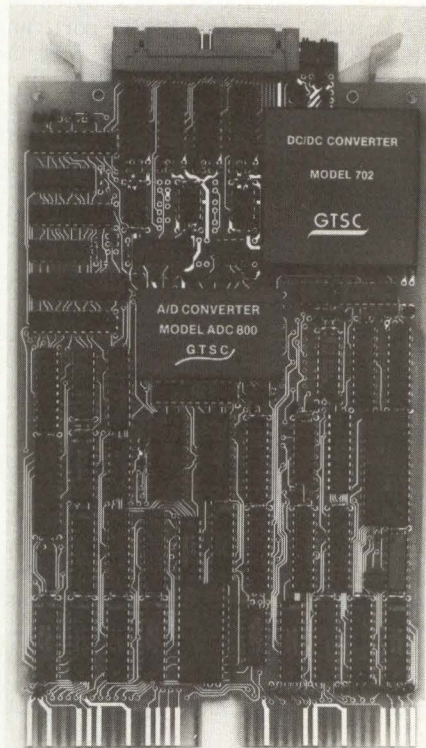
### Clock board sets system time

The battery-backed TOY11 calendar/clock board for the DEC Q-bus is compatible with LSI-11/02, 11/23 and 11/73 processors. The product includes software for standard DEC operating systems to set system time at power-up without operator intervention. It has a 60-Hz crystal-controlled clock for standard line time-clock functions and a five-year rated lithium battery. The board features an alarm function and a millisecond counter for measuring elapsed time. Interrupt signals are programmable for 10- or 1-Hz, one-hour, one-day, one-week and one-month intervals. \$299 (100 units). **Romar Peripherals Inc.**, 4 Rotterdam Dr., Hudson, N.H. 03051, (603) 882-3741.

Circle No 348

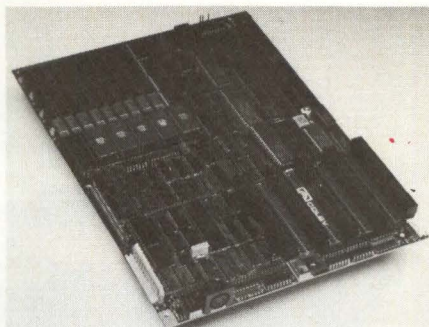
### Analog input board has DMA capability

The model 123 is a DEC LSI-11-compatible analog input subsystem with DMA capability. It incorporates conventional programmed I/O and four-level interrupt interfaces. The subsystem



accommodates as many as 32 single-ended analog input channels and can achieve overall data-transfer rates of 250 kHz. Six DMA modes provide software flexibility, and a calibration/self-test voltage output allows a user to dedicate one or more channels to automatic self-test. The unit is supplied on a standard DEC-style printed-circuit board and resides in a single card slot. \$2,495. **Grant Technology Systems Corp.**, 11 Summer St., Chelmsford, Mass. 01824, (617) 256-8881.

Circle No 349



### Colby computer is IBM-compatible

The Colby single-board computer has the same dimensions and mounting holes as the IBM PC motherboard. It



# New Products

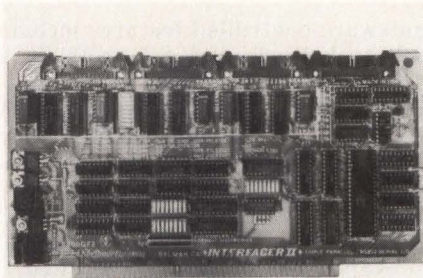
## SUBASSEMBLIES

features an 8088 CPU, 64K bytes of RAM with parity, an RS232 port, an IBM PC-compatible keyboard port, a 5¼-inch floppy disk controller, five expansion slots, a real-time clock with battery backup and an SASI hard disk interface. The Colby can accept as many as six 28- or 24-pin ROMs or EPROMs. \$569. **Colby Computer**, 849 Independence Ave., Mountain View, Calif. 94043, (415) 968-1410.

Circle No 350

### S-100 interface includes three parallel channels

The 8800GF2 interface for IEEE-696/S-100 bus systems provides three full-duplex parallel I/O channels, a serial port and a selectable-rate interrupt timer on one board. Each of the three parallel-data channels incorporates eight TTL-latched input lines and eight tri-state output lines with 24 mA drivers. The board supports data-transfer rates as high as 10 MHz. A



switch-selectable interrupt timer gives fixed-interrupt rates from 50 interrupts per second to 19,200 interrupts per second. Each parallel connector provides power for peripheral devices. The board's serial port provides RS232C  $\pm 12V$  signals or optically isolated 20-mA signals with an internal or external current source. The data-transmission rate is switch-selectable from 50 to 19,200 bps. \$399 for the certified system-component version. **Vector Electronic Co.**, 12460 Gladstone Ave., Sylmar, Calif. 91342. (213) 365-9661.

Circle No 351

### Video-capture system suits IBM PC

The IBM PC-compatible PC-Eye Series 1000 video-capture system handles graphics/image-processing, surveillance/security, quality-assurance and machine-vision applications. The interface board accepts images from inexpensive video cameras and recorders having RS170 or NTSC interfaces at speeds as high as 8 frames per second. The images can be digitized with 1 or 2 bits of intensity for compatibility with the IBM high-resolution graphics adapter or digitized with 4 bits of intensity (600-by-400-pixel resolutions) for display by other compatible graphics adapter boards. The image is transferred under DMA control into main memory at speeds as high as 1M byte per second. The system offers software support for printer output, annotation, storage, comparison, compression and transmission of the video information. Less than \$500. **Chorus Data Systems Inc.**, P.O. Box 810, Hollis, N.H. 03049, (603) 465-2290.

Circle No 352

# HALF SIZE.





# New Products

## LITERATURE

### Manual introduces dot-matrix print heads

This manual on dot-matrix impact print heads introduces the design, application and uses of the technology. The manual discusses basic operating principles, including the actions that occur when a print-head solenoid is fired, electronic drivers, print quality and print-head evaluation. **Magnetic Corp.**, 96 Granby St., Bloomfield, Conn. 06002, (203) 243-8941.

Circle No 353

### Product summary covers disk, tape controllers

This six-page, four-color product summary features interface and performance data on 25 disk and tape controllers for DEC Q-bus and Unibus computers. The brochure also lists by drive and storage capacity many disk and tape drives with which the company's controllers interface. The

brochure also outlines ordering, service and warranty information. **Distributed Logic Corp.**, 12800 Garden Grove Blvd., Garden Grove, Calif. 92643, (714) 534-8950.

Circle No 354

### Color brochure highlights BASYS family

This eight-page, color brochure describes the BASYS family of real-time measurement-and-control systems. The family includes DISKBASYS, a Winchester- or floppy disk-supported system capable of program development and of hosting distributed BASYS satellite networks; PROMBASYS, a large data-acquisition and -control system with solid-state storage media; and MICROBASYS, a remote data-acquisition and -control system for distributed applications. All members of the BASYS family use a proprietary I/OBASIC language that is also de-

scribed in the brochure. The brochure also lists I/O interface options for the BASYS family as well as CPU and storage options for system expansion. **ADAC Corp.**, 70 Tower Office Park, Woburn, Mass. 01801, (617) 935-6668.

Circle No 355

### Brochure details CAD workstation

An eight-page color brochure describes the CDX-5000 standalone PC-board CAD system. The brochure discusses the system's 32-bit internal architecture, memory, built-in database-management package and high-resolution graphics system. One section details the product's object-oriented interface that uses graphics symbols and an optoelectronic mouse input device to control system functions. **Cadnetix Corp.**, 5797 Central Ave., Boulder, Colo. 80301, (303) 444-8075.

Circle No 356

# MORE DRIVE.

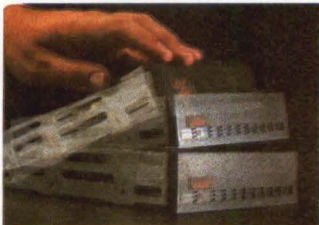
### IMI's new 2300H Series Winchester disk drives.

The 2300H Series is the most rugged disk drive made today, with a shock-proof design tough enough for desk top and portable applications. And IMI includes a full two-year warranty on parts and labor.

The 2306H and 2312H pack 6 and 12 megabytes of storage into half height 5¼" Winchester packages with all the capabilities of your full height drive, and more.



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**More durability.** IMI's exclusive shock isolation system utilizes improved damping materials and low mass head/flexure design. It's so tough you can literally drop it. Just try that with any

other disk drive, full or half.

**More performance.** The patented "dynamic seek complete" and closed loop stepper control circuitry virtually eliminate seek errors. Plus, the 2300H operates on a wider voltage range than a full height.

**More features.** Extensive self test micro diagnostics monitor power supply voltages, spindle speed, and verify the integrity of the positioning system during the power-up cycle. Auto power sequencing reduces starting currents.

**Half size.** The 2300H may be mounted in a variety of configurations in addition to the usual half height mini floppy standards. An optional full height bezel allows mounting in a full height chassis

location. Or, two 2300H drives can be stacked in a full height space, without compromising the shock isolation system. The 2300H is fully compatible with the ST506/412 interface.

For spec sheet and further information, contact:

International Memories Inc.,  
10381 Bandle Drive,  
Cupertino, California 95014,  
(408)446-9779 TWX:910-338-7347.



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CIRCLE NO. 158 ON INQUIRY CARD



# New Products

## LITERATURE

### UNIX guide covers Berkeley enhancements

The revised second edition of the *UNIX Guide* covers System V, System III, Version 7, UniPlus+ and Berkeley enhancements, as well as commands, libraries, system calls and reference

documentation. It provides overviews that relate software tools to text editing, graphics, networking and inter-process communication. \$24.95  
**Pacific Micro Tech**, 5819 Poinsett Ave., El Cerrito, Calif. 94530, (415) 233-3596. **Circle No 357**

### Newsletter examines software production

Intended for professionals involved in the design, development, purchase, maintenance or use of computer software, the *Software Issues* newsletter addresses the development of computer programs, discussing the factors that influence a program's quality. The newsletter contains information regarding design and documentation methods, the psychological issues involved in designing a user interface, software-testing techniques, the how-to of controlling and reducing development and maintenance costs and non-procedural languages and their applications. Published four times a year, \$12 for the first year. **GDW Associates**, P.O. Box 14258, Clearwater, Fla. 34279, (813) 799-3262.

**Circle No 358**

### Glossary provides access to the language of CAD/CAM

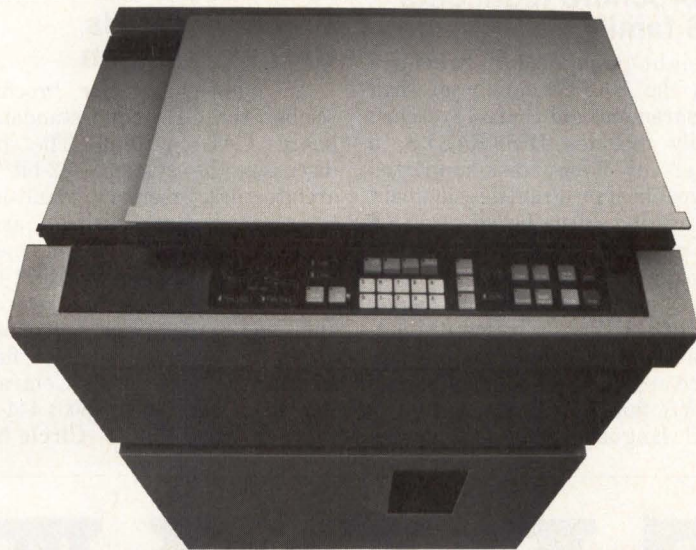
Stuart W. Hubbard's *The Computer Graphics Glossary* defines more than 750 computer graphics and CAD/CAM technical communications terms. The 96-page book includes multiple definitions with notes on idiomatic usages. Photographs and line drawings illustrate key terms. The glossary also contains terms used by the CAD/CAM business community, such as product names, acronyms for professional organizations and commonly used adjectives. Photographs of hardware and equipment complement the explanations. \$24.50. **The Oryx Press**, 2214 N. Central at Encanto, Phoenix, Ariz. 85004, (602) 254-6156.

**Circle No 359**

### Buyers guide lists Multibus products

The *Multibus Buyers Guide* lists more than 1,200 Multibus products, current prices and specifications. The approximately 300-page guide organizes products into 30 categories and provides addresses and telephone numbers for more than 200 manufacturers. \$35 for the first copy, \$19.95 for each additional copy. **Ironoak Co.**, 3239 Caminito Ameca, La Jolla, Calif. 92037, (619) 450-0191.

**Circle No 360**



## Meet the KEL Model 5211 Laser Page Printer

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CIRCLE NO. 156 ON INQUIRY CARD



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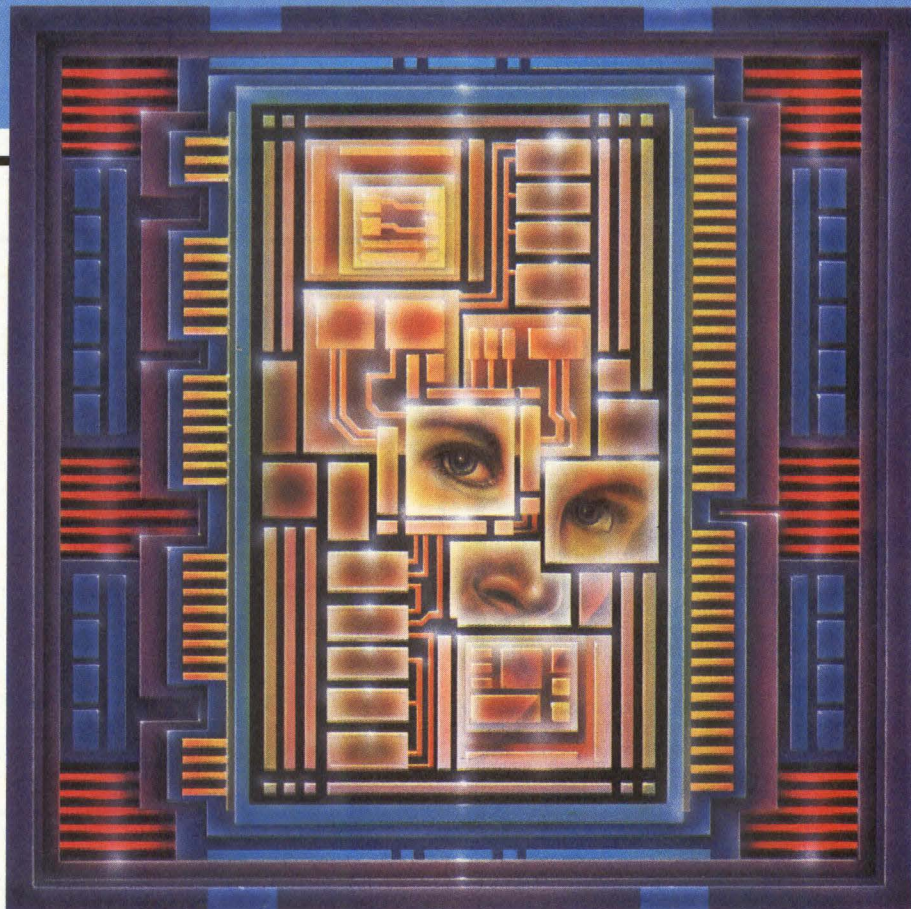
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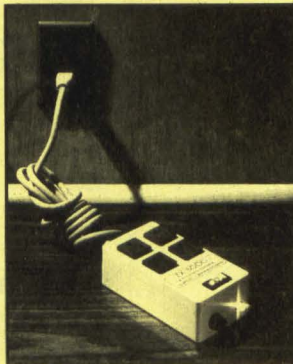
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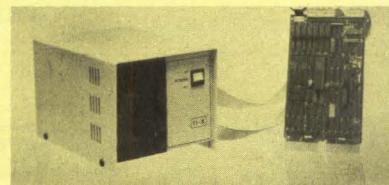
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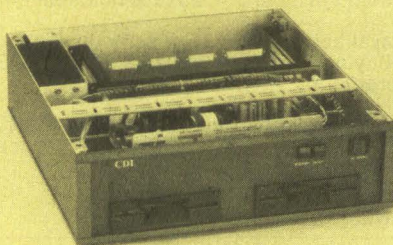
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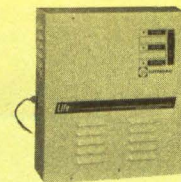
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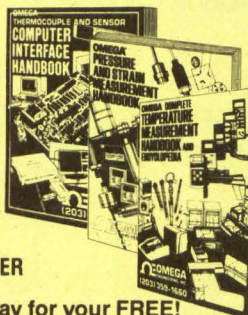
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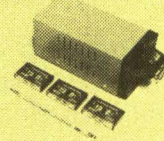
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# Calendar

## JUNE

**13-15 PC-World Exposition**, McCormick Place West, Chicago, sponsored by Mitch Hall Associates. Contact: Paul Belikove, Operations Manager, Mitch Hall Associates, P.O. Box 860, Westwood, Mass. 02090, (617) 329-8090. Also to be held on Oct. 3-5 in Market Hall, Dallas.

**19-20 Office Automation Conference**, New York, sponsored by The Yankee Group. Contact: Lisa Caruso, The Yankee Group, Seminar Director, 89 Broad St., Boston, Mass. 02110, (617) 542-0100. Also to be held on June 26-27 in San Francisco.

**19-21 Third Canadian CAD/CAM & Robotics Exhibition & Conference**, Toronto International Centre of Commerce, Toronto, sponsored by the Canadian Institute of Metalworking (CIM), the Computer and Automated Systems Association and Robotics International. Contact CIM, McMaster University, 1280 Main St. W., Hamilton, Ontario, (416) 528-2777.

**19-21 Computerized Office Equipment Expo/Office Information Systems Conference (COEE/OIS '84)** Rosemont, Ill., sponsored by Ruann International. Contact: Janet Schafer, Show Manager, Cahners Exposition Group, Cahners Plaza, 1350 E. Touhy Ave., P.O. Box 5060, Des Plaines, Ill. 60018, (312) 299-9311.

**19-22 "State-of-the-Art Robot Systems" Course**, Washington, sponsored by Integrated Computer Systems. Contact: Ruth Dordick, Integrated Computer Systems, 6305 Arizona Place, P.O. Box 45405, Los Angeles, Calif. 90045, (213) 417-8888 or (800) 421-8166. Also to be held on July 10-13 in Los Angeles and July 31-Aug. 3 in Boston.

**26-29 "Computer Graphics" 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, (213) 417-8888 or (800) 421-8166. Also to be held on July 24-27 in Palo Alto, Calif., and July 31-Aug. 3 in Washington.

## JULY

**9-12 1984 National Computer Conference**, Las Vegas Convention Center, Las Vegas, Nev., sponsored by the American Federation of Information Processing Societies Inc., the Association for Computing Machinery, the Data Processing Management Association, the IEEE Computer Society and the Society for Computer Simulation. Contact: Ann-Marie Bartels, 1983 NCC, (703) 558-3613.

**9-13 "Introduction to Interactive Computer Graphics" Course**, Wang Institute of Graduate Studies, Tyngsboro, Mass., sponsored by the Wang Institute of Graduate Studies. Contact: Roberta Wesley, Coordi-



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nator of Special Programs, Wang Institute of Graduate Studies, Tyng Road, Tyngsboro, Mass. 01879, (617) 649-9731.

- 15-18 1984 International SPSS Software Users Exchange (ISSUE) National Conference**, Drake Hotel, Chicago, sponsored by ISSUE Inc. Contact: ISSUE '84 Program Chairman, ISSUE Inc., Suite 1970, 444 N. Michigan Ave., Chicago, Ill. 60611, (312) 329-2400.
- 19-21 Syntopican XII Office Automation/Information Systems Conference & Exposition**, McCormick Place, Chicago, sponsored by the Association of Information Systems Professionals. Contact: Matt Smith, Case History Associates, (201) 361-0933.
- 23-25 Summer Computer Simulation Conference (SCSC '84)**, Boston, sponsored by Simulation Councils Inc. Contact: Charles Pratt, Simulation Councils Inc., P.O. Box 2228, La Jolla, Calif. 92038, (619) 459-3888.
- 23-27 SIGGRAPH '84 11th Annual Conference on Computer Graphics and Interactive Techniques**, Minneapolis, sponsored by the Association for Computing Machinery's Special Interest Group on Computer Graphics, the IEEE Technical Committee on Computer Graphics, Eurographics, the Minneapolis College of Art & Design, the University of Minnesota and the Science Museum of Minnesota. Contact: Siggraph '84 Conference Office, 111 E. Wacker Drive, Chicago, Ill. 60601, (312) 644-6610.

**AUGUST**

- 6-7 "Micro/Personal Computers: State of the Art" Seminar**, Chicago, sponsored by Digital Consulting Associates Inc. Contact: Software Institute of America Inc., 8 Windsor St., Andover, Mass. 01810, (617) 470-3380. Also to be held in Dallas on Aug. 9-10.
- 13-15 American Society of Mechanical Engineers (ASME) International "Computers in Engineering" Conference & Exhibit**, Hilton Hotel, Las Vegas, Nev., sponsored by ASME. Contact: Mary S.H. Benedict, Exhibits Manager, or Eileen Dengler, Exhibits Administrator, ASME, United Engineering Center, 345 E. 47th St., 13M, New York, N.Y. 10017, (212) 705-7100.
- 13-17 "Database '84" Course**, Wang Institute of Graduate Studies, Tyngsboro, Mass. sponsored by the Wang Institute of Graduate Studies. Contact: Roberta Wesley, Coordinator of Special Programs, Wang Institute of Graduate Studies, Tyng Road, Tyngsboro, Mass. 01879, (617) 649-9731.
- 15-16 Telecommunications Seminar**, New York, sponsored by The Yankee Group. Contact: Lisa Caruso, Seminar Director, The Yankee Group, 89 Broad St., Boston, Mass. 02110, (617) 542-0100. Also to be held on Aug. 22-23 in San Francisco.

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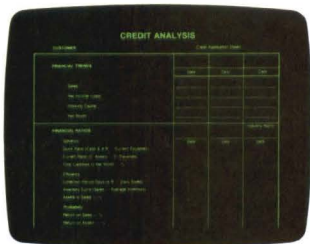
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