

# Mini-Micro Systems

FEBRUARY 1988

THE MAGAZINE FOR SYSTEM INTEGRATION

A CAHNERS PUBLICATION

## THE YEAR OF COLOR A new generation for color hard copy



**Color brightens  
desktop publishing**

**Hot to plot**

**Oracle eyes OLTP**



# *a pen plotter.*



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## **Roundup**

**A buyer's guide  
to non-impact printers**

## **Technology Forum**

**How to quadruple  
modem throughput**



# *It only looks like*

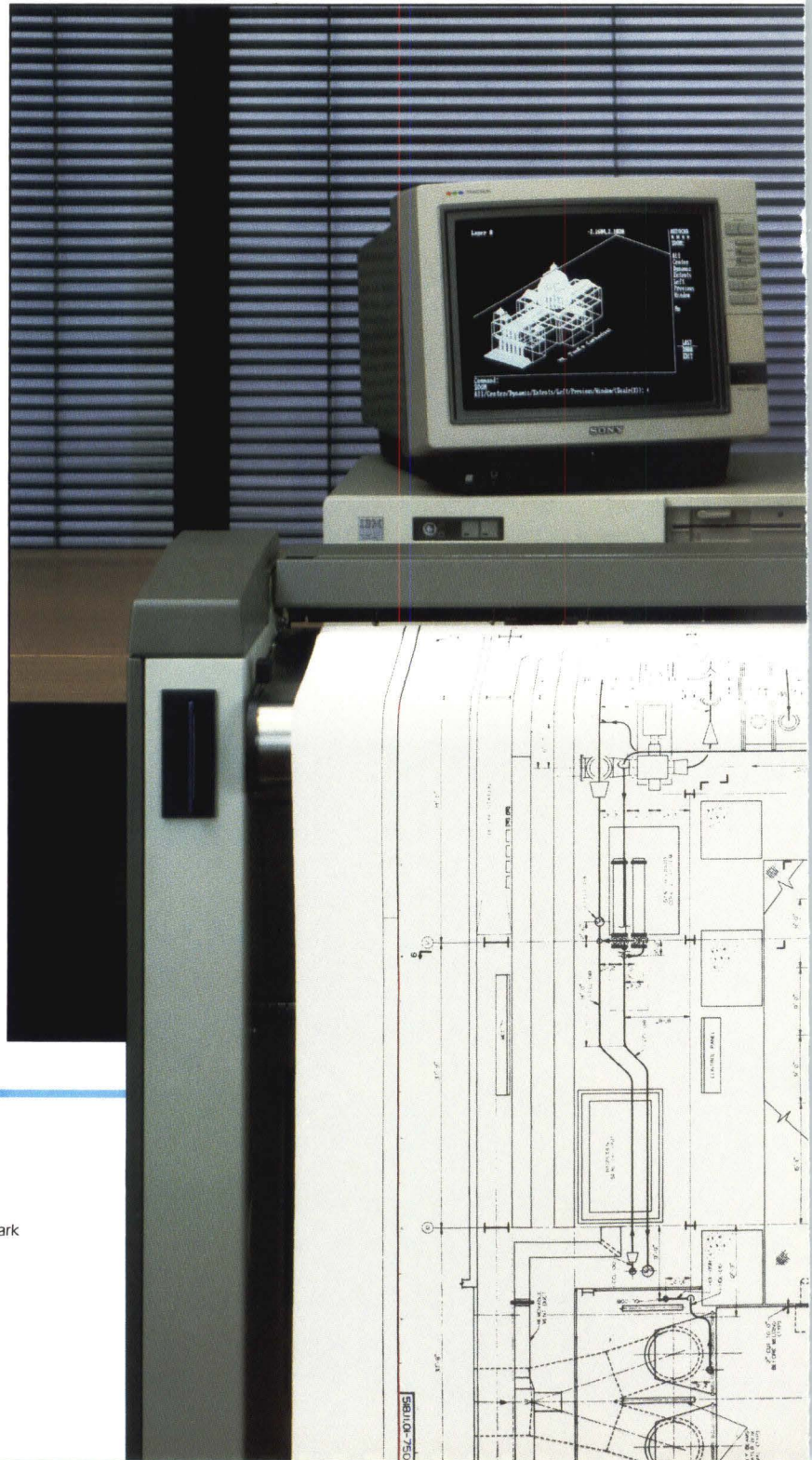
But look again. It emulates pen plotters, reading popular 906/907 and HPGL data formats. It comes in pen plotter widths – 24 and 36 inches. And you can use it with your favorite CAD packages, such as AutoCAD, VersaCAD, or MICRO CADAM.

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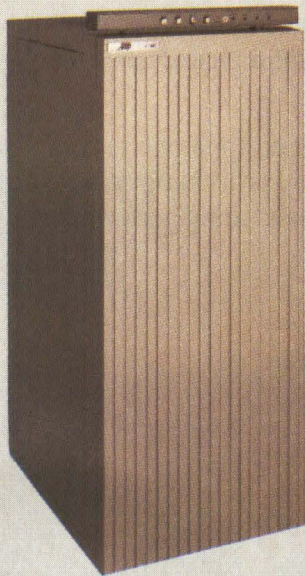
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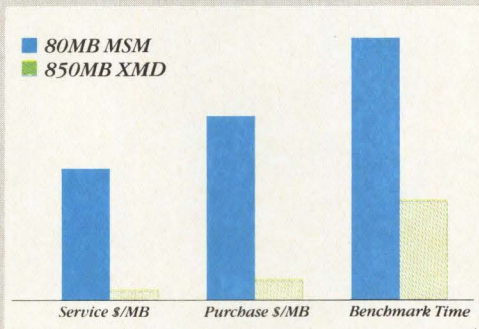
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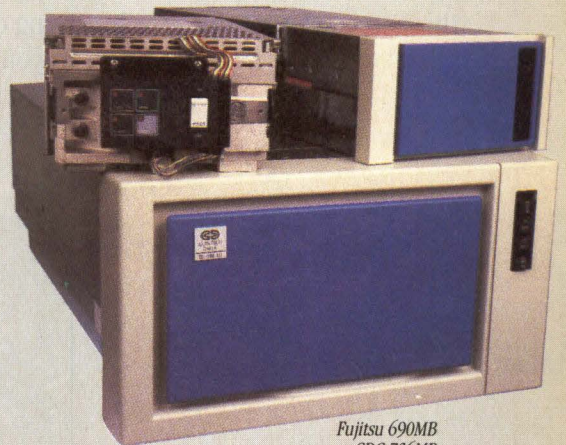
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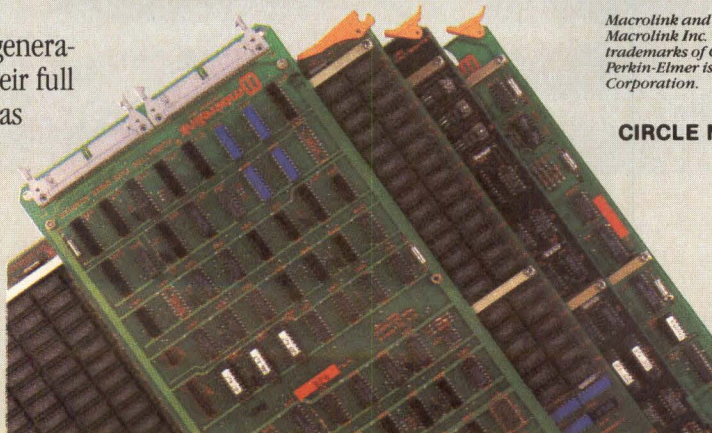
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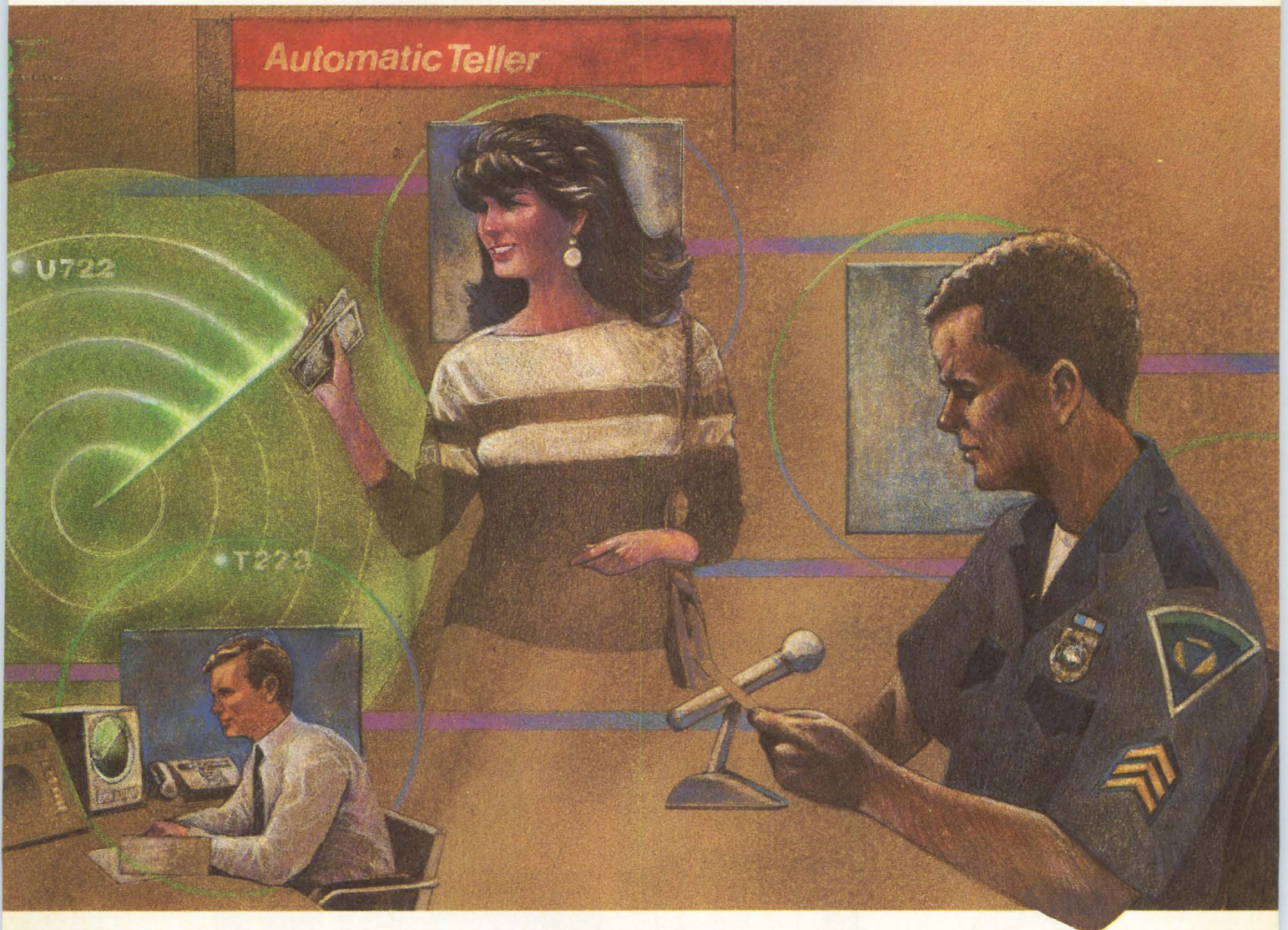
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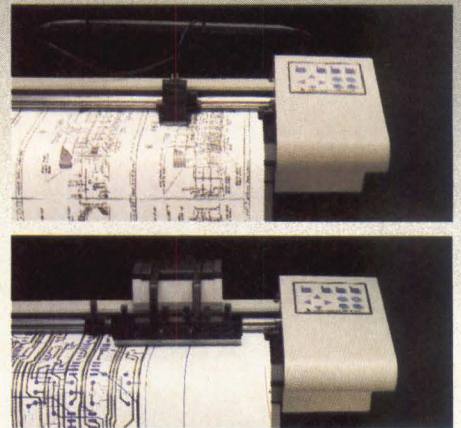
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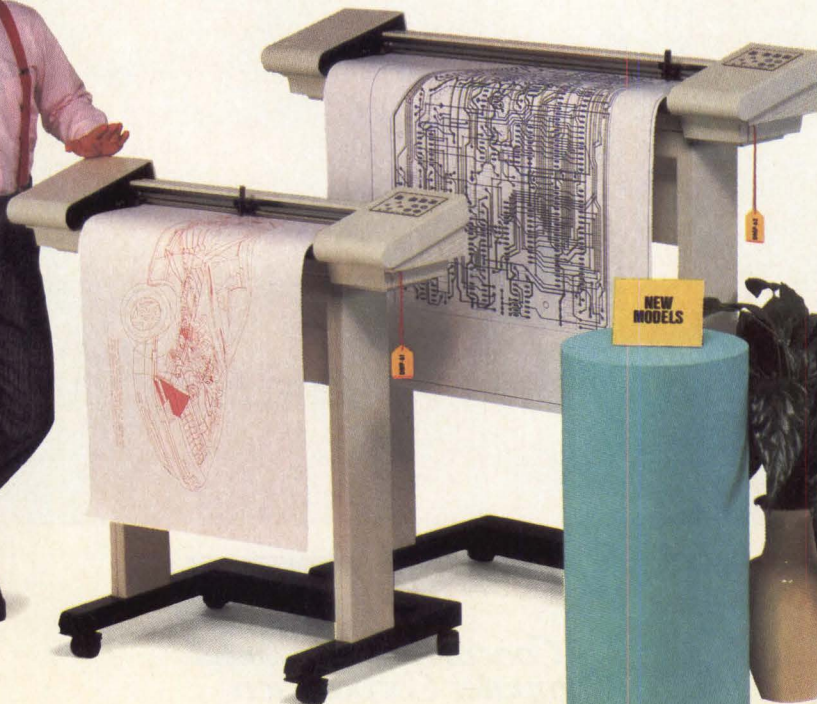
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# Mini-Micro Systems®

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VOL. XXI NO. 2 FEBRUARY 1988

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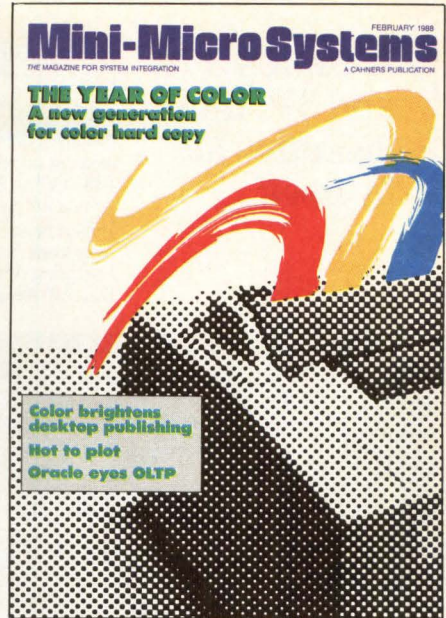
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by **Francis Bacon**, Telcor Systems Corp.

## ■ DEPARTMENTS

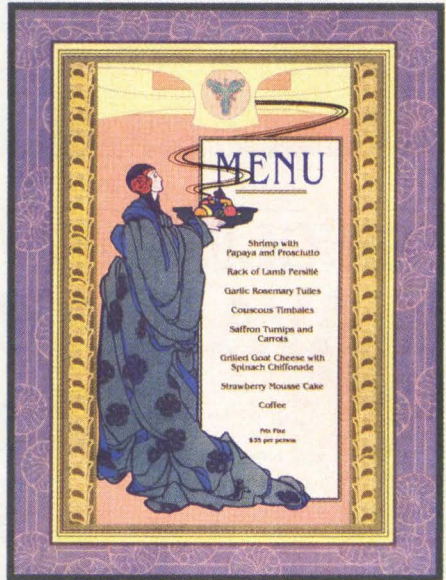
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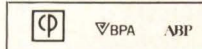
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**KEEPING AMERICA COMPETITIVE**

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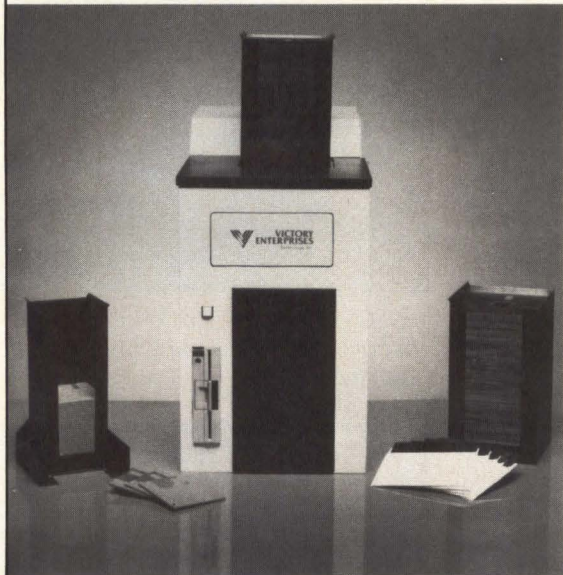




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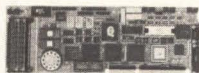
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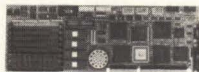
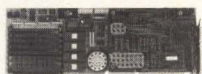
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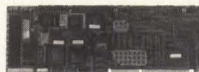
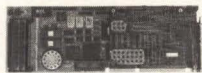
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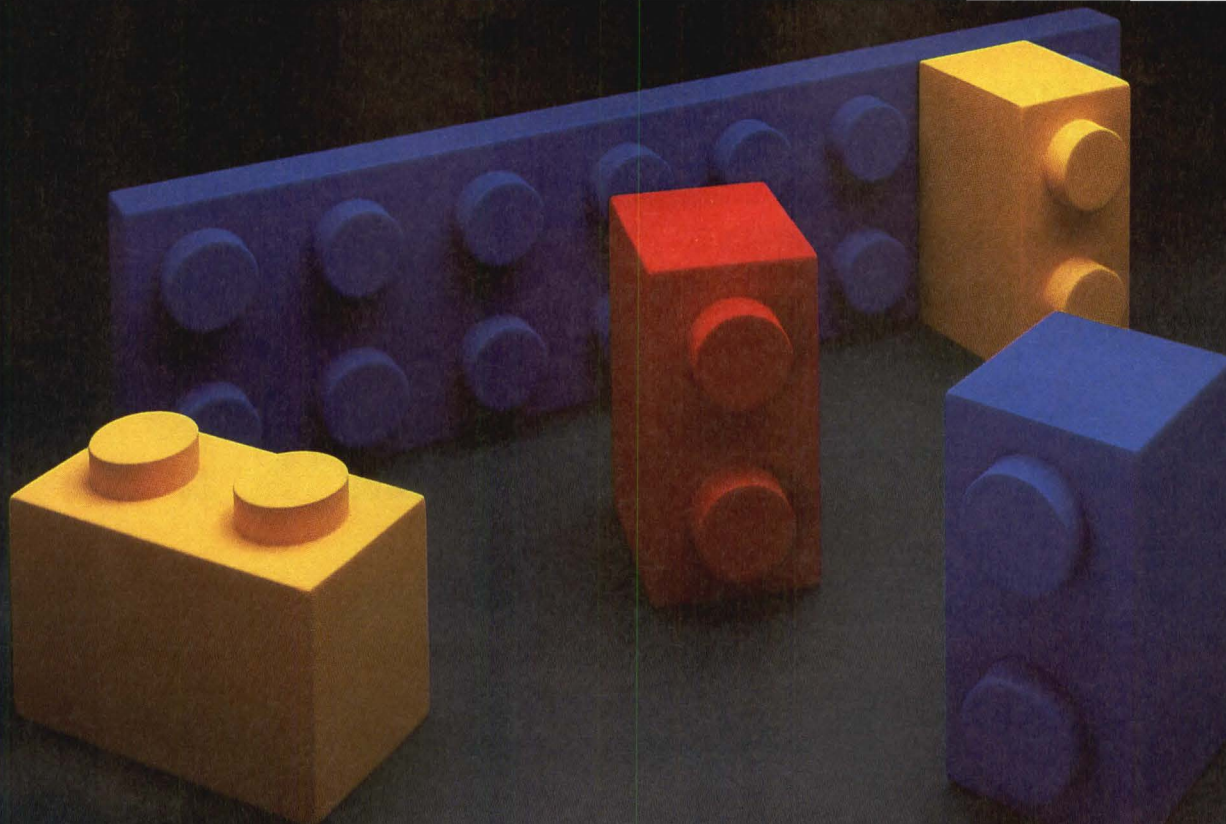
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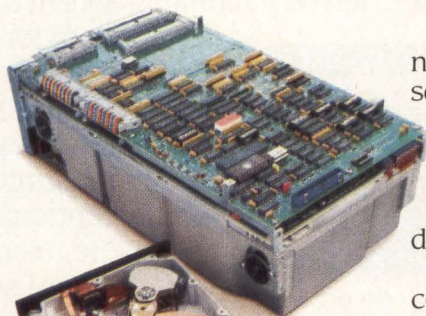
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# BREAKPOINTS

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## **APPLE FINALLY GETS ITS UNIX ACT TOGETHER—ALL ON A DISK**

Apple Computer Inc., Cupertino, Calif., chose the Uniform show in Dallas this month to introduce A/UX, its version of AT&T Co.'s UNIX System V.2 operating system. A/UX is designed for Apple's high-end Macintosh II and comes preconfigured on either an internal (\$4,879) or an external (\$5,549) 80M-byte rigid-disk drive upgrade package for current users. Apple is also selling A/UX bundled with Mac II or development systems. A/UX contains the Berkeley UNIX extensions, Network File System, Streams and the Macintosh Toolbox, plus functions for automatic booting and recovery. That leaves users with 10M bytes of free disk space. By preconfiguring the disk, Apple hopes to spare users from hiring UNIX gurus.—*Mike Seither*

## **CONFUSION SERVED UP IN THE SQL DATABASE RACE**

Everyone knows when Ashton-Tate's SQL Server database environment will be available, but from whom is another story. The relational database software, which is designed to run across a local area network, was developed by three companies: Ashton-Tate, Microsoft Corp. and Sybase Inc. It will also be marketed by the three companies, with Ashton-Tate holding up the retail end and Microsoft and Sybase selling to OEM hardware manufacturers. This may cause some confusion as software developers seek to write programs to run with SQL Server's open architecture. From a user's standpoint, it may also cause problems when something goes bump in the LAN and fingers start to point as to which vendor to blame. Shipments start the second half of this year in an effort to beat IBM Corp. and the database facilities of its OS/2 Extended Edition to the punch. The price: from \$1,500 to \$3,000 per license.—*Tim Scannell*

## **ENTERPRISE CHARTS COURSE FOR OPEN SYSTEMS INTEGRATION**

Captain's log, star date 1988. Forming a consortium called ENTERPRISE, the following organizations have banded together to bolster multivendor computer integration based on open systems networking: Alcoa, Boeing, the British Department of Trade & Industry, the Corporation for Open Systems, Deere & Co., the European Commission, General Motors Corp., TRW and the U.S. Air Force. The ENTERPRISE Networking Event '88 International will be held at the Baltimore Convention Center June 6-8. The group will collectively manufacture a product, with all networking based on open systems: the Manufacturing Automation Protocol (MAP), Technical and Office Protocol (TOP) and various standards promoted by the Corporation for Open Systems.—*Dave Simpson*

## **ADAPTEC, C&T TEAM UP FOR PS/2 CLONES**

Missionary teams from Chips & Technologies Inc. and Adaptec Inc. are on the road to spread this gospel to OEMs: The pieces are in place for OEMs to begin building clones of IBM Corp.'s PS/2 models 50, 60 and 80. Adaptec, Milpitas, Calif., says it has controllers for rigid disk drives, plus a host bus adapter that will connect SCSI disks to IBM's Micro Channel. San Jose-based C&T says it has chips for a lookalike Micro Channel for models 50 and 60, plus silicon that mimics IBM's Video Graphics Array (VGA) for standard monitors as well as flat-panel screens. Silicon to clone PS/2 Model 80 is slated to be out in the third quarter, according to C&T. The upshot: Look for the first PS/2 clones by mid-1988.—*Mike Seither*



### **ADOBE SHAKES HANDS WITH FUJITSU**

Adobe Systems Inc., Mountain View, Calif., announced the signing of a contract with Fujitsu Ltd. of Japan. Under the terms of the agreement, Fujitsu will license Adobe's PostScript interpreter for both Japanese and Western languages. Dr. John Warnock, president and CEO of Adobe, says, "We have attempted in the Japanese version of the PostScript interpreter to provide a high degree of flexibility in the way non-roman alphabets are handled." Major computer, printer and typesetter manufacturers who have announced PostScript interpreter licensing agreements with Adobe include Agfa-Gavaert, Apollo Computer, Apple Computer, AST Research, Dataproducts, Diconix, Digital Equipment, IBM, Linotype Co., NBI, NEC Information Systems, Next, QMS, Quadram, Qume, Texas Instruments, Varityper and Wang Laboratories.—*Joseph P. Lerro Jr.*

### **DEC TARGETS IBM WITH FASTEST IMPACT PRINTER**

The LP29, the highest speed impact printer ever offered by Digital Equipment Corp., Maynard, Mass., targets the financial and transaction processing markets where IBM Corp. is king. The 2,000-lpm band printer (\$38,500) competes with IBM's popular 2,000-lpm 4245. Previously, the 1,200-lpm LP27 was the top of DEC's impact line. The printer is compatible with DEC's mid- to high-end VAX 8000 series and with its MicroVAX 3500 and 3600 products. The printer has a 64-character band and a double-buffering interface to assure performance at full capacity.—*Charles LeCompte*

### **MEGAGRAPHS BOOSTS MAC GRAPHICS**

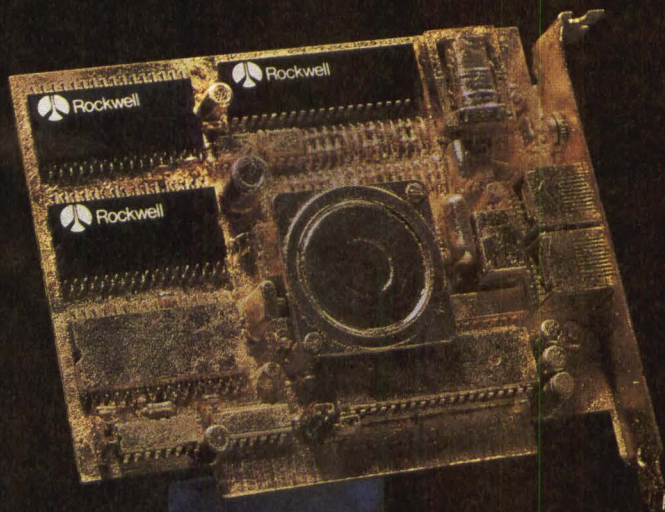
Megagraphics Inc., Canoga Park, Calif., this month begins shipping two products that boost the graphics capabilities of Apple Computer Inc. Macintoshes: the MegaShot video frame grabber and the MegaScreen 2008 Color Video System. MegaShot allows users to capture images from a video camera or VCR for on-screen manipulation in 256 levels of gray. The MegaScreen 2008 includes a Nu-Bus card that pumps resolution up to 1,024 by 896 and allows users to switch between 1-, 2-, 4- or 8-bit modes. As many as 256 colors from a palette of 16.8 million can be displayed in 8-bit mode. The MegaScreen 2008 with a 19-inch color monitor costs \$4,995; pricing for the MegaShot has not been established.—*Dave Simpson*

### **COUNTERPOINT ROUNDS OUT UNIX-BASED MULTIUSER LINE**

The \$7,000 two-user Intel Corp. 80386-based System 15, which comes with a 100M-byte disk drive and 2M bytes of RAM, is now the low-end of Counterpoint Computer Inc.'s UNIX multiuser systems. The San Jose company introduced this computer, along with the 17-user System 22 (\$29,900) and the 64-user System 22E (\$86,825), at Uniforum in Dallas this month. System 22 and 22E use the 25-MHz Motorola Inc. M68020 processor and include Ethernet and SCSI ports, a 60M-byte tape drive and 180M-byte and 720M-byte Winchester, respectively. Counterpoint, which merged with Taiwan-based Multitech Industrial Corp. in November, plans to market the systems to OEMs worldwide beginning in April.—*Mike Seither*



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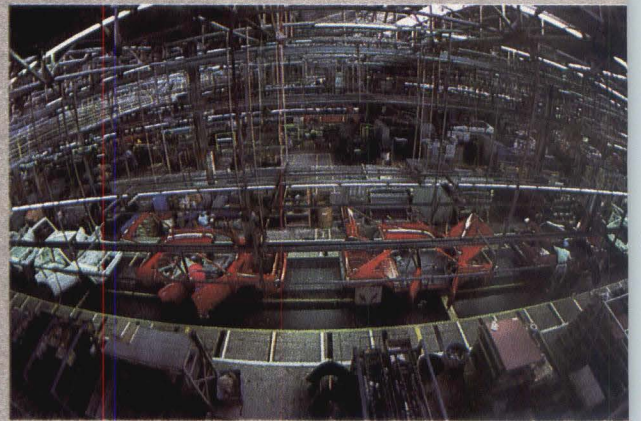
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# INTERPRETER

TRANSACTION PROCESSING SOFTWARE

## Oracle extends DBMS reach into on-line processing

Mike Seither, Senior Editor

In the world of relational database management systems, Oracle Corp. clearly reigns as one of the superpowers.

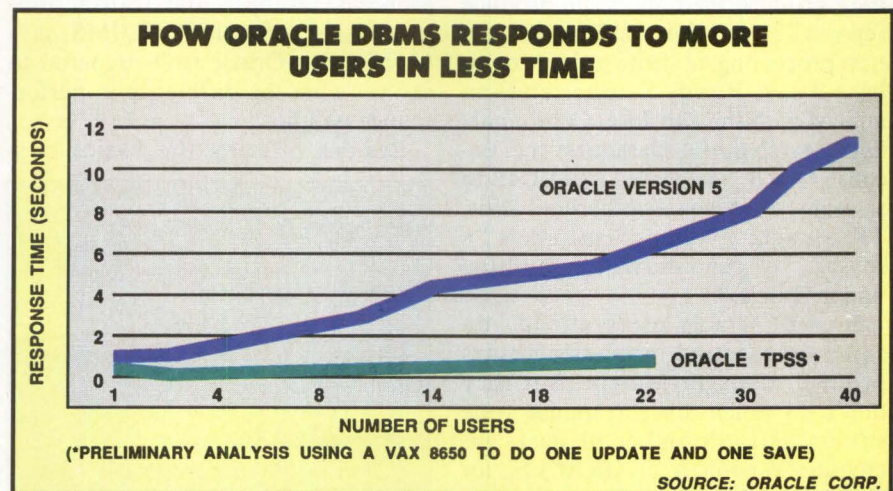
Since its founding some 10 years ago, the Belmont, Calif., company has quickly taken ground by marketing a relational database management system that is portable over a wide range of hardware platforms. These range from IBM Corp. mainframes and Digital Equipment Corp. minicomputers to a number of UNIX-based systems and personal computers. In the past five years sales have climbed from \$5 million to more than \$130 million.

Oracle's recipe for success has been decision support—letting big corporate users get to and manipulate information from a single, or distributed, database. Rather than sit back and enjoy the ride on top, however, the software company is gearing up for changes. These include plans to combine the power of its decision support software with the flexibility of on-line transaction processing.

The result: In March, Oracle will begin beta tests of its latest DBMS product, ORACLE Version 6.0, that includes the Transaction Processing Subsystem (TPSS) option. Oracle will release TPSS this summer for DEC minicomputers and for UNIX computers like those made by Sun Microsystems Inc. and Sequent Computer Systems. By the third quarter, Oracle expects TPSS to be ready for large IBM systems.

### Bet on the buffer

TPSS culminates more than a two-year effort involving a rewrite of about half the ORACLE code, according to Oracle product manager



David Martin. The system is built around a large memory buffer to increase throughput and a "redo log" to ensure the integrity of database information.

The idea behind the memory buffer is to cut down on disk I/O, the bottleneck of any transaction processing system. Under TPSS, chunks of the database are read into memory. An algorithm keeps the most recently used data inside memory, while older, less frequently used information moves back out to disk. Users processing transactions work on data in memory and make changes there, not on disk. Then, entire database pages are read back to disk at once. "In effect," says Martin, "TPSS piggybacks multiple transactions into a single [disk] write."

Peter Burris, a systems software analyst with International Data Corp., Framingham, Mass., says this piggybacking scheme is unique and should differentiate Oracle from other relational database vendors.

Meanwhile, changes made to database records in memory simultaneously go to a "redo log" on tape. The

redo log is the cornerstone of TPSS and provides what Oracle calls "real-time backup" that runs as a continual background process. That is, any change made to a database record is mirrored on tape. Should a disk fail, or even the processor, the latest change is still available on tape.

Under TPSS, users can configure the redo logs to whatever size they want. For example, small logs might be necessary for applications requiring a quick recovery after failure. On the other hand, users who don't want to mount tape all the time might go for longer logs.

### A move to new markets

Oracle hopes TPSS will allow it to move into a number of markets that require on-line transaction processing. These include Wall Street brokerages, mail-order houses, credit-reporting services and banks. Oracle also hopes to woo manufacturers who are eyeing cost-saving techniques such as just-in-time inventory control.

Although a final price list is not yet available, the TPSS option will cost



25 to 30 percent more than the current ORACLE DBMS. For example, ORACLE Version 5.0 for a VAX 8978 now costs about \$144,000. ORACLE Version 6.0 with TPSS will be priced around \$200,000 for the same VAX machine.

Some industry observers believe Oracle may be on to a good thing with TPSS. "If they come through with their promise, customers can produce reports . . . and have on-line transaction processing, all from a single database," says Randy Southerland, an analyst with the San Jose, Calif., market research outfit, Dataquest Inc. Because Oracle has ported its DBMS to so many machines, Southerland adds, TPSS might give those customers "a reason to consolidate everything under Oracle."

Present Oracle users already do some transaction processing, says product manager Martin. But they don't do much since response time suffers as the number of users increases. Version 5 of ORACLE, for example, delivers a little better than two-second response time when eight users are on the system (see "How Oracle DBMS responds to more users in less time"). But response time increases to nearly 12 seconds when 40 users are on-line. Under benchmarks on a VAX 8650, TPSS delivered a one-second response time with 22

users on-line, and nearly instantaneous response with eight users. In fact, Oracle expects final versions for VAX systems to run a consistent 30 transactions per second (tps) for a large number of users.

When TPSS is ported to IBM mainframes, however, it is expected to really shine. In fact, it will probably outperform Big Blue's own hierarchical database and transaction-processing software, DB2/IMS, says Martin. But Oracle isn't prepared to say yet what the difference in performance will be.

Besides offering the basics of a

transaction processing system, Oracle also plans to come out with procedural language (PL/SQL) that will allow the new TPSS software to do what Oracle is known for best—manipulate data. PL/SQL, which will be integrated with the TPSS library, is capable of grouping a number of SQL (structured query language) statements and executing them as a single statement, rather than doing each individually.

Database managers can build and store a library of such procedures that manipulate all manner of variables, including cursors and records. Pricing of PL/SQL was still pending at press time.

Oracle isn't the first relational database company to eye the on-line transaction processing market. Sybase Inc., Berkeley, Calif., got the ball rolling last year and has made some early inroads into the Wall Street brokerages. IDC's Burriss says TPSS is Oracle's way of "protecting its flank from Sybase" while trying to push forward against IBM, the clear-cut leader in transaction processing.

Dataquest's Southerland agrees that Sybase got the jump on Oracle with transaction processing and that the start-up has been "attracting attention out of proportion to its size. But now that Oracle is in step, they could feed off each other." □

### FACT FILE

ORACLE Version 6.0, with the Transaction Processing Subsystem.

**Oracle Corp.**  
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\*\*Offers tenfold improvement over ORACLE version 5.0, either in the number of simultaneous users or in transaction throughput.

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\*\*Available for DEC and UNIX-based systems by mid-1988; for IBM systems in third quarter.

## DATABASE MANAGEMENT

# Freeform DBMS the 'object' of startup company's affection

Tim Scannell, Senior Editor

While software developers and others talk about object-oriented applications programs and environments, at least one company has taken the initiative to do something about it.

Last month, newcomer Servio Logic Corp., Beaverton, Ore., unveiled an object-oriented data management system based on Digital Equipment Corp.'s VAX minicom-

puter running the VMS operating system and compatible with IBM Corp.'s PCs and Sun Microsystems Inc.'s workstations.

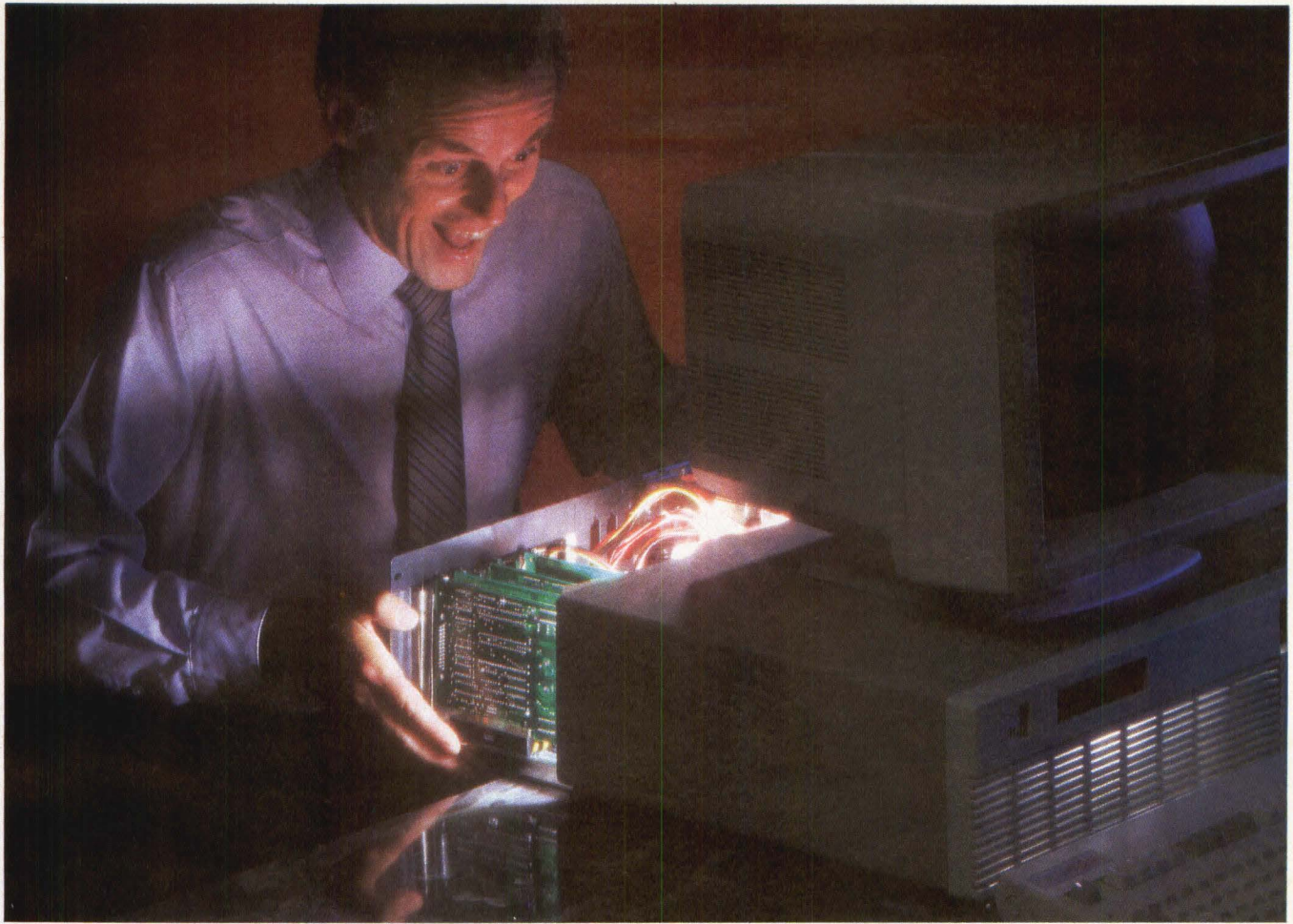
Called GemStone, the information management system consists of two parts: first, an object-oriented manager that resides on the DEC VAX and maintains all of the system's programming commands and calls; second, a programming environment, called OPAL, which is based on a

personal computer or workstation front-end.

Together, they form a system that accommodates all types of data, and stores and recalls the data in a variety of loosely structured formats.

GemStone targets scientific and data intensive applications where large amounts of often unlike data must be quickly handled and catalogued, says senior product manager Michael Connell.





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DATABASE MANAGEMENT

Some initial beta test sites for the system include the National Oceanographic and Atmospheric Administration (NOAA) and the National Aeronautics and Space Administration (NASA). But Connell says typical buyers will be volume end-users like Fortune 500 corporations, not the federal government. At least 20 percent of product shipments will be to OEMs, he adds.

**Locks data in cells**

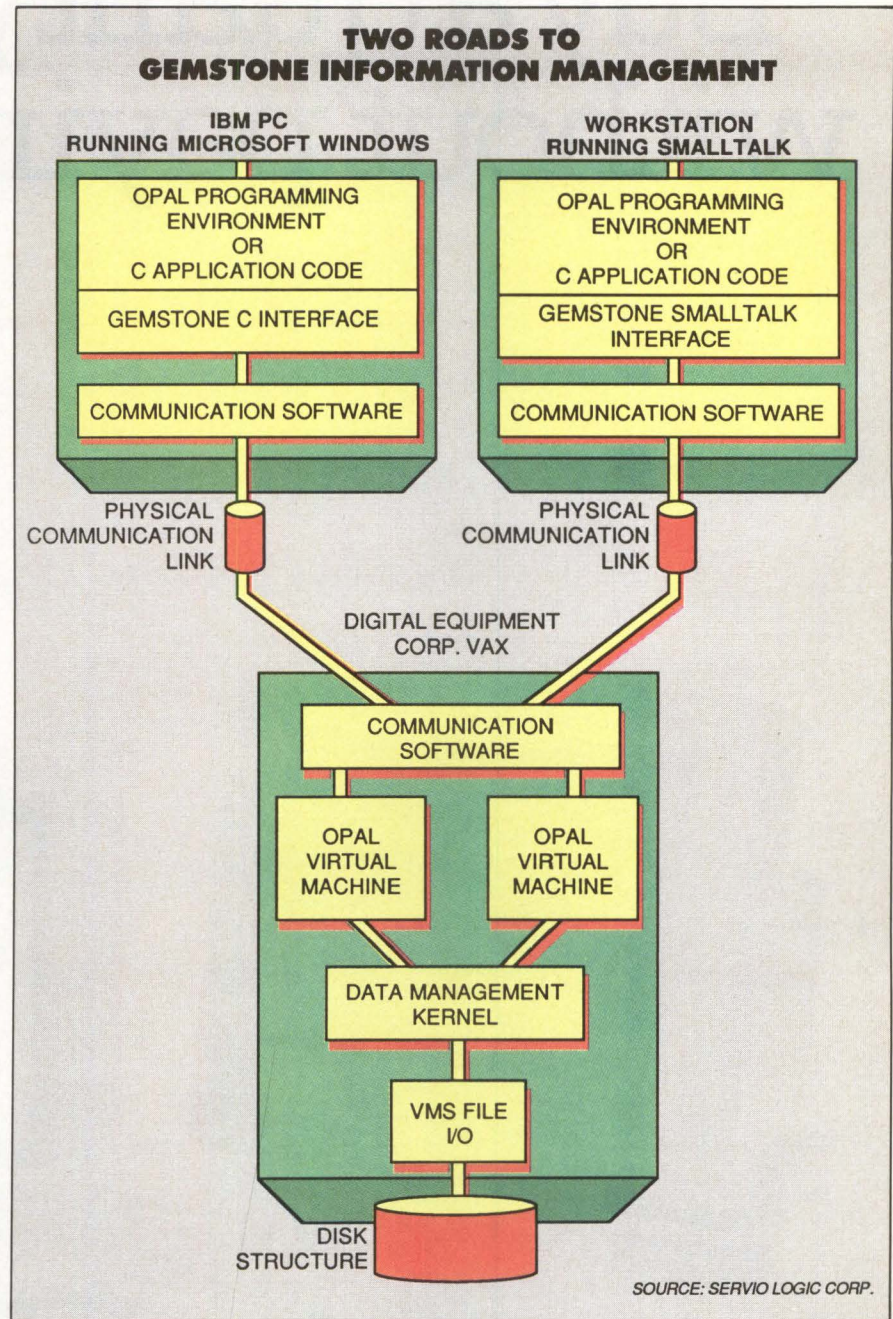
The major difference between GemStone—which is priced from \$10,000 to \$100,000 per license, depending on the application—and other data base management systems is the way it handles data. Traditional filing systems store data without reference to structure or behavior, while full-blown data management systems—even those with a relational capability—capture data according to a predefined structure.

In an object-oriented data management system, however, programming commands and data are stored separately in "data cells." These cells can be as small as a single byte, or as large as an extensive CAD/CAM drawing. A data cell can also comprise numerous small cells that exist independently within a larger cell.

A key benefit of data cell storing is that the data doesn't have to be stored according to a pre-defined format since each cell is a separate entity. To access data, the operators of the information management program—which are also contained in cells—point to a specific operand or data cell and basically ask it to perform a series of operations on itself.

The operators act like the conductor of an orchestra, who motions to each musician during a complicated symphony to perform a specific musical action. In the case of Servio Logic's data manager, the data-cell performers are not locked into marching to the same beat as the musicians in an orchestra, however.

What does this mean to software developers? It means increased freedom, for one thing. Developers can build GemStone applications using either the OPAL data management



and manipulation language—which resides on the VAX host system—or in the C language, running under Microsoft Corp.'s Windows, or on a workstation under Xerox Corp.'s SmallTalk environment. A GemStone C interface converts C applications code into a form compatible with OPAL, while a similar interface handles SmallTalk code. Links between the host minicomputer, an IBM PC or compatibles and workstations are

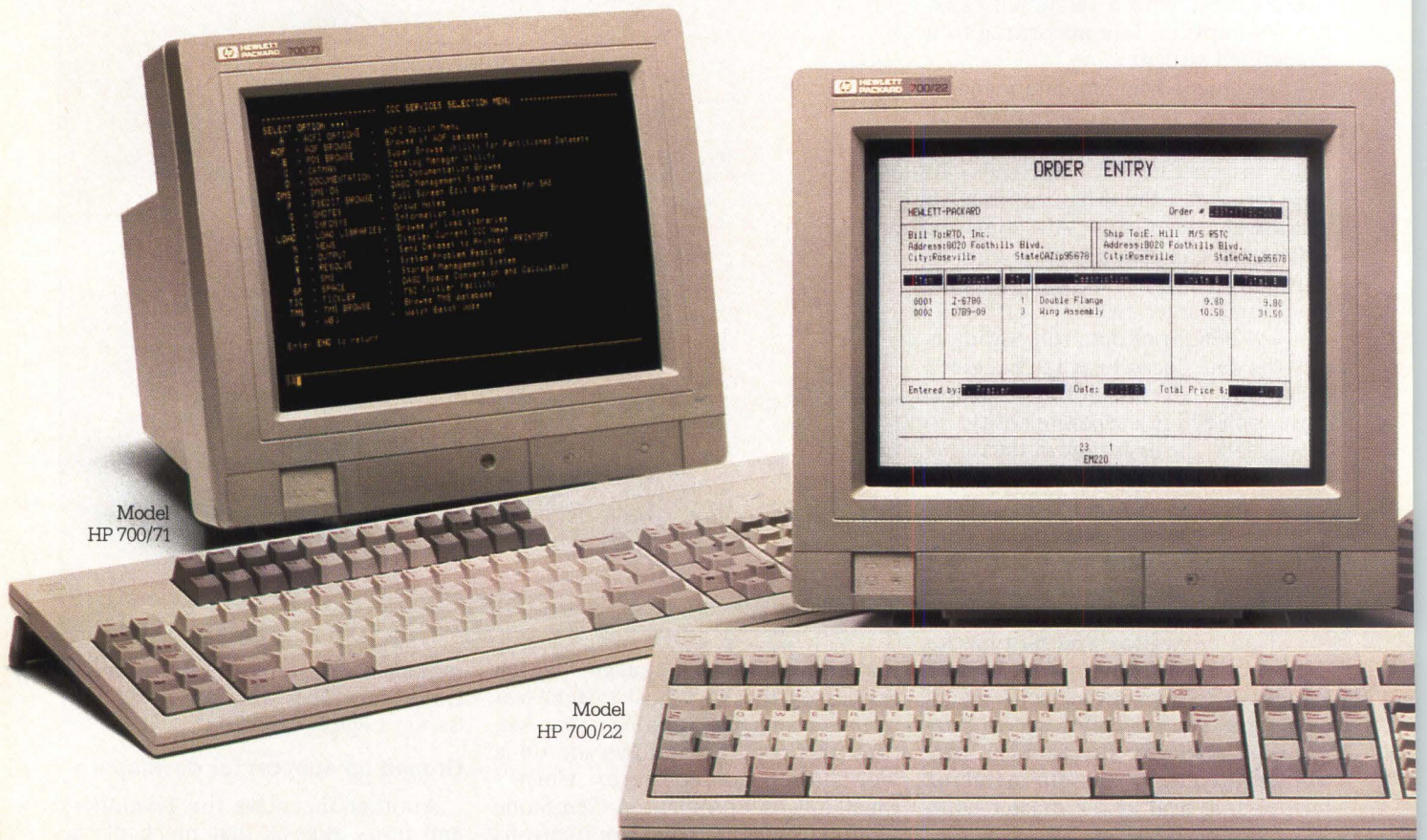
managed via standard communications interfaces and software, says Servio Logic's Connell.

**Ground up support for developers**

Another incentive for developers and users alike is that much of the software developed for GemStone—such as development tools for vendors and applications utilities for users—is expected to turn up in the public domain. Servio Logic already



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## DATABASE MANAGEMENT

has pulled together a GemStone user group to assist developers and users. Plans are to freely distribute public domain software to members of this group, and to offer support and service.

"We're not really selling into an object-oriented community," cautions Connell. "Initially, we will be much more concerned with education than promotion."

Selling an object-oriented data base—or any new type of data base for that matter—into what is considered a mature market may be Servio Logic's toughest challenge. Not only are developers and users unfamiliar with object-oriented environments at this point, but they also may hold off committing to one vendor before they hear the siren calls from other, more established, vendors. These include Microsoft and Lotus Development Corp., both of which are planning to enter the object-oriented world with a passion once IBM begins shipping the

OS/2 operating system equipped with Microsoft's Presentation Manager software toward the end of this year.

Lotus has already announced a new object-oriented version of its 1-2-3 spreadsheet program called 1-2-3G, which will debut soon after the Presentation Manager hits the streets.

### Inexperience a negative factor

Another factor working against Servio Logic is its background and relative inexperience in the computer software industry. The company presently has about 25 people on staff, most of them in research and development. It is also an offshoot of a Singapore-based company that has its roots in the agricultural business, not in the bits and bytes of the computer industry.

The one thing working in Servio Logic's favor is that it has a product. Others are still talking about what they might be doing sometime toward the beginning of next year. This situa-

tion is both a blessing and a curse. Being there first does establish a beachhead, but it also mandates commitment to a specific course to follow.

Fortunately, Servio Logic plans to adhere to established standards like DEC's DecNet and the federal government's Transaction Control Protocol/Interconnect Protocol (TCP/IP), and to continue developing the product as feedback flows in from its 13 or more beta test sites.

The company is flirting with expanding its information management system into other environments besides DEC's VAX VMS. For now, however, it is concerned with ironing out present problems and making a small splash in new applications waters.

"We're the first company started from scratch in this marketplace," says Connell. "We're not taking the world by storm, but we continue to grow strongly." □

## GRAPHICS SYSTEMS

# Graphics tool kit: a cart before a minisuper horse

Mike Seither, Senior Editor

As microcomputers give way to supermicros, and minicomputers step aside for superminis and minisupers, software is having a difficult time keeping up.

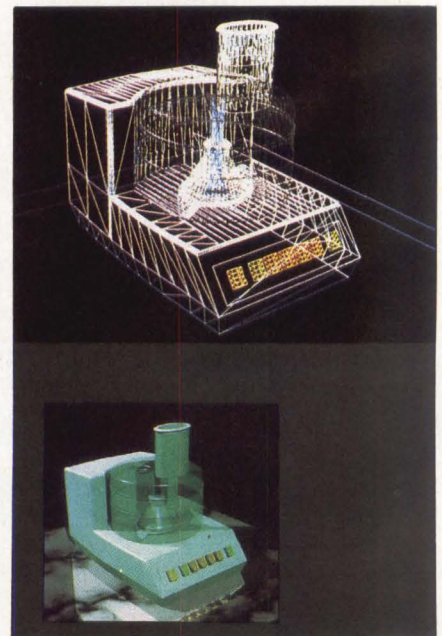
So, in an effort to tip the scales a bit in its favor, a young Sunnyvale, Calif., company has unveiled a software tool kit that will make it easier for developers to create standardized programs for its soon-to-debut minisupercomputer. The tool kit might also smooth the entry of a 3-D graphics minisupercomputer system the company plans for later this year.

Ardent Computer Corp.'s (formerly Dana Computer Inc.) "visualization tool kit" will allow software developers to call on a library of high-level commands to do the dirty

work of creating, rendering and highlighting complex objects like molecular models or moving fluids. This kit would be a boon to high-end 3-D graphics users like scientists and engineers.

The key to Ardent's tool kit is a graphics database called Doré, short for Dynamic Object-Rendering Environment. With it, developers will no longer have to write algorithms for such things as hidden surfaces or shading, says Bruce Borden, director of graphics software at Ardent. In-

**Ardent's graphics software tool kit** allows users to specify the attributes of an object's image, such as wire frame, flat or smooth surfaces. Here, identical data is used to present two different views of a food processor, without recoding the application. The first (A), is a 2-D wire-frame view, while the second, (B) is a 3-D image with shading and enhanced features. When run in real time on the upcoming Titan minisupercomputer, the blades in B will be able to be depicted as spinning.





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## GRAPHICS SYSTEMS

stead, they will be able to concentrate on what they do best—model, analyze and interpret scientific and engineering data.

Whether or not the kit will catch on, however, is still up in the air since success is riding on the as yet unannounced 3-D minisupercomputer, code-named "Titan." Titan reportedly uses a 64-bit proprietary processor capable of doing 16 million floating point operations (MFLOPS) a second. The system, about the size of a three-drawer file cabinet, also uses a number of reduced instruction set computer (RISC) chips running in parallel to do integer calculations. Initially, Ardent is expected to market a two-processor version for between \$75,000 and \$100,000. Company officials indicate a four-processor model is feasible.

Ardent has been working on Titan for more than two years since the company was founded in 1985 by ex-Convergent Technologies Inc. president Allen Michels. The chief architect is C. Gordon Bell, a 23-year engineering veteran of Digital Equipment Corp., who pioneered the idea of the minicomputer. However, Ardent isn't the only company interested in pushing single-user 3-D graphics systems. Arch-rival Stellar Computer Inc. of Newton, Mass., reportedly has a similar graphics-based

supercomputer under wraps that it also intends to debut sometime this year.

### Doing what they do best

In an effort to create steam for a new standard, the company intends to keep Doré "open" much like Sun Microsystems Inc. did with the Network File System (NFS) and AT&T Co. did with the UNIX operating system. In that way, Doré will be able to run on hardware platforms other than Ardent's. Ardent will license the Doré source code for \$250 to universities and research laboratories. Commercial users will have to pay \$15,000, plus additional support fees, to get the code and learn how it works. Binary copies will cost \$200.

Doré actually builds on existing graphics interface standards. It implements the ANSI standard for 2-D graphics—Computer Graphics Interface (CGI)—by providing 2-D primitives like arcs, bars, circles and filled areas. In addition, Doré features Ardent's enhanced port of Massachusetts Institute of Technology's X Window System. Ardent's version will support full color and allow moving images to be produced inside screen windows, without loss of performance, according to Borden.

On top of all this, Doré adds an expanded library of 3-D primitives,

### FACT FILE

3-D Graphics tool kit  
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#### Circle 488

\*\*Dynamic Object-Rendering Environment Doré, a library of graphics primitives for visualizing computer-intensive applications.

\*\*High-level database allows software developers to create complex geometric objects and control such things as shading, texture, transparency and source of light.

\*\*Target hardware platforms include supercomputers and high-end graphics workstations.

\*\*Source code licenses: \$250 for universities and research labs, \$15,000 for commercial users. Per-copy binary license, \$200.

such as cones, spheres and cubic solids and polygonal meshes. Users can add their own solids, as well as data, to this collection to illustrate the results of analysis.

Likewise, Doré's command set can change the appearance or geometric shape of an object once it's invoked on the screen. For example, a user can specify to make a cube transparent, solid or wire frame, then scale or rotate the image. A "virtual" studio allows objects to be viewed from different "camera" angles and with several sources of light. □

## COMPANY PROFILE

# DG walks on the VAR side to regain lost momentum

Megan Nields, Staff Editor

Let's say you're a "small" company—somewhere around a billion dollars—and you can't match the sales power of companies like IBM Corp. and Digital Equipment Corp. What is your competitive strategy?

If you happen to be Data General Corp., Westboro, Mass., you strengthen your flagging value-added reseller channel and have them sell your products for you. But first, you have

to convince them that your products can compete against the big guns of the industry.

VARs have always been a major force behind the strength of Data General. In fact, about 50 percent of Data General's business goes through its VAR channel.

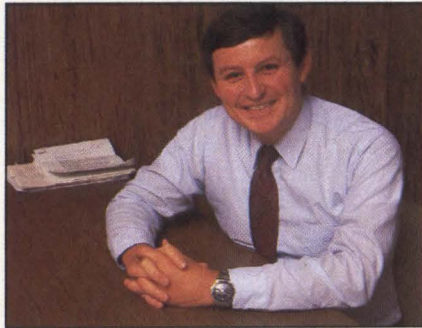
However, DG's relationship with its VARs has had its ups and downs. During the past several years, DG has lost some notable VARs, such as McDonnell Douglas Co., St. Louis, Mo.

The loyalty of other VARs has been strained by what they cite as sagging product development and complicated business procedures.

Despite such criticism, and recent financial setbacks, International Data Corp. in Framingham, Mass., ranks DG fairly high compared to other vendors in its relations with VARs. In fact, says IDC market watcher Stephen Bosley, the company should see some added revenue coming from its VAR channels. Even so, in Bosley's







**Ward MacKenzie**, vice president of Data General's VAR Marketing and Development Group, has a simple formula for success: keep everybody happy.

view, "It may take a while for DG to convince more resellers to carry their products."

Changing VAR perceptions about its products is a primary concern at DG, points out Ward MacKenzie, vice president of DG's VAR Marketing and Development Group. The down-but-not-out computer company has made a decision "to aggressively go after the maximum number of ways we can translate our computers into systems," he says.

One of the most important ways to do this is to beef up the VAR channel. "We have a long history in this business and a successful base of VARs around the world," says MacKenzie, who explains, "Our strategy is very simple: to help our VAR base succeed. That way we'll all be happy. For DG to be successful, our VARs have to be successful as well."

#### Assist and recruit

DG plans on helping VARs in two

ways. The first is to assist the existing base of VARs by giving them all the tools they need to be successful in their particular business. The second is to look at certain VARs who are not selling DG equipment and convince them that they should be.

Mackenzie sums up the new campaign as "a very aggressive set of programs designed to enhance our business relationship with existing VARs and aggressively recruit new ones."

As part of this courting campaign, DG has instituted a new dollar-volume discount schedule that cumulatively discounts everything a VAR buys from DG. MacKenzie says this somewhat counters the current trend of most companies, which are decreasing margins and discounts and putting pressure on VARs to make a profit from their own added-value.

Since VARs invest heavily in selling DG's products, they deserve this discount, says MacKenzie. "We want our VARs to have adequate profits so they can reinvest in their market. It is in our own best interest to help make them as prosperous as possible."

Another way the company is achieving VAR satisfaction is through the formation of four regional VAR councils. Meetings are held quarterly with groups of VARs who represent major territories in the United States. The VAR councils discuss present and prospective ideas and programs.

"We get a tremendous amount of feedback about what our VARs like about us and what we could be doing better," MacKenzie notes. VARs "tend to be really honest since they are running a business based on the

relationship with their vendor. And because it's a partnership, we in turn must listen to them."

#### Perk up the relationship

VAR perks besides the discounts include financial plans where DG pays for administration costs, and a program that allows VARs to lease systems to customers. DG finances the lease, and the VAR gets credit for the sale.

For those VARs who want to make the switch to DG, the company has set up conversion centers in Massachusetts and California that allow VARs to make the leap from the systems they now sell to DG machines. Both centers can also work on converting the VAR's current base of installed equipment and products to run in place with DG's products.

It becomes "a zero-risk decision for VARs to transfer to Data General machines," says MacKenzie. "Very seldom do we go through the whole conversion process without getting the end-business. And this way, the entire business relationship is sealed before anything is actually signed."

Other VAR programs in the works include a revamped licensing program and a new market-penetration strategy—all aimed at building more long-term VAR partnerships. "Year-to-year growth numbers don't mean much in this business," says MacKenzie. "We are looking at more long-term, strategic kinds of business. We want people to see Data General as the preferred VAR supplier."

Just what kind of VARs is DG looking for in its comeback quest? Basically, "a company that has a mission to

## Highlights of Data General's VAR comeback campaign

Data General Corp. has adopted a multilayered strategy in a campaign to woo value-added resellers:

- Instituted a single dollar-volume discount schedule that cumulatively affects everything a VAR buys from DG.
- Established four regional VAR councils to assist VARs and discuss ideas and programs.
- Picked up the tab for some administrative costs related to VAR programs.
- Established a program that allows VARs to lease systems to their customers.
- Set up "conversion centers" that let non-DG VARs switch to DG machines and bridge systems to their customers.
- Launched a revamped VAR-licensing program and market-penetration strategy.



# TEK COLOR PRINTERS

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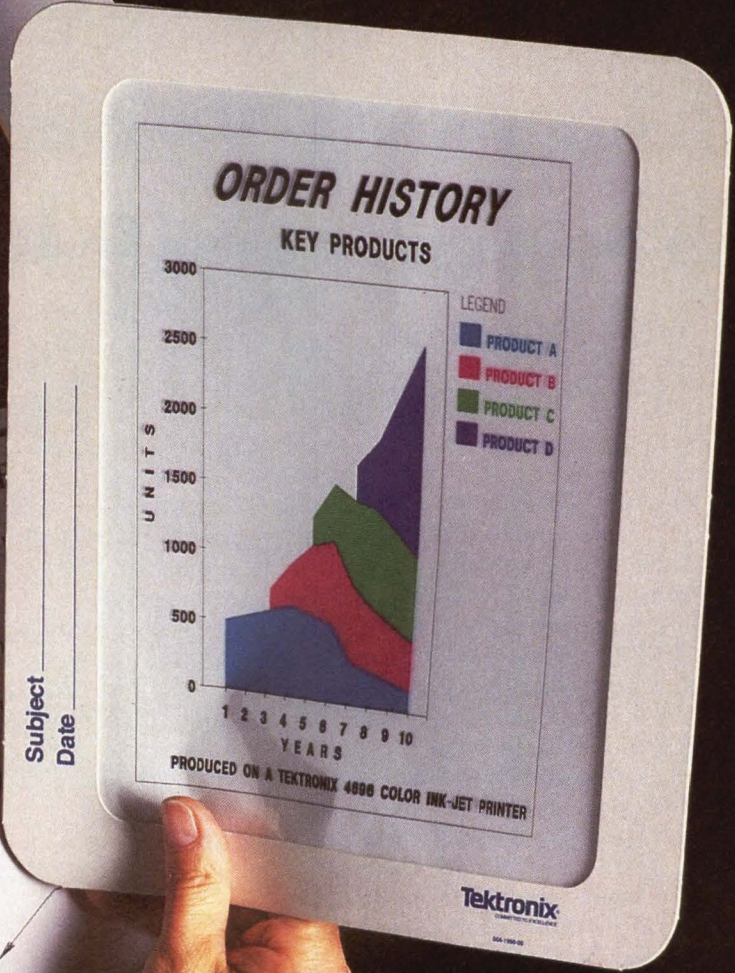
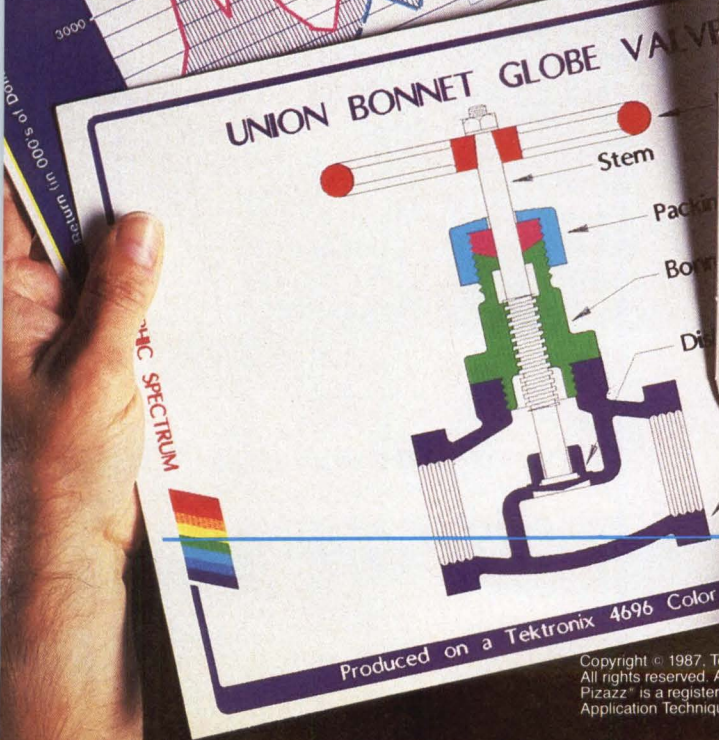
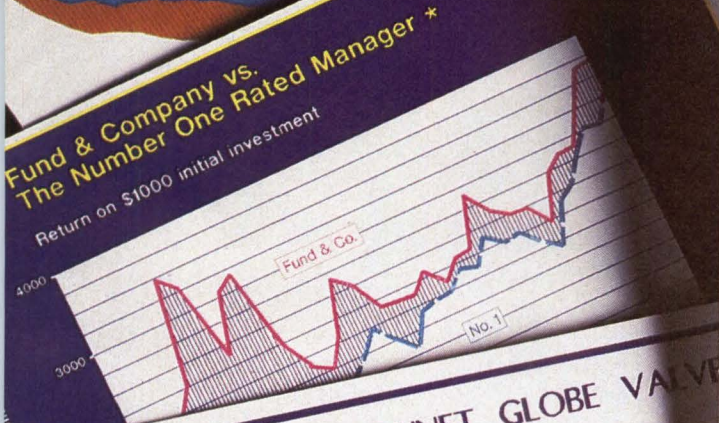
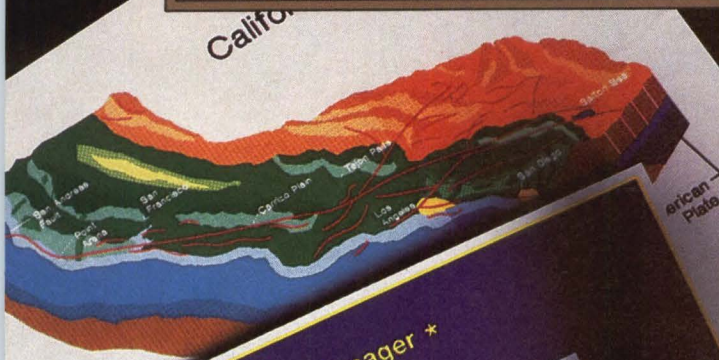
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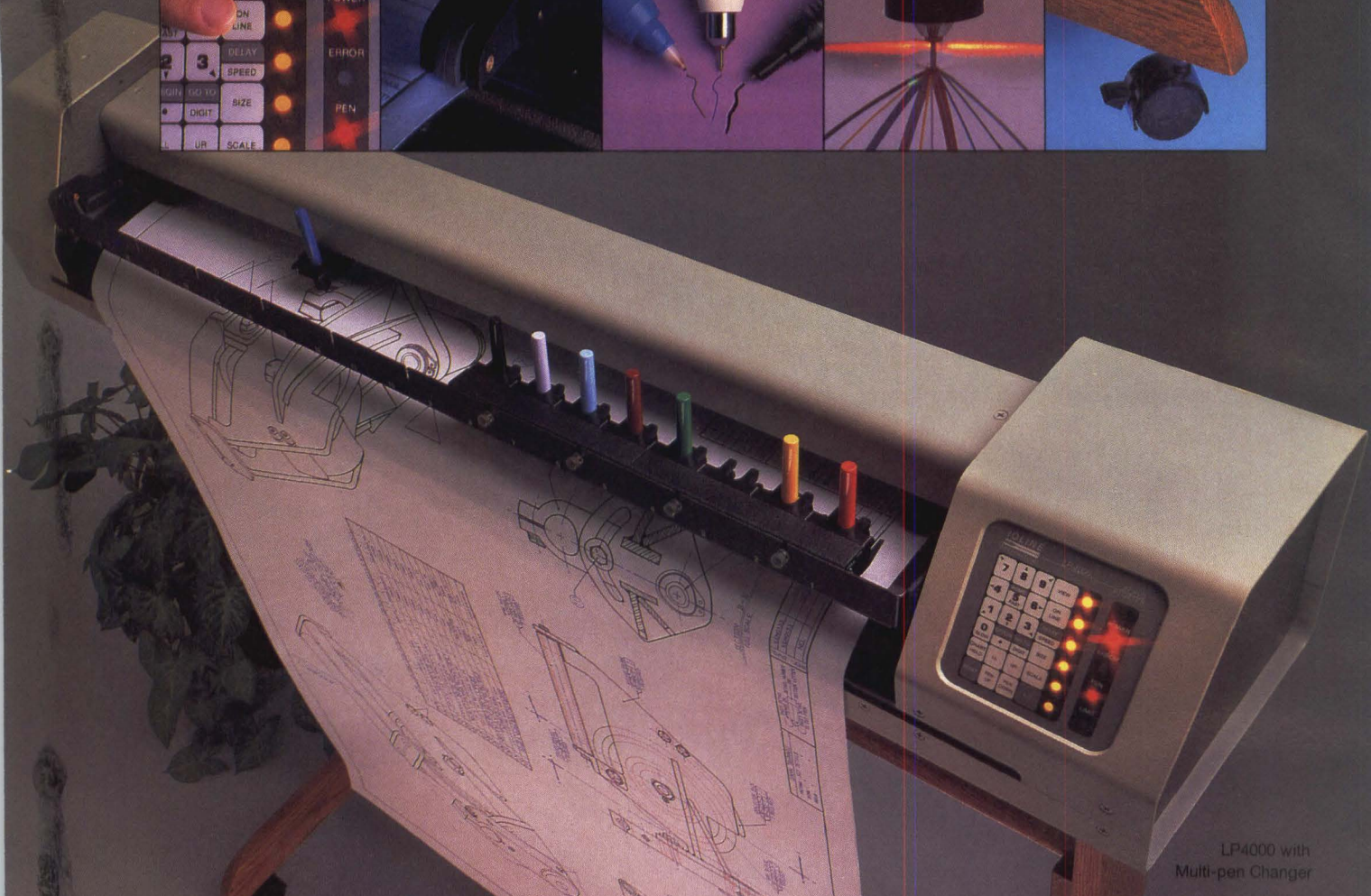
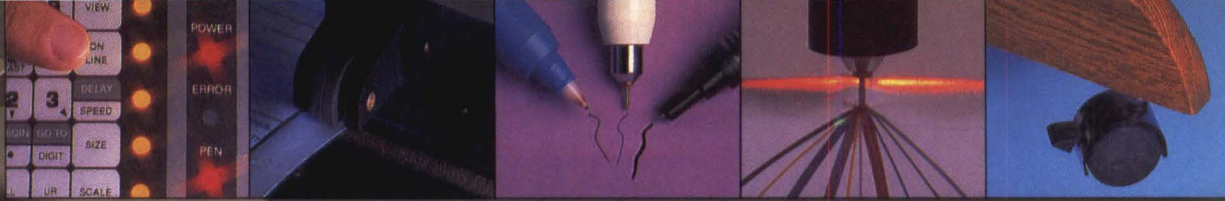


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CIRCLE NO. 16 ON INQUIRY CARD





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CIRCLE NO. 17 ON INQUIRY CARD





COMPANY PROFILE

solve specific problems for customers and the technical skills and marketing expertise to establish a strong position in their specific area of business," states MacKenzie. "VARs aren't just resellers of computers, they are solutions providers. Keeping that in mind, as well as the idea of a true business partnership, is the key."

And what do the VARs themselves think about DG? On the whole there is renewed enthusiasm about present and future relationships.

President Tyce McIntosh of Com-

pusystems, Fort Wayne, Ind. (who is also chairman of one of the DG VAR councils), says, "The biggest change we've seen in the past year is creativity. The programs are a lot more in tune with our needs." Compusystems sees a lot of two-way communication.

McIntosh cites the new leasing program as a very attractive draw to DG. "The company is much more alert to marketing and support than they have been in the past. They're not just product oriented."

Others share McIntosh's opinion.

Jean Rauch, manager of local system support at Online Computer Library Center Inc., Dublin, Ohio, says, "In the past, we did not have a very good relationship with Data General. There wasn't a real spirit of cooperation."

But, the situation began to change last September. DG rehired its former Online account manager and later assigned a second account manager to the VAR. DG also improved its maintenance and billing systems, Rauch notes. □

GRAPHICS SOFTWARE

# X Window standard wins support, not products

Tim Scannell, Senior Editor

Is the world ready for yet another standard that promises to easily and efficiently tie together like and unlike computers into a well-oiled network?

Both Digital Equipment Corp. and the Massachusetts Institute of Technology think so. They have released the latest version of a graphics operating environment, along with a tool kit that lets software developers construct high-level graphics applications, without concern for the hardware or networks on which they'll run.

The system, called X Window System Version 11, has won the backing of some of the leading computer manufacturers in the industry, including IBM Corp. and Hewlett-Packard Co.

Hold the applause, however, because X Window is not yet out of the woods. As with many would-be standards, it receives verbal support from a variety of heavyweight vendors, but it doesn't generate real-life products.

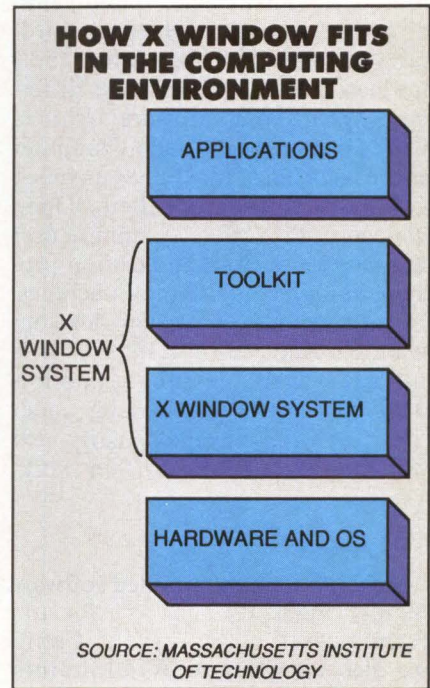
For example, Sun Microsystems Inc. officially supports X Window. Furthermore, Sun is working with DEC, MIT and others to develop a 3-D extension that will be compatible with such current graphics standards as PHIGS and PHIGS Plus. Sun also

was the only vendor to demonstrate X Window Version 11 at the July SIGGRAPH show in Anaheim, Calif. However, Sun still promotes its network extensive windowing systems (NeWS) environment over the DEC-MIT product. NeWS has been available to software developers since May 1987 and has about 39 licensees, says marketing director Jim Davis.

"There are extensive technical discussions as to why either environment is better," says Davis, "but, as to which one is used, we really don't care. We support both."

Also, while the ANSI's Technical Committee on Computer Graphics Standards (X3H3) has agreed to consider X Window as a proposed standard, critics like ex-Apple Computer Inc. chairman Steven Jobs—who has referred to X Window as "brain dead"—insist there may be better alternatives around the corner. The critics caution not to jump too hastily to a graphics conclusion.

MIT professor Steven Lerman, director of the \$50 million Project Athena that gave birth to X Window, counters, "We have fought a lot of religious battles to get X Window



**The X Window System layer** connects applications to hardware, providing windowing, graphics and text capabilities, either locally or across a network. The tool kit layer can be used by software developers to create common user interfaces.



## GRAPHICS SOFTWARE

going. No one will ever call anything perfect. That's the nature of computer science."

The X Window System has had a fairly meteoric rise into the applications spotlight, but it stems from many years of research at MIT into so-called "work group" computing. Project Athena (MMS, March 87 Page 49) is a five-year program launched near the end of 1983 to look into the use of powerful workstations in an educational environment.

Initially, only a handful of companies and three or four people worked full time to develop Version 10 of the product, a prototype unveiled in January, says Lerman. In contrast, this latest version has been worked on by at least 80 programmers and software engineers, nearly half of whom are DEC employees. Athena has also evolved into a fairly massive programming effort, consisting of some 19 million bytes of source code and some 9M bytes of documentation.

The benefit of a system like X Window centers on a single, "plain vanilla" environment through which third-party developers can filter their products, and users can access different programs and hardware architectures. For instance, Apollo Computer Inc., Chelmsford, Mass., has unveiled X Window software, called "Open Dialogue," that offers a common user interface for various application programs running on different machines. Priced at about \$2,500 per development kit and run-time library, it is initially available for Apollo's DN3000 workstation running under UNIX. It will be available early next year for DEC, IBM and Sun workstations

### X on the spot

Makers of computer-aided software engineering tools, such as Atherton Technology Inc., Sunnyvale, Calif., are also adopting X Window into their design fold, because it offers a common operating environment for various hardware and software systems. From all indications, X Window will also be easily migrated to the Open Systems Interconnection (OSI) architecture when that becomes available, observes Atherton's president and chief executive officer, Dr. Banin.

In X Window's corner is the fact it is virtually in the public domain, meaning developers can have access to the system and source code for about the price of the magnetic tape that contains it. X Window also reportedly increases the amount of computing power available to users at a small increase in price—at least on large-scale minicomputers. For example, a DEC VAX minicomputer operating at 1 million instructions per second (MIPS) with seven users costs about \$17,000 per user. But, a VAX with 20 MIPS and seven users operating under X Window, averages about \$21,000 per seat, according to DEC worksystems marketing manager Chris Reed.

### Tools are now the need

Despite the cost-justification figures, however, X Window has not managed to dramatically sweep the industry. And one of the reasons for this is that, thus far, there has been nothing generically available for third-party software developers to work with to develop X Window-type products. There were pieces, but no tools to pull them together.

Some companies, Hewlett-Packard for one, took the initiative and developed their own tool kits for developers of software for specific computers. Other companies, like Microsoft Corp., have demonstrated X Window-based interfaces on microcomputers and are considering them as interface alternatives.

As a result, X Window has mostly resided in the development labs of MIT rather than in the R&D think tanks of major corporations. DEC is the exception since it has been working with MIT on X Window from the beginning. DEC recently announced that all of its future systems and software would sport X Window compatibility.

Now that X Window is out on the streets, the toughest battles are yet to be fought in terms of competition and acceptance. For instance, IBM supports X Window Version 10 on its RT PC system and plans to provide a tool kit for X Window Version 11 sometime early this year. But, the tool kit is being developed with the help of Carnegie-Mellon University, not

MIT. So, it is not yet clear if there are any differences between it and the DEC-MIT version. Also, while MIT's X Window is functionally similar to Microsoft's Windows graphics environment, it is not presently compatible with the Presentation Manager portion of Microsoft's Operating System/2. That's something MIT will have to correct since OS/2 is being groomed to be the future platform for high-performance personal computers and personal-computer-based workstations.

MIT, meanwhile, is pushing X Window with a passion. More upgrades are slated in three to six months, targeting toward such environments as the IBM PS/2, Apple Computer's Macintosh and the Ada programming language. "There are a lot of applications, and a lot more will come," enthuses Lerman.

### A system in search of ideas

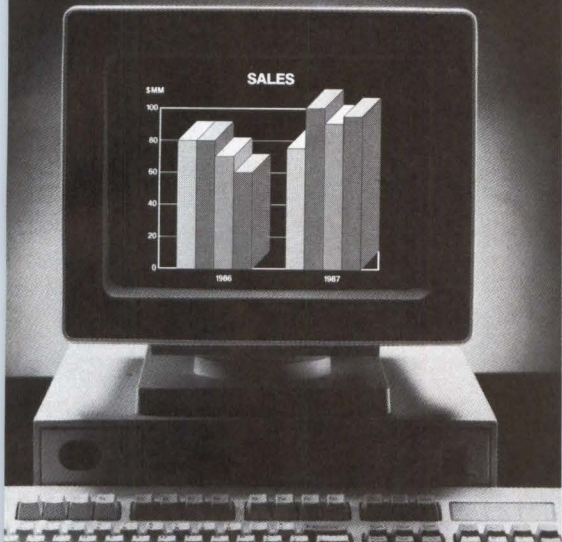
Recently, the university announced plans for an industry-sponsored consortium to solicit ideas and promote the implementation of further versions of X Window. Headed by Robert Scheifler, director of MIT's Laboratory of Computer Science, the consortium will appoint specific companies and individuals to continue development of the graphics interface and ensure that the project stays on course. "We see ourselves as leaders, trying to develop things before they are standards," states Lerman.

At the moment, DEC and MIT are thumping the hardest for X Window. DEC encourages all of its third-party developers to explore X Window as a user interface within their products and has enveloped X Window into the corporate-wide vision of distributed computing. Says workstation software program manager Richard Treadway, "Now, we can build systems that interface with people a lot closer to the way they work."

MIT, this year, has also moved from time-sharing computers at its Cambridge, Mass., campus to completely networked and X Windowed workstations. The network consists of 500 workstations linked through 60 file servers and used by about 5,000 students and faculty. □



# FROM CREATION



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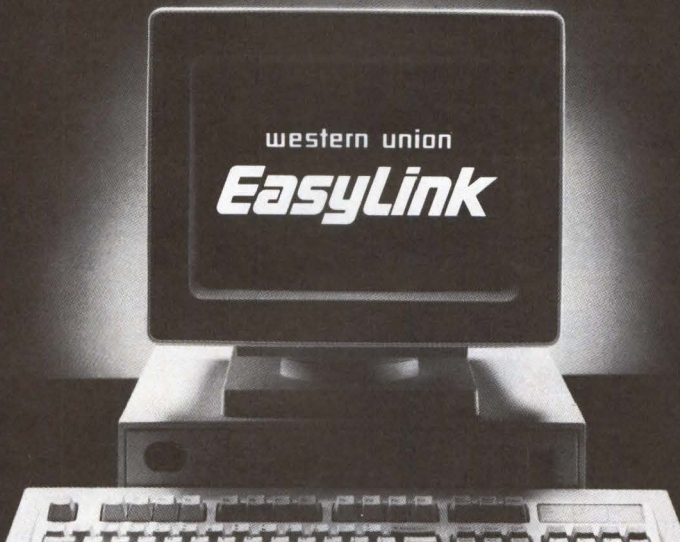
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# SETTING THE TABLE FOR COLOR

User demand for, and  
technology developments  
in, color hard copy create  
new opportunities  
for VARs, OEMs and  
system integrators

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**A new generation of printers  
based on thermal ink-jet  
technology will offer letter quality  
text along with color graphics  
capabilities.**

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**Greg Porell**, CAP International Inc.

A number of forces are shaping the color hard copy (CHC) marketplace—among them, improved product reliability, falling prices, quantum leaps in output quality and the increasing availability of software drivers. These forces, according to CAP International Inc.'s Color Hard Copy Market Requirements Service, Marshfield, Mass., will push CHC placements to 2.1 billion products by 1991 and will generate \$4.7 billion dollars. For system integrators, value-added resellers (VARs) and OEMs, such numbers mean not only substantial challenges but also lucrative opportunities.

First and foremost in the minds of system builders, for whom price/performance is the operative phrase, should be the progress made in product technology. The old barriers that stymied acceptance of color devices are falling. In the past, CHC products suffered from reliability problems, low resolution (180 dots per inch and below), slow print speeds (over 4 minutes per 8.5-by-11-inch image) and few interface options. However, today's reliable products offer impressive specifications: high-resolution print (300 to 400 dpi), faster output (less than 50 seconds for an 8.5-by-11-inch image) and a number of serial, parallel or video interface options.

Adding more fuel to the color market is the development of software drivers for the peripherals. Tremendous growth in software application packages that support full-color output allows system integrators, VARs and end users to employ CHC products in ways that were not possible in the past. Presentation graphics and personal computer CAD software drivers have been active development areas, and progress is being made in desktop publishing applications. In fact, Adobe Systems Inc. has introduced a full-color version of PostScript (see "Color

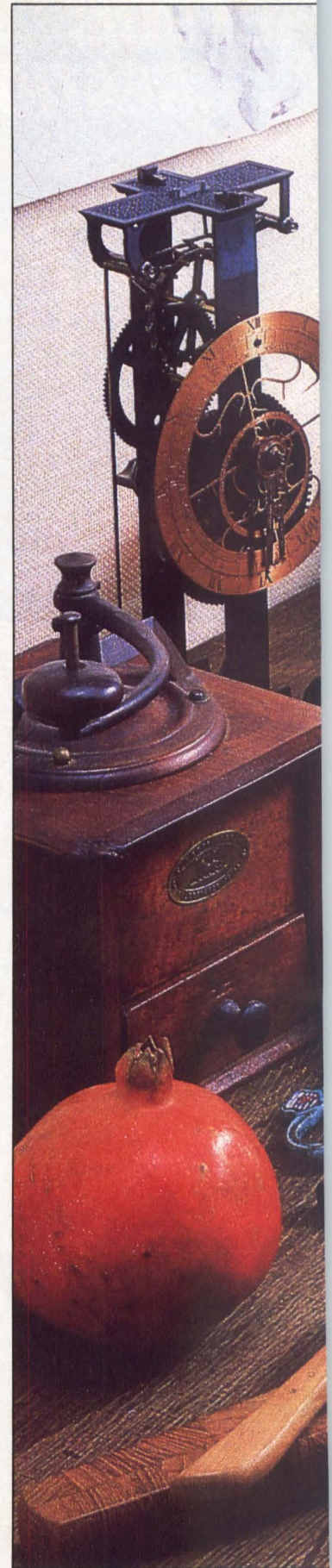


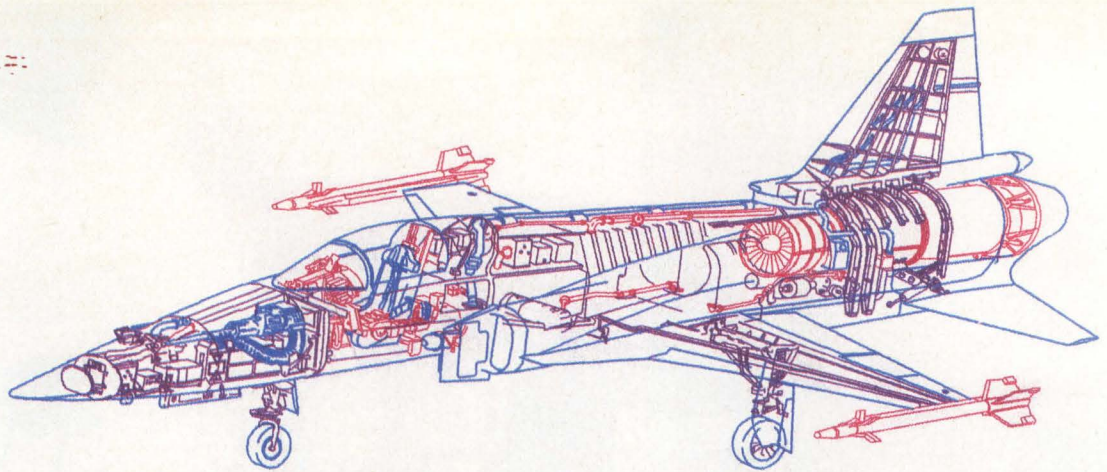




Image printed by Iris 3024 ink-jet printer from Iris Graphics.



**JDL's dot-matrix printers** can serve as small-format (17 by 22 inches) CAD/CAM output devices. (Sample output, right.)



comes to desktop publishing”).

In addition, CHC products are hitting the market running with a wide selection of software drivers available at introduction. For example, when Hewlett-Packard Co. recently announced its PaintJet thermal ink-jet printer, more than 50 software drivers were available. Furthermore, Xerox Corp. claims its 4020 ink-jet printer has over 150 software drivers available for end users. This is a significant step toward easing the use of CHC devices for end users and increasing the applications of color technologies.

Perhaps most important for steady growth has been the falling prices for color hard copy devices. CalComp recently reduced the pricing of its 5800 Color Electrostatic Plotter Series by approximately 38 percent. The company now offers 400-dpi, full-color electrostatic plotters ranging in price from \$49,000 to \$69,000, down from a top-end price of more than \$100,000. And this downward slide in prices appears in both impact devices (dot-matrix

printers and pen plotters) and non-impact machines (ink-jet and thermal-transfer, electrostatic, electrophotographic and photographic units). Moreover, these attractive prices have come while performance marches ahead.

**Dot-matrix, a versatile vet**

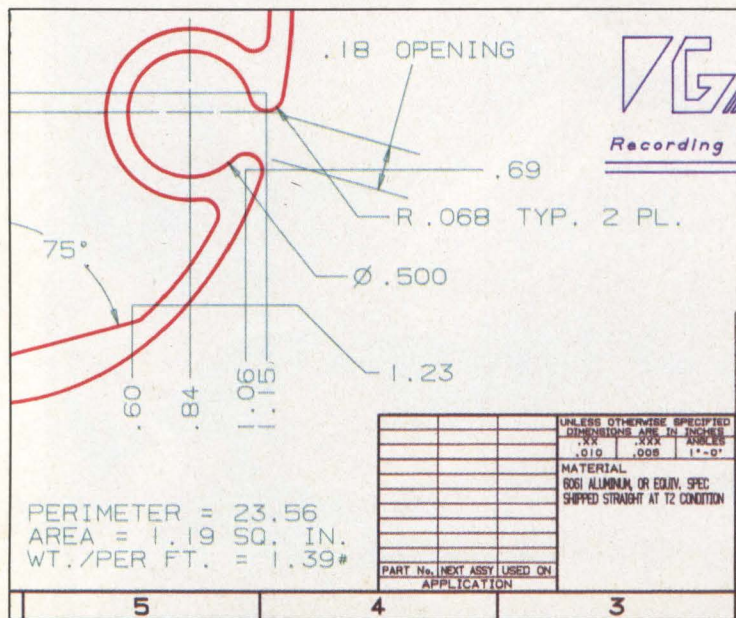
More than 40 percent of CHC product introductions in the past have been based on dot-matrix technology. These products offer color as a standard feature or as an inexpensive option because new applications demand full-color capability. Their greatest appeal is versatility in text-quality selection, printing speeds and full-color graphics on plain paper.

Matrix technology, despite rumors to the contrary, continues to evolve. Advances in paper handling and improved printhead designs make higher resolutions at faster speeds possible. For example, the increasing use of 24-wire printheads and precisely controlled servos allow users to mix text and graphics on a page at relatively high resolutions (up to 360 dpi).

NEC Information Systems Inc. offers the P5XL, and more recently, the P9XL, which have 24-wire printheads, 360-by-360-dpi print resolution and bidirectional printing capabilities. In addition, Alps Electric (USA) Inc. has introduced the P2400C and ALQ series, which were the first product lines to offer interchangeable printheads with either 18- or 24-wire configurations. Okidata introduced its Microline 290 series, which offers print speeds up to 400 cps, 288-by-72-dpi resolution, nine- and dual-nine-wire printhead configurations.

Japan Digital Laboratories (JDL) and Juki Office Machine Corp. have both introduced dot-matrix printers that can serve as small-format (17 by 22 inches) CAD/CAM output devices. These units offer HP Graphics Language compatibility, and JDL offers a vector-to-raster graphics converter for high-volume plotting. JDL is also offering roll-paper feed for large-format engineering/scientific plots, thereby bridging the gap between printers and pen plotters.

**Pen plotters** such as Western Graphtec's MP3000 series have captured the largest share of placements in the total market. (Sample output, below.)





Pen plotters, (such as Western Graphtec Inc.'s MP3000 A- and B-size plotters) traditionally strong color hard-copy participants, have captured the largest share of placements in the total market and are expected to be one of the leaders through the rest of the decade. This steady growth can be attributed to new personal computer CAD applications and product price/performance improvements.

The \$4,895 CalComp 1023 offers cut-sheet media selection and the company's Batchplot software utility driver, which can plot as many as 60 AutoDesk Inc. AutoCAD plots in a single batch run.

Houston Instrument recently introduced the DMP-60 series, with a number of optional features. Geared toward the personal computer CAD market, the DMP-60s plots sizes from 8.5 by 11 inches to 36 by 48 inches. Two models are available in the series, the DMP-61 and DMP-62. The DMP-61 offers plotting speeds of 32 inches per second (ips) and is priced at \$4,695, while the \$6,495 DMP-62 allows users to select one of 23 media sizes and plots at 24 ips. Both units have on-board Motorola Inc. 68000 microprocessor-based intelligence that features such capabilities as multiple fonts, filled fonts, closed-area fill capability with 15 fill patterns, 10 character sets and a new smooth-curve generating algorithm.

Houston Instrument's wide-format SCAN-CAD Accessory is also available for the DMP-60 series and allows the plotter to function as an input scanning device for the input of

data to a host system. This scanner is priced at \$2,995. Also available is a 1M-byte buffer board option with a replot feature that plots multiple originals without reloading the plot file from the computer.

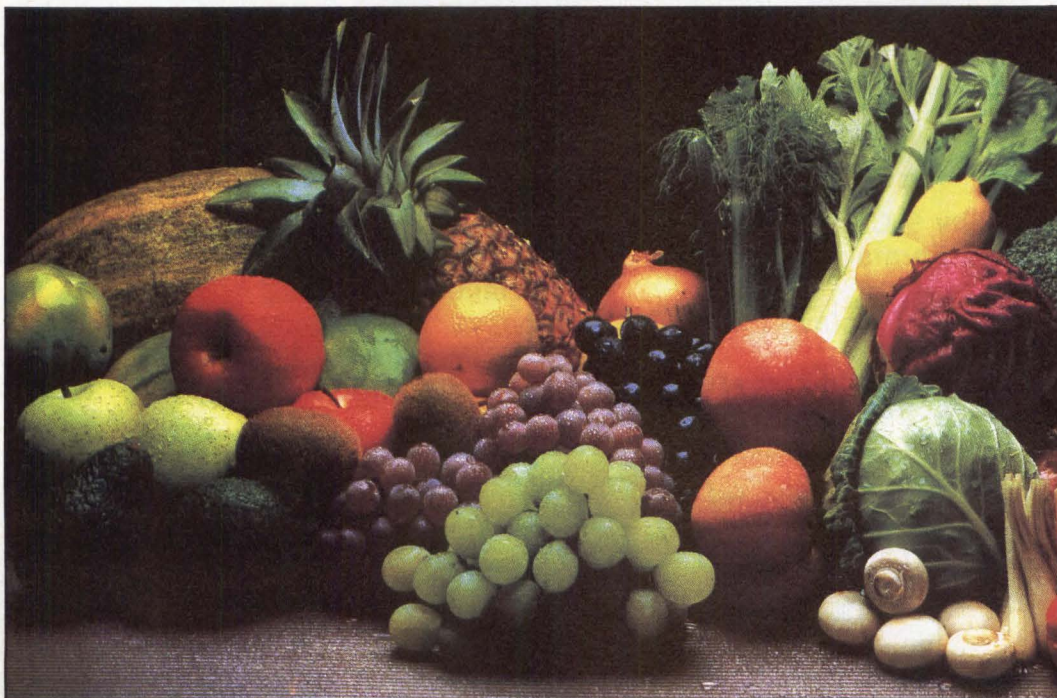
Benson Inc. sells what it refers to as the Smart Buffer Plot buffering system with its recently introduced, large-format 16 series. Offering cut-sheet and roll media selection, the buffer option, by enhancing data throughput, provides faster plotting speeds.

Similar performance gains have also taken place in small-format plotters, with introductions such as the ImageGraph from Fujitsu Components. The \$1,200 unit produces 8.5-by-11-inch and 11-by-17-inch plots, offers HP Graphics Language compatibility and a standard 6K-byte buffer.

#### Electrophotographic future shines

All the CHC activity in electrophotographic technology has been concentrated in color copier configurations and in prepress proofing applications. Xerox recently introduced the 1005 full-color copier and Canon U.S.A. Inc., the Color Laser Copier system. These products are beginning to offer features found on traditional monochrome copiers such as reduction/enlargement, cut-sheet paper tray feeders and sorters and slide adapters to make copies from 35-mm slides.

These devices have print speeds of up to 6 pages per minute (ppm) and resolutions of 400 dpi. The developments in color copiers are



**Canon's electrophotographic Color Laser Copier system produces up to 5 pages per minute at resolutions of 400 dpi. (Sample output, left.)**



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expected to fuel the continued growth of CHC applications by allowing users to produce multiple copies of original documents presentations and reports.

One interesting area of color hard copy has been the grafting of color electrophotography to page-printer configurations. Currently, Colorocs Corp. is working on the development of a page printer configuration. This device is expected to hit the market in late 1988 and will produce up to 6 ppm in full-color at 300 dpi and over 20 pages per minute in monochrome. This device will function as a dual-purpose device and is expected to be priced at approximately \$20,000.

With these developments, electrophotography is expected to be a major player in the CHC marketplace.

#### Electrostatic gets passing grades

Since the introduction of the ECP-42 from Versatec Inc. in late 1982, four other manufacturers including Benson, CalComp, Precision Image and Synergy Computer Graphics Corp. have entered the color electrostatic marketplace with a number of different approaches to the electrostatic plotting process.

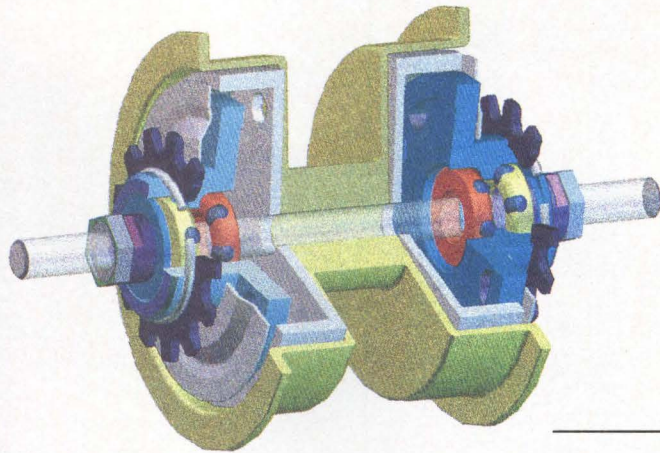
Most of the vendors offer 400-dpi plot reso-



**Versatec plotters** provide different interfaces and emulation modes. (Sample output, above.)

lution in sizes from 8.5 by 11 inches to 34 by 46 inches with a number of different interface and emulation modes. Data throughput and plotting speeds have also benefited from a number of developments.

These vendors use single-pass, four-pass, five-pass and drum-based plotting techniques. However, the single-pass technology incorporated into products from Synergy and Benson makes it possible for four charging stations and



**Hewlett-Packard's thermal ink-jet** PaintJet engine heats the ink, creating a bubble that forces ink through a nozzle. (Sample output, above.)

four toning stations aligned in a row to apply all four toners in a single pass. No paper rewinding and refeeding is necessary as is the case in CalComp and Versatec multiple-pass plotting approaches. Also, Precision Image has developed a product that offers cut-sheet media and a helical scanning approach on a drum-based plotting area.

#### Ink jet wins friends

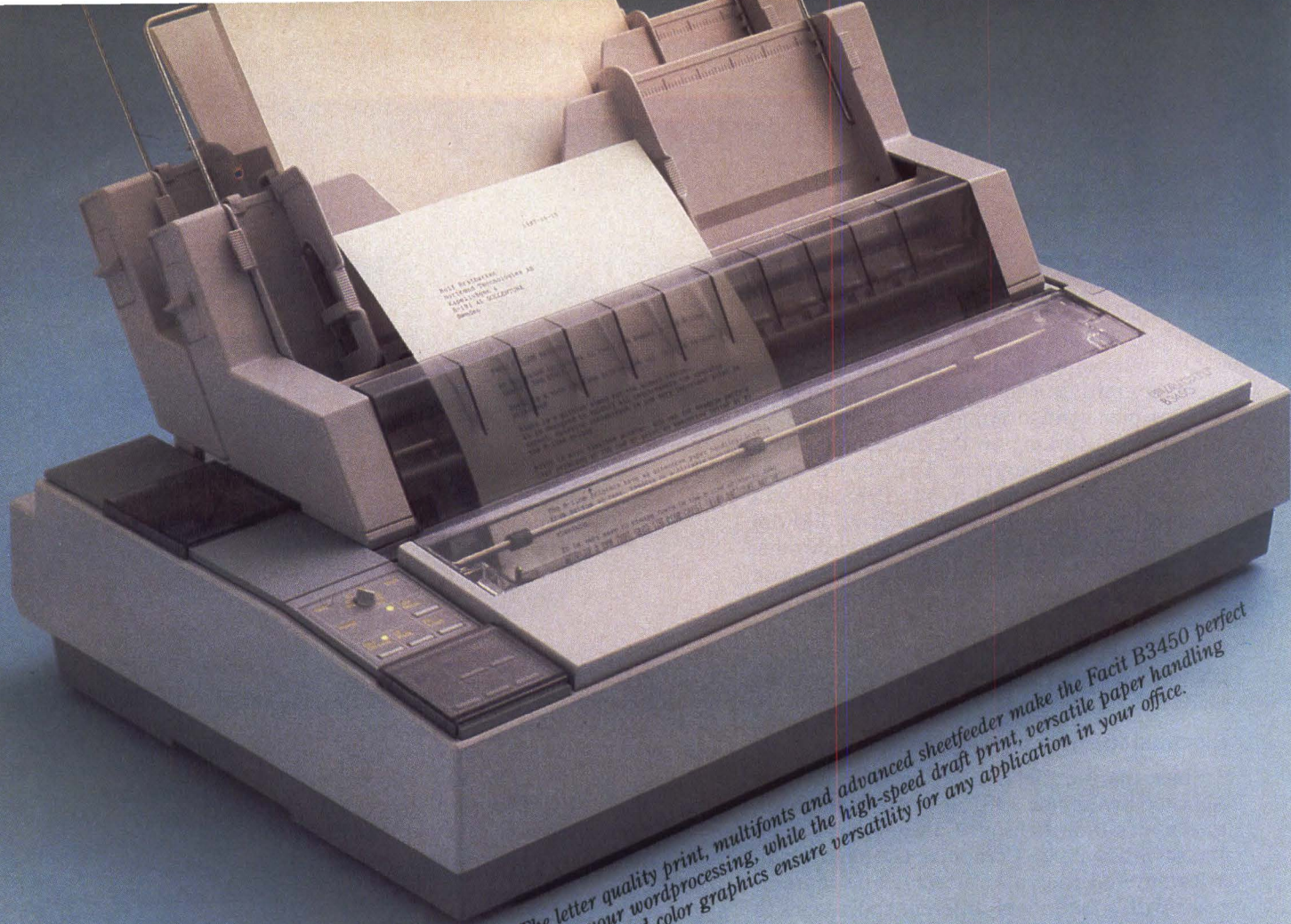
A number of product developments in the ink-jet area are expected to offer significant growth potential. A new generation of printers based on thermal ink-jet technology will offer letter quality text along with color graphics capabilities. These developments will allow ink-jet technology to capture some of the traditional office-environment applications.

Recent introductions such as HP's PaintJet offer the thermal ink-jet approach—the ink is heated, creating a bubble that forces ink through a nozzle. According to HP, this technique addresses the clogging problems formerly associated with ink-jet technology, and the improved ink projection allows faster print speeds. The PaintJet uses disposable printheads and costs \$1,395.

A similar process, but with a different ink chemistry, is used in Howtek Inc.'s PixelMaster. The PixelMaster uses solid-ink rods that are melted and projected on paper from a 32-nozzle, circular printhead. Melting solid ink and the ink's chemical properties allow the PixelMaster to print on a number of different media, including plain paper.

Ink-jet technology has also found applications in large-format areas. Iris Graphics Inc.'s 3024 offers a selection of eight different dot sizes and produces an image that is close to a continuous tone when looked at with the naked





*The letter quality print, multifonts and advanced sheetfeeder make the Facit B3450 perfect for your wordprocessing, while the high-speed draft print, versatile paper handling and color graphics ensure versatility for any application in your office.*

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draft printer. And add a 4-color ribbon to make it a fully-fledged color printer. Furthermore, you can use almost any type of paper since the B3450 features four paper paths to serve different applications.

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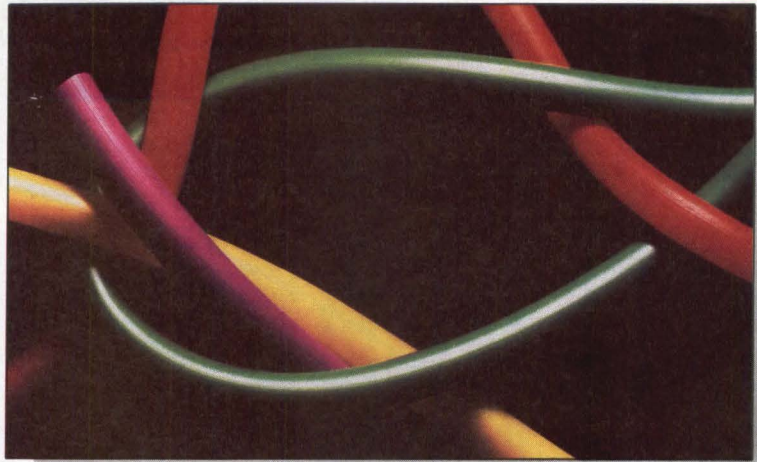
eye. This product is being used in prepress graphic arts applications, but can also be used as an engineering/scientific printing device for integrated circuit design applications.

#### Photographic improves its image

The photographic technology area has experienced and benefited from a number of the market developments driving the other technologies. But, the trend in the market is toward full systems offerings with vendors such as General Parametrics Corp. and most recently, Matrix Instruments Inc., offering input, image processing and output peripherals combined with creation software packages. These systems integrate text and graphics and supply output devices such as 35-mm slide makers, thermal transfer devices and ink-jet printers.

Image resolutions in the photographic area have been climbing toward 2,000 by 2,000 lines. Such products as the ImageMaker from Presentation Technologies produce text slides from a process similar to phototype setting. The unit comes with a selection of font wheels and uses a light beam to trace the characters, imaging them on film.

Another promising technology advance is the use of photographic technology in the color copier area. Konica Business Systems' Color 7 and Ilford's recently introduced CC120 furnish



Sony Corp. of America introduced units that use video capture systems. The print quality of dye-diffusion transfer printers resembles an almost continuous tone image. Dainippon Printing Co. Ltd. has displayed a diffusion system for prepress proofing applications where high quality is required.

#### Why now for CHC?

Although some industry analysts stress intangible causes, such as aesthetics or the power of color communication, CHC market activity can be traced to more concrete origins. First, more full-color monitors are being used with personal computers and workstations. In 1986, the number of monitor vendors' color shipments almost equalled those for monochrome units. In fact, industry participants feel that 1987 was the year when the shipments of color monitors passed monochrome unit shipments.

A second key impetus is the color copier. Products such as the Xerox 1005 and Canon Color Laser Copier based on electrophotography, lower cost thermal-transfer color copiers from such companies as Sharp Electronics Corp. and Panasonic Industrial Co. and photographic-based color copiers from Konica and Ilford will generate multiple copies of the color originals created by the installed base of over 1 million color hard-copy devices. Color copiers will be able to produce these documents with greater ease and therefore exploit the communicative powers of color.

Third, the image processing capabilities of host systems, including personal computer systems in the IBM Corp. PS/2 and Apple Computer Inc. Macintosh II class and entry-level workstations perform image manipulation and processing operations that were prohibitively expensive in the past. And image-capture systems allow the input of additional graphics or text to be merged with existing data.

With market drivers falling into place and product technologies enabling CHC products

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**Ilford's photographic copier, the CC120, furnishes high-quality copy capability at under \$17,000. (Sample output, above.)**

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### The old barriers that stymied acceptance of color devices are falling.

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high-quality copy capability at under \$20,000 (both are \$16,995). These are the first copier configurations utilizing photographic technology at this low cost.

#### Thermal transfer heats up

A number of approaches are being taken in the area of thermal transfer. Traditionally it has been based on a wax donor ribbon. Now, heat-resistive ribbon, sublimation and dye diffusion are emerging.

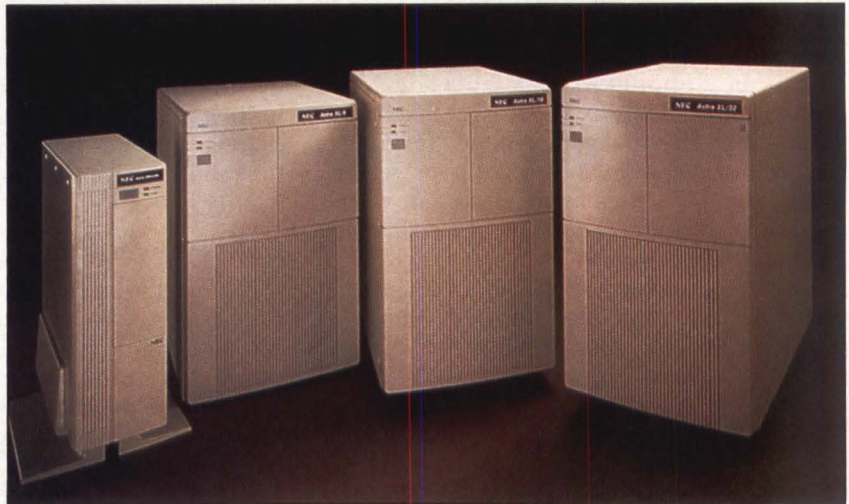
Products from Calcomp, Versatec, Mitsubishi Electronics America Inc., Seiko Instruments U.S.A. Inc. and Shinko Electric Co. Ltd. are making inroads in personal computer CAD, desktop publishing and presentation graphics. These products offer 8.5-by-11-inch and 11-by-17-inch output, 300-dpi resolution and print speeds of under 1 minute per page.

Technology developments in the sublimation and dye-diffusion transfer printing methods were also demonstrated during 1987. And Hitachi America Ltd., Eastman Kodak Co. and



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**Hitachi's dye-diffusion thermal-transfer printers create output that resembles an almost continuous tone image. (Sample output, above.)**

to meet the demands of end users, color hard copy appears to be well on its way to being a major player in the overall printing and plotting marketplace. CAP International's most recent end user research indicates a 71 percent

increase in purchase intentions for CHC devices. More than 48 percent of the survey respondents indicated that they "definitely" or "probably" would purchase a color printer or plotter in the next year. This is twice the percentage indicated a year ago in similar end-user research. This purchase likelihood increases to over 75 percent in the next two years, according to CAP research. This interest is not all from first-time purchasers, either. Survey results indicate that 80 percent of the end users intend to purchase an additional color output device.

For system integrators, VARs and OEMs building color into the desktop publishing, office automation, business graphics and image processing systems users will be buying, the market is green. □

Interest Quotient (Circle One)  
High 532 Medium 533 Low 534

**Greg Porell**, associate director at CAP International Inc., is responsible for research and client support of the Color Hard Copy Market Requirements Service. Prior to joining CAP, he was managing editor of *Electronic Imaging* magazine.

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# COLOR BRIGHTENS DESKTOP PUBLISHING

What's expensive and slow, but saves money and time? For some applications, the answer might be PostScript-based color desktop publishing.

David Simpson, Senior Editor

Within two months, you'll be able to buy a color desktop publishing system, complete with Adobe Systems Inc.'s PostScript page description language and a 300-dot-per-inch (dpi), color thermal-transfer printer. If that seems too good to be true, that's because, in part, it is.

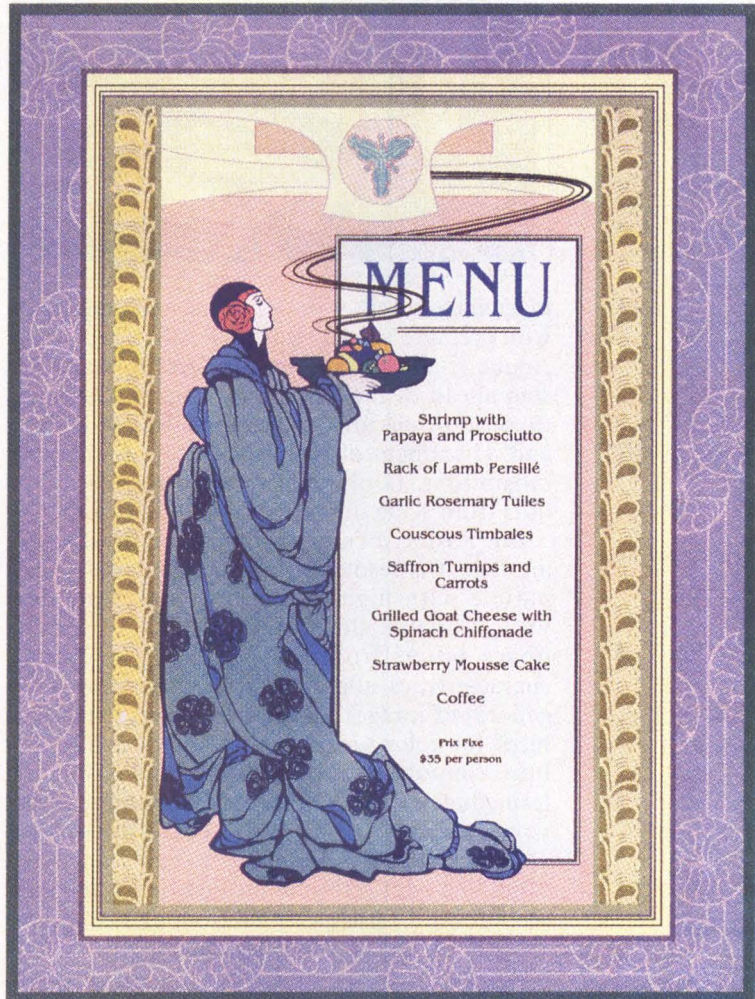
For one thing, the controller and printer alone will cost almost \$25,000. Add a personal computer and page-composition software and the price approaches or exceeds \$30,000, depending on whether you go with an IBM Corp. PC or an Apple Computer Inc. Macintosh. Moreover, you'll have to plan your coffee breaks around the printing, because the system is slow. For example, a typical 8½-by-11-inch page with color graphics and text will take between 1 and 2 minutes to print.

Nevertheless, the appeal of adding color to PostScript-based desktop publishing will be irresistible to some, particularly for applications such as prepress color proofing and presentation graphics.

## QMS packs one-two-three punch

QMS Inc. expects to be the first company to field a PostScript-compatible color printer marketed for desktop publishing. Shipments are slated for this month or next. The brain of the system is a QMS controller residing in an enclosure that attaches to the printer. A Motorola Inc. M68020 microprocessor powers the controller. The enclosure also includes a rigid disk drive for functions such as downloading fonts. At press time, QMS was undecided about the optimum amount of RAM, noting that it would be between 4M bytes and 16M bytes.

The heart of the system is the G650 color



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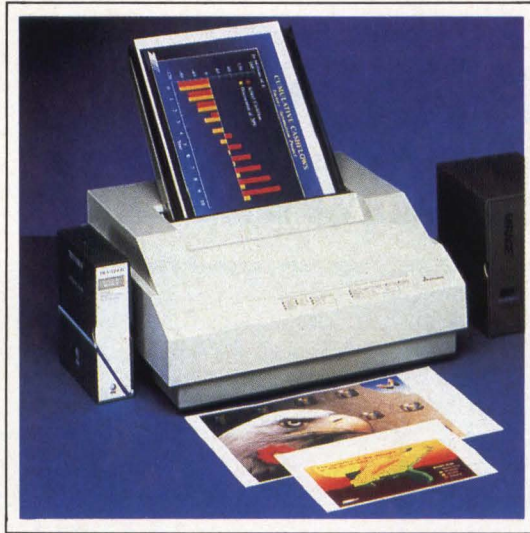
**This image** was created on an Apple Macintosh Plus using Adobe Illustrator software and a prototype QMS printer based on a Mitsubishi thermal-transfer print engine and a PostScript controller.

thermal-transfer print engine manufactured by Mitsubishi Electronics America Inc. This engine uses a sequential color wax-transfer process and square pixels, and prints in seven colors (red, green, blue, yellow, cyan, magenta and black).

The muscle of the system is a color version of PostScript, which allows users to specify cyan,



**At the heart of QMS' color printer is Mitsubishi's 300-dpi, G650 thermal-transfer printer. The unit prints in seven colors: black, cyan, magenta, yellow, red, green and blue.**



magenta and yellow or red, green and blue. And with pressure mounting from PostScript clones, Adobe is adding color capabilities to stay one step ahead of the emulators. Foremost among those additions are features for color correction and adjustment of screen angles on four-color separations. (Differently rotated screens keep dots from lying directly on top of each other.)

But PostScript's most important advantages are that it is resolution-independent and compatible with high-resolution typesetting devices, such as the Linotronic 300 and 500 image setters from the Linotype Co. These characteristics allow users to send computer-generated images directly to prepress equipment for color separations. This procedure, in turn, eliminates time-consuming and costly intermediate steps. "Call it 'desktop prepress,' if you like," says Tony Bove, co-editor of the *Desktop Publishing* newsletter in San Francisco. "But," he adds, "the connection between color graphics editing on personal computers to color separation and prepress equipment will be the most important catalyst for the acceptance of desktop color printers in the office."

The last piece of the puzzle is page-composition application software. And most popular packages, such as Aldus Corp.'s PageMaker 3.0 and Xerox Corp.'s Ventura Publisher, have recently added robust color capabilities. Alternatively, value-added resellers and software developers can write their own customized applications around PostScript and printers such as QMS'. Graphics packages such as Adobe's Illustrator and Aldus' FreeHand allow users to specify color percentages and to create color separations.

QMS will sell its printer through its tradi-

tional channels—OEMs, VARs and distributors. The company's reseller subsidiary—Laser Connection Inc.—will also sell the system through a limited number of key distributors.

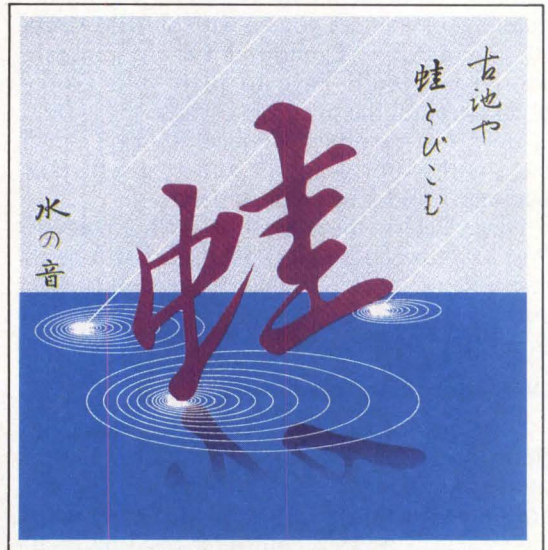
Although the QMS is one of the first PostScript-based color desktop publishing systems—and many others are sure to follow—it serves as a model for identifying potential applications.

### The proof's in the PostScript

Despite the high cost, there are two key application areas that can benefit from color desktop publishing: prepress proofing and presentation graphics for small groups.

Using a system such as QMS' for prepress proofing can save time and money because it eliminates a step in the conventional color-proofing process. In most publishing scenarios, users send color images to the printer and get color proofs, called Chromalins. These proofs are used to check the color of the image. Chromalins usually cost about \$150 per page.

A PostScript-based system enables users to proof and correct their color hard copy and then send the files directly to the printing house (assuming the printing house has a PostScript-compatible device), thus bypassing the intermediary color-proofing step. The goal, of



**This image of Kanji characters** was originally painted and then scanned into Adobe Illustrator software running on a Macintosh Plus. The output device was a prototype QMS printer based on a Mitsubishi thermal-transfer print engine and PostScript controller.



## Color laser printers to debut in third quarter

The check's been in the mail for over a year now, but it looks as though affordable color laser printers will finally arrive in the third quarter of this year. That's according to Frank Rowe, executive vice president at Colorocs Corp., which is expected to be the first to develop an under-\$40,000 color laser printer.

Colorocs designs the engines and delivers prototypes to controller manufacturers and OEMs. QMS Inc. and Texas Instruments Inc. are among the OEMs that have received prototypes from Colorocs. Sharp Corp. manufactures the print engines in Japan.

The color laser printer is based on the same technology that is behind Colorocs' color copier: The laser puts down an image on a photoreceptor, which in turn picks up toner. Colorocs plans to ship this color copier in March. Printer speeds will depend on how the controllers are implemented, but Rowe expects it to print four-color pages, with text, at about 10 pages per minute. Black-only speeds will push 30 to 40 ppm. Rowe also estimates that the system, including controller, will cost between \$30,000 and \$35,000.

course, is to eliminate the iterative and costly process of sending images to the printing house, receiving Chromalin proofs, correcting them if they're wrong, resending the page, and so forth.

On the down side, the color quality from the in-house printing machine will probably not exactly match what you'll get from the commercial printer. However, Liz Bond, director of marketing at Adobe, maintains that the color quality of the hard copy will be "adequate enough that you'll be able to use it as a proofing device."

The degree that colors from the Mitsubishi engine will match the final color separations depends, in part, on the quality of the software—both the PostScript interpreter and the application software. "You're never going to get an exact match between color output and the printing press," says Jonathan Seybold, president of Seybold Seminars, a Malibu, Calif., publisher of reports on the desktop publishing market. "What you want is a predictable match," he says.

In fact, even Chromalins don't exactly match the final color separations. Thus, with a PostScript-based color-printing system, you get a match that may not be exact, but it's as good as possible and about as good as using the traditional method.

### Buyers remain skeptical

Some prospective buyers remain skeptical. "Color proofing is a pretty generous word for it," says David Dunkelberger, vice president and creative director at Weisz and Yang Inc., a graphics design company in Westport, Conn. Dunkelberger is afraid that the mismatch in color between the Mitsubishi engine and color separations will cause the same design problems as the current mismatch between the screen (monitor) color and printer output.

Weisz and Yang Inc. was one of the first companies to get a prototype of the QMS output system. However, at press time, the company had not received the PostScript version. "I don't want to downplay it," says Dunkelberger, "It's just that I have to see it." To create color comprehensives for corporate clients, Weisz and Yang uses various combinations of Apple Macintosh IIs, SEs and Pluses, Mitsubishi monitors and the thermal-transfer engine. Also, they use a turnkey system from Lightspeed Inc., based on a Macintosh II; a SuperMac Spectrum monitor; and color page-layout software.

It should be noted that PostScript-based color desktop publishing will not eliminate color separations, at least in the near term. The 300-dpi thermal-transfer printers are just not exact enough to be used for final color separations. It could, however, eliminate interim proofing. "The driving force catalyzing desktop color printing," says *Desktop Publishing's* Bove, "will be lower proofing costs."

Adobe is refining the color calibration powers of PostScript, and application package developers are also adding more precise color-specifying functions. Current versions of PageMaker, Ventura Publisher, Apple's MacPublisher and Quark Inc.'s XPress, for example, have features for adding spot color. In addition, companies are licensing Pantone Inc. ink colors (referred to as the Pantone Matching System, or PMS), which will enable them to get as close to printing-press output as possible.

The next step for PostScript is Display PostScript which, according to Adobe's Bond, will be available later this year. Display PostScript will be either loaded by flexible disk or be resident on a monitor controller and will provide true what-you-see-is-what-you-get (WYSIWYG) in color. Additionally, it will be

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**'You're never going to get an exact match between color output and the printing press. What you want is a predictable match.'**

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bundled with workstations such as the Macintosh II and Intel Corp. 80386 machines.

Another potential application for color desktop publishing is presentation graphics. However, because of the slow output speed of the QMS system, these jobs initially will be limited to small-group presentations, say, less than 25 copies. To make this application more attractive, you can run film through the Mitsubishi engine to create color transparencies for overheads that will match the color handout material.

However, the high cost of the QMS system will be difficult to justify for this type of application. Herb LaButte, manager of automation services for Dana Corp.'s Center of Technology group, Ottawa Lake, Mich., says that his company could not justify the system for internal use. "It's relatively slow and expensive, and we don't have the volumes right now," he says, adding, "What I'd like to see is something in the \$10,000 range."

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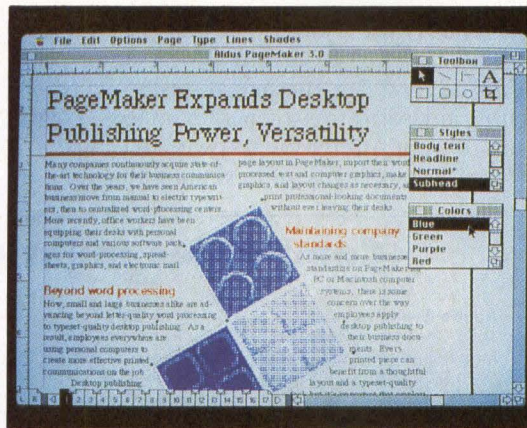
**'The driving force catalyzing desktop color printing will be lower proofing costs.'**

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Dana Corp., Toledo, Ohio, makes automotive parts for major customers such as Ford Motor Co. and General Motors Corp. The company uses Ventura Publisher software running on PC clones and Apple LaserWriter Plus printers as output devices for its publications. One potential market for the QMS system, says LaButte, is as a replacement for plotters in corporate-level presentation graphics applications in Fortune 500 companies.

Potential buyers should be aware of some serious drawbacks to color desktop publishing. As with monochrome laser printers, the advent of color desktop publishing does not give users their own printing presses. All medium- and high-volume printing or duplicating will still be done on large, high-speed printing presses. In addition, current desktop publishing technology can't deal with color photographs.

The ultimate goal, of course, is to have a fast, inexpensive color laser printer that prints at resolutions that are acceptable for color separations. "What is really needed," says Bove, "is a higher resolution PostScript-based raster plotter in the \$20,000-to-\$40,000 range. This plotter must provide the quality and correction




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**The newest version of Aldus' PageMaker page-composition software, version 3.0, includes a variety of color-specification features.**

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features of color prepress systems, while using software that is based on the Macintosh II or 80386 machines."

#### **VAR/OEM opportunities abound**

Color desktop publishing opens up a variety of profit opportunities for resellers, OEMs and system integrators. OEMs and controller manufacturers, for example, can follow the lead of QMS and develop specialized hardware to drive emerging printer technologies. Printer manufacturers can improve color capabilities, resolution and speed. And software developers can write drivers and add to the functionality of leading desktop publishing packages or develop their own, customized, packages to target vertical markets with technical documentation and graphics arts.

Software developers and VARs can also create custom templates for color desktop publishing systems. Another opportunity to add value is to provide integrated software solutions such as, say, combining a drawing program with a page-composition package and driver software for PostScript devices. In the Macintosh environment, this integration is largely taken care of, but in the PC environment the task often requires the skills of a system integrator.

Color desktop publishing also will add to the fortunes of VARs and system integrators. Unlike black-and-white desktop publishing, color prepress proofing and similar applications require skills that are beyond the ability of most end users. "The largest market is for people that don't want to be, or can't be, system integrators," says Seybold, who adds, "Dealers are migrating to becoming VARs."

Bove expects typesetting houses to be among the first customers for PostScript-based color desktop publishing systems. He adds that there are well over 200 Linotronic service companies, not counting large corporations, which



have in-house typesetting equipment. As the price of systems such as QMS' decline, ad agencies and graphics-arts outfits will line up to buy.

"[The QMS system] is only a building block," says Gary Carroll, QMS' senior product manager. He further states: "We're not selling any software to generate images. There's a lot of opportunity for software developers."

As the complexity of desktop publishing in-

creases, the integration task will go beyond hooking up various pieces of software to encompass networking, printer sharing, file servers, optical disks, scanners and film recorders. This integration task is well-suited to system integrators and VARs. □

Interest Quotient (Circle One)  
High 535 Medium 536 Low 537

### Companies mentioned in this article

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Circle 349

**Aldus Corp.**  
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**Apple Computer Inc.**  
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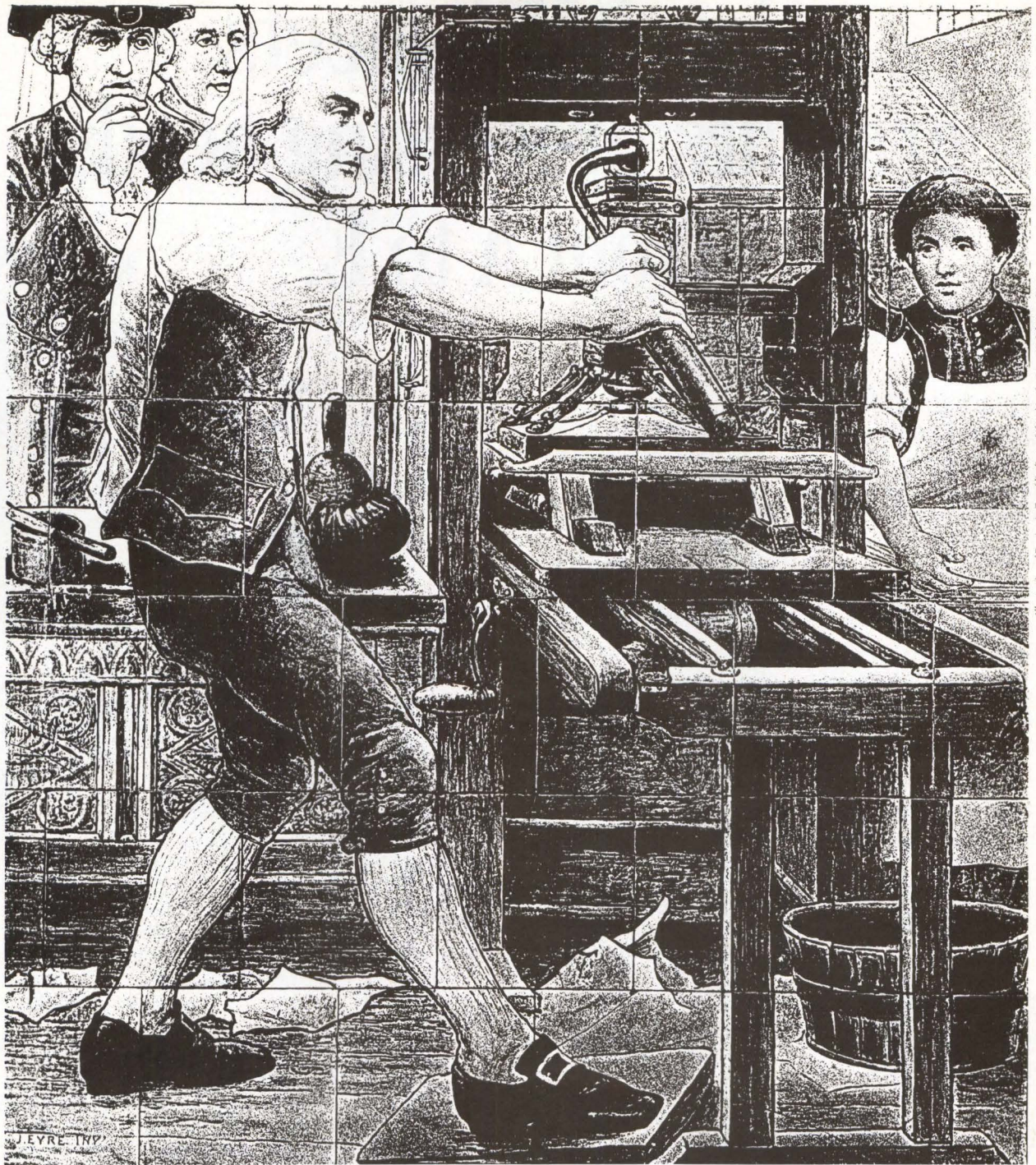


Illustration of Benjamin Franklin first exhibited in the Great Exhibition of 1851, now permanently on display in the Cafe Royal, Edinburgh

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The high speed VP-30 has a disk storage capacity expandable to 40Mb and can handle plots up to 44".

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in progress. But the VP-10 and VP-30 rasterize data independently of the host computer, so you can stay productive while your plots are being produced. And both processors can receive input while they're outputting a plot.

## Compatible with a variety of software packages and output devices.

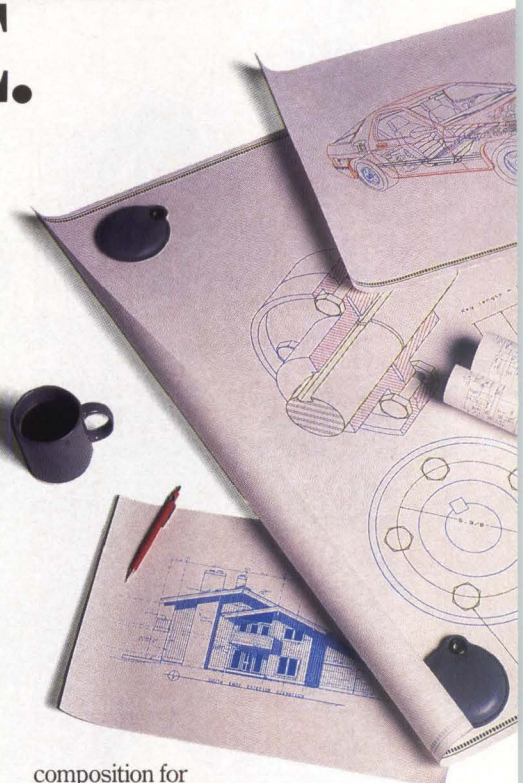
The VP-10's pen plotter emulation feature allows compatibility with hundreds of graphics software packages, including VersaCAD, AutoCAD, and SAS. The VP-30 can be used with such popular packages as CADAM, CADS4X and Scicards/Quickplot.

The VP-10 supports electrostatic plotters from Benson, CalComp and Versatec, as well as small color raster devices from Seiko and Mitsubishi. Input data formats include KMW.PLT, HPGL (HP pen plotters), and CalComp 906/907. The VP-30 supports Versatec, Benson and CalComp electrostatic plotters – including color – and drives them at full speed. It accepts CalComp 906/907, 925, 960 and KMW.PLT data formats.

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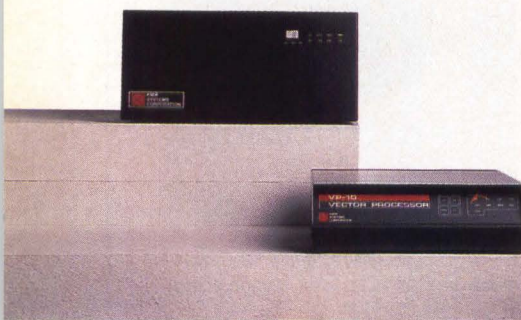
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**CIRCLE NO. 26 ON INQUIRY CARD**



# SMART PLOTTERS GET FASTER

With local intelligence, pen plotters overcome the slow mechanical limitations of motors, pens and moving parts

Edward R. Teja, Contributing Editor

Despite the widespread integration of personal computers into computer aided engineering (CAE) systems, they still remain the new kids on the block. And although the watchword in computer system integration appears to be "desktop," most design centers where mechanical designers, architects, civil engineers and other planners toil over sketches or blueprints are found in large facilities. In these shops, teams of engineers rely on relatively large equipment to produce complex designs.

Selecting the right peripheral to provide hard copies of drawings on paper, vellum, polyester film media or transparency film ranging in size from ANSI A to E is the system integrator's job.

*Mini-Micro Systems* has examined the current generation of pen plotters and finds they provide the resolution and throughput that used to come only from large, expensive flatbed plotters (see Table). The new plotters are available in space-saving upright roll-feed and cut-sheet configurations and are priced from about \$1,700 to \$14,000.

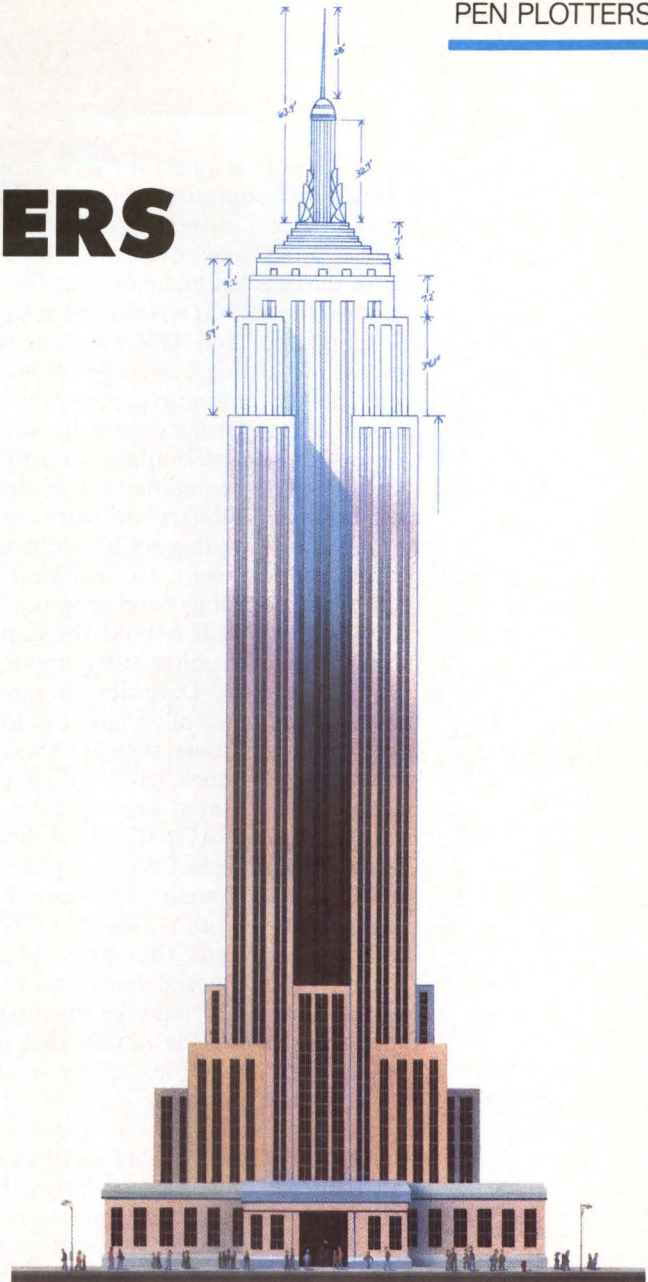
These prices reflect a spectrum of plotting capability and a choice of pen configurations from one to 20. For example, mechanical resolution (the accuracy with which the plotter places a dot on the media) varies from within 0.004 mm to within 0.0002 mm. However, price doesn't always indicate performance so much as it indicates the choice of options. Some vendors do offer low-cost units that plot slower or handle small sized output. Zericon's model 3600-D, for instance, plots at only 7 ips, for \$1,695. It's hard to argue that this is low performance. You are getting at least what you paid for. But not all vendors adhere to this marketing strategy. Instead, they choose to pack high performance into all models and then let system integrators and value-added resellers upgrade to get additional features that

might be needed for a specific application—features such as extra pens.

Both Houston Instrument and Ioline Corp., for example, treat their plotters as single-pen units that expand, in the case of Houston Instrument, to six pens, and, in the case of Ioline, to 20 pens. Ioline features a single-pen unit that, for \$500 above base price, upgrades to an eight-pen plotter. Then, once this upgrade is accomplished, the system integrator adds as many as three four-pen trays at \$100 apiece. This strategy ensures that the system integrator can specify a particular performance level, without having to pay for unneeded options.

## Smartly drawn

As with more glamorous peripherals, plotters have followed an upward path toward more



**The speed of the pen across the media is but a small part of the throughput story.**



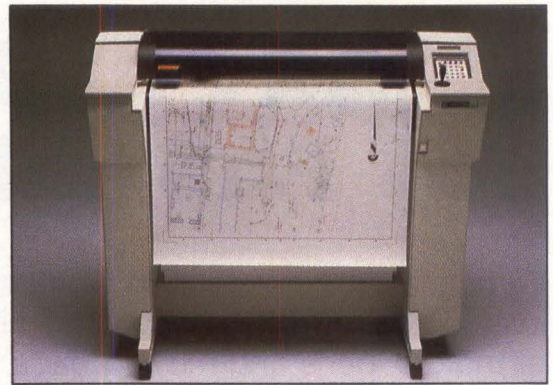
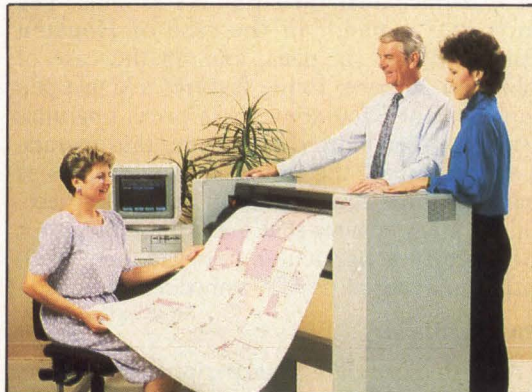
intelligence. This local intelligence can support a variety of computer systems, without the need for special drivers in the host.

Local processing power also allows the plotters in this market niche to offer firmware that supports the HP-GL (Hewlett-Packard Graphics Language) and DM/PL (Digital Microprocessor Plotting Language) command sets. And this commonality provides a certain amount of standardization in the way hosts talk to plotters and, perhaps more important, it indicates which combinations of design packages, hosts and plotters will work together. But beyond executing this set of commands, some plotter vendors want to provide the system with even more high-level graphics functions, functions that will extend the capability of plotters to more sophisticated applications.

In the world of 3-D, for instance, pen plotters haven't made much of a mark. But local intelligence permits plotters, such as CalComp's Plotmaster, to tie in more tightly with popular CAD packages. Prominent among these are Autodesk Inc.'s AutoCAD, Micro Control Systems' CADKEY and VersaCAD Corp.'s VersaCAD. For example, Houston Instrument's \$4,695 model DMP-61 and \$6,495 DMP-62 have built-in commands that provide automatic closed-area fill, special fonts and cross hatching. CAD packages that take advantage of these functions can provide output that used to be too laborious or complex to be worthwhile with only low-level products.

Because plotters can do so much, matching devices and needs is more difficult than ever. CalComp has broken up its 1040GT family of eight-pen plotters and now offers devices that vary widely in capability and also in price—from \$4,895 to nearly \$14,000 (installed). The new 1032 replaces the familiar 1041GT (CalComp will continue to service the 1041). The 1032 plots drawings up to D size, and it features built-in optical sensors that help the plot-

**Hewlett-Packard's DraftMaster** plotters use a 10-MHz Motorola M68000 microprocessor to provide intelligent graphics functions.



**Houston Instrument's DMP-62** plotter handles cut-sheet drawings up to ANSI E size at speeds up to 32 ips.

ter to automatically adjust force, velocity and acceleration parameters to pen type—liquid ballpoint, fiber or plastic tip, etc. CalComp's other three plotters produce drawings up to E size. The top two models of this family handle both cut-sheet and continuous-roll with either paper or one of the various films.

Most vendors offer a model or two that features continuous-roll paper handling for unattended operations. To exploit that feature even more, CalComp also offers a software utility called BatchPlot that lets AutoCAD users plot up to 60 drawings in one run.

Taking advantage of the recent improvements in plotter technology, Hewlett-Packard Co. has replaced its family of 758X model plotters. The new \$9,900 HP DraftMaster, which handles cut-sheet paper, and the \$11,900 roll-feed DraftMaster II represent substantial price reductions over older models along with improvements in performance. (The DraftMaster I upgrades to a model II with a field-installed \$2,500 option.)

#### The speed's the thing

A large part of the competition and product differentiation among these peripherals centers on how fast the plotters plot. Given equal resolution and repeatability, the name of the game should be throughput. But plotter manufacturers talk about throughput only indirectly by touting pen acceleration and plot speed.

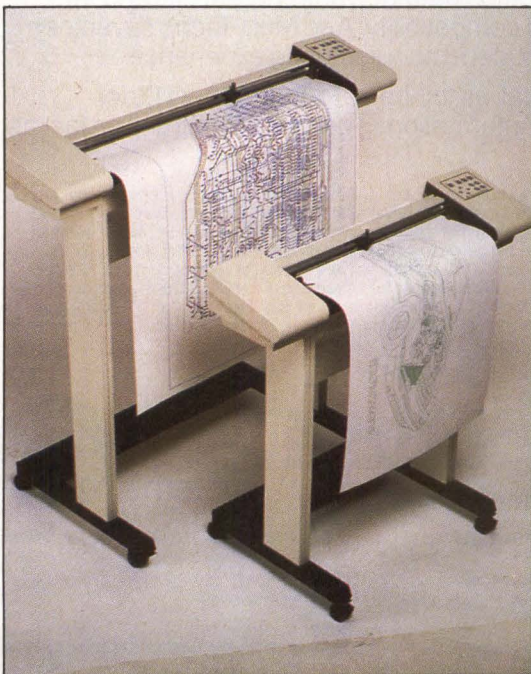
Acceleration, as the word implies, refers to how fast the plotter moves its pen. It is measured in terms of the lateral force exerted on the pen; the more Gs exerted on the pen, the faster it takes off. Older models accelerate at less than 1G. Most of the newer plotters range as high as 4Gs. And some vendors specify the



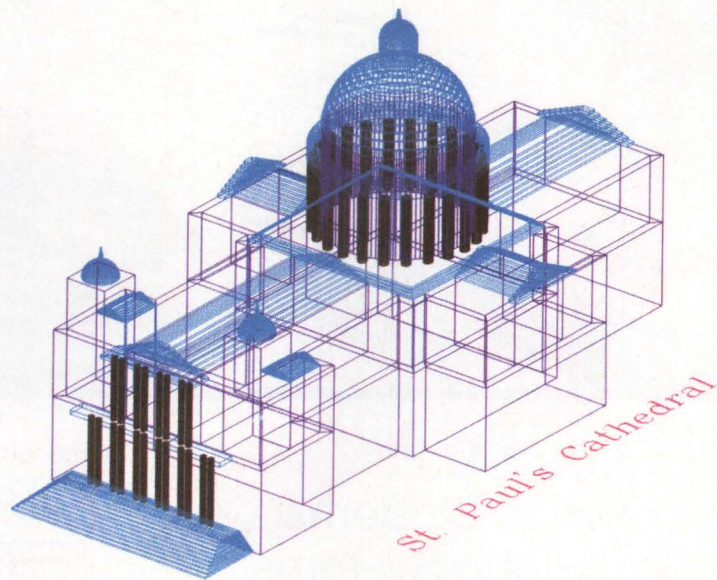
pen's acceleration differently for each direction in which the pen moves. For instance, both of HP's DraftMaster plotters claim 5.7G diagonal acceleration and 4G acceleration on the axis.

Pen acceleration is limited not so much by positioning mechanics as by overall plotter-system design. For example, if the media-handling components of the plotter can't keep pace with the pens, the media will distort or even tear. Media distortion affects repeatability and, when sufficiently severe, can render a drawing worthless. And the larger the media, the worse the problem. Some companies compensate by slowing pen movement for plotters that work with E-sized drawings. And most vendors make the plot speed and acceleration programmable because the amount of media distortion is going to depend on the particular media (its thickness, smoothness, etc.). At any rate, the maximum quoted speed is not usually the maximum rate that the pens can move. Rather, it is the maximum rate that the pens can move while producing a quality of output the vendor is willing to guarantee.

Houston Instrument's DMP-61 (the fastest unit listed in the Table) pushes the capability of the pens at 32 inches per second (ips), according to the vendor. When they try to write faster, the ink won't flow freely enough to produce a completely solid line. But the high speed, even



**CalComp's 1040GT family** of plotters use a proprietary Batchplot utility to run as many as 60 plots in a batch.



higher than the vendor rates, is available for doing quick check plots, which are analogous to draft-quality text from a printer.

HP attacks the media-distortion problem directly. DraftMaster plotters depend on 3-inch-wide strips of polyimide placed along the front and rear edges of the platens. This strip, called a media stabilizer, dampens media movement. Stable media lets the plotter provide its best quality at its highest speed, and the 24-ips plot speed doesn't tax the limits of ink flow.

Speed at any cost is not a design goal of plotter manufacturers. Most plotter vendors, therefore, make the plot speed programmable. Furthermore, raw speed—the speed of the pen across the media—is but a small part of the throughput story.

The other part is efficiency—how well the algorithm that plans the path the pen takes does its job. When the fastest route between two points is a straight line, brute speed wins out every time; but when the pen's route is more complex, local intelligence proves its worth.

The firmware in CalComp's 1040GT family of plotters works hard to minimize the amount of pen movement and the number of pen changes required for any particular drawing. The 1040GT family has one of the slowest pen acceleration specs—1.2G—but, according to CalComp, the algorithms in the plotter's proprietary ROMpack firmware cartridge give it as much as 100 percent more throughput than pen plotters with equal plotting speed and acceleration.

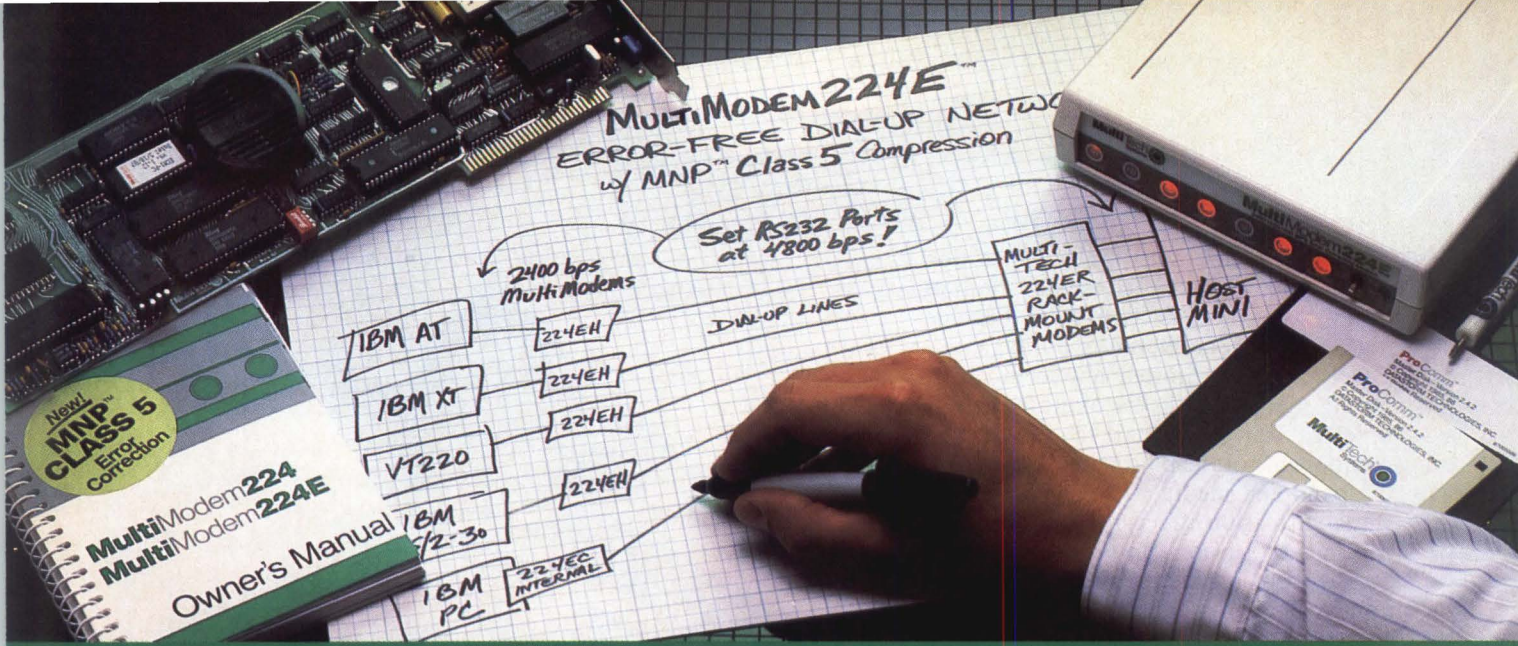
CalComp's strategy bears up well under close inspection. Plotters with local intelligence in-

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**CalComp's Plotmaster** furnishes the high-level commands that design packages such as AutoCAD use to obtain the shading and multiple colors needed for quality 3-D graphics, as above.

---





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crease performance by combining long series of commands into macro commands that eliminate unnecessary pen motion. Furthermore, the intelligent plotter can anticipate drawing problems and provide solutions. The HP family of plotters, for example, uses a 10-MHz Motorola Inc. 68000 processor to provide features such as a continuous smooth-curve

**Most implementations are in multiple-user environments, where the cost of the plotter can be shared by several workstations.**

generator. Normally a shallow curve is treated as a series of individual drawing events. The smooth curve generator is a software feature that looks ahead to identify an approaching shallow curve and then maintains the plotter speed while drawing the curve. HP's DraftMaster eliminates unnecessary pen-up moves. That helps speed things considerably. By combining pen-up commands, the plotter can move the pen directly to the beginning of the next vector on the curve.

Unfortunately, the very fact that local intelligence bears so heavily on performance means that it isn't possible to make direct comparisons without benchmarking the drawings that a system must actually handle.



**Ioline's LP4000 features 20 ips plotting on A- through E- sized media and on roll stock as wide as 37-inches.**

#### A POINT-TO-POINT PLOTTER COMPARISON

	Sheet size	Maximum acceleration (G)	Plot speed (ips)	Mechanical resolution (mm)	Pens	Base model price (\$)
<b>CalComp</b>						
1023	A-D	2.8	30	0.0125	8	4,895
1042GT	A-E	1.2	24	0.0005	8	9,900
1043GT	A-E	1.2	24	0.0005	8	8,905
1044GT	A-E	1.2	24	0.0005	8	13,900
<b>Hewlett-Packard Co.</b>						
DraftMaster I 7595	A-E	4	24	0.0002	8	9,900
DraftMaster II 7596	A-E	4	24	0.0002	8	11,900
<b>Houston Instrument</b>						
DMP-61	A-D	4	1-32	0.0005	1-6	4,695
DMP-62	A-E	2	1-32	0.0005	1-6	6,495
<b>Ioline Corp.</b>						
LP3700	A-E	2	10	0.0025	1-20	4,195
LP4000	A-E	0.8	20	0.001	1-20	5,495
<b>RDK Inc.</b>						
RY-5200	A-D	2	20	0.003	8	5,395
RY-5214	B-D	4	16	0.0125	4	4,895
<b>Zericon</b>						
3600-D	C-D	1	7	0.004	1	1,695 (direct from manuf.)

Source: Mini-Micro Systems



Compressing the pen's many requested movements into just a few requires buffer memory. Furthermore, buffer memory is important for caching vectors sent from the host computer. RDK Inc. provides a 12K-byte buffer for its four-pen model RY-5214 (\$4,895) and 128K bytes of buffer space for its eight-pen model RY-5200 (\$5,395). Ioline's LP4000 and LP3700 plotters have standard buffers of 4K bytes and 14K bytes (which will handle about 1,500 vectors), respectively. The company also offers a 512K-byte hyperbuffer with plot-optimization intelligence. The RY-5214 uses ceramic and ballpoint pens and can be adapted for ink pens and pencils.

The real world buffered

**The real world buffered**

In some cases, sufficient buffer memory for optimization tasks still might not be enough for the overall application. Houston Instrument features an optional 1M-byte buffer (\$995) that equips its plotters to work with local area networks. And this strategy makes sense, for at \$6,000-plus for a pen plotter, it is reasonable to expect most implementations to be aimed at multiple-user environments, where the cost of the plotter can be shared by several workstations.

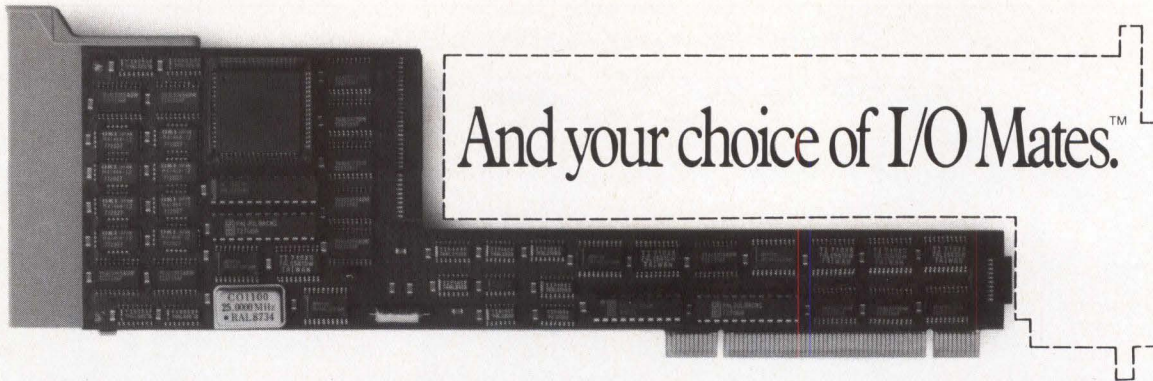
Certainly, pen plotters aren't an all-purpose output device, and pen plotting isn't the only technology competing in its market area, but, in terms of price and performance, the current generation is keeping pace with the needs of the system integrator. □

**Companies mentioned in this article**

<p><b>CalComp</b> 2411 W. La Palma Ave. Anaheim, Calif. 92803 (800) 225-2667 Circle 343</p>	<p><b>Houston Instrument</b> 8500 Cameron Road Austin, Texas 78753 (512) 835-0900 Circle 345</p>	<p><b>RDK Inc.</b> P.O. Box 14743 Austin, Texas 78761 (512) 832-5464 Circle 347</p>
<p><b>Hewlett-Packard Co.</b> 16399 W. Bernardo Drive San Diego, Calif. 92127 (800) 367-4772 Circle 344</p>	<p><b>Ioline Corp.</b> 19417 36th Ave. W. Suite D1 Lynnwood, Wash. 98036 (206) 775-7861 Circle 346</p>	<p><b>Zericon</b> 4423 Enterprise St. Freemont, Calif. 94538 (415) 490-8380 Circle 348</p>

Interest Quotient (Circle One)  
High 538 Medium 539 Low 540

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CIRCLE NO. 28 ON INQUIRY CARD



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If you're an OEM looking for a dot matrix printer built especially to suit your needs, contact Honeywell Bull Italia, Printers Division, 120 Howard St., Suite 800, San Francisco, CA 94106. Or call us at 415-974-4340.

## Honeywell Bull

Customers are more important than computers.

CIRCLE NO. 30 ON INQUIRY CARD



# ION DEPOSITION COMES OF AGE

VARs, OEMs and system integrators take-note: Improved reliability and attractive prices are getting the attention of end users

**Megan Nields**, Staff Editor

Ever since its birth in the mid-1970s for bar-code applications, ion deposition has been touted as one of the most promising forms of non-impact printing technologies. Now that ion-deposition printers have been on the market for several years, it appears that the initial promise is not just hot air.

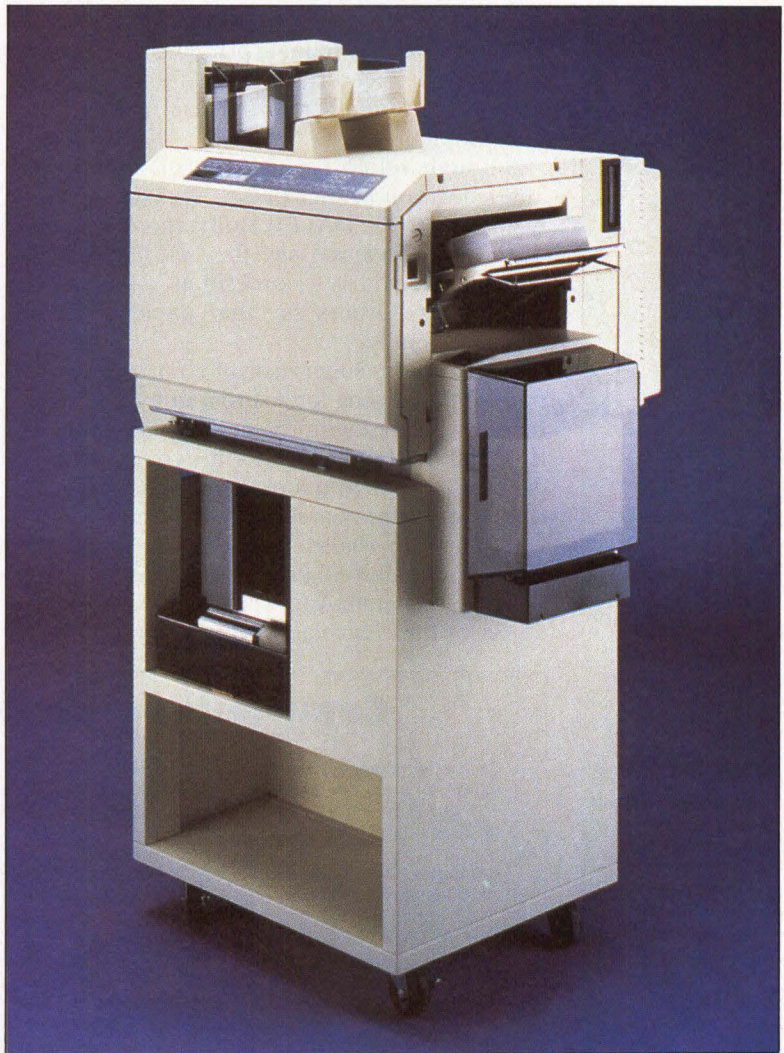
High reliability and low cost are the biggest boons cited by users in a recent survey conducted by DATEK Information Services, Waltham, Mass. The research company has come out with a study called "Ion Deposition: The Users' Perspective," that surveys 75 users of Delphax Systems printers. Delphax, of Randolph, Mass., is the major manufacturer of ion-deposition print engines for OEMs such as C. Itoh Electronics Inc., Honeywell Bull Inc., Northern Telecom Inc. and Xerox Corp.

Ion-deposition printers "give a lot of capability for a relatively low price," says Mike Zeis, DATEK research director. "Cost-conscious people can now use a non-impact page printer. The printer market is expanding because of this."

What justifies such boosterism? Delphax cites a 500,000-page MPBF (mean pages between failure) for its 75-page-per-minute and higher print engines (the S6000) and a 250,000 MPTF for its 30-ppm units (the S3000). Users report that these figures are accurate, with some claiming even higher reliability rates. "There just isn't too much inside to break," according to one user.

Users generally agree that, at this stage of the game, ion deposition is not directly competing with laser technology. Ion printers are mostly being used for high-volume, internal applications such as financial and technical reports, system output and database listings. Of the users surveyed by DATEK, 97 percent are "very" to "somewhat" satisfied with the print quality for these applications.

However, the gap between laser and ion



deposition may be narrowing. Fred Collins, director of sales and marketing for the Image System Division of C. Itoh in Torrance, Calif., feels that ion deposition is in its early stages compared to laser technology, and that it is improving continuously. "We see a very bright future for these printers. Print-quality and

**The Delphax S3000G** is a 30-ppm, non-impact ion-deposition printer designed for the OEM marketplace.



price/performance are improving all the time. We expect them to compete with laser printers in a year or two."

Others echo the enthusiasm. Bill Wells, vice president of marketing for General Business Technology Inc. (GBT), Irvine, Calif., says his company's romance with ion deposition began about four years ago when they began selling Delphax's 60-ppm model with a GBT controller.

"These are very reliable printers," Wells says. "They just keep cranking and cranking. They're also much more cost-effective than laser technology."

Although reliability is high on the list of ion-deposition printer pluses, it exacts a price. According to the DATEK study, more than half of those interviewed say they must clean the machine regularly—sometimes as often as every shift. Others say that paper must be loaded carefully.

John Fenton, supervisor of computer operations and planning for Ashton-Tate Corp., Torrance, is pleased with the performance of the C. Itoh 3000L 30-ppm printer his company uses, but feels that high maintenance costs and the lack of a warranty are less than attractive.

But on the whole, according to researcher Zeis, the reliability figures of the DATEK study were phenomenal. And what does Delphax, the object of these accolades, think about all this?

Marketing manager Jerry Pinsky says, "I don't want to seem overly enthusiastic, but ion-deposition technology is being received extremely well. It fits in all levels of printing and will print on virtually everything." He cites an example of a shoe manufacturer in England that prints on shoes.

Delphax's 30-ppm print engine is being hailed as an "incredible breakthrough in price performance" by GBT's Wells, although he feels the current quality of fonts "leaves a bit to be desired at the moment."

But Delphax is addressing this problem. It promises to deliver in the first quarter of this year fonts and type styles with 300-by-300-dot-per-inch resolution that, according to Pinsky, "will be equal to—if not better—than anything else in the printer market." Delphax is working on other quality enhancements such as improved toner and print cartridges, he says.

Wells feels that when the enhancements come through, the difference between ion and laser quality will diminish greatly.

Perhaps, Pinsky expresses it best when he says, "We are looking at a technology that has come of age. We've been saying this is good stuff, and now we are proving it." □

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Interest Quotient (Circle One)  
High 514 Medium 515 Low 516

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## Companies who OEM from Delphax

**Check Technology Corp.**  
1284 Corporate Center Drive  
St. Paul, Minn. 55121  
(612) 454-9300

**Computer Entry Systems**  
2120 Industry Parkway  
Silver Spring, Md. 20904  
(301) 683-3370

**Datagraphix Inc.**  
10981 San Diego Mission Road  
San Diego, Calif. 92138  
(619) 291-9960

**Derex Inc.**  
7716 Wiles Road  
Coral Springs, Fla. 33067  
(305) 753-0840

**Digital Controls Corp.**  
3495 Newmark Drive  
Miamisburg, Ohio 45342  
(513) 433-5455

**DSI**  
1440 S. Lipan  
Denver, Colo. 80223  
(303) 777-8211

**General Business  
Technology Inc.**  
1891 McGaw Ave.  
Irvine, Calif. 92714  
(714) 261-1891

**Honeywell Bull Inc.**  
3800 W. 80th St., MN-70  
Minneapolis, Minn. 55431  
(612) 896-3800

**Micro Research Industries**  
3027 Rosemary Lane  
Falls Church, Va. 22042  
(703) 573-9538

**Mitope Corp.**  
1770 Walt Whitman Road  
Melville, N.Y. 11747  
(516) 420-0200

**NBS-Anser Inc.**  
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Fort Worth, Texas 76117  
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**NBS Southern Inc.**  
100 N. Belcher Road  
Clearwater, Fla. 33575  
(813) 441-198.

**Northern Telecom Inc.**  
2100 Lakeside Blvd.  
Richardson, Texas 75081  
(214) 437-8000

**Unisys Corp.**  
P.O. Box 41811  
Detroit, Mich. 48232  
(313) 972-7000

**Xerox Corp.**  
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Rochester, N.Y. 14692  
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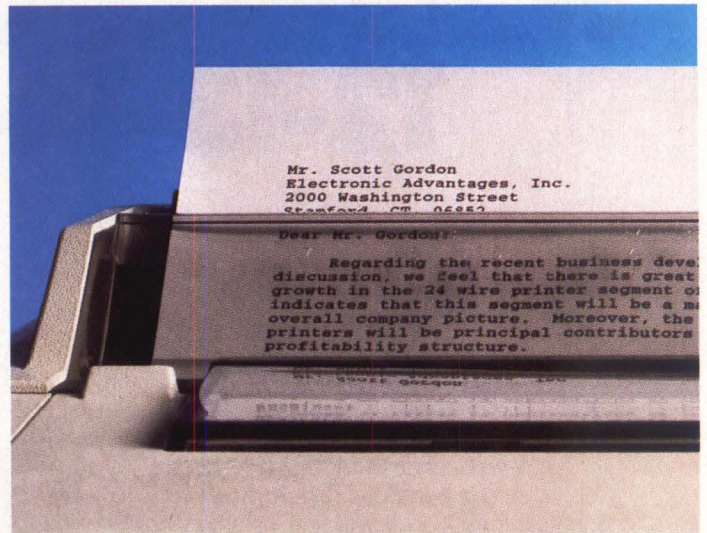


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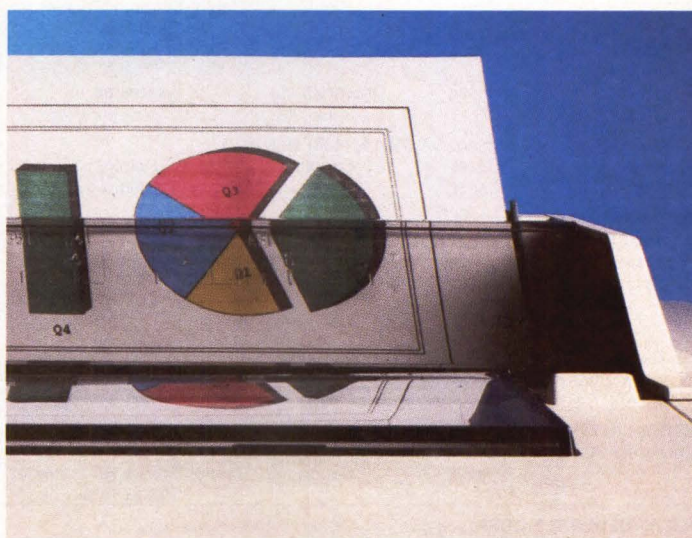




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CIRCLE NO. 32 ON INQUIRY CARD



## NON-IMPACT PRINTERS

Company Model	Print method	Engine	Emulations	Print speed	Interfaces	Resolution (dpi)	Color printing? (yes/no)	Price (quantity)
<b>ACER TECHNOLOGIES CORP.</b> <span style="float: right;">Circle 622</span>								
401 Charcot Ave., San Jose, CA 95131, (408) 922-0333								
LP-75	laser	Ricoh	HP LaserJet PLUS	6 ppm	RS232C, RS422, Centronics, parallel	300	N	\$2,395(Q1)
<b>ACOM COMPUTER INC.</b> <span style="float: right;">Circle 623</span>								
3534 Atlantic Ave., Long Beach, CA 90807, (213) 424-2986								
LX3808	laser	Canon	HP LaserJet PLUS, IBM	8 ppm	RS232C, Centronics, IBM twinax	300	N	\$4,495(Q1)
LX3815	laser	Ricoh	HP LaserJet PLUS, IBM	15 ppm	RS232C, Centronics, IBM twinax	300	N	\$7,995(Q1)
LX3820	laser	Canon	HP LaserJet PLUS, IBM	20 ppm	RS232C, Centronics, IBM twinax	300	N	\$24,995(Q1)
<b>ADVANCED TECHNOLOGIES INTERNATIONAL INC.</b> <span style="float: right;">Circle 624</span>								
1900 Wyatt Dr., #4, Santa Clara, CA 95054, (408) 748-1688								
1570/DW-3	laser	Ricoh	Diablo, Epson, HP LaserJet PLUS	15 ppm	RS232C, Centronics	300	N	\$6,800(Q1)
2670/DW-3	laser	Dataproducts	Diablo, Epson, HP LaserJet PLUS	26 ppm	RS232C, Centronics	300	N	\$15,400(Q1)
2670/GR-2	laser	Dataproducts	Versatec	1,750 lpm	Versatec parallel	300	N	\$16,900(Q1)
<b>APPLE COMPUTER INC.</b> <span style="float: right;">Circle 625</span>								
20525 Mariani Ave., Cupertino, CA 95014, (408) 996-1010								
LaserWriter	laser	Canon	Diablo	8 ppm	RS232C, AppleTalk	300	N	\$4,499(Q1)
LaserWriter Plus	laser	Canon	Diablo	8 ppm	RS232C, AppleTalk	300	N	\$5,299(Q1)
<b>AST RESEARCH INC.</b> <span style="float: right;">Circle 626</span>								
2121 Alton Ave., Irvine, CA 92714, (714) 863-1333								
TurboLaser/EL	laser	Ricoh	Diablo, HP	8 ppm	RS232C, Centronics	300	N	\$1,995(Q1)
TurboLaser/PS	laser	Ricoh		8 ppm	RS232C, AppleTalk, Centronics	300	N	\$3,995(Q1)
<b>AT&amp;T</b> <span style="float: right;">Circle 627</span>								
5555 Touhy Ave., Skokie, IL 60077, (312) 982-2000								
495	laser	Hitachi	HP LaserJet, Qume	up to 10 ppm	RS232C, Centronics, IBM parallel	300	N	\$3,595(Q1); \$2,516(Q100)
<b>BROTHER INTERNATIONAL CORP.</b> <span style="float: right;">Circle 689</span>								
8 Corporate Place, Piscataway, NJ 08854, (201) 981-0300								
HL-8	laser	Canon	Diablo, Epson, HP LaserJet PLUS, IBM	8 ppm	RS232C, Centronics	300	N	\$2,695(Q1)
<b>BULL PERIPHERALS CORP.</b> <span style="float: right;">Circle 628</span>								
303 Wyman St., Waltham, MA 02154, (617) 890-5200								
MP 6060	magnetic	Bull		90 ppm	Dataproducts	240	N	\$77,851(Q1)
MP 6090	magnetic	Bull		90 ppm	Dataproducts	240	N	\$97,314(Q1)
<b>CANON U.S.A. INC. (PRINTER DIV.)</b> <span style="float: right;">Circle 629</span>								
One Canon Plaza, Lake Success, NY 11042, (516) 488-6700								
BJ-80	ink jet	Canon	Canon, IBM	110-220 cps	Centronics			\$679-\$799(Q1)
BJ-130	ink jet	Canon	Canon, IBM	220 cps	parallel	360	N	\$995(Q1)
LBP 8II	laser	Canon	Canon	8 ppm	RS232C, Centronics	300	N	\$2,750(Q1)
<b>CIE TERMINALS INC.</b> <span style="float: right;">Circle 630</span>								
2505 McCabe Way, Irvine, CA 92714, (714) 660-1421								
LIPS 10 PLUS	laser	Konica	Diablo, Epson, HP LaserJet PLUS	10 ppm	RS232C, Centronics, parallel	300	N	\$2,995(Q1)
<b>C. ITOH DIGITAL PRODUCTS INC.</b> <span style="float: right;">Circle 631</span>								
19300 S. Hamilton Ave., Suite 110, Torrance, CA 90508, (213) 327-2110								
Jet-Setter	laser	Konica	Epson, IBM, HP LaserJet PLUS	5 ppm	RS232C, RS422, parallel	300	N	\$1,795(Q1)
<b>C. ITOH ELECTRONICS INC.</b> <span style="float: right;">Circle 632</span>								
19300 S. Hamilton Ave., Torrance, CA 90508-9116, (213) 327-9100								
MegaLine	ion deposition	C. Itoh	line printer	30 ppm	parallel		N	\$12,995(Q1)
MegaPro	ion deposition	C. Itoh	Diablo	30 ppm	parallel	300	N	\$17,000(Q1)
<b>CITIZEN AMERICA CORP.</b> <span style="float: right;">Circle 633</span>								
2401 Colorado Ave., Santa Monica, CA 90404, (213) 453-0614								
Overture 110	laser	Mita	Diablo, Epson, IBM	10 ppm	RS232C, Centronics	300	N	\$1,995(Q1)
<b>DATA GENERAL CORP.</b> <span style="float: right;">Circle 634</span>								
3400 Computer Dr., Westboro, MA 01580, (617) 898-4081								
6454	laser	Canon	Canon	8 ppm	serial	300	N	\$2,795(Q1)





```
RECORD      1.1                XYZ Company                COMMAND MODE
PAGE 1 OF 1                                LEVEL 1 OF 1
INPUT                               FILE: MAIL.DTA             1: 4 4:32765
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ENTER COMMAND

R - Read Record          E - Edit Current Record
D - Delete Record       A - Append Records
I - Insert Record(s)    Q - Quit (Exit)
V - Verify Record(s)    US- Locate next unverified rec
T - Display Totals      Z - Zero Total(s)
M - Mass Edit           D - Display Stats
PA- Patch Append       PE- Patch Edit
L - Level Set          F - Find Record by content
FM- Show Find Mask     FX- Enter New Find Mask
FL- Find Like Level    S - Save
P - Page Mode / Page Advance  PG- Page Mode Off
FE- Find Exceptions/Errors  C - Clear / Reset

1:Prev 2:Next 3:Edit 4:Append 5:Find 6:Totals 7>Delete 8:Verify 9:Exit 10:HELP
```

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## NON-IMPACT PRINTERS

Company Model	Print method	Engine	Emulations	Print speed	Interfaces	Resolution (dpi)	Color printing? (yes/no)	Price (quantity)
<b>DATA TECHNOLOGY CORP.</b> <span style="float: right;">Circle 635</span>								
2551 Walsh Ave., Santa Clara, CA 95051, (408) 727-8899								
CrystalPrint VIII	liquid crystal shutter	Casio	HP LaserJet PLUS	8 ppm	RS232C, parallel	300	N	\$2,495(Q1)
CrystalPrint Series II	liquid crystal shutter	Casio	HP LaserJet PLUS	6 ppm	RS232C, parallel	300	N	\$1,995(Q1)
<b>DATAMETRICS CORP.</b> <span style="float: right;">Circle 636</span>								
8966 Comanche Ave., Chatsworth, CA 91311, (818) 341-2901								
DmC-1600	thermal			700 lpm	RS232C, RS422, Centronics	152	N	\$25,000(Q1); \$23,000(Q100)
DmC-1900	thermal			600 lpm	Centronics	200	Y	\$35,000(Q1); \$33,000(Q100)
DmC-4680	thermal			300 lpm	RS232C, IEEE 488	200	N	\$7,500(Q1); \$7,000(Q100)
<b>DATAPRODUCTS CORP.</b> <span style="float: right;">Circle 637</span>								
6200 Canoga Ave., Woodland Hills, CA 91365, (818) 887-8000								
LZR 1230	laser	Toshiba	Diablo, Epson, HP LaserJet PLUS	12 ppm	RS232C, Centronics	300	N	\$3,495(Q1)
LZR 2600 Series	laser	Toshiba	Diablo, Tektronix, line printer	26 ppm	RS232C, Centronics, Dataproducts	300	N	\$12,900-\$19,900(Q1)
SI480	ink jet		Dataproducts, Diablo, IBM	200, 400 cps	RS232C, Centronics	240	N	\$2,795(Q1)
<b>DATASOUTH COMPUTER CORP.</b> <span style="float: right;">Circle 638</span>								
4216 Stuart Andrew Blvd., Charlotte, NC 28217, (704) 523-9500								
PW 1080	LED array	NEC	Diablo, Epson	8 ppm	RS232C, Centronics	300	N	\$1,995(Q1)
PW 3080	LED array	NEC	Diablo, Epson, IBM	8 ppm	Centronics, IBM coax	300	N	\$4,995(Q1)
PW 5080	LED array	NEC	Diablo, Epson, IBM	8 ppm	Centronics, IBM twinax	300	N	\$4,995(Q1)
<b>DECISION DATA COMPUTER CORP.</b> <span style="float: right;">Circle 639</span>								
400 Horsham Rd., Horsham, PA 19044, (215) 674-3300, (800) 523-6529								
6415	laser	Ricoh	Epson	15 ppm	Centronics, IBM twinax	300	N	
<b>DELPHAX SYSTEMS</b> <span style="float: right;">Circle 640</span>								
35 Pacella Park Dr., Randolph, MA 02368, (617) 961-2312								
S3000G	ion deposition	Delphax	Diablo, HP LaserJet PLUS	30 ppm	Centronics, Dataproducts	300	N	
S3000L	ion deposition	Delphax	Dataproducts	300 ppm	Centronics, Dataproducts	300	N	
S6000-2	ion deposition	Delphax	Dataproducts, IBM	60, 75 ppm	Dataproducts, IBM channel	240	N	
<b>DEREX INC.</b> <span style="float: right;">Circle 641</span>								
7716 Wiles Rd., Coral Springs, FL 33067, (305) 753-0840								
DRL20	laser	Kyocera	Diablo, Epson, HP LaserJet PLUS, IBM, NEC, Qume	18 ppm	RS232C, Centronics	300	N	\$8,395(Q1); \$6,995(Q100)
S3000II	ion deposition	Delphax	Diablo, HP LaserJet PLUS	30 ppm	RS232C, Centronics, Dataproducts	300	N	\$14,950(Q1); \$12,700(Q100)
S6000II	ion deposition	Delphax	Dataproducts, IBM	75 ppm	Dataproducts, IBM channel	240	N	\$59,900(Q1); \$50,000(Q100)
<b>DICONIX INC.</b> <span style="float: right;">Circle 642</span>								
3100 Research Blvd., Dayton, OH 45420, (513) 259-3100								
150	ink jet		Epson, IBM	150 cps	RS232C, Centronics	192	N	\$479(Q1)
300w	ink jet		Epson, IBM	310 cps	RS232C, Centronics	192	N	\$749(Q1)
<b>DIGITAL EQUIPMENT CORP.</b> <span style="float: right;">Circle 643</span>								
129 Parker St., Maynard, MA 01754, (617) 897-5111								
LN03	laser	Ricoh		8 ppm	RS232C		N	
LN03 PLUS	laser	Ricoh		8 ppm	RS232C	300	N	
ScriptPrinter	laser	Ricoh		8 ppm	RS232C	300	N	
<b>ELECTRONIC FORM SYSTEMS</b> <span style="float: right;">Circle 644</span>								
2395 Midway Rd., Carrollton, TX 75006, (214) 250-7000								
Formwriter 2X	laser	Canon	Epson	8 ppm		300	N	\$6,595(Q1)
Formwriter 8	laser	Ricoh	Epson	15 ppm		300	N	\$8,995(Q1)
Formwriter 10XD	laser	Canon	Epson	20 ppm		300	N	\$24,995(Q1)
<b>EPSON AMERICA INC.</b> <span style="float: right;">Circle 645</span>								
2780 Lomita Blvd., Torrance, CA 90505, (213) 539-9140								
GQ-3500	laser	Ricoh	Diablo, Epson, HP LaserJet PLUS	6 ppm	Centronics		N	
<b>FACIT INC.</b> <span style="float: right;">Circle 646</span>								
9 Executive Park Dr., Merrimack, NH 03054-0334, (603) 424-8000								
P7080	laser	Ricoh	Diablo, Epson, HP LaserJet PLUS	8 ppm	RS232C, Centronics	300	N	\$3,895(Q1)
P7150	laser	Ricoh		15 ppm	RS232C, Centronics	300	N	\$6,495(Q1)



Soricon's DataSWEEP™1



# Finally. DATA ENTRY has been made DATA EASY.

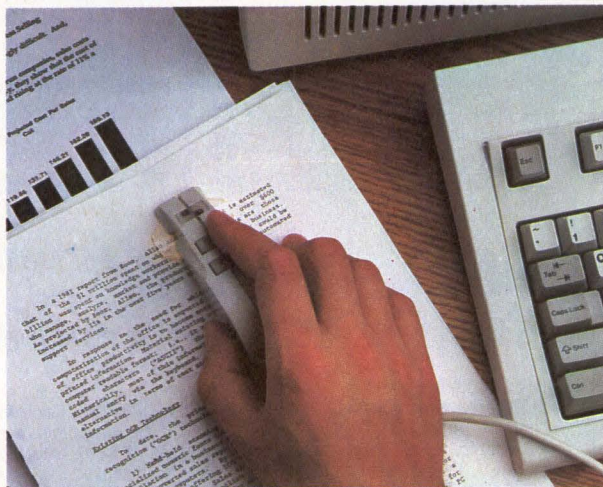
With DataSWEEP™1 from Soricon. An intelligent, hand-held character reader/data entry system that provides the OEM, VAR and System Integrator with a solution-oriented system peripheral for *selective*, high-speed data input.

Provide your personal computer customers with the enhanced productivity of Soricon's OCR/ICR technology. With the continuing rise in keyboard data entry costs, DataSWEEP 1 is a must for increasing data entry accuracy and productivity.

Ergonomically designed, it's the ideal price/performance solution for keyboard users in a wide variety of industries such as banking, insurance, securities, legal, medical and general office workplaces.

When you consider the DataSWEEP 1 features and compare them to typical keyboard data entry, it becomes clear that intelligent character recognition (ICR) technology will become the standard method to efficiently and cost-effectively execute data entry.

- Scanning speed: 170 effective wpm
- Accuracy: Typically 99.3%
- Easy and quick to install and operate
- Requires very little host memory



The Soricon DataSWEEP 1 "A Better Way"

- Multi-font capability: Most office fonts from typewriters, laser printers, daisy wheels, near letter quality dot matrix printers and some typeset text and proportionally spaced type
- Automatically compensates for variations in user technique
- The system adjusts automatically to the specific type style
- Works with the IBM PC, XT, AT and 100% compatibles

DataSWEEP 1 comes complete with the hand-held intelligent character reader, interface board (uses one full-size expansion slot), software diskette, user manual plus full service and manufacturer support.

Soricon's proprietary character recognition technology is not limited to DataSWEEP 1. It can be customized (*in fact, that is our business*) to function with other hosts, non-intelligent terminals, etc.

Call Soricon today TOLL-FREE,  
1-800-541-SCAN for more  
information and a DataSWEEP 1  
demonstration.

 **SORICON**  
CORPORATION

4725 Walnut St. Boulder, CO 80301  
(303) 440-2800 FAX: 303-442-2438



## NON-IMPACT PRINTERS

Company Model	Print method	Engine	Emulations	Print speed	Interfaces	Resolution (dpi)	Color printing? (yes/no)	Price (quantity)
<b>FUJITSU AMERICA INC.</b> <span style="float: right;">Circle 647</span>								
3055 Orchard Dr., San Jose, CA 95134, (408) 432-1300								
RX7100	LED array	Fujitsu	Diablo, Epson, HP LaserJet PLUS	5 ppm	RS232C, Centronics	300 N		\$1,160(Q1)
RX7200	laser	Fujitsu	Diablo, Epson, HP LaserJet PLUS	12 ppm	RS232C, Centronics	300 N		\$2,110(Q1)
RX7400	laser	Fujitsu	Diablo, Epson, HP LaserJet 500 PLUS	22 ppm	RS232C, Centronics	300 N		\$6,380(Q1)
<b>GENERAL BUSINESS TECHNOLOGY INC.</b> <span style="float: right;">Circle 648</span>								
1891 McGaw Ave., Irvine, CA 92714, (714) 261-1891								
6625XP	laser	Ricoh	IBM	15 ppm	RS232C, Centronics, IBM twinax	300 N		\$7,495(Q1)
6636XP	laser	Canon	IBM	8 ppm	RS232C, Centronics, IBM twinax	300 N		\$3,995(Q1)
6640XP	ion deposition	Delphax	IBM	30 ppm	Centronics, IBM twinax	300 N		\$15,995(Q1)
<b>GENERAL COMPUTER CORP.</b> <span style="float: right;">Circle 649</span>								
580 Winter St., Waltham, MA 02154, (617) 890-0880								
Personal LaserPrinter	laser	Ricoh		6 ppm	SCSI	300 N		\$2,599(Q1)
<b>GENICOM CORP.</b> <span style="float: right;">Circle 650</span>								
One Genicom Dr., Waynesboro, VA 22980, (703) 949-1000								
5010	laser	Hitachi	Diablo, HP LaserJet PLUS, IBM	10 ppm	RS232C, Centronics	300 N		\$3,495-\$3,695(Q1)
<b>HARRIS CORP. (COMPUTER SYSTEMS DIV.)</b> <span style="float: right;">Circle 651</span>								
2101 W. Cypress Creek Rd., Fort Lauderdale, FL 33309, (305) 973-5125								
PL4508	laser		Diablo, Epson, Qume	8 ppm	RS232C	300 N		\$7,495(Q1)
<b>HEWLETT-PACKARD CO. (BOISE DIV.)</b> <span style="float: right;">Circle 652</span>								
11311 Chinden Blvd., Boise, ID 83714, (208) 323-6000								
LaserJet Series II	laser	Canon		8 ppm	RS232C, RS422, parallel	300 N		\$2,595(Q1)
<b>HEWLETT-PACKARD CO. (VANCOUVER DIV.)</b> <span style="float: right;">Circle 653</span>								
P.O. Box C-006, Vancouver, WA 98668-C006, (206) 254-8110								
QuietJet Plus	ink jet			160, 192 cps	RS232C, Centronics		Y	
ThinkJet	ink jet			150 cps	RS232C, Centronics		Y	
<b>THE HOLOSCAN CORP.</b> <span style="float: right;">Circle 654</span>								
4 Olsen Ave., Edison, NJ 08820, (201) 549-9000								
H-28/DP-100	laser	proprietary	proprietary	28 ppm	RS232C, Centronics, Dataproducts		N	\$17,000(Q1)
H-28/S-500	laser	proprietary	Tektronix	28 ppm	RS232C, IEEE 488, Centronics, Dataproducts		N	\$24,500(Q1)
H-29/WP-300	laser	proprietary	Diablo, Epson, HP LaserJet PLUS, NEC, Qume	28 ppm	RS232C, Centronics	300 N		\$19,000(Q1)
<b>HONEYWELL BULL INC.</b> <span style="float: right;">Circle 655</span>								
300 Concord Rd., Billerica, MA 01821, (617) 671-6000								
PRU7260 Model 80	ink jet	Ricoh	Diablo	up to 8 ppm	RS232C, RS422, Centronics	300 N		\$3,600(Q1)
<b>HOWTEK INC.</b> <span style="float: right;">Circle 656</span>								
21 Park Ave., Hudson, NH 03051, (603) 882-5200								
Pixelmaster	ink jet	Howtek	Diablo, HP	2 ppm	RS232C, Centronics, GPIB	240 Y		\$4,495(Q1)
<b>IBM CORP.</b> <span style="float: right;">Circle 657</span>								
Old Orchard Rd., Armonk, NY 10504, (800) IBM-2468								
Quietwriter III	thermal	IBM		160-274 cps	IBM PC parallel	240 N		\$1,699(Q1)
Personal Pageprinter	laser			up to 6 ppm	video	300 N		\$2,199(Q1)
Color Jetprinter	ink jet			15-50 cps	IBM PC parallel		Y	\$745(Q1)
<b>IMAGEN CORP.</b> <span style="float: right;">Circle 658</span>								
2650 San Tomas Expressway, Santa Clara, CA 95052-8101, (408) 986-9400								
2308/S Image-Server XP	laser	Canon	Diablo, Epson, IBM, Tektronix	8 ppm	RS423, Centronics, Dataproducts, Versatec	300 N		\$8,950(Q1)
7320 ImageServer XP	laser	Canon	Diablo, Epson, IBM, Tektronix	20 ppm	RS423, Centronics, Dataproducts, Versatec	300 N		\$32,950(Q1)
ImageStation/S	laser	Canon	Diablo, Epson, IBM, Tektronix	8 ppm	RS423, Centronics	300 N		\$5,595(Q1)





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Chicago, Illinois

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## NON-IMPACT PRINTERS

Company Model	Print method	Engine	Emulations	Print speed	Interfaces	Resolution (dpi)	Color printing? (yes/no)	Price (quantity)
<b>IRIS GRAPHICS INC.</b> <span style="float: right;">Circle 659</span>								
12 Jacob Way, Reading, MA 01867, (617) 438-1500								
2024	ink jet	Iris		8 min. per page	Versatec	240	Y	\$49,500(Q1)
2044	ink jet	Iris		12 min. per page	Versatec	240	Y	\$84,500(Q1)
3024	ink jet	Iris		6-12 min. per page	GPIO, IEEE 488, Versatec	240	Y	\$75,000(Q1)
<b>KANEMATSU-GOSHO (U.S.A.) INC. (INFORMATION SYSTEMS GROUP)</b> <span style="float: right;">Circle 660</span>								
333 S. Hope St., Suite 2800, Los Angeles, CA 90071, (213) 626-1123								
M5311	laser	Canon		20 ppm	RS232C; Centronics; IBM coax, twinax	300	N	\$18,974(Q1)
<b>KENTEK INFORMATION SYSTEMS INC.</b> <span style="float: right;">Circle 661</span>								
6 Pearl Court, Allendale, NJ 07401, (201) 825-8500								
K-2+	LED array	Kentek	Diablo, HP LaserJet PLUS	15 ppm	RS232C, RS422	300	N	
K-3	LED array	Kentek	Diablo, HP LaserJet PLUS	24 ppm	RS232C, RS422, Centronics	300	N	
K-4	LED array	Kentek	Diablo, HP LaserJet PLUS	24 ppm	RS232C, RS422, Centronics	300	N	
<b>KYOCERA UNISON INC.</b> <span style="float: right;">Circle 662</span>								
3165 Adeline St., Berkeley, CA 94703, (415) 848-6680								
F-1000A	laser	Kyocera	Diablo, Epson, HP LaserJet PLUS, NEC, Qume, line printer	10 ppm	RS232C, Centronics	300	N	\$2,895(Q1)
F-2010	laser	Kyocera	Diablo, Epson, HP LaserJet PLUS, NEC, Qume, line printer	10 ppm	RS232C, Centronics	300	N	\$4,635(Q1)
F-3010	laser	Kyocera	Diablo, Epson, HP LaserJet PLUS, NEC, Qume, line printer	18 ppm	RS232C, Centronics	300	N	\$8,395(Q1)
<b>MANNESMANN TALLY CORP.</b> <span style="float: right;">Circle 663</span>								
8301 S. 180th St., Kent, WA 98032, (206) 251-5500								
MT90	ink jet		Diablo, Epson, IBM	220 cps	serial, parallel		N	\$799(Q1)
MT910	laser	Kyocera	Diablo, Epson, IBM, HP	10 ppm	serial, parallel		N	\$3,695(Q1)
<b>MILTOPE BUSINESS PRODUCTS INC.</b> <span style="float: right;">Circle 664</span>								
1770 Walt Whitman Rd., Melville, NY 11747, (516) 756-7660								
3801	ion deposition	Delphax	HP LaserJet PLUS, IBM, QMS, Xerox	90 ppm	Centronics, Dataproducts	240	N	\$84,000(Q1); \$65,000(Q100)
Series 37	ion deposition	Delphax	HP LaserJet PLUS, IBM, QMS, Xerox	37 ppm	Centronics, Dataproducts	300	N	\$26,750(Q1); \$19,700(Q100)
Series 75	ion deposition	Delphax	HP LaserJet PLUS, IBM, QMS, Xerox	75 ppm	Centronics, Dataproducts	240	N	\$77,000(Q1); \$56,000(Q100)
<b>MITEK SYSTEMS INC.</b> <span style="float: right;">Circle 665</span>								
6225 Nancy Ridge Dr., San Diego, CA 92121, (619) 587-9157								
120T	laser	Canon		8 ppm	RS232C, RS422, parallel	300	N	\$4,995(Q1); \$3,496(Q100)
125T	laser	Canon		8 ppm	RS232C, RS422, parallel	300	N	\$6,295(Q1); \$4,406(Q100)
150T	laser	Ricoh	Diablo, Epson, HP LaserJet, HP-GL	15 ppm	RS232C, parallel	300	N	\$9,995(Q1); \$7,206(Q100)
<b>NBS SOUTHERN INC.</b> <span style="float: right;">Circle 666</span>								
100 N. Belcher Rd., Clearwater, FL 34625, (813) 441-1981								
Mercurion 1/80	ion deposition	Delphax	Dataproducts, IBM	80 ppm	RS232C; Centronics; IBM coax, twinax, parallel	240	N	\$59,950(Q1)
3840	laser	Hitachi	IBM	40 ppm	RS232C; RS422; Centronics; IBM coax, twinax, parallel	240, 300	N	\$45,000(Q1)
<b>NCR CORP. (PERSONAL COMPUTER DIV.)</b> <span style="float: right;">Circle 667</span>								
1601 S. Main St., PCD-1, Dayton, OH 45479, (513) 445-7478								
6416	laser	Canon	Diablo, ISO 646	500 lpm	RS232C, Centronics	300	N	\$3,220(Q1)
<b>NEC INFORMATION SYSTEMS INC.</b> <span style="float: right;">Circle 668</span>								
1414 Massachusetts Ave., Boxborough, MA 01719, (617) 264-8000								
Silentwriter LC-860+	LED array	NEC	Diablo, HP LaserJet PLUS, IBM	8 ppm	RS232C, Centronics	300	N	\$2,995(Q1)
Silentwriter LC-890	LED array	NEC	HP LaserJet PLUS	8 ppm	RS232C, RS422, AppleTalk, Centronics	300	N	\$4,495(Q1)
LC-3360	laser	NEC	Dataproducts, Diablo, Epson, HP LaserJet PLUS	30 ppm	RS232C, RS422, Centronics	300	N	\$10,995(Q1)

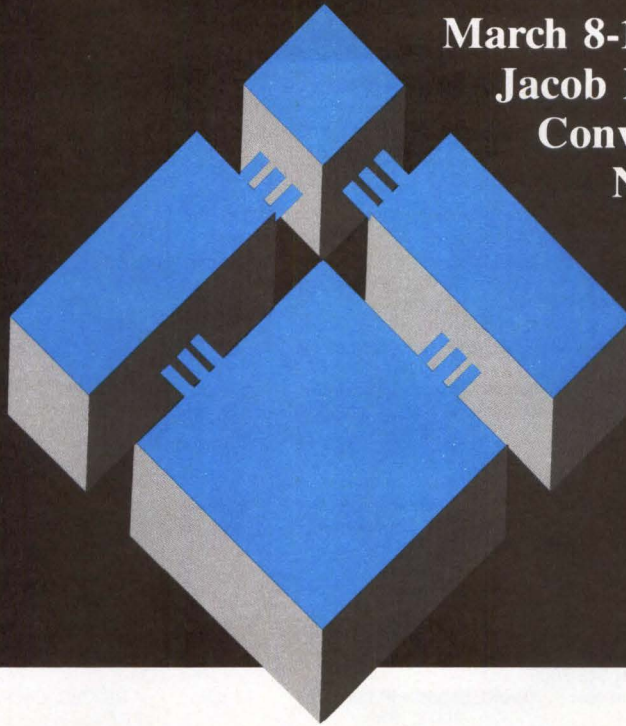


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## NON-IMPACT PRINTERS

Company Model	Print method	Engine	Emulations	Print speed	Interfaces	Resolution (dpi)	Color printing? (yes/no)	Price (quantity)
<b>OFFICE AUTOMATION SYSTEMS INC. (OASYS)</b> <span style="float: right;">Circle 669</span>								
9940 Barnes Canyon Rd., San Diego, CA 92121, (619) 452-9200								
LaserPro 1510	laser	Ricoh	Diablo, Epson, HP LaserJet PLUS, IBM, NEC, Qume, line printer	15 ppm	RS232C, Centronics	300	N	\$7,295(Q1)
LaserPro 2200	laser	Minolta	Diablo, Epson, HP LaserJet PLUS, IBM, NEC, Qume, line printer	22 ppm	RS232C, Centronics, Dataproducts		N	
LaserPro Silver Express	laser		Diablo, Epson, HP LaserJet PLUS, IBM, NEC, Qume, line printer	8 ppm	RS232C, Centronics	300	N	\$2,795(Q1)
<b>OKIDATA</b> <span style="float: right;">Circle 670</span>								
532 Fellowship Rd., Mt. Laurel, NJ 08054, (609) 235-2600								
Laserline 6	ink jet	Ricoh	HP LaserJet PLUS	6 ppm	RS232C, Centronics	300	N	\$1,795(Q1)
Okimate 20	thermal	Okidata	Apple, Atari, Commodore, IBM	12-20 lpm	RS232C, Centronics		Y	\$268(Q1)
<b>OLIVETTI USA (OFFICE PRODUCTS DIV.)</b> <span style="float: right;">Circle 671</span>								
765 US Highway 202, Somerville, NJ 08807, (201) 526-8200								
PG108	laser	Canon	HP	8 ppm	RS232C, RS422, Centronic*	300	N	\$2,595(Q1)
<b>PANASONIC INDUSTRIAL CO.</b> <span style="float: right;">Circle 672</span>								
2 Panasonic Way, Secaucus, NJ 07094, (201) 348-7000								
KX-P4450	laser	Panasonic	Diablo, Epson, HP LaserJet PLUS, IBM	11 ppm	RS232C, Centronics	300	N	\$2,595(Q1)
<b>PERSONAL COMPUTER PRODUCTS INC.</b> <span style="float: right;">Circle 690</span>								
11590 W. Bernardo Court, Suite 100, San Diego, CA 92127, (619) 485-8411								
LaserImage 1000	laser	Ricoh	Diablo, Epson, HP LaserJet PLUS, HP-GL, IBM	6 ppm	RS232C, RS422	300		\$2,495(Q1)
LaserImage 2000	laser	Ricoh	Diablo, Epson, HP LaserJet PLUS, HP-GL, IBM	8 ppm	RS232C	300		\$3,495(Q1)
LaserImage 3000	laser	Ricoh	Diablo, Epson, HP LaserJet PLUS, HP-GL, IBM	15 ppm	RS232C	300		\$6,395(Q1)
<b>PRIME COMPUTER INC.</b> <span style="float: right;">Circle 673</span>								
Prime Park, Natick, MA 01760, (617) 655-8000								
3410	laser	Hitachi	Diablo, IBM	10 ppm	RS232C, Centronics	300	N	\$3,955(Q1)
<b>PRINTRONIX INC.</b> <span style="float: right;">Circle 674</span>								
17500 Cartwright Rd., Irvine, CA 92713, (714) 863-1900								
L1012	laser	Mita	Diablo, Epson, HP LaserJet PLUS	12 ppm	RS232C, Centronics		N	\$3,495(Q1)
L2120	laser	Canon	Diablo, line printer	20 ppm	RS232C, Centronics, Dataproducts		N	\$15,995(Q1)
<b>QMS INC.</b> <span style="float: right;">Circle 675</span>								
One Magnum Pass, Mobile, AL 36618, (205) 633-4300								
KISS plus	laser	Canon	Diablo, Epson, HP-GL, IBM, Qume	8 ppm	RS232C, Centronics	300	N	\$2,390-\$3,490(Q1)
Lasergrafix 1510	laser	Ricoh	Diablo, Qume, Tektronix	15 ppm	RS232C, Centronics, Dataproducts, IBM, Versatec	300	N	\$11,995(Q1)
PS 810	laser	Canon	Diablo, HP-GL	8 ppm	RS232C, RS422, AppleTalk, Centronics	300	N	\$5,495(Q1)
<b>QUADRAM OLP</b> <span style="float: right;">Circle 676</span>								
One Quad Way, Norcross, GA 30093, (404) 923-6666								
QuadLaser I	laser	Ricoh	Epson, HP LaserJet PLUS, IBM, Qume	8 ppm	RS232C, parallel	300	N	\$3,495(Q1)
QuadLaser Plus	laser	Ricoh	Epson, HP LaserJet PLUS, IBM, Qume	8 ppm	RS232C, parallel	300	N	\$3,795(Q1)
QuadLaser PostScript	laser	Ricoh		8 ppm	RS232C, RS422, AppleTalk, parallel		N	\$3,995(Q1)
<b>RICOH CORP.</b> <span style="float: right;">Circle 677</span>								
3001 Orchard Parkway, San Jose, CA 95134, (408) 432-8800								
PC Laser 6000	laser	Ricoh	Diablo, Epson, HP LaserJet PLUS, IBM	6 ppm	RS232C, Centronics	300	N	\$2,395(Q1)
<b>SEIKO INSTRUMENTS USA INC.</b> <span style="float: right;">Circle 678</span>								
1130 Ringwood Court, San Jose, CA 95131, (408) 943-9100								
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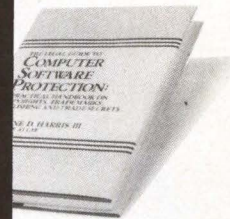
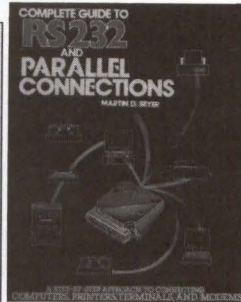
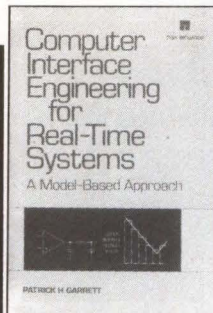
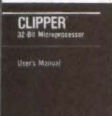
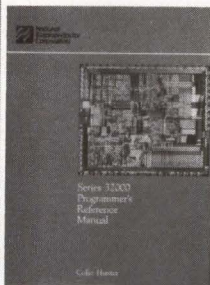


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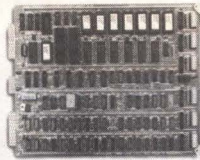
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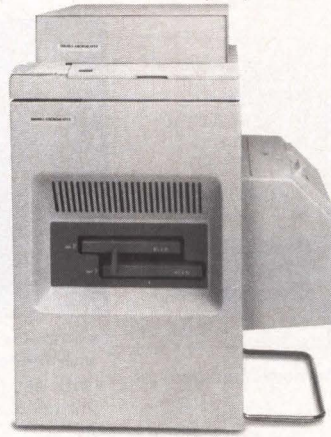
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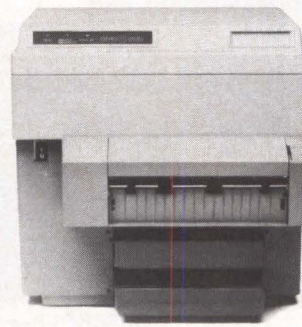
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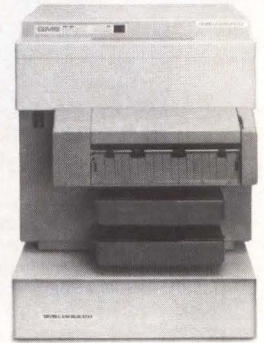
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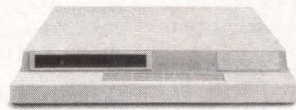
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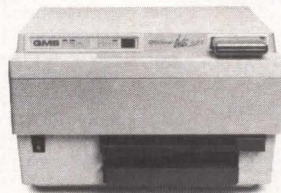
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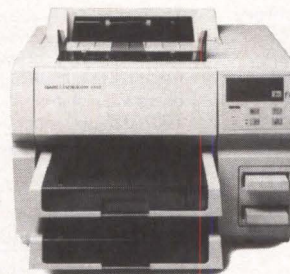
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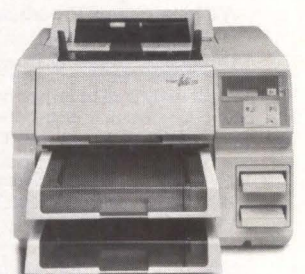
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TELCOR ON COMPRESSION

## How to quadruple dial-up communications efficiency

**Francis Bacon**  
Telcor Systems Corp.

Why would anyone buy a 2,400-baud modem if they could communicate at 9,600 baud for the same money? Why would anyone pay four times the phone charges? Why would anyone wait four times longer for remote information to be displayed on a computer screen?

The answer, of course, is that no one would. Almost anyone who believed that dial-up communications performance could be increased by a factor of four, without major upheaval, would take advantage of the opportunity. This is the promise of data compression. Until now, that promise has been unfulfilled by compression techniques that were either not effective or which were difficult or expensive to implement.

All that has changed since the introduction of a patented data compression model last year by Telcor Systems Corp. The power of the model is derived from a data compression technique that simply works better than the previous ones—such as the Huffman or Lempel-Ziv models. While the design of these models is interesting, the really important point is that consistent 4:1 data compression is now a reality for virtually any modem or dial-up line.

The Huffman model is based on a table that translates each of the 256 ASCII character set into a coded bit pattern for transmission to the receiver. Most of these Huffman codes are actually longer than the original ASCII version of the character. Huffman works because the most frequently used characters have fewer

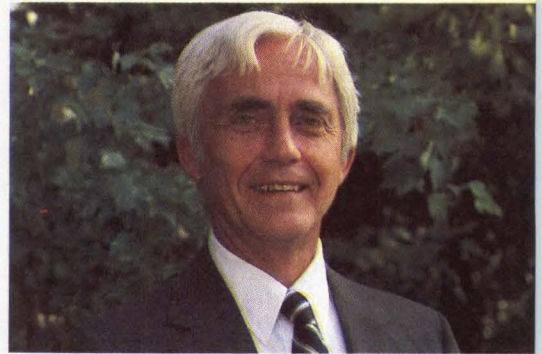
bits than the ASCII so that, on average, the number of bits needed to represent a message is reduced.

### Setting the table for Huffman

An example of how a Huffman encoding table might look is shown in Fig. 1. The table has 256 entries, one for each character. Each entry could consist of, say, 15 bits that are divided into three fields containing three, four and eight bits, respectively. Seven characters can be represented in the field containing three bits (plus the "non-character" code). Fifteen characters can be represented in the field containing four bits (plus the "non-character" code). The remaining 234 characters can be represented in the field containing eight bits.

The Huffman table is organized from top to bottom in descending order of frequency. That means that the most frequently used characters are encoded in three bits in the top seven table entries. If the first three bits contain a recognized character code, that is taken to be the value of the character, and the remaining bits in the entry are ignored.

Immediately below the top seven are encoded the next most often used 15 characters, in descending order of frequency. In each of those 15 table entries, the first field (three bits) is encoded with a special non-character value. That non-character code indicates that the software should look in the second field (four bits) for the actual character code. In this example, therefore, it takes seven bits to represent the next most frequently used 15 characters. The first three bits comprise the non-character code and the second four bits represent the character being transmitted. The remaining eight bits in the entry are



*Consistent 4:1 compression is now a reality for virtually any modem or dial-up line.*

ignored. Seven bits is still slightly better than the eight bits required for the full ASCII character.

If the character being transmitted is not one of the 22 most frequently used characters, it will be represented in one of the remaining 234 table entries, with the least frequent occupying entry 234.

In each of those entries it will take more bits to represent a character than it would to represent the ASCII version of the character, that is, 15 bits versus eight. In these entries, both the first and second fields contain the special "non-character" value, which tells the software to go on to the third and, in this case, last field for the character code.

### Exchanges places at the table

Huffman tables may be either static or dynamic. A static table is one in which the frequency of each character in the message is assumed and so the order of the character in the table is determined ahead of time. That order is fixed so that, even if the actual frequency changes, the software will continue using the same table. Obviously, both the sender and receiver would have created identical tables prior to transmission to enable proper interpretation of the message codes.

In a dynamic Huffman model, a frequency algorithm determines which characters are represented at

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**Francis Bacon** is chairman of Telcor Systems Corp.

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TELCOR ON COMPRESSION

which levels in the table. Every time a character is used, its position in the table is exchanged for the position of the character immediately above it. The bit patterns in the table themselves do not actually change. What changes is the assignment of the bit patterns within a table entry to represent a particular character. An exchange is always made after the code currently assigned is sent across the line. This ensures that both sender and receiver can update their respective copies of the table in synch.

For example, let's suppose a data stream shifted from using uppercase and lowercase letters to all uppercase. In the first instance, the lowercase "e" might be the most frequently used character and be at the top of the table. Uppercase "E", on the other hand could very well be at the bottom. Once the shift to all uppercase occurred, every time E was used its table assignment would be swapped to the next higher level until it

reached the top. Along the way, it would cross the boundary between 15- and 7-bit representation and then the boundary between 7- and 3-bit representation.

The major advantages of the Huffman model are its simplicity and the fact that it does not require much memory to implement. The fact that it can only represent single characters one-for-one, rather than a string of characters, limits its data compression ability. A model that can process a string of characters at one time is Lempel-Ziv.

**Lempel-Ziv varies the string**

Unlike Huffman, which uses a fixed table to convert each of the 256 ASCII characters into a corresponding compressed-bit pattern, Lempel-Ziv uses a table of variable size to express combinations, or strings, of characters of varying length.

Lempel-Ziv works by building strings of variable lengths and assign-

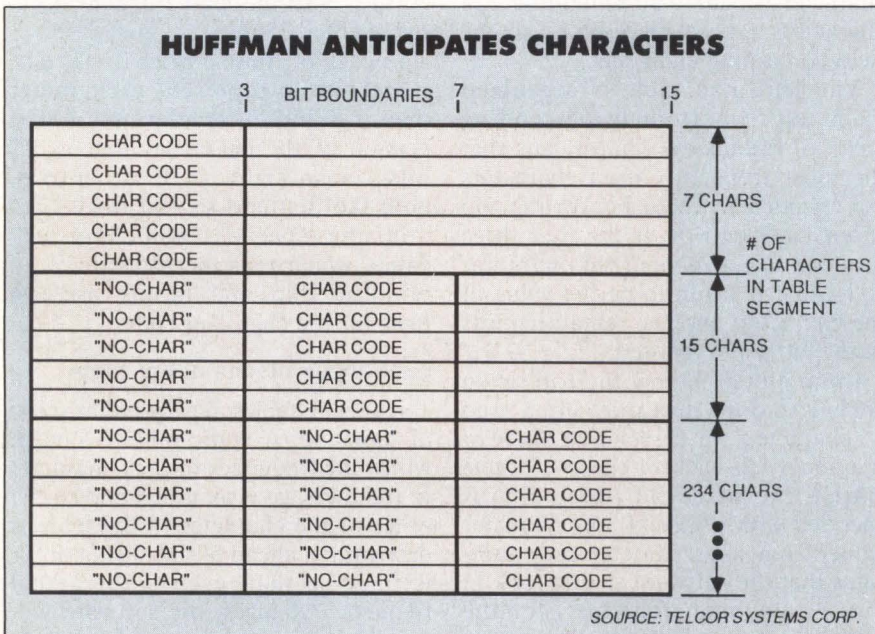
ing string numbers to them. All one-character strings (i.e., the members of the ASCII character set) are predefined in the table. The string number of each ASCII character is preset to its number within the ASCII set. For example, the string number for "a" is 97, "b" is 98 and so on.

As soon as the software begins to see, so called "virgin" strings, i.e., strings that haven't yet been stored in the table, it begins writing these strings to a table and referencing them with string numbers. For instance, suppose we were sending the entire ASCII character set again and again through the model. Each of the ASCII characters would already be assigned string Nos. 1 through 256.

As we first start to send the alphabet through, the first virgin string encountered would be "ab." (Because "a" is known but "ab" is new). Accordingly, this string would be stored in the table and assigned string No. 257. As the table entry for "ab" is created, the string number for "b" is sent so that the receiver knows that the second letter being sent is a "b." In the future, when "ab" is sent, the receiver will know that 257 means "ab" and so the string number will be sent instead.

The next virgin string identified would be "bc" when the software encounters the "c." This time the string number "67" is sent so the receiver knows that the third character in the stream is a "c." Both sender and receiver assign a string number (258) to the new string and put the string in their tables. The next time the software sees the string "bc" the number 258 will be sent instead of the ASCII value "bc."

Virgin strings always consist of a string known to the table plus one additional character which, when added to the known string, makes the string unfamiliar. For example, on the second reading of alphabet, the string "ab" will be known but the string "abc" will not. Therefore, the sender transmits the string number of the known part of the string (257) so that the receiver will also know that the string sent is 'ab.' Then the sender



**Fig. 1. The Huffman table** is organized from top to bottom in descending order of frequency. Each entry could consist of, say, 15 bits divided into three fields of three, four and eight bits. Seven characters can be represented in the field containing three bits (plus the "non-character" code). Fifteen characters can be represented in the field containing four bits (plus the non-character code).



## TELCOR ON COMPRESSION

assigns a string number for the "abc" string and goes on to take the "c" as the first character of the next string. Since "c" is known, the software goes on to consider the next character, "d." Since "cd" is known, the software considers the next character, "e." Because "cde" is a virgin string, the "cd" gets sent in the form of its string number to the receiver. A string number (514) is then assigned by the sender to "cde."

### Strings begin to pile up

The receiver now knows that the character after "ab" was "c" and is also able to assign a string number to "abc." Because string numbers are always assigned in the same order at both sender and receiver, the string numbers always agree.

However, one distinguishing performance feature of Lempel-Ziv is that, even if the input to the model is a steady stream of characters—"a, b, c, d, e" and so on—the output will soon become bursty. In our example, once we get past the first 256 strings, the output of the model is "ab, cd, ef" and so on. When we get past the 768th character, the output is "abc def efg" and so on. Between the character groupings time is spent by the software in searching the table, assigning string numbers, and filling (or reading) transmission containers. The bursty nature of Lempel-Ziv results in the "jerky screen" effect that mirrors the start-stop pattern of the transmission stream.

Another limitation of Lempel-Ziv is the so-called boundary problem. That problem occurs when portions of the same string occur over and over again in the table, even though, logically, it would make sense to have only one copy of a string occupy space. Take, for example, the string "there." Embedded within this string are also the strings "here" and "ere," which may very well have their own string number assignments taking up space in the table.

The issue of table capacity and efficiency is important for Lempel-Ziv. Typically, what happens when the size of the table reaches its prescribed

limit, and the software cannot find a location for a string number it wants to assign, is that the table collapses and the software starts over, constructing a new one. The result of this rebuilding process is that highly efficient string number assignments are temporarily lost, greatly reducing data compression. Typically, Lempel-Ziv must rebuild its table about every 3,000 characters, which in most cases is every few seconds.

It is possible in some versions of the model to "freeze" the table once it has been built and simply reuse the same assigned string numbers on new data. To do so, however, takes the risk that the new data will reflect the same frequencies of character-pattern usage as the old data. If, in fact, the data were suddenly to go from uppercase and lowercase letters to, say, all uppercase, the model would become horribly inefficient, unless it could build a new table.

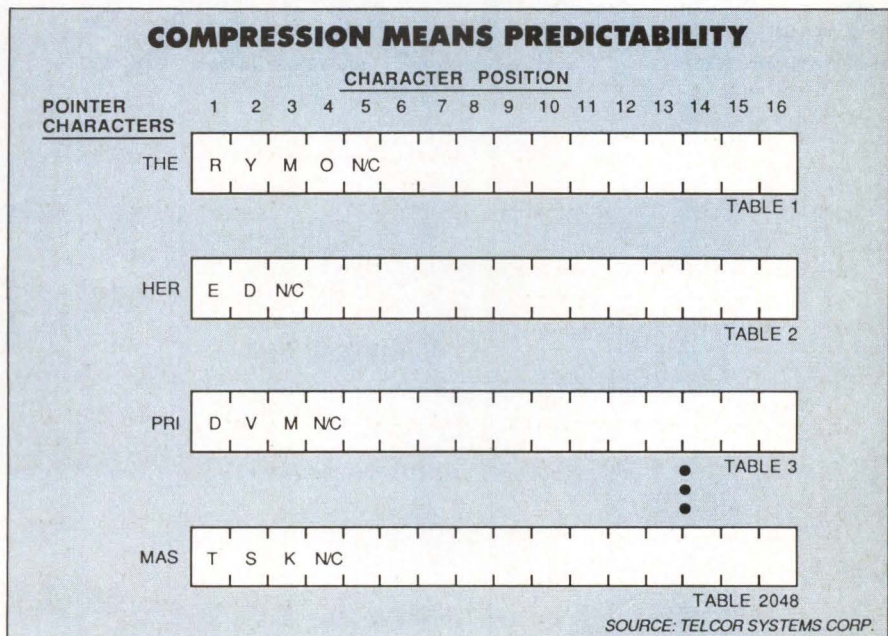
### Telcor converts ASCII

The Telcor model combines con-

cepts from both Huffman and Lempel-Ziv. Like Huffman, Telcor uses a fixed table size to convert single ASCII characters into compressed codes for transmission. Like Lempel-Ziv, the Telcor model uses the fact that certain character strings appear more frequently in a data stream than do other strings. Like Huffman, Telcor adapts so that the more frequently a character is used, the greater the degree of data compression that is achieved.

Telcor uses up to 2,048 tables for data compression. Each table contains up to 16 different characters. Fig. 2 shows how four of these tables might look.

The key to the Telcor model is that, what almost always gets sent across the line is the number of the character position in a table. Further, that position is never more than six bits since we only need to identify 16 positions. As it never takes more than six bits to indicate the position of a character in a table (usually only one or two), Telcor provides efficient data com-



**Fig. 2. Telcor's data compression technique uses up to 2,048 tables, each with up to 16 different characters. For example, in sending the "y" in the word "they" using the tables listed here, the letters in the pointer to Table 1 are the t, h and e.**



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## TECHNOLOGY FORUM

### TELCOR ON COMPRESSION

pression. Four-to-one is typical.

Knowing the position of a character within a table does no good unless the correct table is also known. Telcor uses a table pointer to identify the table containing the character at the specified position. That pointer is created from the three characters that immediately preceded the current character in the stream. Using those three characters, the pointer consists of the following bits: the least significant seven bits of the character immediately preceding this one and the two most significant bits of each of the two other characters. This is an 11-bit pointer that can address up to 2,048 different tables.

If, for example, you were sending the "y" in the word "they" using the tables listed in Fig. 2, the letters used to construct the pointer to Table 1 are the t, h and e. The Telcor model would have created a pointer based on these letters, which in this example is assigned to Table 1. As in the case of the other models, both the sender and receiver construct their tables and pointers in sync. This is done by first sending the uncompressed version of a letter and only then performing synchronous encoding on both ends.

Once the Telcor pointer has been created and identified as being present within the current bit stream, what comes next in the bit stream will be read by the receiver as a character-position value. The bit pattern resident at that position will in fact be the "decompressed" ASCII character.

In our example, the receiver's pointer is pointing toward Table 1 because the letters "the" were the last three received. Now the sender emits a single binary "1," indicating the second bit position in that table is the one with the desired character. One bit has thus taken the place of eight.

The Telcor model, therefore, takes advantage of the fact that certain characters are more likely than others to follow certain three-character strings. For example, r, y, m and n are more likely to follow "the" than will x, !, or %. This allows short numbers to be used as table character positions

and a high average degree of data compression.

As in Huffman, the Telcor model calls for the creation of a special "non-character" value to signal when a character is not in the table. The sender will know if a letter to be sent is new to the table and will, accordingly, send the position of the "n/c" character to the receiver. The sender will also assign the new character to the next available position in the table. At the receiving end, the software sees that what is being referenced is a non-character position. Following transmission of the "n/c" character position, the sender emits the full ASCII bit pattern of the new character. Both sender and receiver update their tables by putting the character in the next available position, just ahead of the "n/c" character.

As new three-character strings present themselves in the data stream, both sender and receiver will also construct new table pointers, using the new string created by the occurrence of a new character and assign that pointer to the next table not currently addressed by a pointer. If all the tables have pointers, the software will create a new pointer and overwrite the table that has been least frequently referenced.

#### Predictability reduces redundancy

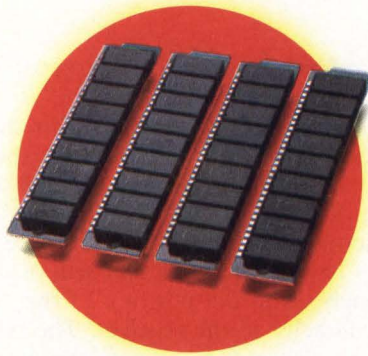
Each time a character that already exists in a table is referenced, it exchanges places with the character immediately to its left. This means that the most frequently referenced characters in a table will require the least number of bits, thus increasing the data compression ratio even more.

Besides achieving the fastest effective data transmission rate of any data compression technique, Telcor has a number of other major advantages over both Huffman and Lempel-Ziv. Unlike Huffman, Telcor achieves significant compression with almost all characters, not just those handful in a select "top tier." □

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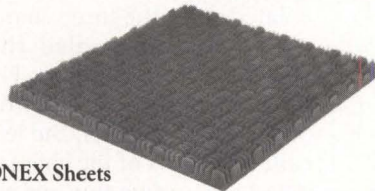


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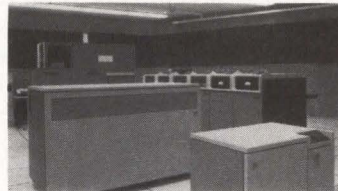


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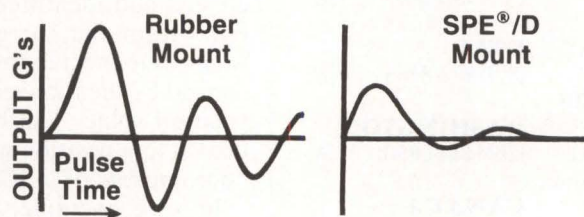
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Megan Niels, Staff Editor



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Circle 541

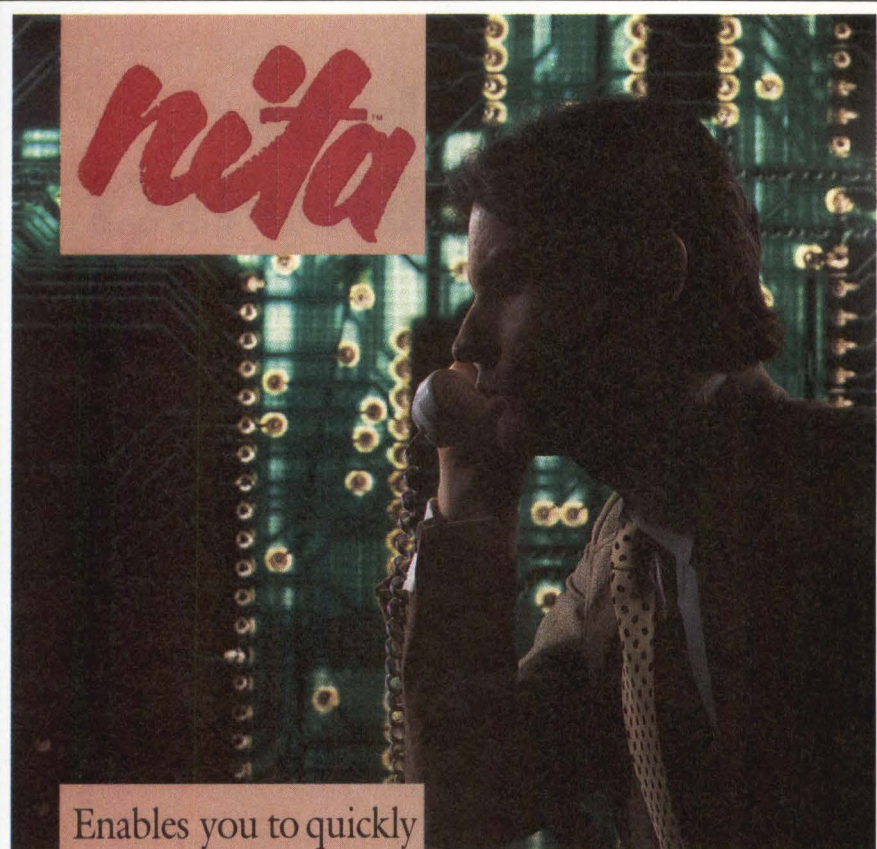
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**Converter links seven peripherals**

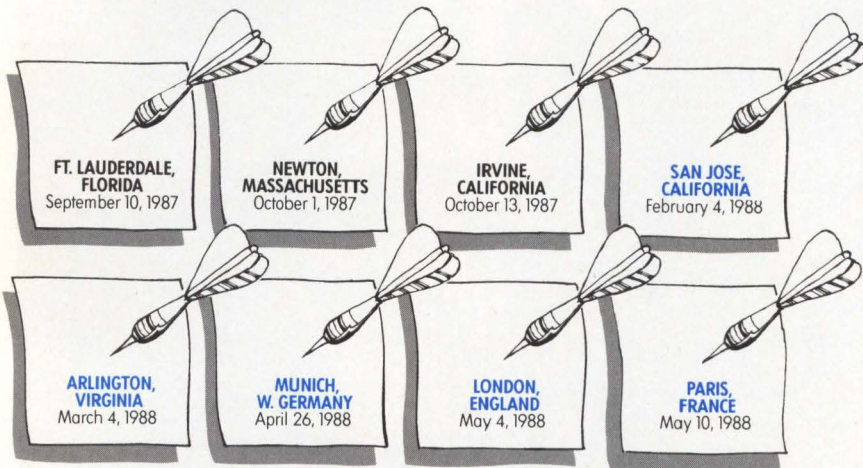
- 45 terminal types
- 18 character sets
- Seven-color support

The SmartNet 5250/T Plus protocol converter connects up to seven asynchronous terminals, printers, personal

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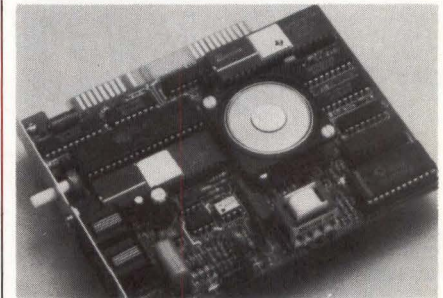
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Circle 544

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Circle 547

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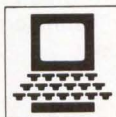
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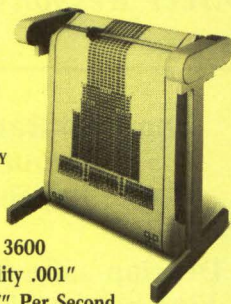
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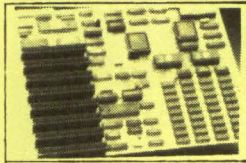


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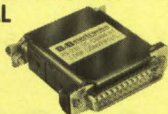
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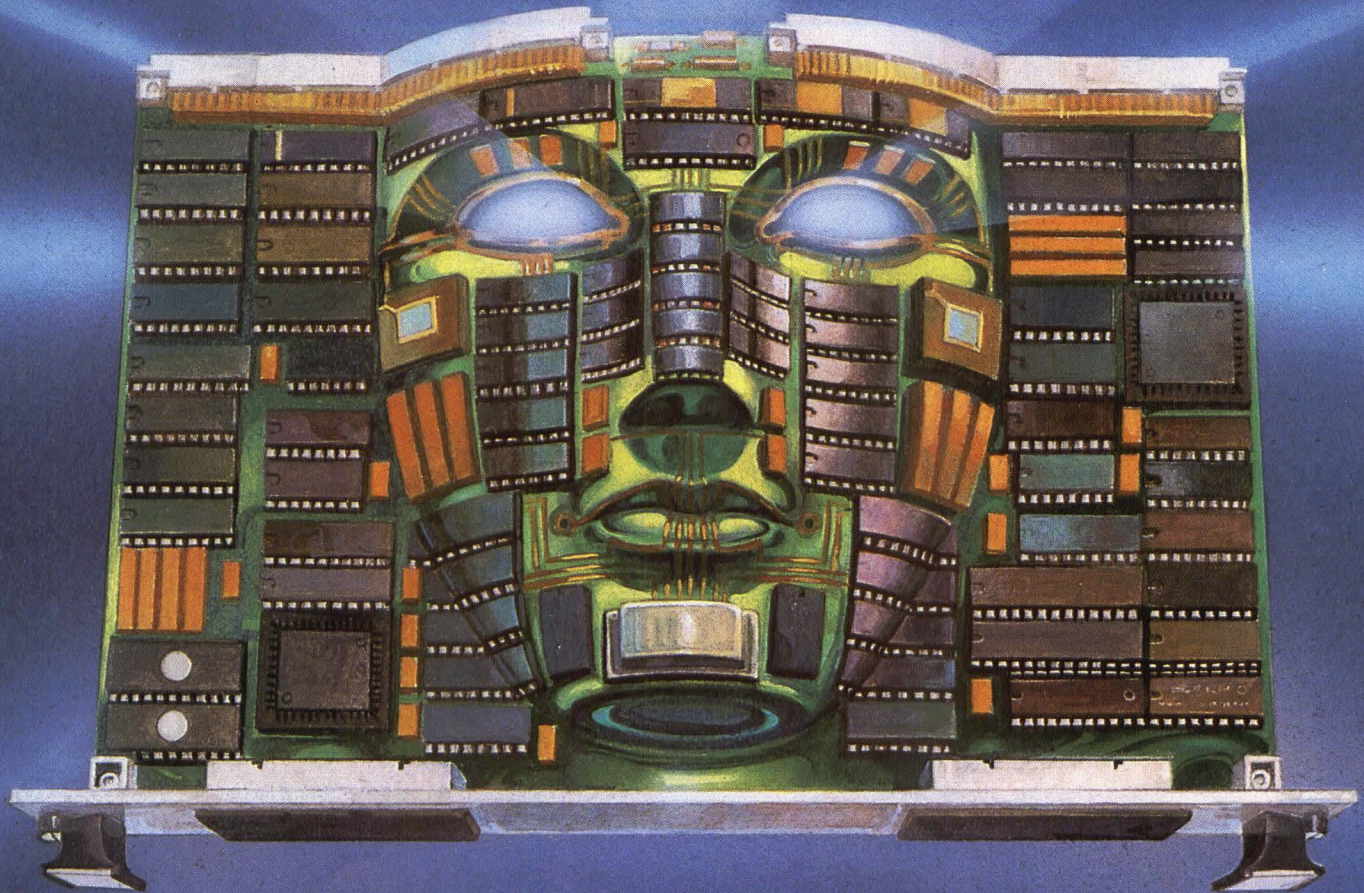
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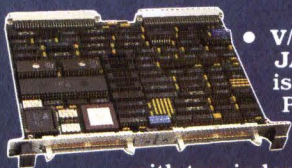
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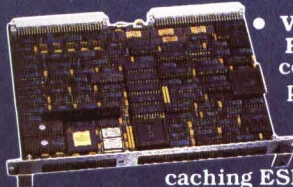
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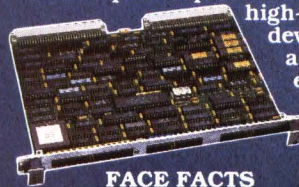


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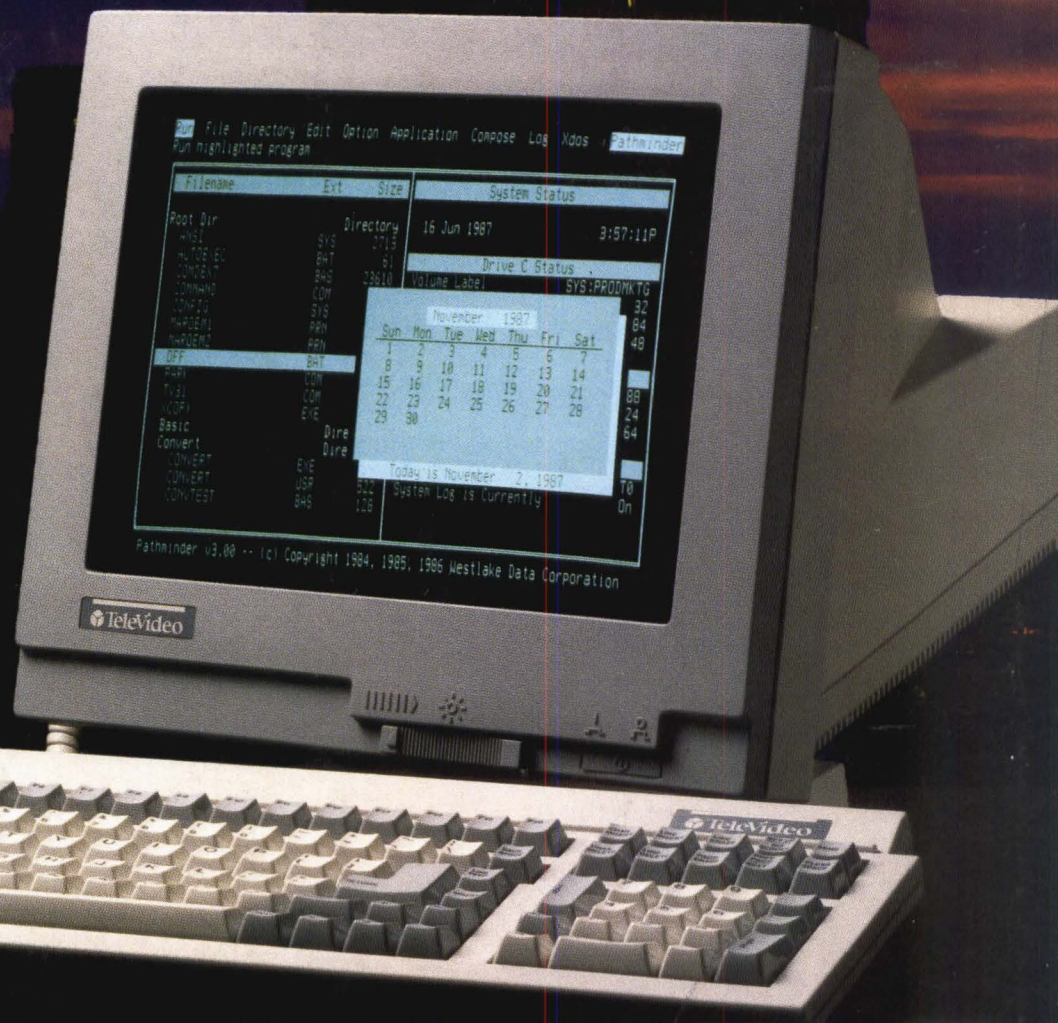
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