Mini-Micro Systems

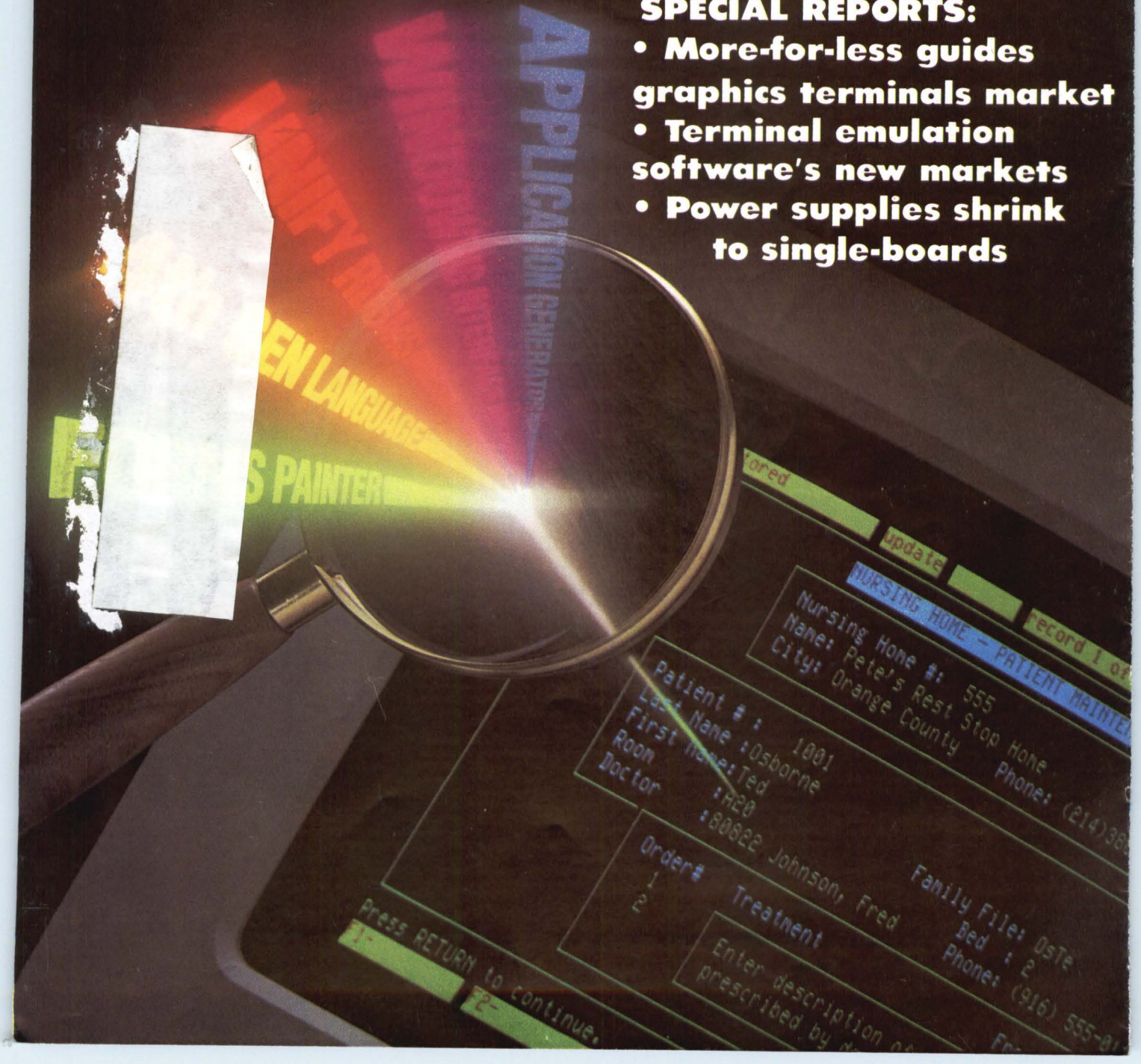
A CAHNERS PUBLICATION

NOVEMBER 1985

Integrated Software Speeds Program Development

SPECIAL REPORTS:

- **More-for-less guides graphics terminals market**
- **Terminal emulation software's new markets**
- **Power supplies shrink to single-boards**



loves changes

In addition, there are a number of HP peripherals for you to choose from: input and mass storage devices, plotters, printers, and more.

Productive programming language options.

You also have a complete set of programming language tools to work with, to help you better meet the needs of your application. For instance, the Series 300 runs HP BASIC, as well as HP-UX — HP's robust version of AT&T's System V UNIX™ operating system. And HP-UX supports industry standard programming languages, too — FORTRAN 77, Pascal, and C.

Link entire systems, not just users.

The Series 300 is designed to be linked with other systems. Your initial application may call for a simple, single-user system. But the Series 300 has what it takes to grow into a sophisticated 100-node LAN based on IEEE 802.3 or Ethernet™. With LAN, the Series 300 can share data with the Series 200 and 500 computers in the HP 9000 family, plus the popular HP 1000 and 3000 family.

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Introducing the HP 9000 Series 300

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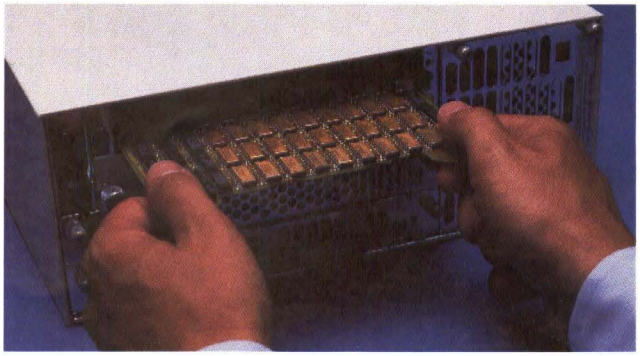
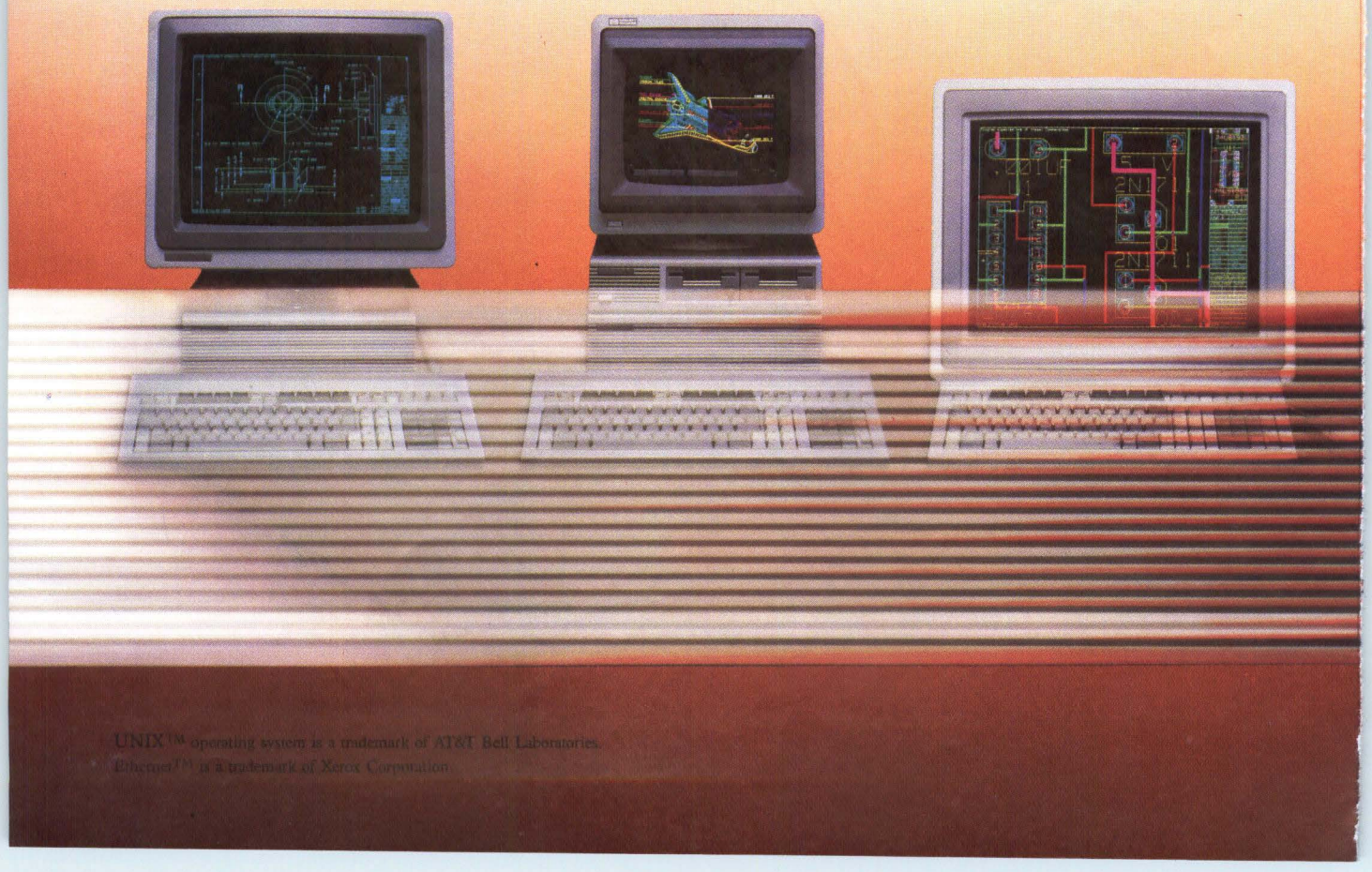
The Series 300 offers you the appropriate processing power for the job, running your choice of two Motorola microprocessors: the 68010 16/32 bit and the 68020 32 bit. You can start with the 68010 and easily upgrade to the 68020 when more processing power is required. Just as important, you have complete object code compatibility across the product line. So when you change processors, there's no need to recompile.



Changing CPUs in the HP 9000 Series 300 is a snap. You simply plug in a new card set and, with object code compatibility, you shift from a 68010 running at 10 MHz to a 68020 running at 16.6 MHz.

Adding peripherals is easy.

The Series 300 has the built-in interfaces to handle HP's large, fully compatible family of peripherals. There are many compatible monitors of varying resolution, too, so you can go from 12-inch monochromatic display all the way to high-speed, high-resolution color graphics.



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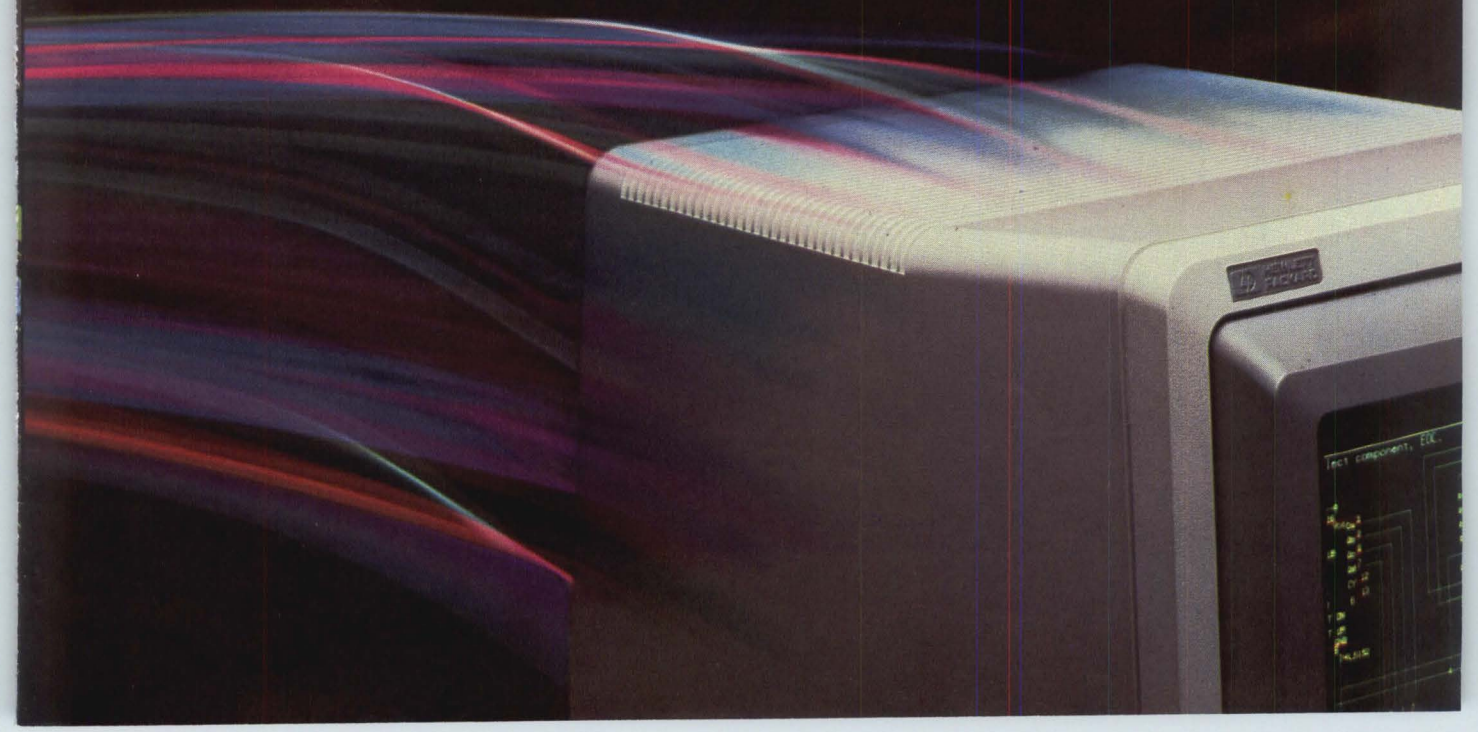

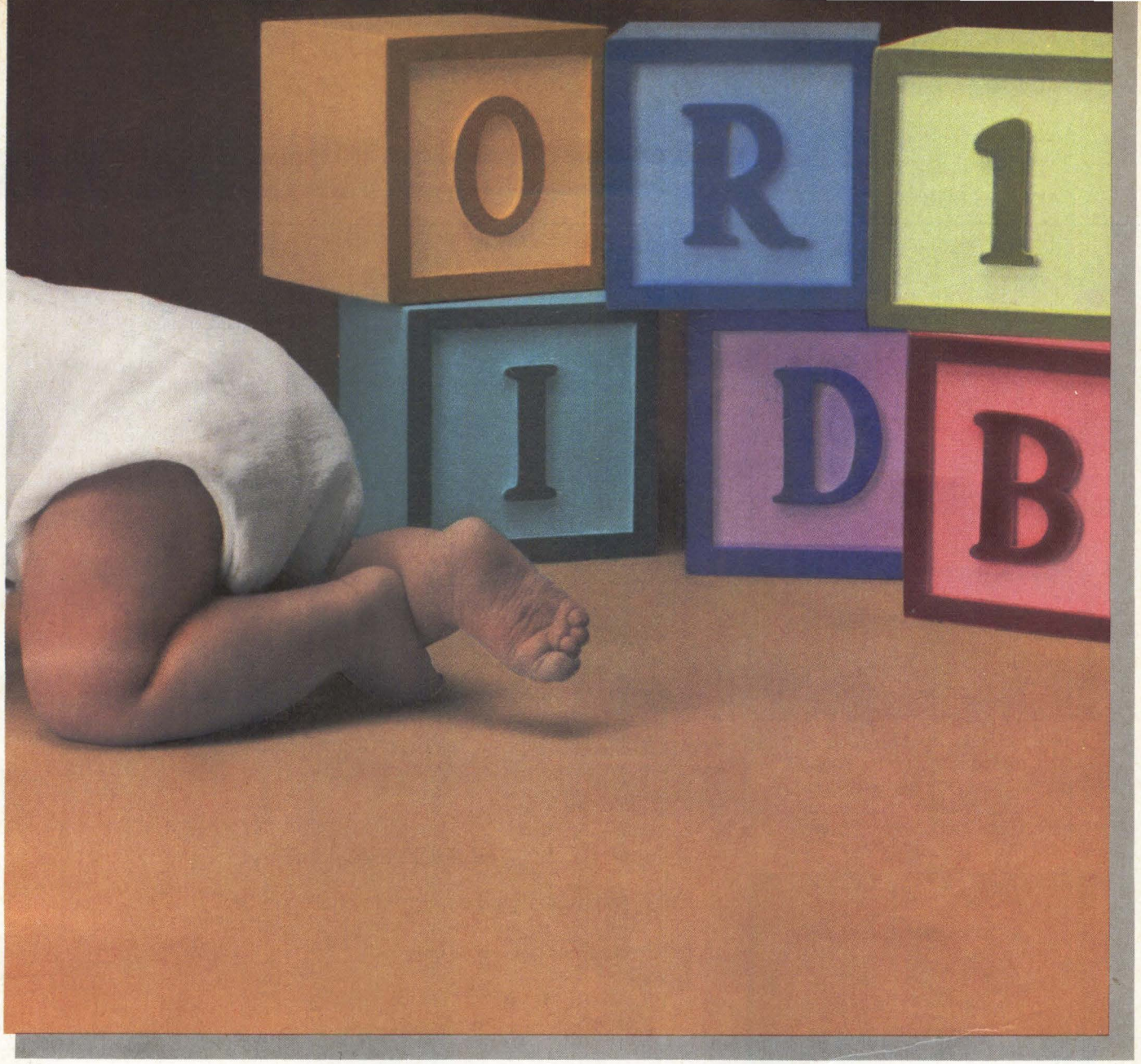

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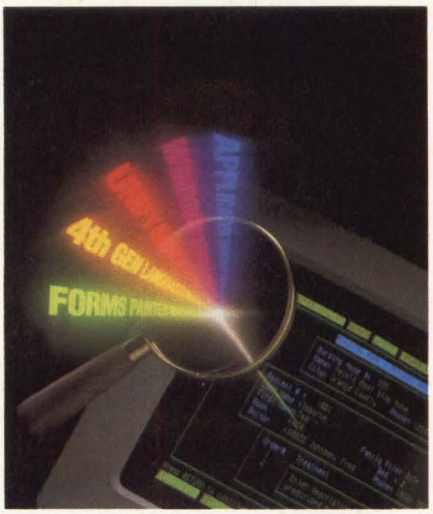


p. 93 . . . Speeding application development. Creative direction by Young & Roehr. Photography by Pat Burt. Color Trend 210 terminal supplied by Intecolor. Courtesy of Unify Corp.

p. 44 . . . . . HP unveils Vectra

p. 69 . . . . . Integrating three systems

NEWS/INTERPRETER

Old and new players bank on powerful VMEbus products 41

Hewlett-Packard unveils AT-compatible Vectra 44

Asynch 10,000-bps-plus modem promises speedier PC links 45

Cooperative 'MAP' standards effort nets results 50

Pacific Perspective: Japanese copyboards: products in search of a market 54

Spec Wars: Two coalitions square off over extended memory 56

New GraphOn terminals pursue DEC-Tek strategy 62

Heard on the Hill: Nippon Telegraph's open door demands patient knocking 66

*EUROPEAN NEWS

PHIGS graphics standard emerges to challenge GKS E1

*Appearing in the European edition only

VERTICAL MARKET INTEGRATOR

IC house integrates three computer systems 69

Integrated computer system controls financial center 81

FEATURES

Feature Highlights 91

Application generator speeds development 93
By combining databases, fourth generation programming languages and windowing interfaces, application generators overcome programming pitfalls

MINI-MICRO SYSTEMS (ISSN 0364-9342) is published monthly (with 4 special Digest issues) by Cahners Publishing Company, Division of Reed Holdings, Inc., 275 Washington St., Newton, MA 02158. Norman L. Cahners, Chairman; Saul Goldweitz, President and Chief Executive Officer; Ronald G. Segel, Executive Vice President and Chief Operating Officer. MINI-MICRO SYSTEMS is published by the Cahners Magazine Division: William Platt, President; Terrence McDermott, Executive Vice President. Circulation records are maintained at Cahners Publishing Co., 270 St. Paul St., Denver, CO 80206. Second class postage paid at Denver, CO 80202 and additional mailing offices. Postmaster: Send address changes to MINI-MICRO SYS-

Systems

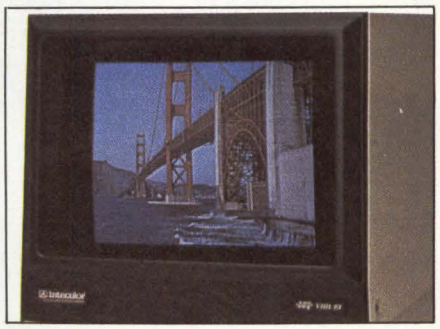
VOL. XVIII NO. 14 NOVEMBER 1985

Users get more for less in graphics terminals 107
In four major market segments, small graphics-terminal vendors compete with more performance and features at lower prices, while larger companies extend their product lines

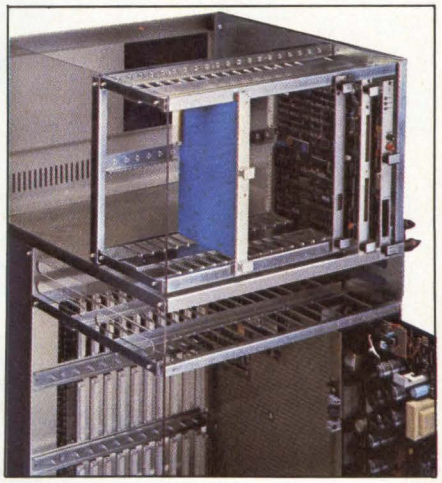
ASCII software claims new markets 119
Terminal emulation and ASCII communication software provides novel ways to integrate diverse applications and machines

Power supplies slim to single-board sizes 128
Smaller, lighter switching-power supplies allow system integrators unprecedented mechanical-design flexibility

VARs take center stage at Comdex/Fall '85 141
Concentrating on value-added resellers' market influences, Comdex/Fall offers strategic guidelines



p. 107 . . . . . Get more for less



p. 128 . . . . . Slim equals flexible

*DIGITAL DIRECTIONS

Floating Point readies array processor for MicroVAX II D2

News briefs D6

Products D9

*Appearing in the DEC demographic edition only

DEPARTMENTS

Editorial Staff 4
Editorial 11
Letters 16
Breakpoints 25
New Products 145
Calendar 166
Career Opportunities 168
Classified Advertising 171
System Integrators' Notebook 172
Index to Advertisers 174
Market Track 177
Artful Intelligence 179
Mini-Micro Marketplace 181

p. 141 . . . . . Comdex preview

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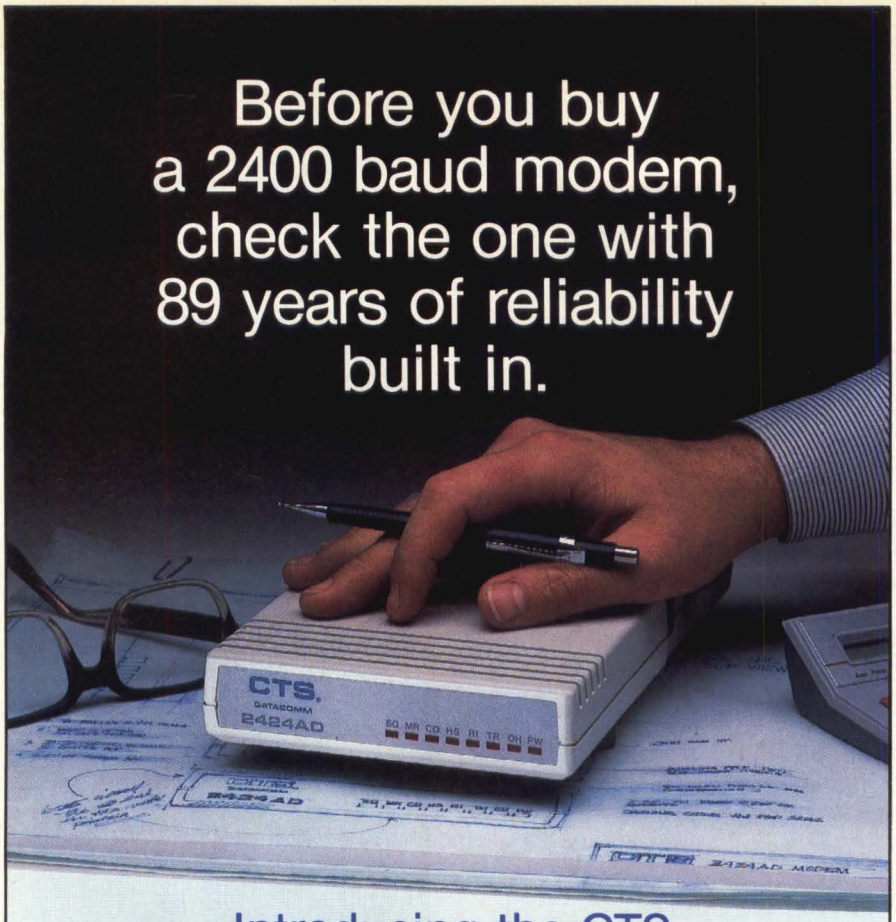

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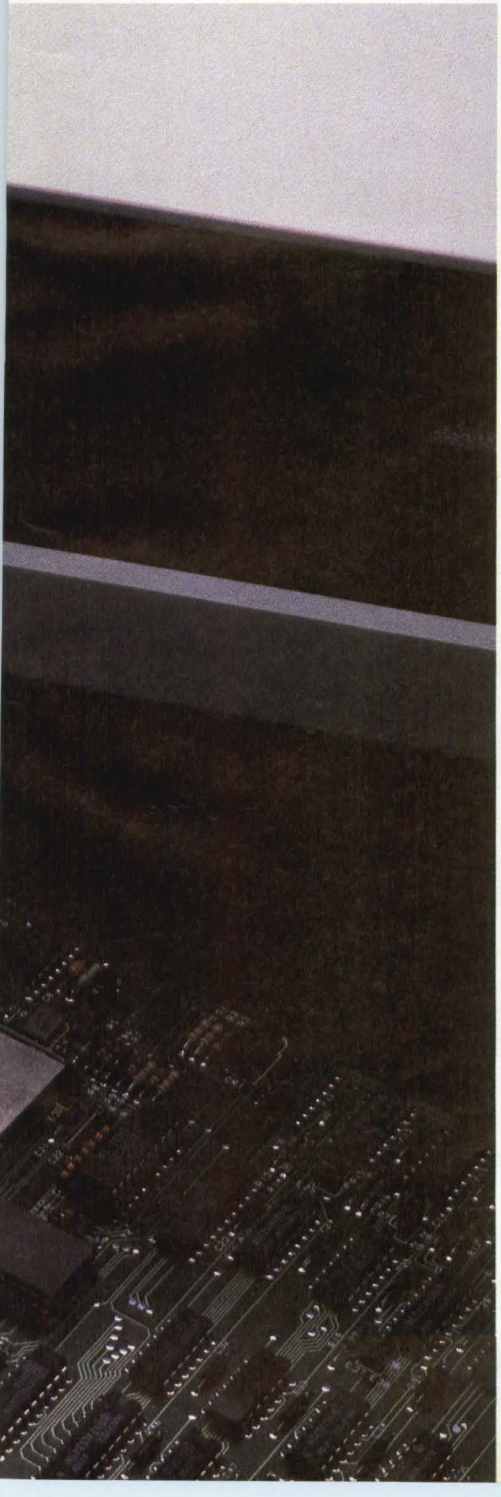

So by using his PC, the president of a company can get real time data out of his factory control manager's iRMX system real fast. And just as easily, pull a file from the lab where they use multi-user systems.

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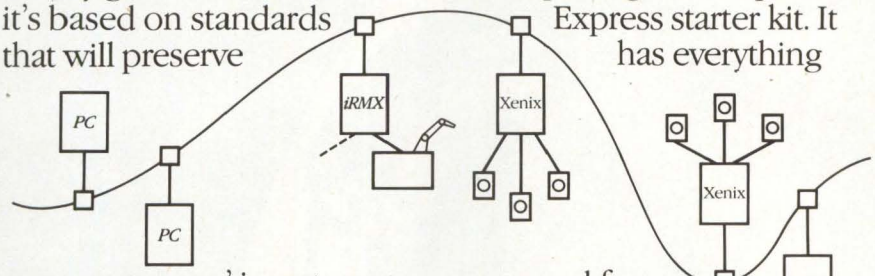

For instance, based on the ISO 7 layer model, OpenNET offers the most complete product solution at every level of integration. Layers one and two are supported by Intel's IEEE 802.3 Ethernet board; three and four by our iNA 960 Transport Software (ISO 8073); and layers five, six and seven are covered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

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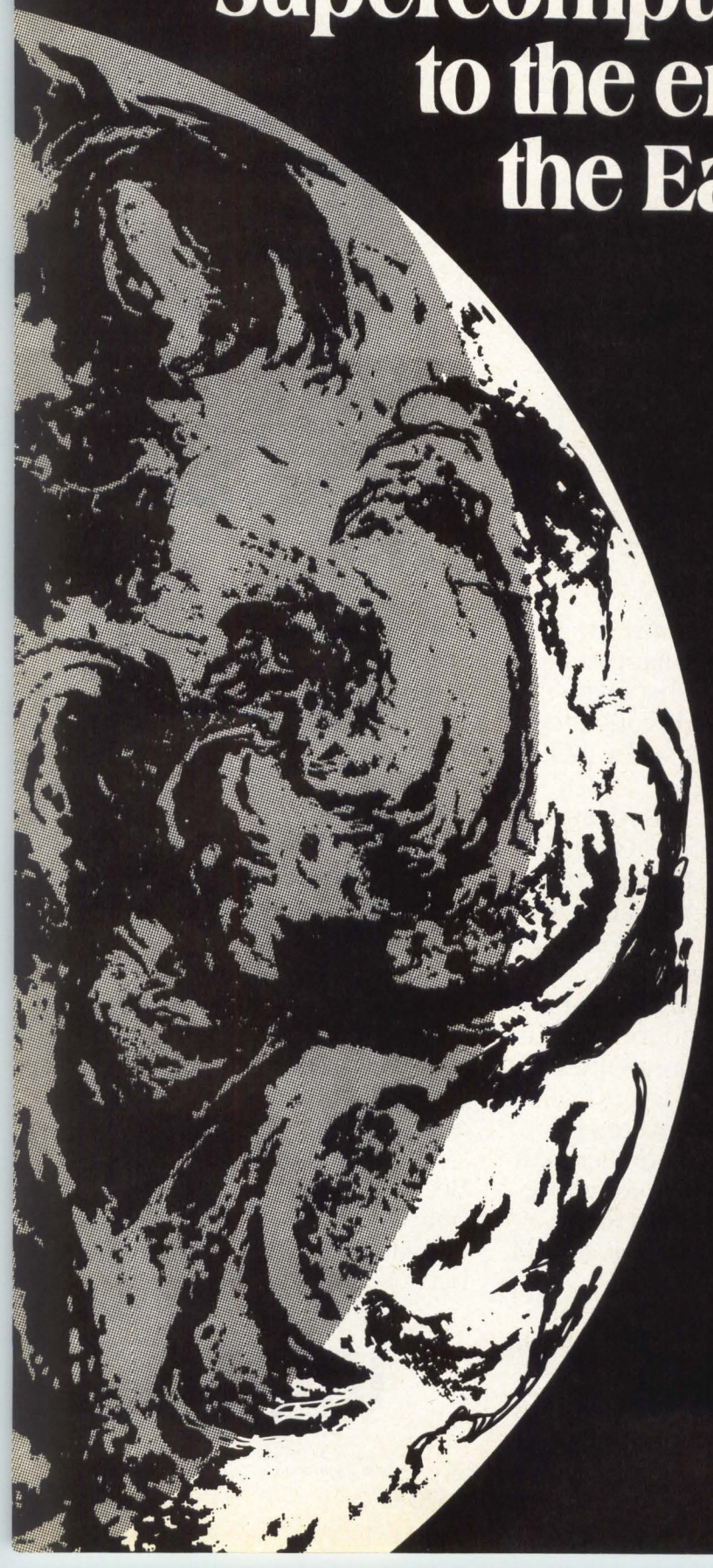

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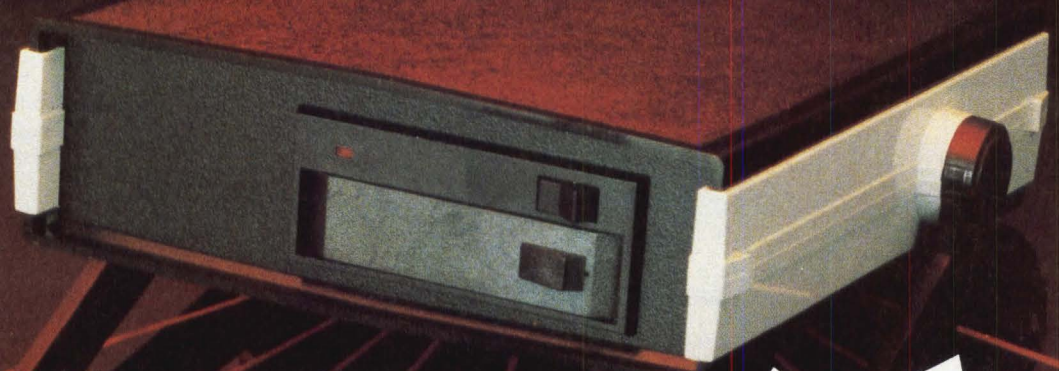

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EDITORIAL

NORWEGIAN ELECTRONICS INDUSTRY EXPANDS

Long a dominant force in fishing, mining and shipping, Norway now gains increasing share in worldwide computer and electronic markets. Indeed, Norwegian manufacturers offer advanced products that possess high quality, technical competence and diverse flexibility. In fact, whereas most U.S. companies continue to endure the 1985 computer industry slump, Norway's electronic industry is expanding by about 20 percent annually. According to the Export Council of Norway, total electronic sales amounted to $722 million in 1984. And exports accounted for approximately half of those sales. These numbers are miniscule by comparison with U.S. business standards, but they demonstrate steady, controlled growth over the past several years.

But how has a relatively small country (4.12 million population) like Norway achieved even limited worldwide success in the fiercely competitive electronics marketplace? I found out the answers firsthand during a recent visit to Norway as a guest of the Export Council. In summation, the answers encompass effective management, tight fiscal control, detailed market research, reliable product performance and aggressive total pricing.

And you only have to look at the countryside to understand why. Because of harsh weather, wide temperature extremes and rugged seashore and mountainous topographies, Norwegian vendors must design, develop and produce quality products that meet severe application demands. They have, therefore, accumulated considerable product expertise in a home market, which, although not large, insists on sophisticated electronics for stringent defense, industrial and commercial needs. Consequently, over time, Norwegian companies have become renown in such product fields as telecommunications, data processing and communications, instrumentation, process control and robotics. Such reputations have attracted the attention of neighboring and distant countries. As a highly developed country with nearly full employment, an experienced work force and a knowledgeable research-and-development structure, Norway opts to expand and pursue worldwide market opportunities.

Prior to my visit, I never regarded Norway as a significant force in the worldwide electronics market. But compelling statistics and capabilities quickly proved otherwise. Norwegian manufacturers prefer to search out specialized markets overlooked or bypassed by well-known industry giants. They then bring their expertise to bear on solving specific problems. Their approach has proved successful in Europe, Asia, the Far East and even in the United States.

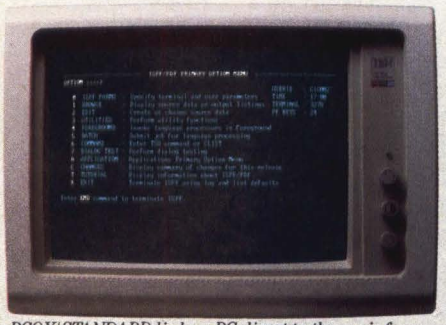
However, Norwegian companies don't try to do it alone in foreign countries. Instead, they open sales offices and hire local talent. They make deals with local OEMs and system integrators. Or, they form joint ventures with prominent domestic vendors.

Alone, Norway doesn't possess the capacity to shake the U.S. computer/electronics industry. But Norwegian companies have successfully dented U.S. markets because American buyers will always purchase foreign, rather than domestic, goods when they get product quality and reliability at a fair price.

George V. Kotelly

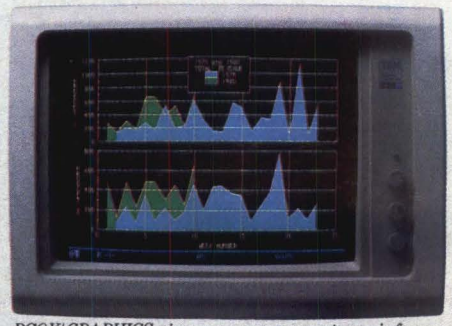
George V. Kotelly
Editor-in-Chief

CXI doesn't answers, just



PCOX/STANDARD links a PC direct to the mainframe. PCOX/PLUS (not shown) can "window" a PC session, host session and two notepads on the same screen.

PCOX/3270 PC turns the PCs you have into the 3270 PCs you need. We also offer an upgrade to 3270 PC for other PCOX products and even for IRMA.



PCOX/GRAPHICS gives you easy access to mainframe data and mainframe graphics like SAS-Graph,™ GDDM™ and DISSPLA.™

PCOX micro-to-mainframe connections are designed with your IBM 3270 network in mind.

At CXI, we've come up with hardware and software solutions that solve problems at both ends of the micro-to-mainframe connection.

Be it coaxial or remote.

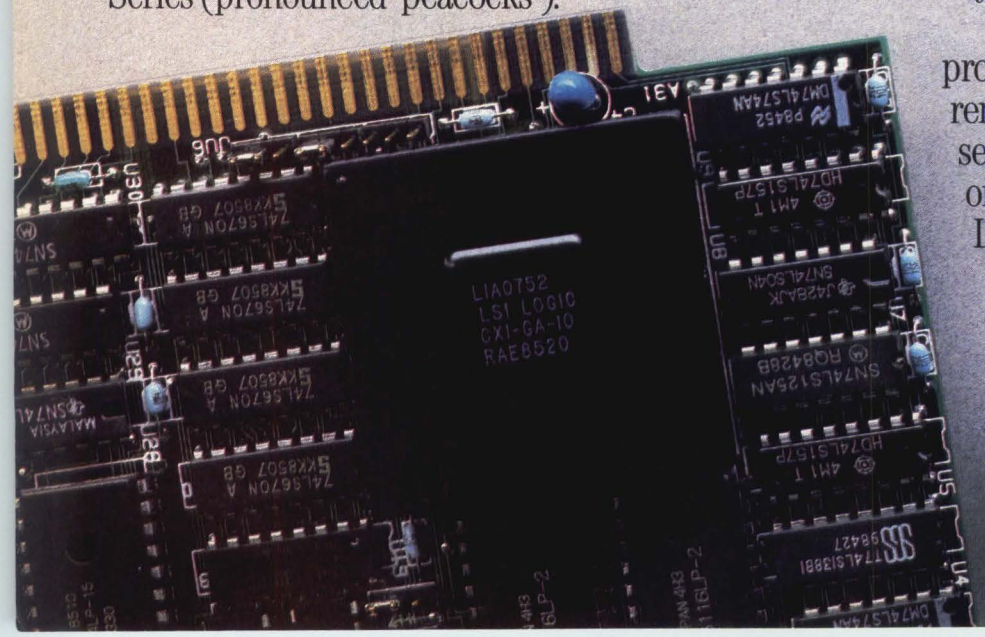
Together we call them the PCOX™ 3270 Series (pronounced "peacocks").

To start with, there's our PCOX/STANDARD and PLUS emulator boards. They link your PCs to the mainframe. And provide file transfers to and from the host.

Our PCOX/3270 PC upgrades your PC to multiple host sessions for a fraction of the price of an IBM 3270 PC. While PCOX/GRAPHICS lets you do true S3G graphics terminal emulation right on a PC.

Looking for micro-to-mainframe connections for your LAN?

Our PCOX/GATEWAY products come in coaxial and remote versions and serve host sessions to your IBM PC Network or NETBIOS-compatible LAN.



We designed this proprietary gate array chip (on your left) to let us fit a lot more capability in a lot less space. With more reliability. It was also the first chip designed exclusively for 3270 terminal emulation.

have all the more of them.

Or snap on one of our smart accessories. Like KEYBOARD MATE. A compact addition to your PC keyboard that gives you single keystroke access to 3278/79 and 3270 PC functions.

We've thought our answers through.

All PCOX products work with IBM® PCs, XTs, ATs and compatibles. They're easy to install. And easy to upgrade. It's as simple as changing a diskette.

But more important, since we design and manufacture everything we sell, we can track and respond to changes in the industry.

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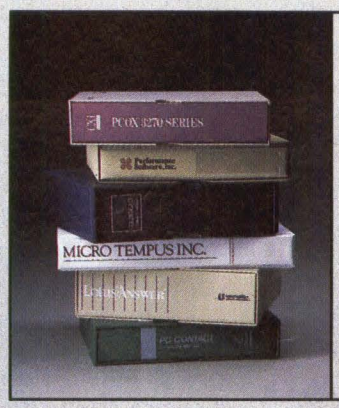
Of course, when you go with CXI, you'll be in the company of other good companies like General Motors, Citicorp, TWA, British Petroleum and more.



PCOX works with all major micro-to-mainframe software.

Whether it's Cincom, Cullinet, Informatics, MSA, Micro Tempus or Performance Software, PCOX runs it. This is due in part to the three application program interfaces we provide. Namely, IBM's, IRMA's and our own PCOX API.

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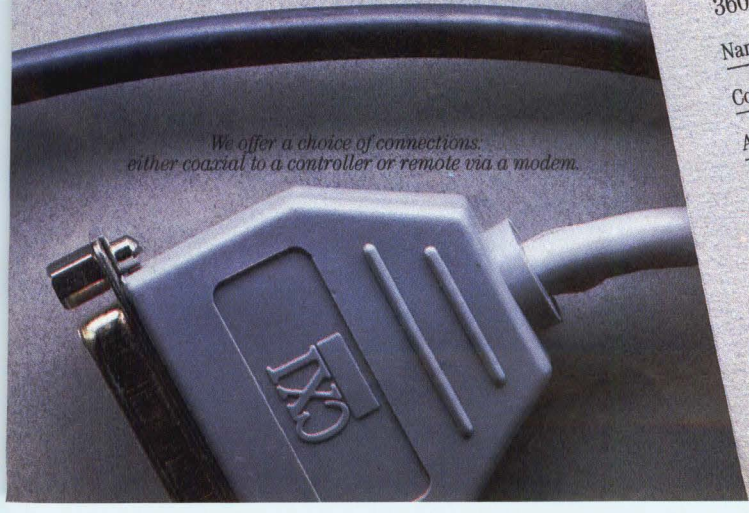

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CIRCLE NO. 8 ON INQUIRY CARD

Guess who just unveiled seven

The new IBM 3161 ASCII Display Station is really seven different ASCII displays in one.

In addition to its own function-rich native mode, the new IBM 3161 can emulate:

- IBM 3101 Model 881
- ADDS Viewpoint*
- Hazeltine 1500*
- Lear Siegler ADM-3A*
- Lear Siegler ADM-5*
- TeleVideo 910*

Besides fitting nicely into existing systems, the IBM 3161 also offers impressive improvements in ergonomics.

Improved Ergonomics For Improved Productivity

Take the 102-key ASCII-style keyboard, for example. Its low profile, gentle contour and typewriter touch make for faster keying with fewer errors. The keyboard has programmable function and editing keys so it can be custom-tailored to meet your application needs.

Then, for comfortable viewing, there's the tilt and swivel of the 12″ display. And the sharp, clear 8 x 16 character matrix for easy reading. Plus cursor, character and field attributes (blink, reverse video, underscore, dual intensity, etc.). And scrolling. And partitioning. And lots more.

The IBM 3163 with Plug-in Cartridge

And, as if that weren't enough, we're also announcing

The sharp 8 x 16 character matrix helps make for easier reading and fewer operator errors.

a second new ASCII display station with even higher function—the IBM 3163.

Outwardly, these two new displays look alike. But the 3163, in addition to its built-in emulation of the IBM 3101 Model 881, also offers the ability to emulate the DEC VT 52 and VT 100* by means of a unique plug-in cartridge.

And while you'll like the power and flexibility of the 3161, for your high-function applications the 3163 goes even further. For example, a 7,680-character buffer and up to three windows enable you to view and modify portions of different host data bases. The 3163 lets you redefine and even recap the keys.

On both displays the setup is menu-guided and written in plain English, so it can be done easily and quickly. The point is, both are designed to improve your user productivity.

Very Attractive Prices

The price per terminal is $695 for the 3161 and $1,095 for the 3163. Quantity discounts are available. What's more, IBM maintenance offerings start as low as $35 per year per terminal for customer carry-in repair.

Now there's a new family of ASCII displays with the quality, service and support IBM is famous for. Both displays are available through IBM Authorized Distributors and IBM marketing representatives.

FEATURES	3161	3163
Lines x Characters	25 x 80	25 x 80
Double-sized chars	No	Yes
Line drawing chars	24	24
Vertical scroll	Jump	Jump/ Smooth
Definable function keys	24	24
Windowing	No	Yes
Partitioning	Horiz	Vert/Horiz

Call 1 800 IBM-2468, Ext. LE/96 for the name of an Authorized Distributor near you.

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*ADDS Viewpoint is a trademark of Applied Digital Data Systems, Inc.; Hazeltine 1500 is a trademark of Hazeltine Corp.; Lear Siegler ADM-3A/ADM-5 are trademarks of Lear Siegler, Inc.; TeleVideo 910 is a trademark of TeleVideo Systems, Inc.; DEC VT 52/VT 100 are trademarks of Digital Equipment Corporation.

different ASCII displays in one.

The IBM 3161 ASCII Display Station

CIRCLE NO. 9 ON INQUIRY CARD

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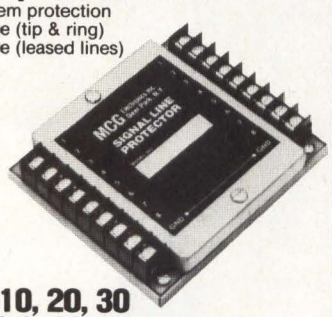
- ☐ BNC, TNC, Twin Ax connectors

DLP-4.2, 4.4
Dial-up/Leased Line
- ☐ Modem protection
- ☐ 2-wire (tip & ring)
- ☐ 4-wire (leased lines)



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CIRCLE NO. 10 ON INQUIRY CARD

LETTERS

PREVAILING RESPONSE

To the editor:

The article, "Integrated UNIX software package supports customized applications" (MMS, July, Page 38), is an interesting presentation of Prevail [Inspiration Systems Inc.'s multiple-function software package]. On the positive side, four components are briefly described with relative accuracy. If brevity demanded that state-of-the-art features be omitted, as well as descriptions of three components, we acknowledge editorial privilege.

However, we feel that some of Prevail's important concepts and capabilities were misunderstood. First, our ADL [applications development language] is designed for generating applications in conjunction with our DBMS [database management system]. With any DBMS-based application, the DBMS must be operating on the end-user system in order for the application to function. Our ADL is not a standalone language; rather, it is one of seven tools provided to our users. In fact, ADL is designed with capabilities that promote DBMS use and enhance programmer productivity in generating DBMS applications—these design features are not features one would see in a general-purpose language.

Secondly, we do not currently offer an electronic-mail capability.

With regard to IBM [Corp.] Systems Network Architecture support, we believe that an intelligent software company leverages the developments of others. With the availability of SNA on hardware that we support, we will interface Prevail to SNA. Many hardware manufacturers have already announced SNA and Inspiration Systems is currently working on this interface.

To compare our product against any other product on the market is difficult. The comparison [with Quadratron Systems Inc.'s Q-Office] cited in the article is representative; the author is comparing apples and oranges. The two products have exactly one component in common—word processing. Prevail offers six other sophisticated and advanced components. Subcomponents, such as forms and menus, are part of our features lists as opposed to being listed as a product component. Our pricing, as a whole or unbundled, is very competitive with other UNIX-based products.

Dennis M. Moyles
Chairman and Chief Executive Officer
Inspiration Systems Inc.
Production Plaza
Sewickley, Pa. 15143

FLIP-FLOP

To the editor:

In your article, "OEM Incorporates Software Duplication" (MMS, September, Page 67), there is an illustration (Page 68) that indicates the results of an analysis of a data-integrity test. The photos are in reverse order. The IXI photo referred to in the copy as being on the left side is actually on the right, implying the competitor's equipment is superior to ours.

Beverly A. Burchette
Marketing Administrator
IXI Laboratories Inc.
Minneapolis, Minn.

To the editor:

I and several other system evaluators noted what we believe to be an error on Page 68 of the article, "OEM Incorporates Software Duplication."

In the block at the bottom of the page is a description of how CPT Corp. measured the ability of IXI Laboratories Inc.'s FDFS format/copy system to accurately reproduce data from master disks. The results of a time-interval analyzer check of IXI Labs' equipment and that of a competitive manufacturer are shown in a pair of photos above the text.

It is believed that either the positions of the photos were reversed or that we here should fold our tents and become cab drivers downtown. Please comment as there are only a limited number of cabs available and I want to be first in line, if need be.

Mervin W. Bierman
Technical Sergeant, U.S. Air Force
Computer Systems Evaluator
Barksdale Air Force Base, La.

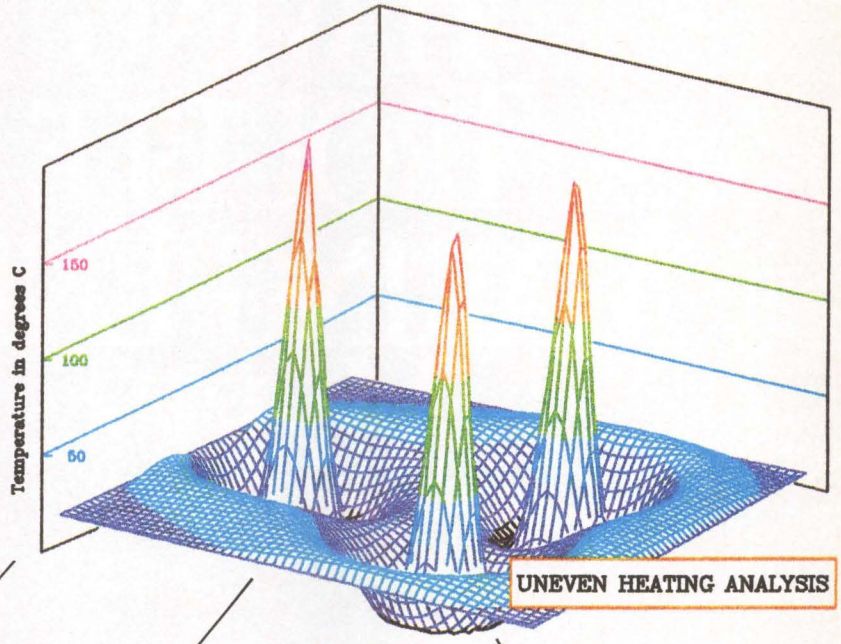
Editor's response:

Stay in the Air Force, sergeant. The photos were reversed.

—J. Donohue

"DOTS INCREDIBLE."

You're looking at letter-quality text created by an AMT printer. The same printer that produced the CAD/CAE diagram you see on the right. Dots incredible! But that's not all. With the AMT, you can print letters or documentation at 45, 100 and 250 cps. Print in *italics* and different type styles and sizes. Print scientific and special symbols--even other languages 中文字. You can print on transparencies and multipart forms. And you can do it all in a RAINBOW of COLOR.



Actual size—you can't get quality like this on a plotter, but you can with AMT.

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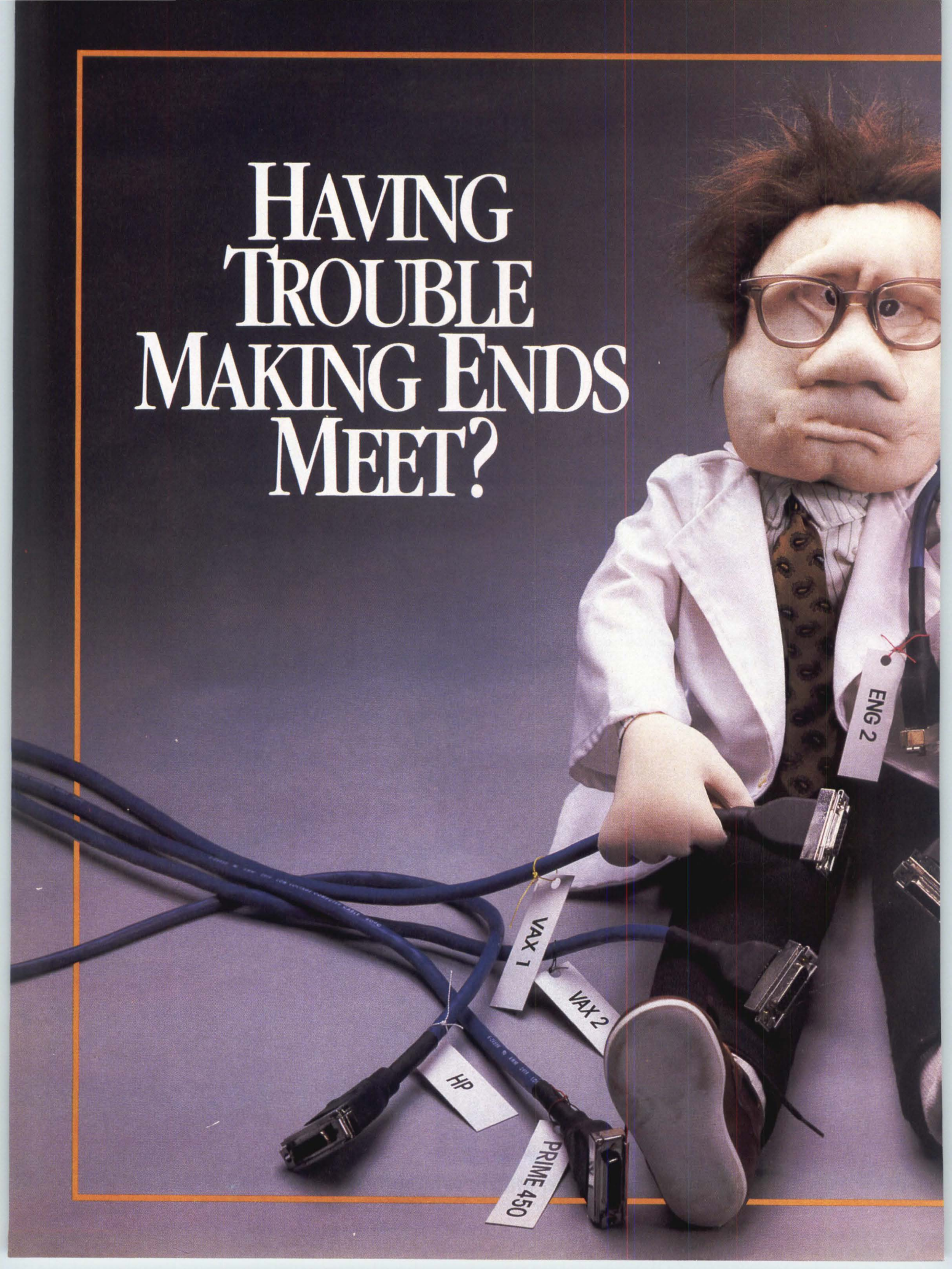
HAVING TROUBLE MAKING ENDS MEET?



You say you have terminals and computers spread all over the building. There are far more users than available computer ports. You need to provide high-speed data links to remote sites. And your boss wants to know why computers and terminals can't talk over the same telephone wiring he does. Is that what's troubling you?

THE DATA PABX SOLUTION

Relax. We understand these problems and have helped over 2,500 organizations of every size and description eliminate them with a solution that's as versatile as it is inexpensive: the MICOM Data PABX.

Think of it as a complete local area network in a box. A MICOM Data PABX automates the switching of terminals and personal computers amongst any number of host computers. It manages computer port contention. It functions as a fallback switch. And it lets you tie everything together by sharing the same inexpensive phone wiring that the boss, and everyone else, talks over.

Think of it as a window into a wide area corporate information system. An extensive family of plug-in interface modules complement its switching functions with local and remote terminal multiplexing, and direct access to X.25 packet data nets, IBM 3270/SNA services and remote computer resources via leased line trunks.

THE NEW INSTANET6000: MORE OF A GOOD THING . . . AND LESS

Now MICOM offers a new generation Data PABX that helps make ends meet faster, easier and at a lower cost than ever before. It features:

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- Price range of $100 to $150 per line

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Ways to combat these losses exist, but many computer users are unaware of their scope and sophistication.

Computer & Communications Security '86 (CCS '86) will bring MIS/DP managers, EDP auditors, and corporate security directors to the companies that can help them meet their computer/communications security needs.

Among the products and services that will be marketed effectively at Computer & Communications Security '86 are:

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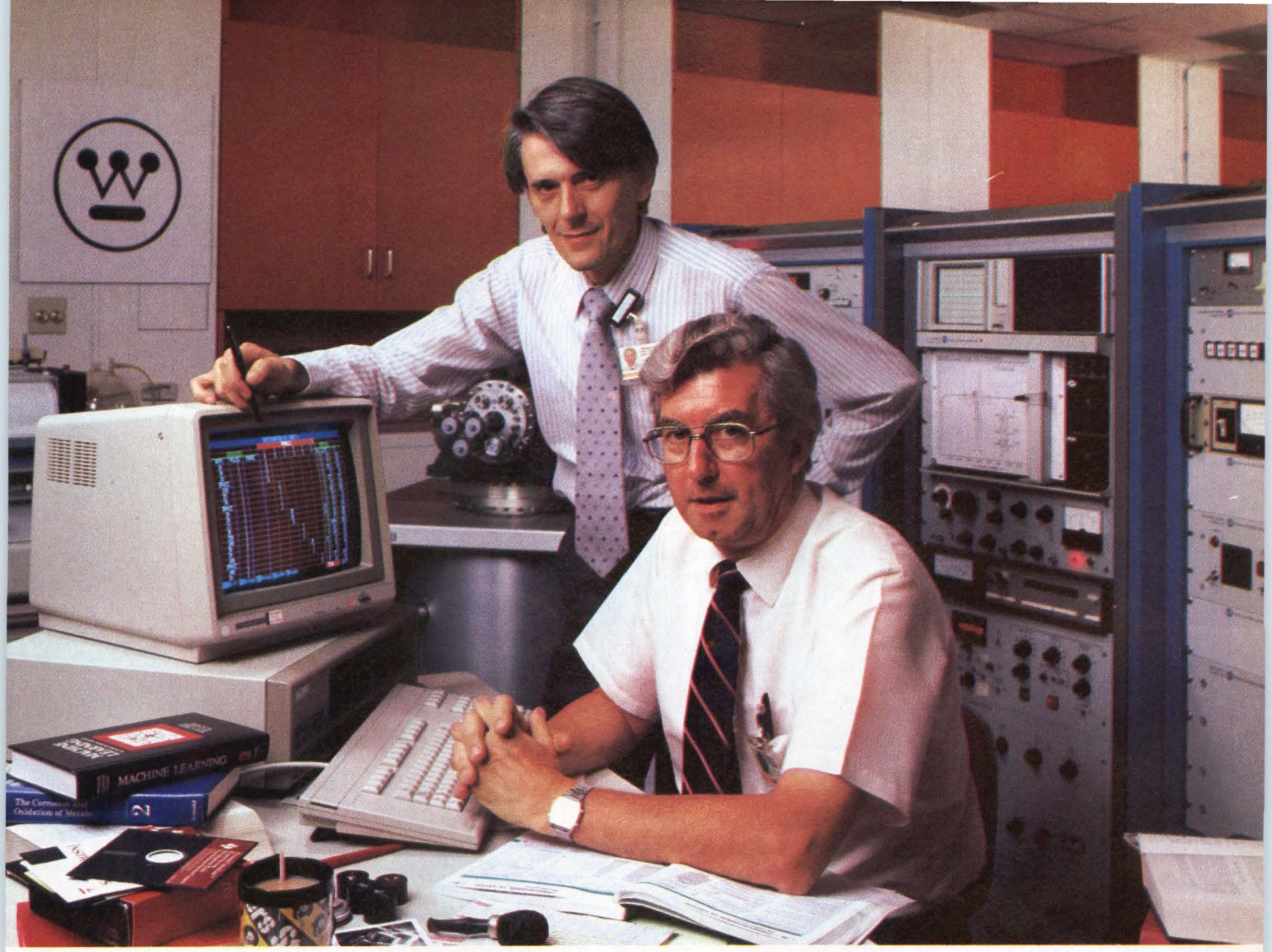

Westinghouse brought in TI's Personal Consultant™ because these experts don't have time to waste.

Personal Consultant is the expert systems development software that's turning the time they spend answering routine questions into research and development.

Dr. Neil Pessall and Dr. Jan Schreurs, research scientists at the Westinghouse Research and Development Center, had a problem. How could they make hundreds of man-years worth of practical knowledge at the Center readily available to Westinghouse and its customers, without pulling the scientists away from their research to answer routine questions?

Their solution was Personal Consultant, a new expert systems development software tool from Texas Instruments for TI or IBM® personal computers.

Designed to run on 512K-Class Personal Computers, Personal Consultant provided Westinghouse an eminently affordable new tool for the development of expert systems. Pessall and Schreurs were especially impressed with its ability to aid experts in developing the knowledge bases and prototyping programs which even first-time computer users could consult for expert advice.

"With Personal Consultant software," says Schreurs, "we found it far easier to teach our experts how to develop a system than teach a programmer to be an expert." In fact, the software's rapid expert system prototyping and simple debugging features enabled the two scientists to demonstrate three different expert systems in as many weeks. Schreurs produced one for training new salespeople and a second to guide repairs and maintenance for the Center's X-ray defractometer.

Pessall's makes material recommendations for tubes and support plates in steam generators.

"Our development of expert systems isn't aimed at replacing experts," says Dr. Pessall. "Its purpose is to give them the time to extend their expertise while the expert systems handle consultations on well-established knowledge and methodology."

To put Personal Consultant from TI to work for your business, call (800) 527-3500, in Canada call (416) 884-9181. Because an expert's time is too valuable to waste.

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The peripherals on the right are backed by a $60 billion company.

The value of the computer on the left just went up.

You've probably invested more in your computer than you like to think about.

So what you should think about is how to get the most out of it. Particularly when it comes to deciding which peripherals to use.

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We suggest you hook up with us. We're CIE Terminals. And we're backed by C. Itoh, one of the largest organizations in the world.

We have a complete line of alphanumeric and graphics terminals, line printers and serial printers designed to make full use of all the capabilities of your computer.

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CIRCLE NO. 15 ON INQUIRY CARD

BREAKPOINTS

IBM TOKEN RING YET TO WED ENTIRE PRODUCT LINE

IBM Corp. has announced that its PCs are the first products that will connect to the company's Token-Ring Network, which provides transmission speeds of 4M bits per second over coaxial cable. The company has also said that customers can opt to implement the Token-Ring Network over unshielded, telephone, twisted-pair wiring. The Token-Ring Network Adapter Card and flexible disk are priced at $695 and will be available in the first quarter of 1986. IBM did not say how long it would be before the company's minicomputers or mainframes could be attached to the network. —*Lynn Haber*

TRIO POOLS TALENT FOR FIBER-OPTIC NETWORKS

AMP Inc., the Harrisburg, Pa., giant in electrical and electronic connection devices, has established a marketing affiliation with two companies in an effort to offer an across-the-board approach to fiber-optic local area networks. Joining AMP will be Lytel Inc., Somerville, N.J., and FOCS Inc., Auburn, Mass. Lytel, a 1984 start-up, manufactures lightwave communications gear such as transmitters, laser diodes and photodetectors. FOCS specializes in fiber-optic installation services.—*Mike Seither*

HONEYWELL INTRODUCES XP AND AP PERSONAL COMPUTERS

In a push to bolster its position in the office-automation market, Honeywell Information Systems Inc., Billerica, Mass., has added the XP (extended processor) and AP (advanced processor) series of personal computers to its family of business machines. According to a company spokesman, both computers are operationally compatible with IBM Corp.'s PC, PC/XT and PC/AT. The XP series incorporates Intel Corp.'s 8088-2 microprocessor, while the AP uses Intel's 80286. Prices for the XP and AP begin at $2,495 and $3,785, respectively; eight models are available.—*Lynn Haber*

TEXAS INSTRUMENTS' TOKEN-RING CHIPS FINALLY ARRIVE

As a result of a joint development program that began in 1982 between IBM Corp. and Texas Instruments, Dallas, TI will market an IBM-compatible local area network chip set, the TMS 380, for IBM's recently announced Token-Ring Network. Beginning early in 1986, TI will offer a $1,985 kit to help vendors develop products. In making the announcement about its network, IBM said that it would make available to third-party vendors the technical specifications so vendors can develop compatible products. TI estimates that more than 25 companies will announce more than 100 Token-Ring Network products by the middle of 1986. Already, companies such as Bridge Communications Inc., Proteon Inc., 3Com Corp. and Ungermann-Bass Inc. have announced products compatible with the network.—*Lynn Haber*

FIRST OPTICAL SUBSYSTEM FOR IBM PCs STORES 3G BYTES ON 1G-BYTE DISK

A proprietary data-compression program enables 3G bytes of data to be stored on one 1G-byte, write-once, read-many optical disk, said to be the first optical subsystem for the IBM Corp. PC family. Produced by Aga Inc., New York, the 12-inch DISCUS 1000 provides non-tamperable text, image- and sound-information storage, is based on the small computer systems interface and uses proprietary host adapter interface cards and device software to operate with a PC/XT, PC/AT, 3270-PC or compatibles. The DISCUS 1000 is priced at $21,500; the data-compression facility is an additional $9,500.—*Bruce MacDonald*

PICK GETS A HELPING HAND IN EUROPE AND AMERICA

Greater awareness of the Pick operating system is the goal of two separate, but complementary, organizations being formed on both sides of the Atlantic. The Spectrum Manufacturers' Association, a group of leading U.S. computer makers whose machines run Pick, aims to establish Pick standards, as well as promote the system. Spectrum is managed by International Data Base Management Association Co. Inc. of San Diego. Meanwhile, IN Informatique of Plaisir, France, is calling for a European association, expected to be called Pick Europe, to boost Pick on the Continent, particularly among academic and governmental organizations.—*Keith Jones*

ITT CONSOLIDATES COMPUTER, COMMUNICATIONS GROUP

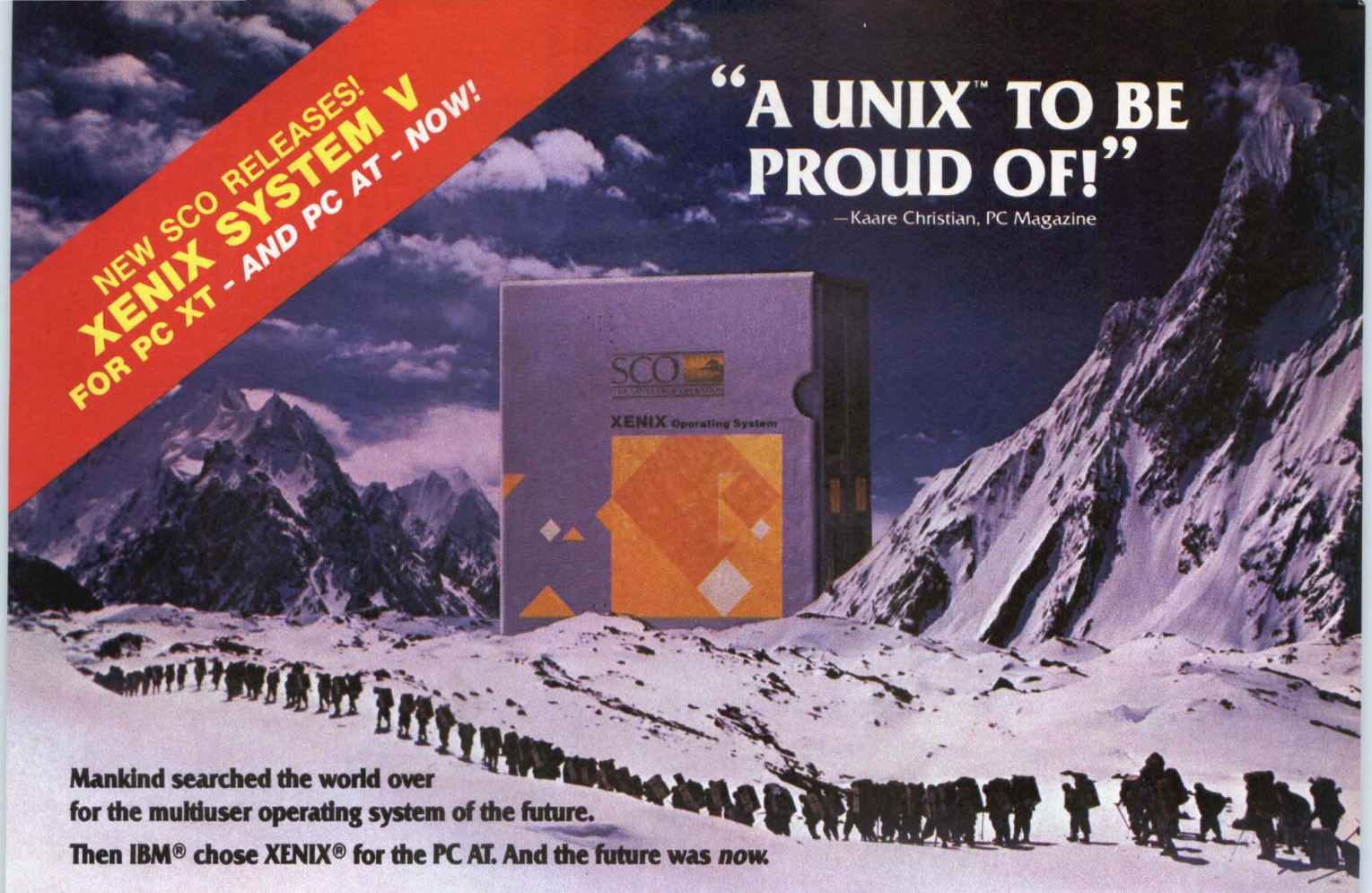
ITT Corp. has merged four separate telecommunications and computer equipment groups into a new organization called ITT Business Systems Group. The business units affected by the consolidation include: ITT Business and Consumer Communications (PBXes, key systems and residential telephones); ITT Courier Terminal Systems (IBM Corp.-compatible terminal equipment and controllers); Qume Corp. (printers and other peripherals); and ITT Information Systems (the Xtra personal computer). ITT says that the realignment will provide business users with a single source for their computer and telecommunications needs. Other observers say the move is an attempt to streamline the company in the face of lagging computer demand.—*Steve Shaw*

OPTICAL DISKS MOVE DOWN IN SIZE, UP IN VERSATILITY

Multipurpose, 5¼-inch optical drives boasting 200M bytes of storage per side can be expected by mid-1986 from such 12-inch optical disk makers as Optimem and Optical Storage International (OSI). Optimem, of Sunnyvale, Calif., is currently defining the product, which is anticipated to handle read-only, write-once and erasable media. OSI, Santa Clara, Calif., is developing a similar product. Both drives will use the small computer systems interface.—*Carl Warren*

COMPAQ MOVES INTO AUSTRALIA

Compaq Computer Corp., Houston, is marketing its line of personal computers through a new subsidiary, CCA Systems Pty. of Sydney, Australia. Compaq microcomputers have been available in Australia since April 1984, but only through ComputerLand of Australia retail outlets.—*Steve Shaw*



Mankind searched the world over for the multiuser operating system of the future.

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THE SANTA CRUZ OPERATION PRESENTS

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TECH FILES: A QUICK LOOK AT NEW PRODUCTS AND TECHNOLOGY

Intel Corp.'s Systems Group, Phoenix, Ariz., has introduced the 310 APEX (advanced processor extensions) series, claimed to be the first in the multiuser XENIX/UNIX microcomputer market to use multiple 80286 CPUs in one system. APEX comes in upgrade kits for Intel's 286/310 series and its new, single-CPU, 8-MHz 286/310 AP series, allowing users to add one, two or three 80286 CPU boards for faster performance. The fully configured four-board 310 APEX 4, for example, can reportedly operate at 5 million instructions per second. APEX kits start at $6,995.—*Fran Granville*

System integrators using the small computer systems interface, take note: In January, **Adaptec Inc.,** Milpitas, Calif., will begin shipping an IBM Corp. PC/XT-based SCSI development system priced at $19,500. For that, developers get a PC/XT, graphics printer with stand, monochrome graphics adapter, Adaptec's host interface and a mouse. Software includes a test-function and documentation library, Microsoft Corp.'s C compiler, PC-DOS and a text editor. The system allows developers to test SCSI-based controllers and intelligent peripherals at data-transfer rates of up to 2M bytes per second.—*Mike Seither*

Compatible with VMEbus, Multibus, Q-bus and IBM Corp. PC/AT architectures, the Series 100 single-board image-processing modules from **Imaging Technology Inc.,** Woburn, Mass., can perform operations such as image averaging and subtraction in hardware in real time. The feedback/input-look-up-tables' processing element is programmable to accommodate various image-processing algorithms. The 80-plus modules in the software library package, which can be called from Microsoft Corp.'s Pascal, FORTRAN or C, speeds the development of user-written image-processing programs.—*Jesse Victor*

COMDEX PREVIEWS: Maxtor Corp., San Jose, Calif., plans to unveil a 280M-byte model XT-3000, 5¼-inch Winchester at Comdex/Fall '85 in Las Vegas, Nov. 20 to 24. The new drive will contain an embedded small computer systems interface. Deliveries are anticipated for the second quarter of 1986.—*Carl Warren*

Any void left by Xerox Corp. with the reported discontinuation of its model 630 daisywheel printer with extended character set (ECS), will be filled by **Fujitsu America Inc.** of San Jose, Calif. Fujitsu plans to introduce a 630-compatible printer, the SP320, which incorporates a 192-character ECS wheel for scientific and technical applications. List price for the printer is $1,495, with shipments to begin in January. Fujitsu will also be showing the nine-pin, $649 DX2200 dot-matrix printer and the 24-pin, dot-matrix DL2400, which features a tractor-feed mechanism that automatically retracts to allow single sheets to be inserted for printing letters. It will be priced at $1,195.—*Mike Seither*

CIE Terminals, Irvine, Calif., has made its first step into the non-impact printer market with the LIPS-10 laser printer. Based on the 10-page-per-minute Konica engine, the unit provides 240-by-144-dot-per-inch (dpi) resolution in graphics mode and 300-by-300-dpi when printing text. Emulation includes Epson America Inc.'s FX80 and Diablo Systems Inc.'s 630; both parallel and serial interfaces are standard. Available in the first quarter of 1986, the LIPS-10 will be priced at $3,500.—*Bruce MacDonald*

Fremont, Calif.'s **Sysgen Inc.** will introduce at Comdex/Fall '85 three hard disk/tape subsystems for the IBM Corp. PC family. The Sysgen Plus is a 70M-byte hard disk/60M-byte quarter-inch cartridge tape unit; the AT Add-In is an internal disk/tape system for the PC/AT with 60M bytes of tape and either a 20M-, 40M- or 70M-byte hard disk; and the Flat-Pak, which sits on top of the PC or XT or under the monitor, can be configured with either a 10M-byte disk/20M-byte cassette tape or a 20M-byte disk/60M-byte cartridge tape. Prices range from $1,395 for the smaller Flat-Pak and $2,095 to $4,995 for the AT Add-In to $5,995 for the Sysgen Plus.—*Bruce MacDonald*

Hoping to tap the low-end PC market, **Epson America Corp.,** Torrance, Calif., will show at Comdex/Fall '85 its Equity I personal computer. Compatible with the IBM Corp. PC, the Equity I accommodates 640K bytes of user memory; two flexible disks or one flexible and one 20M-byte hard disk; and uses an Intel Corp. 4.77-MHz 8088 processor and Microsoft Corp.'s MS-DOS 2.11. With serial and parallel ports and keyboard, the Equity is priced at $995; with monochrome adapter and display, $1,300. Epson is also reportedly planning to introduce a PC/AT-compatible machine.—*Carl Warren*

NOTES FROM OVERSEAS: TDK Corp. of Japan will release this month its own brand of 3½-inch flexible disks. The company has been attempting to coax a higher coercivity out of the present 1.6M-byte standard, aiming to introduce a 2M-byte disk by next spring. TDK currently makes 8-inch and 5¼-inch flexible disks but expects 3½-inch models to be increasingly important in its memory media mix.—*Ichiro Kakehashi*

A hybrid memory medium using bubble technology in a disk compatible with 8-inch flexible drives is now available from **Hitachi Ltd.** Intended for use in heavy-duty industrial applications, the medium features the non-volatile stability of bubbles and is packaged in a sturdy cassette that fits neatly into a drive that matches standard flexible disk drive heights and control software. Three versions are available in samples: 250K bytes, 500K bytes and 1.2M bytes, for about $675, $845 and $1,100, respectively. The company is also working on 4M-byte and 16M-byte, 5¼-inch-compatible versions, as well as 3½-inch-compatible units.—*Ichiro Kakehashi*

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

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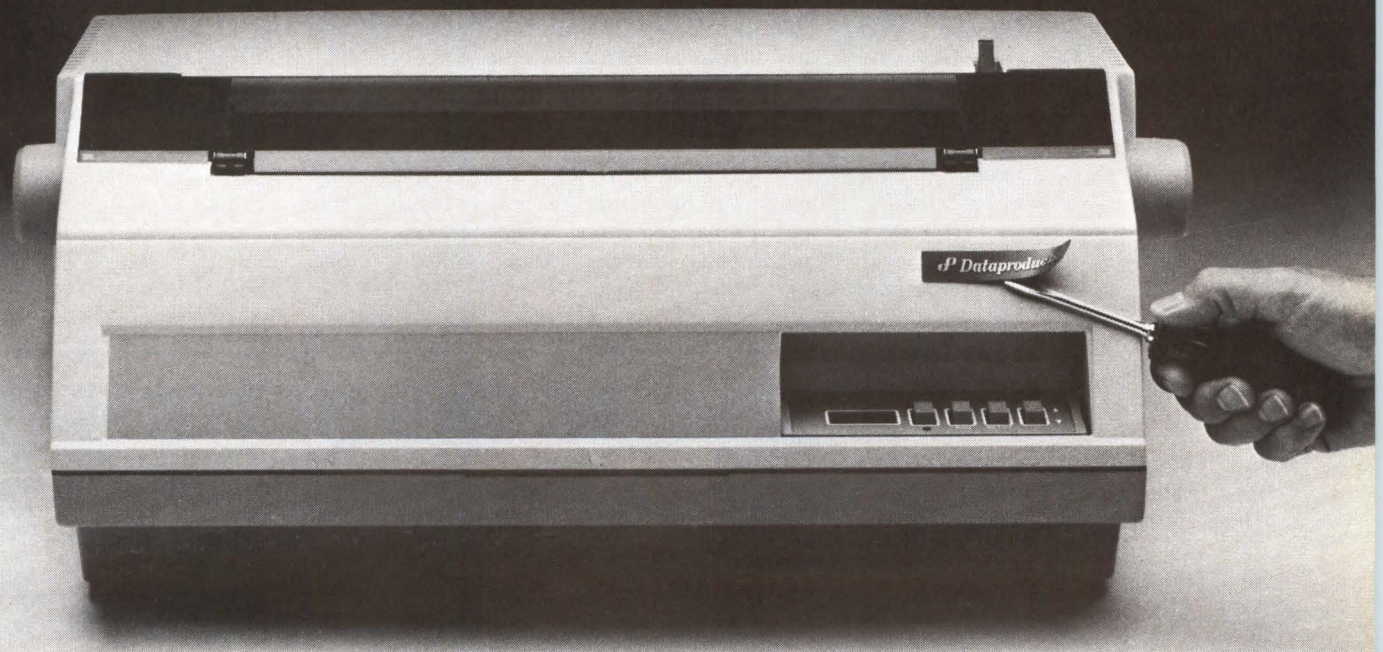

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CIRCLE NO. 18 ON INQUIRY CARD

First new 1/4-inch cartridge since 1971

If you *don't* have data worth preserving, then the reasons for buying Cartrex's new 1/4-inch, high performance, virtually error-free tape cartridge won't mean anything

But, if you are one of the many 1/4-inch tape cartridge users that assume 3M's cartridges just *have* to be "good enough" for today's high performance tape drives, read these simple facts to understand why that isn't true anymore.

The new Cartrex 1/4-inch tape cartridge is the first new tape cartridge design in almost a decade and a half. Tape drive manufacturers now have a new cartridge technology which allows them to advance beyond this previous artificial barrier.

PILOTS HAVE A SAYING, "There are those who have made a wheels-up landing—and those who will." You can apply this expression to those who have lost data and those who will. Unfortunately, data loss isn't always because users haven't backed-up their hard disk. Sometimes it's because their 1/4-inch tape cartridge, where they back up their hard disk, developed hard errors—those insidious errors that tend to increase over time. That's why Cartrex has developed a 1/4-inch data cartridge for today's high performance drives that virtually eliminates errors.

Why a new cartridge

When 3M announced its cartridge in 1971, it was designed for a low capacity tape drive with less than 3 megabytes—2.88 to be exact. The tape was low in density—1600 bits per inch with only 4 tracks and 300 feet of tape.

The tolerances required for the tape drives of the early 1970's were fine for then, but today's tape drives require much tighter tolerance. Today's tape cartridges must work with drives that have 9 or more tracks and bit densities as high as 12,000 bits per inch on 600 feet of tape. That means capacity increases of 2,000 percent packed into the same cartridge.

The reasons that yesterday's cartridge technology simply won't work properly in today's high capacity drives is inherent in the cartridge design.

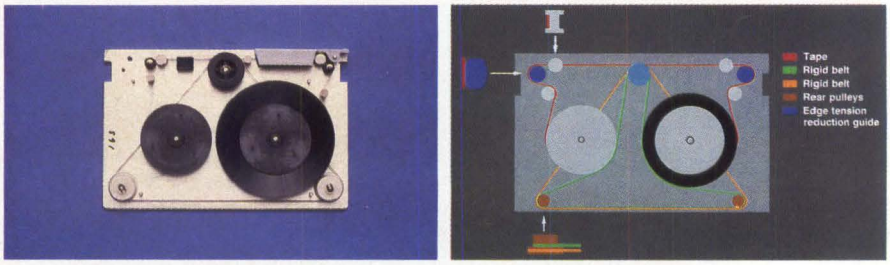
With the significant increases in capacity, the three culprits that make cartridge tolerances so important are fluctuating tape tension, redeposit nodules, and instantaneous speed variations (or ISV).

Tape Tension

Any child who has played with a magnet understands that as the magnet is separated from metal, the magnet's ability to work is decreased. So it's no surprise to find out that the closer the tape drive head is to the tape, the better the reading. This closeness is particularly important when the embedded iron filings get packed tighter in today's high density tape.

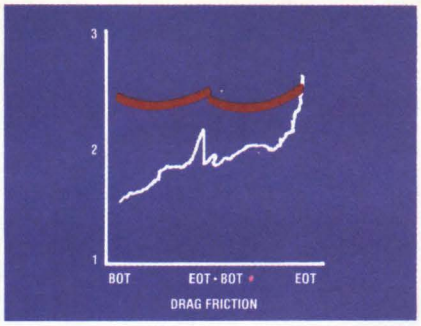
It's also important with the increase in the number of tracks. After all, you wouldn't want the head to be reading an adjacent track any more than you'd want it reading more than one magnetic representation of a bit.

Unfortunately, tape tension historically has not been constant. As the tape unwound, the tension increased. What's important is both the *amount* and *range* of tension. A fluctuating increase or decrease in tension is as unacceptable as low tension is in the first place. As the accompanying graphs



The Cartrex cartridge design (upper left) uses the N2 principle which creates head-to-tape tension by applying a mechanical differential at the rear pulley between a stiff transport belt and a stiff tensioning belt, indicated in green and yellow in the color schematic (upper right).

The conventional 3M design applies drag at the rear pulley to create tension, which creates heat, and limits future speeds much above 90 inches per second.



Good head-to-tape tension ensures the highest probability of reliably capturing data. Fluctuating tape tension allows data loss due to head-to-tape separation and smearing redeposit nodules across the tape head. The Cartrex cartridge, compared to the conventional design, creates constant and higher tension.

show, the Cartrex cartridge has higher tension and flatter profile than the 3M cartridge. This means more reliable data across the entire tape.

Redeposit Nodules

Another reason to keep constant tension is to avoid "redeposit nodules" from smearing across your tape drive's head. What are redeposit nodules? They are the insidious flakes of tape media that break off from the edges of the tape and get dragged up to the edge of the tape head. If the tension is low, or becomes low when the tape starts or reverses, the flakes come up over the edge, get smeared over the head, and reduce its ability to read the data.

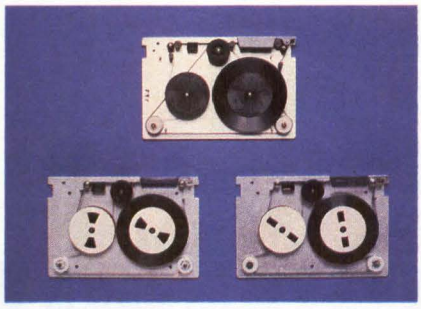
Even worse, however, is that these redeposit nodules are dragged along the surface of the tape and get embedded and packed over time. When your drive tries to read the data, the redeposit nodules act as a tent pole holding up the tape away from the head. As a result, even the best error-recognition algorithm can only tell you one thing—you've lost the data.

You might be wondering what causes the flaking in the first place. Again, it is cartridge design. The basic design uses a tape guide, shown in the accompanying illustration. The problem with this approach, is that it presupposes that the tape will always run parallel to the top and bottom caps of the tape guides. At the low speeds of 30 inches per second typical of when the 3M cartridge was designed, it was less of a problem. But at today's speeds of 90 inches per second and more, the tape wanders. When it presses against the top of the tape guide, the tape's edge pressure builds. Not only does media flake off, but you lose data due to the "coining" or "scalloping" effect.

Cartrex eliminated the cause of the tape coining or scalloping by developing a barrel-shaped roller placed prior to the tape guide. The laws of physics show that by riding on a rounded barrel, the tape will always seek the middle, reducing the tape edge pressure. This seemingly simple addition causes the tape to always enter the tape guide with zero edge pressure. In this way, the possibility of media flaking off and creating redeposit nodules is virtually eliminated.

Instantaneous Speed Variation (ISV)

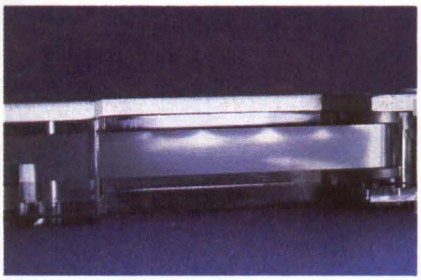
Instantaneous speed variations is exactly what it sounds like—small, instantaneous changes in tape speed as it crosses the tape head. At slow tape speeds and low bit densities—like the 1971 standard of 30 inches per second and 1,600 bits per inch—ISV wasn't as big a problem. At that time, the bits were crossing the head at 48,000 bits per second.



You can compare the Cartrex design on top with the conventional 3M design (lower left) and DEI, a 3M licensee (lower right). The omission of "edge tension reduction guides" (indicated in dark blue on the color schematic) on either the 3M or DEI design means that tape edge pressures will increase causing the magnetic media to flake off, smear across the tape head, and cause "redeposit nodules" to become embedded in the tape.

Today, however, the story has changed. 90 inches per second and 8,000 bits per inch mean that 720,000 bits cross the head every second. A 1,500% increase.

As you may have guessed, speed fluctuations in the 48,000 bits per second made reading data difficult for tape drive electronics. But when the electronics have to guess whether or not the bit rate of 720,000 bits per second is accurate, the electronics can become overwhelmed.



High speed tape without the "edge pressure reduction guide" seldom enters tape guides parallel to the top and bottom. The edge pressure which results creates "scalloping" or "coining" on the tape. The effect is data loss due to head-to-tape separation, flaking media that smears across the head, and "redeposit nodules" that create hard errors.

Never a Single Issue

Your tape drive seldom has the luxury of dealing with an isolated problem. It's usually a combination of ISV, redeposit nodules, and tension problems all together. Now you understand why Cartrex wanted to develop a cartridge for a market that needed a modern alternative.

Where to get it

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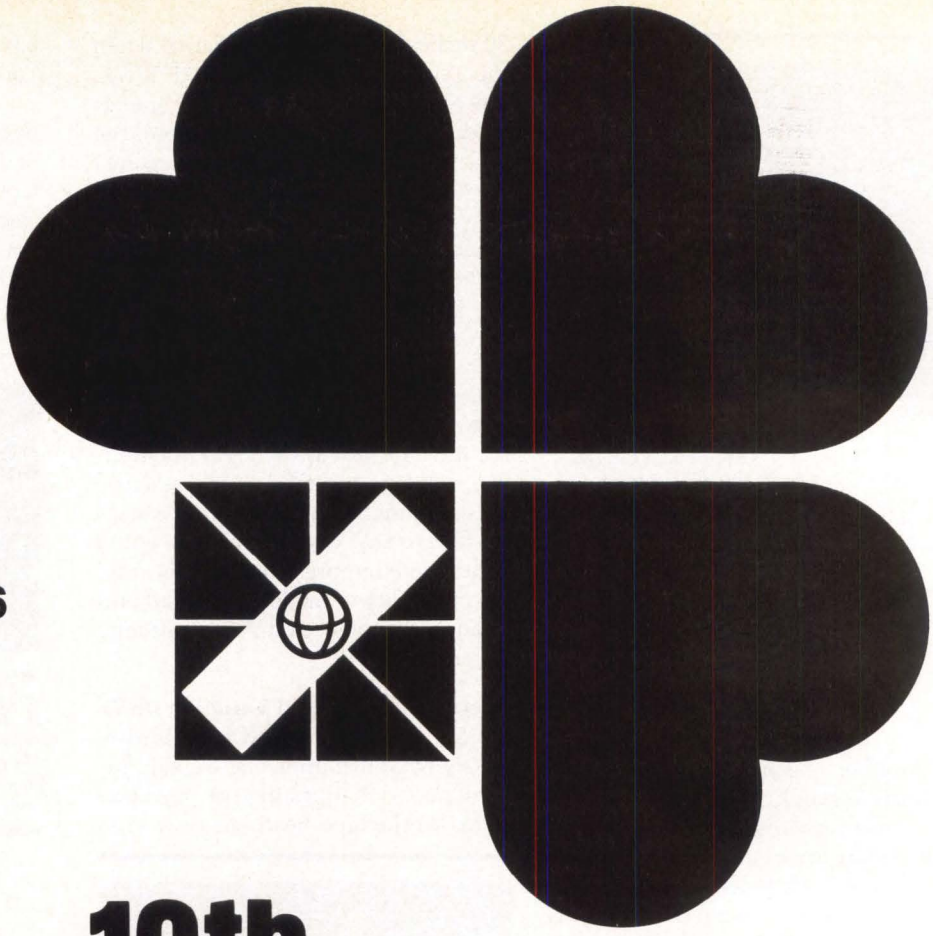

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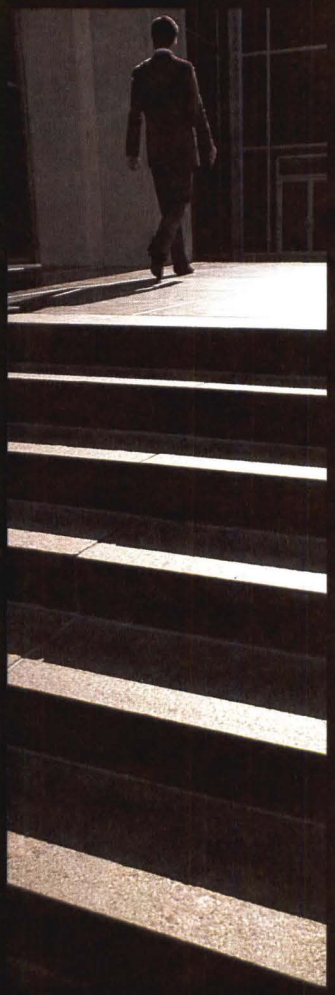

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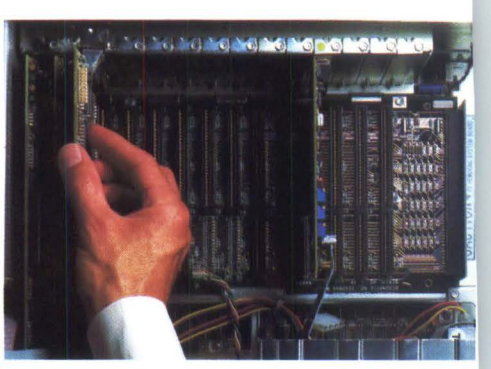

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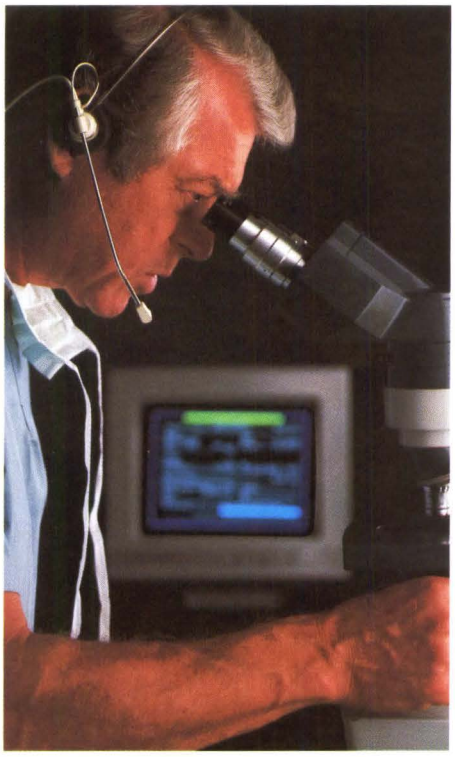

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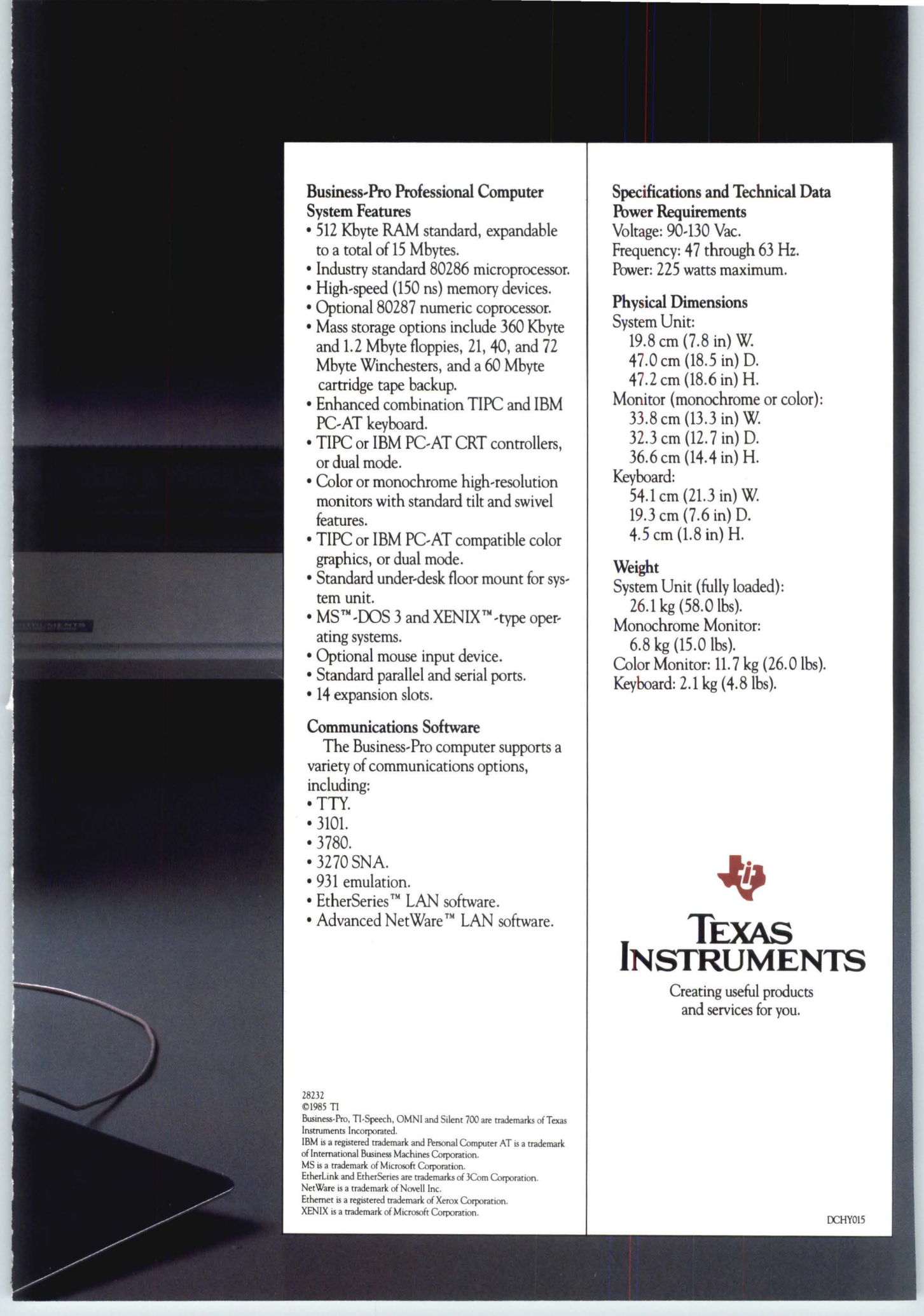

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- High-speed (150 ns) memory devices.
- Optional 80287 numeric coprocessor.
- Mass storage options include 360 Kbyte and 1.2 Mbyte floppies, 21, 40, and 72 Mbyte Winchesters, and a 60 Mbyte cartridge tape backup.
- Enhanced combination TIPC and IBM PC-AT keyboard.
- TIPC or IBM PC-AT CRT controllers, or dual mode.
- Color or monochrome high-resolution monitors with standard tilt and swivel features.
- TIPC or IBM PC-AT compatible color graphics, or dual mode.
- Standard under-desk floor mount for system unit.
- MS™-DOS 3 and XENIX™-type operating systems.
- Optional mouse input device.
- Standard parallel and serial ports.
- 14 expansion slots.

Communications Software

The Business-Pro computer supports a variety of communications options, including:

- TTY.
- 3101.
- 3780.
- 3270 SNA.
- 931 emulation.
- EtherSeries™ LAN software.
- Advanced NetWare™ LAN software.

28232
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MS is a trademark of Microsoft Corporation.
EtherLink and EtherSeries are trademarks of 3Com Corporation.
NetWare is a trademark of Novell Inc.
Ethernet is a registered trademark of Xerox Corporation.
XENIX is a trademark of Microsoft Corporation.

Specifications and Technical Data

Power Requirements

Voltage: 90-130 Vac.
Frequency: 47 through 63 Hz.
Power: 225 watts maximum.

Physical Dimensions

System Unit:
19.8 cm (7.8 in) W.
47.0 cm (18.5 in) D.
47.2 cm (18.6 in) H.
Monitor (monochrome or color):
33.8 cm (13.3 in) W.
32.3 cm (12.7 in) D.
36.6 cm (14.4 in) H.
Keyboard:
54.1 cm (21.3 in) W.
19.3 cm (7.6 in) D.
4.5 cm (1.8 in) H.

Weight

System Unit (fully loaded):
26.1 kg (58.0 lbs).
Monochrome Monitor:
6.8 kg (15.0 lbs).
Color Monitor: 11.7 kg (26.0 lbs).
Keyboard: 2.1 kg (4.8 lbs).

TEXAS INSTRUMENTS

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Old and new players bank on powerful VMEbus products

Mike Seither
Associate Western Editor

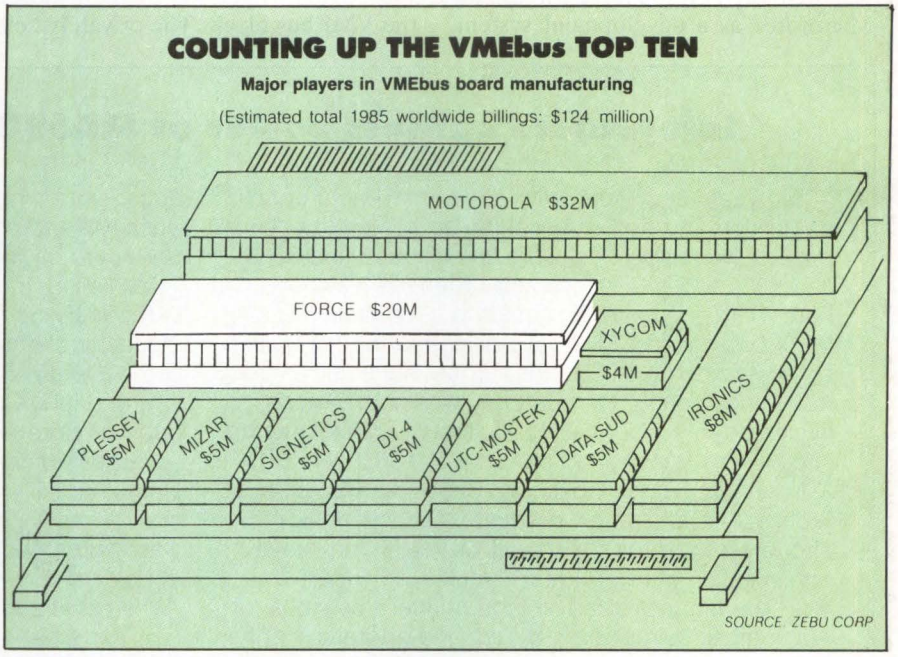
Two California manufacturers, one an old hand in the VMEbus market and the other a newcomer, have introduced single-board computers that take advantage of the computing muscle of Motorola Inc.'s 32-bit MC68020 microprocessor.

Not content to stop there, Force Computers Inc. of Los Gatos and Dual Systems Corp. of Berkeley have also taken the wraps off UNIX-based development and multiuser systems grounded on the VMEbus, as well as a host of support boards. Both companies hope to sway system integrators to their camp with an eye to a growing market. Various analysts predict 1985 worldwide revenues from $75 million to $124 million in VMEbus products.

Actually, Force has already captured a considerable slice of that market. The privately held American company (often viewed as a European enterprise because design and manufacturing take place in Munich, West Germany) is expected to attain sales of about $20 million by the year-end, according to Zebu Corp., a Sunnyvale, Calif., market-research organization. Zebu president Richard Main places Force in an undisputed second spot behind Motorola in the VME market.

Force has made its presence known by marketing a steady stream of VMEbus devices, from CPU and memory boards to I/O modules and mass-memory interfaces. Force points to more than 30 products on the market and plans to introduce 10 more by the end of this year.

Force's new SYS68K/CPU-20, with a base price of about $4,500, operates with a clock frequency of 16.7 MHz on the 68020. It comes with eight sockets that can accommodate up to 512K bytes of electrically programmable ROM and 128K bytes of static RAM and a serial port. The CPU-20 is built to use the MC68881 floating-point coprocessor, which can operate at 12.5 MHz or 16.7 MHz, depending on the board configuration.



Force is also packaging a debugging command set with the CPU-20 that resides in EPROM. Called FORCEbug, it allows users to test and debug hardware on the VMEbus and test functions of on-board devices.

According to Force president Sven Behrendt, the CPU-20 card should become a mainstay of Force's product line, offering VMEbus customers a way to harness the full 32-bit power of the 68020. CPUs account for about 34 percent of the company's total sales, adds Behrendt.

Will boxes sell boards?

In addition to its CPU-20, Force is also introducing a low-cost all-VMEbus development system that runs on UNIX System V. Priced at about $6,000, the Microforce-1 operates on the MC68010 microprocessor, comes with a 1M-byte main memory, one expansion slot, a 25M-byte (unformatted) Winchester disk drive, and ports for two users, communications and a printer. The compact unit measures 16 inches square and 6 inches high.

The system is being targeted at OEMs looking for a low-cost UNIX system that is hardware- and software-compatible with larger VMEbus systems. Another market would be target

systems: OEMs would get a fully configured system and use the single expansion slot in the Microforce-1 to design their own value-added board. The strategy behind the Microforce-1 is to "sell boxes to sell boards," says Behrendt.

Zebu's Main contends that the Microforce-1 has an attractive price, especially compared to similar systems, such as Motorola's VME-10, which costs nearly twice as much. But he questions how many of the systems will be sold. "A few people will use the Microforce as a development system, but that will be accidental and incidental," he says. The reason? Only two programmers can use the system at a time. Most software development shops have teams of 30 or 40 programmers working in unison on a large multiuser system, such as a Digital Equipment Corp. VAX, explains Main.

Dual: A new face in VME

Compared with Force, which began as a VMEbus board manufacturer in 1981, Dual Systems is the new kid on the VMEbus block. The privately held company announced a full line of VME products as recently as last summer. Shipments of most of the boards are expected by the year-end, according to Joel Libove, Dual's vice president of research.

Founded in 1980, Dual has been a manufacturer of S-100 bus boards and UNIX multiuser systems. Now the company, with annual revenues estimated at $12 million, wants to position itself as a supplier of high-performance VMEbus modules, as well as complete systems.

The main components of Dual's

Integrators harness power of MC68020 with VMEbus

Two years ago, Autologic Inc., a manufacturer of pagination and phototypesetting equipment for newspapers, was using Intel Corp.'s Multibus I and 8085 and 8086 CPUs in its systems. Then the Newbury Park, Calif., company switched to a Motorola Inc. MC68000-based CPU board designed for the Multibus I. According to George Vargas, Autologic's director of engineering, the company was not so much interested in sticking with a Multibus I architecture as in making a transition to Motorola's MC68020 CPU.

Now Autologic is faced with choosing a 32-bit bus architecture for its new products, and is leaning strongly toward the VMEbus. "We really don't have any intention of using [Intel's] Multibus II," says Vargas. The biggest disadvantage of Intel's new bus for Autologic is its multiplexed data and address line, he adds.

"You have to present data and address information separately on the bus," he says, "and that takes more hardware and reduces throughput. Since we do graphics, speed is important."

There is another factor steering Autologic toward the VMEbus, says Vargas, and that's the ready supply of VMEbus products already on the market. According to industry analysts, there are more than 100 board vendors that offer VME products, compared with a little over a dozen who plan to make Multibus II boards. The only company now shipping a significant number of Multibus II boards is Intel, says Jeff Roloff, president of Central Data Corp., Champaign, Ill. Central Data, which makes VMEbus boards, has a Multibus II communications board in development.

"It's easy to pick and choose the VME boards we want," says Ron Schreck, head of the digital design group at Varian Associates' instrument division in Palo Alto, Calif. "If our primary vendor's factory burns down, we can always get a similar board from another source." It's also a question of economics, Schreck adds, explaining that he just switched from one vendor's VME graphics board to another and realized per-board savings of $200.

Marketing, too, played a role in the selection of the VMEbus by Schreck's group, which makes instruments for chemical analysis. One of Varian's major competitors is European; VMEbus enjoys a large following on the Continent. "We have a better sales edge [in Europe] if we use VME," says Schreck.

Vargas admits that his preference for the VMEbus stems partially from a prior bias against Intel's Multibus I. He says that the specifications for that bus were "either too loose or too tight," and that he had trouble finding vendors whose boards would work. "When Multibus II came out, I was leery of it," Schreck explains.

Other vendors echo that sentiment. Says Lee Higby, director of product marketing for August Systems Inc., Tigard, Ore., which has chosen the VMEbus: "We had some residual concern about design problems we had with Multibus I. By the time we populated a chassis with 12 boards, it wouldn't work. There were too many timing problems."

August manufactures a variety of process-control equipment and is now involved in a team-design competition to upgrade part of the Federal Aviation Administration's air traffic control system. August is bidding on a contract to build a communications processor based on the 68020. Although the main system will rely on a proprietary bus, August plans to use the VMEbus for the I/O subsystem.

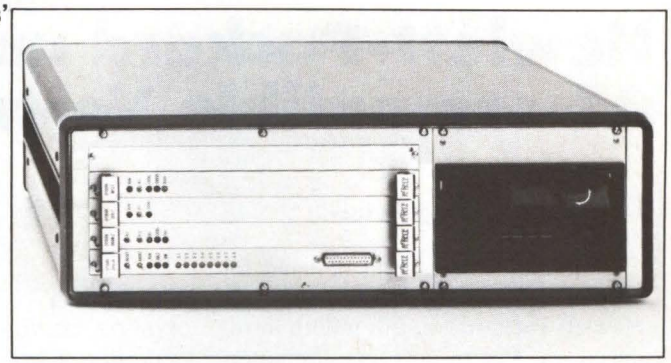
A deciding factor for going with VMEbus is that it is an open standard in the public domain, says Higby. "From a marketing standpoint, we believed there would be a much wider acceptance of devices for the VMEbus than Multibus II," he says. "From what I've seen, there are more than 400 VME products out there."

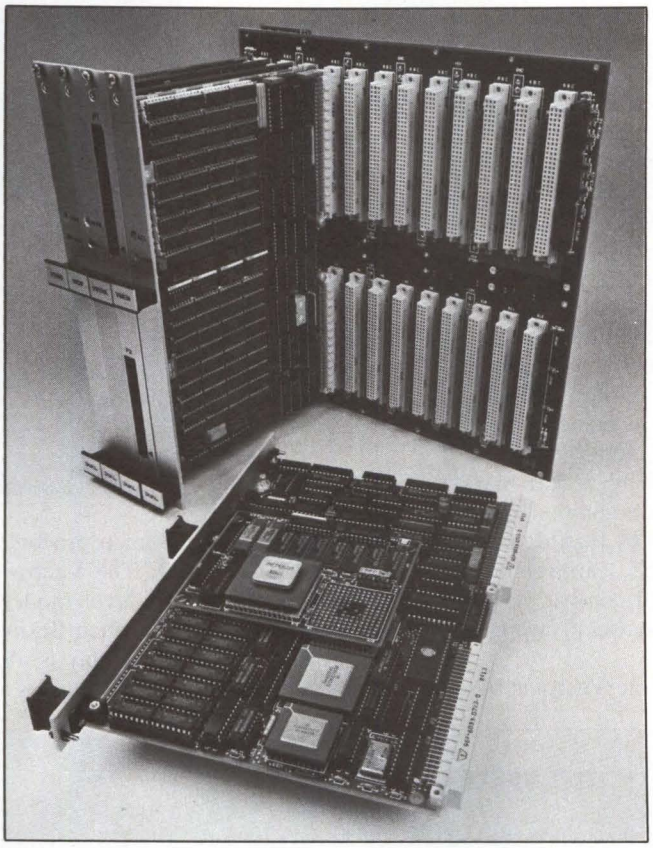
VMEbus-board line include:

- The VMPU-32, a 68020-based CPU board with 1M byte of dual-ported main memory, paged memory management and optional floating-point coprocessor ($5,250).
- The VMEM 2M-byte memory module, which uses 256K-byte RAM chips and features a prefetch cache to speed access time ($3,995).
- The Optimatrak-32 storage module device (SMD) and enhanced small device interface disk controllers, which feature data-transfer rates of 20M bits per second. Dual claims a full track can be read or written in slightly more than one rotation of the disk (SMD: $2,900).
- The V9TRK nine-track tape controller, which offers addressing in either 24-bit or 32-bit architectures and supports tape densities to 6,250 bits per inch ($1,250).

Other Dual VMEbus boards include a system controller ($495), an I/O processor ($1,495), an eight-port RS232 module ($495) and a 12-slot backplane ($895).

Force Computers' *Microforce-1, a UNIX-based development system, features an MC68010 CPU, 25M bytes of Winchester capacity, and ports for two users, communications and printer.*





The chassis of Dual's *Chaparral system has 12 slots for VMEbus boards. The system operates on the MC68020 processor and can be configured with up to 17M bytes of main memory and two 337M-byte Winchesters.*

Dual accents throughput

With about 150 manufacturers now in the VMEbus business—most of those as new to the game as Dual—Libove says his company will accent its products' high I/O performance. "We want to make a high-throughput multiuser system," he says. "We consider disk I/O very important."

In terms of its product line, Libove believes Dual's is as complete as any of the competition, with two exceptions. Dual has no graphics board, and it has to buy an Ethernet board from another supplier. He says the company plans to introduce a proprietary graphics board in late 1986.

Dual also plans to go beyond the VMEbus board business by bringing out a line of multiuser systems called Chaparral. Production is scheduled to begin early next year, Libove says. The systems will be built around the 68020 CPU and other Dual VMEbus components. It can be configured with up to 17M bytes of main memory, and will cost from about $19,000 to $33,000. The system's chassis contains slots for 12 VMEbus boards.

The low end of the Chaparral line will come with an 85M-byte Winchester and a 1.6M-byte flexible disk drive (both 5¼-inch) and UNIX System V, version 2.2. The middle and high end of the systems will differ mainly in the amount of available disk and tape capacity and main memory. A top-of-the-line system will be able to support two 337M-byte, 8-inch Fujitsu America Inc. disk drives.

According to Zebu's Main, the new Force and Dual CPUs will have to compete head-on with similar boards recently brought to market. One of those, also based on the 68020, is the IV-3201 from Ironics Inc. of Ithaca, N.Y.

Main says that Ironics, worth about $8 million, is a strong candidate to control the No. 3 market position. Ironics, like Force, produces a wide range of VMEbus boards in an attempt to become an all-in-one supplier to system integrators. Besides CPUs, Ironics offers high-speed controllers for direct-memory access, SMD disk controllers and an array of memory boards. □

Hewlett-Packard unveils AT-compatible Vectra

Lynn Haber, Associate Editor

HP's Vectra *personal computer features high-resolution (640 by 400 pixels) text and graphics on both its monochrome and color displays.*

Conceding to a market demand for IBM Corp. PC/AT compatibility, Hewlett-Packard Co. this month introduced the Vectra personal computer, thereby redirecting the Cupertino, Calif., computer manufacturer's marketing strategy.

"Hewlett-Packard finally learned that, if they're after market penetration, it's better to be a true clone than half a clone," comments Molly Upton, an industry watcher with International Data Corp. (IDC), Framingham, Mass. Upton refers to HP's previous decision to implement a non-PC-compatible, MS-DOS operating system on its HP 150 personal computer.

Chris Kryzan, Vectra product manager, underscores Upton's analysis. "Computer users are mandating IBM compatibility from vendors. And, if manufacturers want to retain market share and distribution-channel growth, they must respond to that demand." According to IDC, approximately 800,000 PC/ATs and compatible units are expected to have been shipped by the year-end.

Like the PC/AT, the Vectra is based on Intel Corp.'s 80286 microprocessor and runs MS-DOS 3.1. The Vectra is available in three entry-level models, each available with a 5¼-inch flexible internal drive. A color display is also available, and the unit features a screen resolution of 640 by 400 pixels. Base price for the model 25 with 256K bytes of RAM, 360K bytes of flexible disk storage and a 12-inch monochrome monitor is $3,199.

Vectra reportedly runs 30 percent faster than the PC/AT because it incorporates an 8-MHz microprocessor as opposed to the AT's 6-MHz chip. However, HP does not plan to implement a multiuser operating system on the Vectra until some time in 1986. (The PC/AT can be configured with XENIX.)

According to the company, Vectra, with HP's implementation of MS-DOS 3.1, is application- and I/O-compatible with the PC/AT running PC-DOS 3.1. But HP won't commit itself to a multiuser system until the company completes its investigation of industry-standard multitasking, multiuser operating systems. "It's conceivable that we won't introduce a XENIX product, but that's not the company's strategy at this time," says Kryzan.

IDC's Upton doesn't believe that

THE VECTRA AT A GLANCE

Model	Memory (RAM) (K bytes)	Disk	CPU	Operating system	Programming languages supported	Display	Price ($)
25	256	360K-byte flexible	Intel Corp. 80286	MS-DOS 3.1	BASIC Interpreter, Macro Assembler, Lattice C Compiler, COBOL, FORTRAN, Pascal, Turbo Pascal	12-inch monochrome or color, 640 x 400 pixels	3,199
35	256	1.2M-byte flexible	same	same	same	same	3,399
45	640	1.2M-byte flexible	same	same	same	same	3,599

Source: Hewlett-Packard Co.

customers will be deterred by this decision. "Down the road, HP is talking about endorsing some version of UNIX," she says. But she adds that HP wants to make sure the multiuser system they choose fits in well with the company's overall products and marketing strategy.

According to HP, a concurrent server can be formed by combining the Vectra with Microsoft Corp.'s Windows. When connected to HP's OfficeShare local area network, Windows allows users to network Vectras with HP's touchscreen personal computers, IBM PCs, PC/XTs and PC/ATs. Users can communicate with the HP 3000, 1000 and 9000 minicomputers via HP's AdvanceNet LAN. Additionally, emulation software allows the Vectra to emulate Digital Equipment Corp. VT100 terminals, IBM's 3278 terminal and the HP 2392 terminal.

More help for VARs

Along with its new personal computer marketing strategy, HP is expanding its retail dealer and OEM programs. It has established a retail dealer-affiliated value-added reseller (DAVAR) program that allows retailers to sell HP products to qualified resellers, pending company approval.

The company has also extended its OEM program to make personal computer sales more attractive to value-added dealers of HP products. (HP defines an OEM as someone who adds hardware or software value to a computer.) In the past, HP's VAD program was geared toward minicomputer-system sales; profits for VADs on personal computer sales were significantly less than those possible with minicomputer sales.

Referred to as "PC/OEM," the extended VAD program aims at recruiting system integrators by adding price-protection measures and offering supply discounts. According to Pradeep Jotwani, third-party programs manager at HP, the enhanced OEM program focuses on high-volume VADs—those who buy a minimum of $200,000 a year in HP equipment. Smaller VADs will be steered toward the DAVAR program. □

Asynch 10,000-bps-plus modem promises speedier PC links

Stephen J. Shaw
Washington Editor

Eighteen months and approximately $4 million after its foundation, Telebit Corp. has released a super-fast dial-up modem for personal computers that links to ordinary telephone lines. Called "TrailBlazer," the new unit from the Cupertino, Calif., company combines military-type signal-processing techniques with powerful integrated circuits (ICs) to transmit full-duplex, asynchronous data at rates of 10,000 bits per second (bps) and above. That's five times faster than conventional dial-up units.

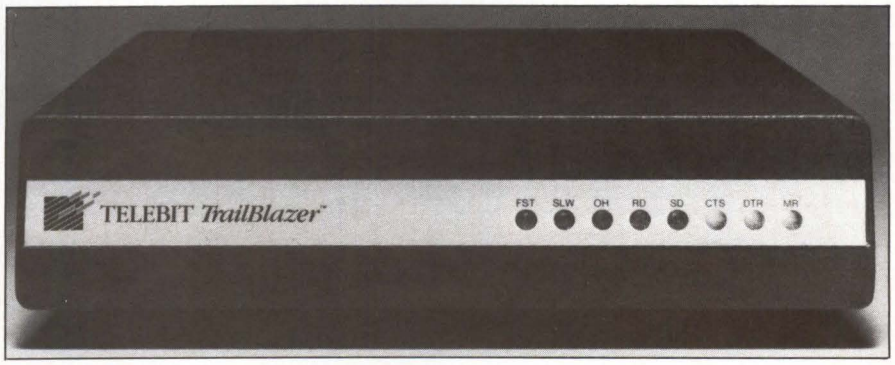
If anything, Telebit is being deliberately conservative in its claims about the unit's speed. According to company founder Paul Baran, the modem theoretically can transmit and receive data at rates as high as 22,000 bps. This assumes a perfect, noise-free telephone connection—a condition that never exists in the real world of networks using a phone system designed for less demanding voice communications. Thus the more modest claim of 10,000 bps and above.

"It's a product with a lot of potential," comments Kent Nutt, a telecommunications analyst with market research company Dataquest Inc., San Jose, Calif. "In terms of its technology, it's several steps ahead of others in the market."

A board version of the TrailBlazer was recently tested by *Mini-Micro Systems* on a Compaq Computer Corp. portable computer set up in Washington. Modified Crosstalk software from Microstuf Inc., Marietta, Ga., was used in the test. The modem was used to send files to a standalone version on a system at Telebit's headquarters in California.

Telephone circuits were established through three long-distance carriers, AT&T Co., GTE Sprint Communications Corp. and Western Union Corp. The TrailBlazer modem in Washington transmitted files through each carrier, respectively, at 14,819 bps, 11,023 bps and 9,198 bps. The TrailBlazer is priced at $1,995 for the IBM Corp. PC card version and at $2,395 for the standalone unit. The modified software, called Crosstalk-Fast, costs $195 and supports the Hayes Microcomputer Products Inc. command set.

Telebit notes those prices are sharply



Designed for asynchronous *personal computer communications at rates in excess of 10,000 bps over ordinary telephone lines, Telebit's TrailBlazer modem comes in either standalone (shown) or card versions.*

higher than the average price of approximately $300 for 1,200-bps and $775 for 2,400-bps dial-up modems. But Telebit marketing director Mary Schaller contends that the TrailBlazer's speed more than makes up for the economic difference in lifetime costs.

For instance, transferring 320K bytes of information from a flexible disk through a 1,200-bps modem requires 44 minutes; at 10,000 bps it requires slightly more than 5 minutes. In AT&T daytime line charges, the 1,200-bps transmission would cost $18.23, vs. $2.65 for the 5-minute call. Used just 15 minutes a day, Schaller says, the TrailBlazer would justify its cost, compared with that of a 1,200-bps modem, in just six months.

The modem achieves its high throughput rates through a non-standard modulation technique that stems partly from founder Baran's experience with Rand Corp. in the 1950s, when Rand worked with the U.S. military on signal processing and spread-spectrum communications. Conventional dial-up modems use two data carriers on a telephone circuit. Data is modulated to frequencies that are located in or near the frequency center of the channel.

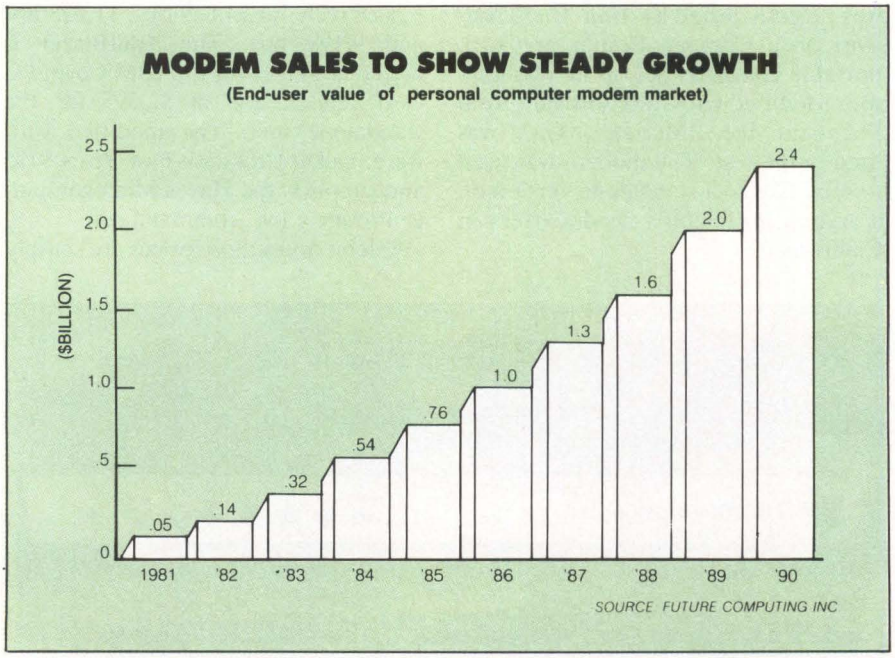
In contrast, the Telebit modem uses a Texas Instruments TMS 320 chip to analyze the entire frequency spectrum of a telephone channel, usually from 0 to 4,000 Hz. During the "handshake" of two TrailBlazer modems, during which test data is transmitted between the two units, the chip determines how many carriers are usable for data transmission by measuring the amount of line noise at every 7.8-Hz increment. Separate packet-data carriers are established at each usable increment. So, instead of only two data carriers, the TrailBlazer theoretically could employ as many as 512 data carriers in nearing the impossible ideal of the perfect, noise-free telephone connection.

In reality, the TrailBlazer dynamically assigns data carriers from approximately 300 Hz to 3,400 Hz to achieve optimum data throughput. The line is analyzed at the beginning of each connection and throughout the call. If line conditions improve or degrade during the course of a call, the modem increases or decreases the number of data packets being transmitted.

The TMS 320 chip also analyzes and assigns the number of bits per packet that can be sent on each carrier—either two, four or six. If line conditions are extraordinarily poor, the modem falls back to 1,200-bps full duplex and 300-bps full duplex transmission at Bell 103 and 212A standards, respectively. In addition to the TI chip, the TrailBlazer also contains a Motorola Inc. MC68000 chip for generalized housekeeping functions and an Advanced Micro Devices 7901 chip to perform analog-to-digital conversion. "Telebit's packetized-ensemble approach and bandwidth control is really quite an accomplishment," says analyst Nutt.

Because of the unusual modulation technique, the TrailBlazer is able to employ an automatic request/repeat protocol for error-free communications. If a data packet is lost in transmission or transmitted in error, the receiving unit requests a repeat transmission. Since the transmission rate is dynamic, the overall throughput is only marginally diminished. Other high-speed modems utilize a forward error-correction scheme whereby the receiving terminal evaluates the transmission, determines if any data is lost or garbled, then corrects it without a retransmission.

"Forward error-correction is not 100 percent foolproof, but we can guarantee error-free data transmission," says Schaller.



The personal computer modem market *will grow at a compound average growth rate of 26 percent from 1985 to 1990, when it will total $2.4 billion, according to Future Computing.*

Consistent 14,000 bps in tests

In June, Blue Cross/Blue Shield of Oklahoma obtained for testing two Fastlink modems from the units' distributors and marketers, Digital Communications Associates Inc. of Alpharetta, Ga. (DCA, which sells a 3270 emulation card, IRMA, for IBM PCs, will sell the TrailBlazer under the name of "IRMA's Fastlink" through its sales force to retail outlets and other resellers. Telebit will concentrate on the OEM and value-added reseller market.) Blue Cross/Blue Shield intends to replace its conventional 1,200-to-2,400-bps modems with the new units for doctors to phone in claims. For local calls, the new modems consistently average 14,000-bps throughput rates in the tests.

The older modems are linked to an IBM 3725 front-end processor. Ac-

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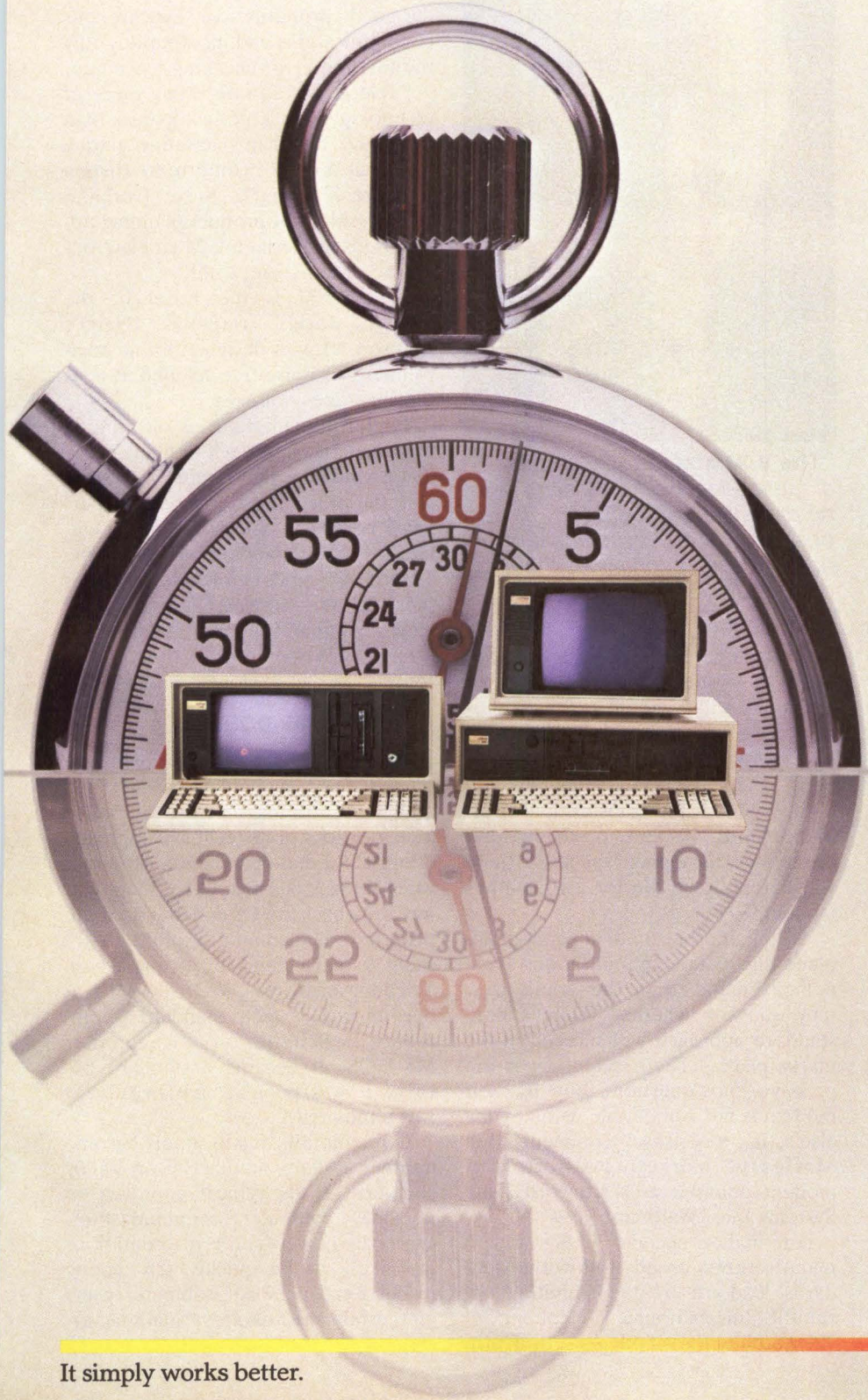

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cording to Mike Latty, technical advisor to Blue Cross/Blue Shield, without the faster modems, the volume of claims will eventually force the organization to add more data ports—at a cost of $20,000 per port.

Telebit executives refuse to provide any sales figures for the TrailBlazer. Schaller says that the company had "commitments" for approximately 10,000 units, but most of them, she admits, are earmarked for the Telebit/DCA joint venture. "We're shipping in the hundreds now," comments Telebit president A.R. Johnson.

A study issued in September by Dataquest estimated that sales of personal computer modems operating at 9,600 bps and higher will grow at a 73.4 percent compound annual growth rate through 1989. The study projects that unit sales will jump to an estimated 388,000 by 1989.

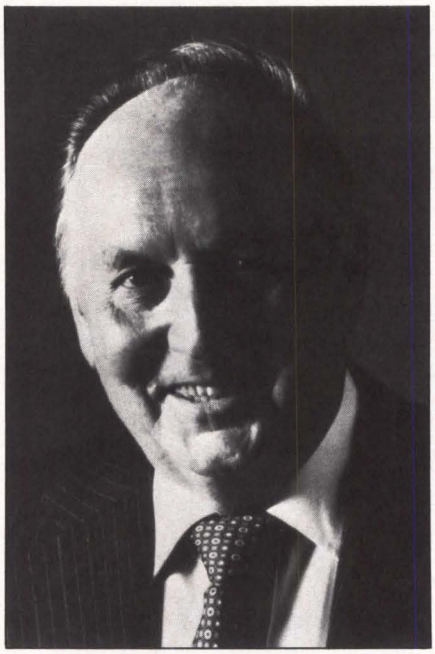
The Dataquest report lists no category for 4,800-bps modems in the belief, says analyst Nutt, that users who wish to buy modems faster than 2,400 bps will jump immediately to 9,600-plus units. With more sophisticated, and costly, error-correction techniques required at both 4,800 and 9,600 bps because of poor line quality, "It seems logical to take modem speeds from 2,400 to 9,600 to 12,000 bps rather than stop at the intermediate 4,800-bps level," he says.

Future Computing Inc. of Richardson, Texas, predicts personal computer modem sales will reach $2.4 billion by 1990. Total sales will reach an estimated $760,000 in 1985, the research company says.

Line costs demand high speed

The push for higher speeds in dial-up modems has been largely driven by the sharp increase in cost for dedicated telephone lines—the preferred transmission medium for higher-speed modems. Dedicated lines do not go through nearly as many noise-producing switches. And, until now, the problem for higher speed, direct-distance dial-up modems has been achieving throughput rates comparable to modems used with dedicated lines.

Kim Myhre, a modem-industry analyst for International Data Corp. of



"The V.32 standard *is the Edsel of the modem world," asserts Telebit president H.R. Johnson. "It was designed for an environment of noise-free telephone lines that just does not exist."*

Framingham, Mass., disagrees with Nutt's assessment that the 9,600- bps-plus units will wipe out the 4,800-bps market. She points to the installed base of 4,800-bps modems in organizations where numerous modems are used, such as banking institutions. But, Myhre adds, because of the natural economies at higher speeds, "there will definitely be life for a 10,000-bps modem."

Although other modem vendors applaud the data-communications technology embodied in the TrailBlazer, they question whether Telebit's non-standard approach will succeed in the marketplace. "Their technology is impressive, no question, but if their modem is not compatible with anyone else's, it's too risky," comments Bob McGeary, marketing director of modem manufacturer Concord Data Systems Inc., Waltham, Mass.

For higher speeds, U.S. modem manufacturers usually follow the standards lead set by the Comité Consultatif Internationale Téléphone et Télégraphie, the standards-setting arm of the International Telecommunications Union. In April, the CCITT adopted the V.32 standard for 9,600-bps dial-up modems. Unlike the Telebit approach, however, the standard is designed primarily for synchronous communications and incorporates only the forward error-checking technique.

"Telebit has an interesting piece of technology, but larger companies than they have failed in marketing unique gear that does not conform to existing standards," remarks Steve Durham, vice president of product planning applications at Cermetek Microelectronics Inc., Sunnyvale, Calif.

"The V.32 is the Edsel of the modem world," responds Telebit's Johnson. "It was designed for an environment of noise-free telephone lines that just does not exist."

Telebit, he maintains, is offering an asynchronous approach to high-speed, dial-up modems that is more consistent with the practical requirements of personal computer communications. Unlike the V.32 standard, he adds, the TrailBlazer modem includes features such as auto-answer, auto-dial, the Hayes command set and a board-level version—elements that users have come to expect in slower modems.

Remember MS-DOS!

Telebit does have a representative on a CCITT modem working group and is putting together a proposal to have portions of its technical approach adopted for dial-up communications at rates above 9,600 bps. Other than that, any drawbacks to its non-standard approach to data communications do not seem to have much of an impact on Telebit executives. "We're looking at becoming a de facto standard," comments Schaller. "Remember MS-DOS. It became a standard because it was popular, not because it was annointed."

If Telebit fails, it will simply become another casualty among Silicon Valley start-ups. If its radical approach to personal computer communications succeeds, however, the reverberations are likely to be quickly felt among professional personal computer users and established modem manufacturers. □

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Cooperative 'MAP' standards effort nets results

Lynn Haber, Associate Editor

A cooperative demonstration this month connecting networks using General Motors Corp.'s Manufacturing Automation Protocol (MAP) and Boeing Computer Services' (BCS) Technical and Office Protocol (TOP) proves standards work, users mandate them and manufacturers bank on them.

The demonstration, held at Detroit's Autofact '85 show on Nov. 4 to 7, emphasized the collaborative effort by GM, BCS and more than 20 industry participants to tie the factory and the corporate office into a cooperative communication environment.

More specifically, according to Mark Adler, staff program manager with the advanced engineering group at GM in Detroit, the demonstration was meant to show that multivendor end-to-end communication can exist within an IEEE 802.4 local area network interconnected to an IEEE 802.3 LAN and a wide area network for remote LAN access.

Most significant in the Autofact demonstration was the implementation of the National Bureau of Standards' (NBS) "Internet" protocol, which was not used at the first open systems interconnection (OSI) demonstration at the 1984 National Computer Conference in Chicago. Based on the seven-layer International Standards Organization communication model, Internet provides the Layer 3 (Network) protocol necessary to establish communication between different networks.

Initiated in 1980, MAP was necessitated by GM's need for communication among various pieces of computerized factory equipment—from programmable controllers to robots. GM's goal is to standardize communication among different vendors' equipment to allow for effective computer-integrated manufacturing.

BCS' TOP effort parallels the MAP effort—but within the office environment—with the support of a network users group. Comprised of about 80 companies with major data-processing departments, the group plans to standardize office automation and resource sharing.

GM's MAP specifications are written for an IEEE 802.4 broadband, token-passing bus LAN. BCS' TOP outlines communication protocols for the IEEE 802.3 baseband carrier sense multiple access with collision detection (CSMA/CD) LAN.

Internet ties networks

According to Laurie Bride, manager of networking technology at BCS in Bellevue, Wash., Internet creates an intermediate open system (IOS). The IOS acts as an interface that allows interaction between two intermediate network systems such as 802.3 and 802.4.

The workstations and computers that ran applications in the demonstration are referred to as end systems, explains Bride. If two end systems running applications are to communicate with each other, a corresponding (Layer 3) protocol must run in each of those end systems to allow routing to take place between those systems. "The Layer 3 protocol gives the capability for a hybrid network link between the factory-floor network and the office network," she says.

Beside the implementation of Internet, the level of sophistication attained at this year's demonstration resulted from MAP enhancements to the Transport and Session (4 and 5) layers. Additionally, according to GM's Adler, the MAP selection for the Ap-

PUTTING THE NETWORKS TOGETHER

ISO layer	MAP protocol selection	Status
7. Application	NCC demo - ISO file transfer and GM programmable device messaging. Autofact demo - ISO CASE (communication application service elements) ISO FTAM (file transfer and access managment)	subsets implemented at NCC subsets implemented at Autofact
6. Presentation	ISO/GM	null at NCC null at Autofact
5. Session	ISO/GM	null at NCC subsets implemented at Autofact
4. Transport	ISO/NBS Class 4	implemented at NCC implemented at Autofact
3. Network	ISO/NBS Internet	null at NCC implemented at Autofact
2. Data Link	IEEE 802.2 Class 1 IEEE 802.4 Token Medium Access	implemented at NCC implemented at Autofact
1. Physical Link	IEEE 802.4 Broadband	implemented at NCC implemented at Autofact

Source: National Bureau of Standards

The implementation of the Internet protocol Network *(Layer 3) represents the key advancement at the Autofact '85 OSI-related demonstration. Internet was not used at the 1984 NCC demonstration. In addition to the Layer 3 implementation, protocol implementation enhancements were also made in Layers 5, 6 and 7.*

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plication layer (Layer 7) includes a more complete subset of ISO communication application service elements (CASE) and ISO file transfer and access management (FTAM), than was implemented at NCC.

The MAP/TOP specifications demonstrated at Autofact enable systems to create, read, write and delete files from other systems. At last year's NCC demonstration, the systems could only read files on their own systems.

Other protocols, not currently standard but slated to be implemented for the demonstration, include a directory service, network management and a subset of GM's Manufacturing Message Format Standard (MMFS) that allows programmable devices to talk to each other, to robots and to end-computer units.

According to Adler, the demonstration effort involves testing and coordinating products from over 20 vendors. Participating in the MAP network are: Advanced Computer Communication Corp., Allen Bradley, Asea Information Systems Inc., AT&T Information Systems, Concord Data Systems Inc., Digital Equipment Corp., Gould Inc., Hewlett-Packard Co., Honeywell Information Systems Inc., IBM Corp., Industrial Networking Inc., Intel Corp., Motorola Inc., NCR Corp., Northern Telecom Inc. and Siemens Communication Systems Inc.

Participants in the BCS 802.3 network include ACDS Graphic Systems Inc., Charles River Data Systems Inc., ComputerVision Corp., Excelan Inc., Intergraph Corp., International Computers Ltd. and Sun Microsystems Inc.

NBS has also been intensely involved in developing computer communication standards over the past several years. The role of the NBS, according to Robert Blank, director of its Center for Computer Systems Engineering, Gaithersburg, Md., is to organize the industry to make implementation decisions on OSI standards and to test OSI-based products.

Before the Autofact demonstration, GM and BCS used NBS tests to make sure that participating vendors had conformed to the specifications and that all the equipment would communicate.

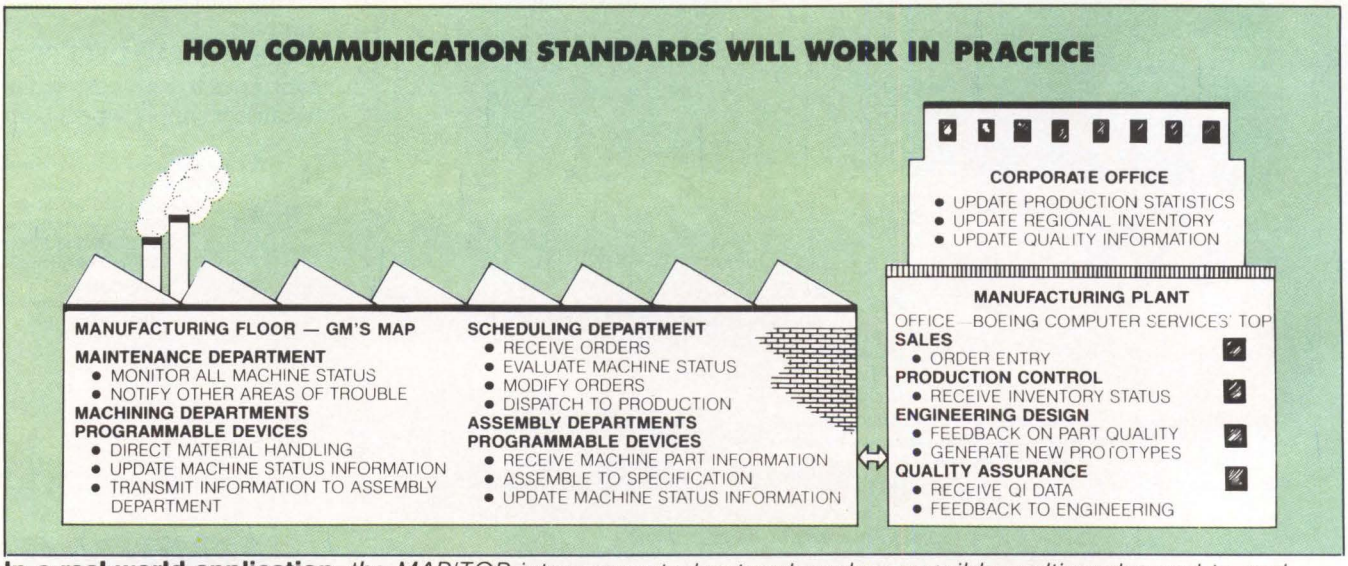
Industry participants are hopeful that their standards-development work will translate into real products and eventually open networking architectures. Because the OSI reference model is layered, products can implement the OSI protocols currently in place. More advanced products can then be based on the existing implementations. Already, some companies have OSI products either under development or on the market.

According to BCS' Bride, users could expect to see OSI-related products at Autofact as a result of the MAP/TOP work. Gould, Andover, Mass., is expected to announce two MAP products that will reportedly allow users to connect incompatible networks. The Gould NW 0200 MAP Gateway allows users to incorporate various standalone devices, such as robots and personal computers, in a multivendor factory-floor environment. The Gould UTX/32 MAP software was designed for the company's PowerNode 6000 and 9000 computers. Using the UTX/32, each PowerNode computer may serve as a full node on a MAP network.

According to Gould, the Gateway performs a non-transparent message store-and-forward from a node on one network to a node on another network. Using all the layers of the ISO networking model, the Gateway performs protocol translations to connect different network architectures along a MAP-controlled network.

The NW 0200 is based on Motorola's MC68010 microprocessor, has a 0.5M-bit memory, a MAP controller board and a 10M-bit-per-second (bps) modem board. The VME-based bus uses the MTOS real-time operating system with MAP data link. According to the company, the product has completed certification testing and complies with MAP 2.1 at 10M bps.

For users of Modway, Gould's pro-



In a real-world application, *the MAP/TOP interconnected network makes possible multivendor end-to-end communications between the factory-floor LAN and the local and remote corporate office networks.*

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prietary LAN, the company offers a Modway Replacement Gateway Program.

Also scheduled to be exhibited at Autofact was Intel's recently announced iSXM 554 COMMengine board, based on the company's Multibus I architecture. According to the company, the product meets the first four ISO layers and satisfies MAP specifications for industrial LANs.

The iSXM 554 module was designed for OEMs supplying industrial-automation products and allows factory equipment, such as cell controllers, robots, programmable controllers, gateways, vision systems and automated vehicle-guidance systems to be linked via networks. According to Intel, all these devices can be linked to a MAP network without system redesign.

Intel also offers a separate software product preconfigured for the iSXM 554 module, called MAP-NET networking software, that satisfies the remaining three MAP layers. □

PACIFIC PERSPECTIVE

Japanese copyboards: products in search of a market

Ichiro Kakehashi
Tokyo Correspondent

As many as a dozen Japanese companies have been making electronic copyboards for a year and a half; now they have to figure whom it's best to sell them to.

Still sketching in market strategies for ideas that may be ahead of their time, companies like Fujitsu Ltd., Ricoh Co. and Sharp Corp. generally promote the products as elements of teleconference systems. Combining the copyboard's copying ability with facsimile communication, they reckon, will broaden sales prospects. Until now, promotion in the Japanese domestic market has emphasized copyboard merits as replacements for the old-fashioned chalk boards.

The term "copyboard" is most commonly used to define a large writing surface that can sense what is written on it and transfer the information in smaller size for reproduction, usually by thermal printer. However, methods of operation differ widely from machine to machine. Matsushita Graphic Communication Systems Inc. offers two systems, the Panaboard UB-1200 and UB-1800, in which a vertical bar scans the writing surface from left to right. It takes 10 to 20 seconds to read an image on their respective 1,200-mm-by-900-mm (approximately 48 inches by 35 inches) and 1,800-mm-by-900-mm writing surfaces. The advantage of these independent scanners, says the company, is that they can read either from papers fixed to the surface or from script written directly on the board in black, red or blue felt-tipped markers. Copies of the images are made on thermal paper.

By contrast, Matsushita Communication Industrial Co. offers the WG-5000 on which the writing surface is a continuous roll that presents an area of 1,152 mm by 864 mm, written on by felt-tip markers. Copies are produced on thermal paper every 10 seconds.

The first commercial copyboard was introduced in May 1984 at the Tokyo International Business Show by Oki Electric Industry Co. Since then, Oki claims, it has shipped over 10,000 of its thermal-reproduction Kawaraban copyboards to the Japanese market. According to analysts, the overall Japanese market for such boards will total 60,000 units, for a value of about $105 million, in the fiscal year that ends in February. Japanese manufacturers think the market will double in the following year.

They may, however, have to alter their sales strategy before that occurs. So far the technique has been to appeal to schools, suggesting that students can be freed from the distraction of taking notes during lectures. An instructor can scribble on a copyboard and printouts be distributed to the class, they imply, allowing the students to concentrate on what's being said. A more promising approach, many companies agree—and one with a larger market—is touting a hybrid product that combines the scanning and copying functions of a copyboard with the ability to transmit the information like a facsimile machine. Such a system could link conference participants across town or across an ocean.

One domestic incentive for adding facsimile communications to copyboards arises from the development of Japan's digital data-communication network, based on fiber-optic-cable trunk lines installed earlier this year. The Nippon Telegraph and Telephone Corp., now a private corporation but still effectively a monopoly, is working with the Japanese Ministry of Posts and Telecommunications to test the high-speed data network.

But, so far, the complexities of reducing information to digital form for transfer over telephone lines make the equipment too expensive for most companies.

So, today, the copyboard market is largely limited to research institutions and the largest corporations. Nonetheless, manufacturers expect prices to come down rather quickly—leading to their forecasts for a $210 million market next year.

Other copyboard manufacturers in Japan today include Casio Computer Co. and Matsushita Electric Industrial Co. OEM customers who offer copyboards from other makers include: Lion Office Project Corp., Pilot Pen Co. and Fuji-Xerox Co., all of whom market Fujitsu boards, and Plus Corp., which sells Oki Electric boards. Oki Electric products are marketed in the United States by Okidata of Mt. Laurel, N.J.

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*Source: Newton-Evans Research Co.
1985 survey.

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Spec Wars: Two coalitions square off over extended memory

Michael Tucker, Associate Editor

In what is either a major confrontation or a tempest in a teapot, two coalitions of companies are facing off on the issue of extended-memory board specifications for the IBM Corp. PC.

Last April, Lotus Development Corp., Cambridge, Mass., and Intel Corp., Hillsboro, Ore., placed their specifications in the public domain under one banner. In July, Microsoft Corp., Bellevue, Wash., announced that it, too, would support the specification, which was promptly named the "Lotus/Intel/Microsoft Expanded-Memory Specification (EMS)." The three companies hope to make their EMS the industry standard.

However, in June, AST Research Inc., Irvine, Calif., and Quadram Corp., Norcross, Ga., announced an "enhanced" version of the Lotus/Intel specification and proposed it as the industry standard for extended-memory boards instead. Ashton-Tate, Culver City, Calif., and Digital Research Inc. (DRI), Monterey, Calif., then said they would support the AST-Quadram specification as well as the Lotus/Intel original—a move widely interpreted by many as making them de facto partisans of the AST-Quadram alliance.

Meanwhile, IBM, which happens to make the machine everyone else is arguing about, has no comment on either standard. "I think we'll just stay out of this one," says an IBM spokesman.

Lotus/Intel stands Above Board

The need for extended-memory boards for the IBM PC stems from its operating system, Microsoft's PC-DOS, which limits the user to addressing 640K bytes of memory at a time. Lotus, whose spreadsheet users were hampered particularly by the 640K limit, and Intel, which is trying to bring its chip expertise to the PC-peripheral market, began close cooperation on the problem roughly a year ago. In April, they announced their EMS and Intel introduced its Above Board, a memory-expansion board meeting the spec. Lotus also announced that its new Symphony Release 2 would be written to the EMS.

The new specification was greeted warmly by a host of hardware and software vendors—particularly as Lotus and Intel placed it in public domain. That meant that any board maker that wished to compete with the Above Board could be confident that its customers could run Lotus software. When, shortly thereafter, Microsoft announced its intention of supporting the spec as well, partisans of the Lotus/Intel/Microsoft EMS were quick to conclude that the game was, more or less, over. They reasoned that with two of the leading software makers in America behind the new spec, as well as Intel, it simply couldn't fail to become a standard.

"The Microsoft announcement is particularly important," explains Jim Kinlan, manager of technical marketing for Lotus. "Now we have the support of the company that developed the operating system [MS-DOS] itself. It means that any new operating system from Microsoft—including the rumored MS-DOS 4.0—will work with the spec. We're very interested in compatiblity, and working with the makers of Microsoft makes that possible. Some people have tried to produce an EMS without that support."

AST on a Rampage

The companies trying to produce an EMS "without that support" were AST and Quadram, which had been working on their own solution to the memory problem for almost a year before the Lotus/Intel announcement. In fact, the two companies seemed to have been somewhat taken aback when Lotus/Intel appeared to attempt to create a standard by fiat. "They were very polite," notes Jerry Bower, AST senior product-marketing manager, "but it was a set thing, cast in

HOW THE SPECS STACK UP

Specification	Lotus/Intel/Microsoft	AST/Quadram
Coalition members	Lotus Development Corp. Intel Corp. Microsoft Corp.	AST Research Inc. Quadram Ashton-Tate
Maximum memory expansion	Up to 8M bytes of additional RAM	Up to 8M bytes of additional RAM
No. of windows into higher memory	4	16
Ability to swap data below 64K	No	Yes
Boards available	Intel Above Board Quadram Liberty	AST Rampage! Quadram Liberty X
Current software support	Lotus Microsoft Ashton-Tate Digital Research Inc. (DRI)	Ashton-Tate DRI

Competing expanded-memory specifications *differ primarily in their use of high memory. Each is attempting to become the industry standard.*

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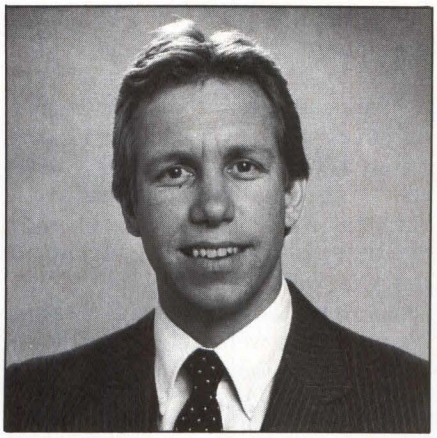


"If you're going to create *a standard, you've got to have all the major players involved," says Jerry Bower, AST senior product-marketing manager, responding to the Lotus/Intel standards announcement.*

concrete....They said, 'Here it is, here's your standard.' Around here we have a general feeling that this sort of thing can't be imposed. If you're going to create a standard, you've got to have all the major players involved."

Then came the June announcement. "We wanted to do more for the end-user," contends Bower. "Basically, we support the Lotus/Intel/Microsoft spec, but we've gone beyond it. In general, what we've done is provide hooks for software developers and their applications."

The "Enhanced EMS" (EEMS) is embodied in AST's Rampage! board and Quadram's Liberty X. (Quadram's older Liberty board supports the original Lotus/Intel/Microsoft spec.) The boards and their specifications differ from their Intel/Lotus/Microsoft counterpart in that they allow more swapping of data into the "high memory" of an IBM PC—i.e., into the area between 640K bytes and 1M byte. AST and Quadram say that this makes for greatly increased performance, particularly for multitasking programs. Lotus/Intel/Microsoft say that it actually makes the spec cumbersome and might severely degrade its ability to deal with multitasking operating systems.

The EEMS also allows a program to swap data into memory below 64K bytes. Lotus/Intel/Microsoft say this is extremely dangerous because it is in that region that MS-DOS dwells, and conflicts might arise between DOS requirements and application requirements. "We think our spec is as flexible as you can get," says Bower. "The Lotus/Intel spec is really a subset of what we're doing."

Enter, and/or exit, Ashton-Tate

The support for the EEMS was not long in coming. DRI quickly announced that it liked the specification and might write a driver for it. Ashton-Tate not only said it would support the spec, it participated in the AST/Quadrum June press conference. Even the booklet containing the EEMS has a cover photo that shows the company logos of AST, Ashton-Tate and Quadram.

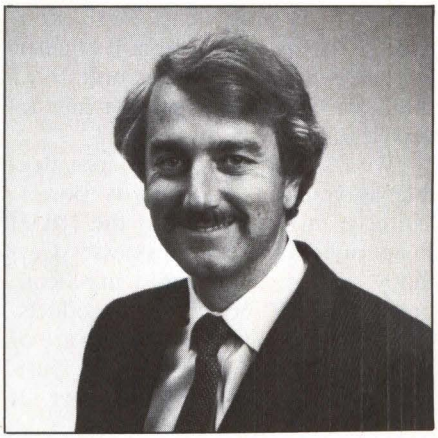
However, Ashton-Tate's participation has grown ever more mysterious since EEMS' introduction. When an Ashton-Tate spokeswoman was recently contacted on the matter, her comment was a terse, "We're supporting both standards. We're not taking one side or the other. Do you understand?"

How one interprets those remarks depends on whom one talks to. As AST's Bower says, "It depends on how you look at it. After all, supporting our spec means that you effectively support their spec, just by implication, [and] I think what Ashton-Tate is saying is that they'll write their software so that it'll also run on an Intel board...that's understandable."

There are, however, other views. "I've got a lot of respect for AST," says Lotus' Kinlan, "but they didn't work with us. They didn't work with the big software companies. I think that, after we made our announcement, they hurried out and got some software companies to support their own spec."

"I'm personally unaware of any software that takes advantage of anything that's not provided in the Lotus/Intel/Microsoft spec," adds Jim Johnson, Intel's operations manager for its personal computer operation.

Meanwhile, both sides claim that their spec is better. The AST/Quadram group stresses technical superiority; the Lotus/Intel/Microsoft group pushes the benefits of standards. "Our feeling," says Bower of AST, "is that, if we're going to set a standard, let's do it right the first time. That way we don't have to go back and add a lot of things later."



"AST is a very good company," *says Intel's PC operations manager Jim Johnson, "and we respect them highly. [But] we believe that our spec will be the standard because we've gathered the major players in the field."*

"On paper, AST is arguing the technical elegance of their product," responds Kinlan, "but what does technical elegance mean to the end user?...It's not clear to me that, if people can't use it, 'technical elegance' has any merit for the end user. What's important to users is that they can buy one board and know it will be compatible with a broad range of software."

"Compatibility was our central concern," adds Intel's Johnson. "Look at UNIX—there's an example of where the standard wasn't adhered to...nobody was there controlling the situation. If you're going to be a standard, you've got to be so explicitly."

AST's Bower counters: "We're for a standardization. We'd like to see an industry standard, but one developed openly, by the industry as a whole. You can't impose this sort of thing from above."

"We can't cram anything down anybody's throat," replies Johnson. "We can only provide a service. We worked

with Lotus to solve a customer's problem. If the market accepts it, then it will succeed; if not, then it won't. But I think we can see the market has accepted it."

"We think our spec is about as flexible as you can get," insists Bower. "Intel is just beginning in the [IBM] PC-peripheral-board business. Certainly, they're experienced in silicon, but not in PC-board-level products. It's only natural they weren't aware of what people who'd been in the business for years really had to offer. If they had been, I think they would have been a lot more flexible."

The happy warriors?

Through it all, everyone involved in the debate claims to like everyone else involved in the debate. "I will say that AST is a very good company," says Johnson, "and we respect them highly. [But] we believe that our spec will be the standard because we've gathered the major players in the field."

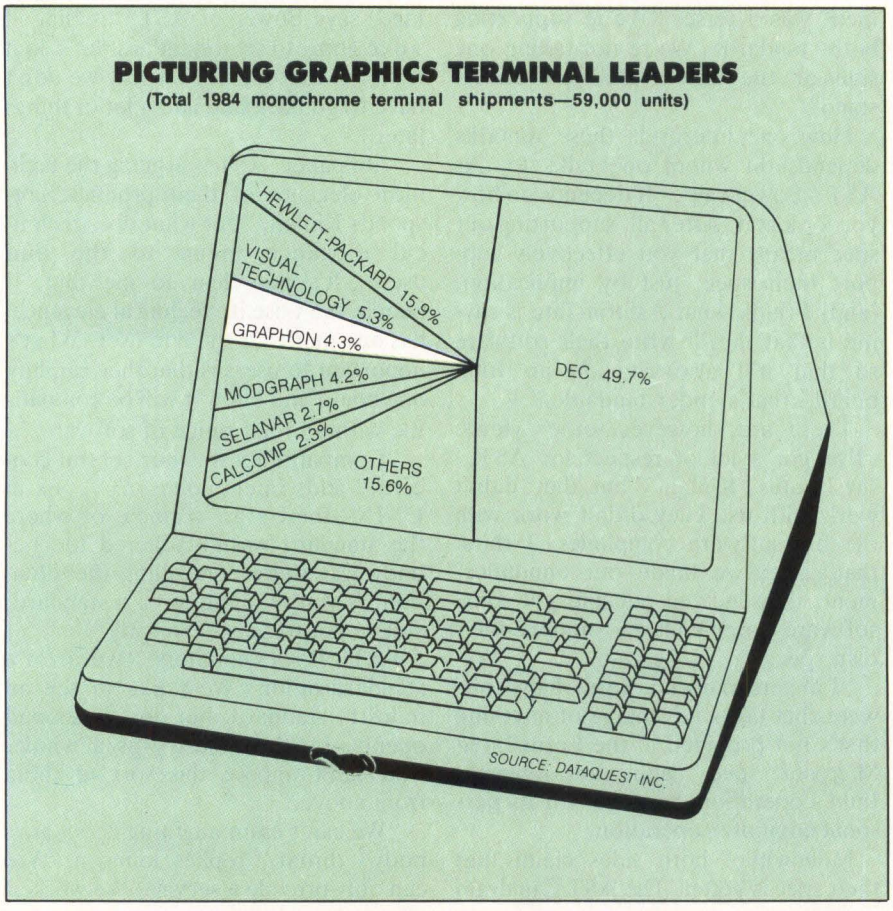
"I admire AST," chimes in Lotus' Kinlan. "It's just that, for reasons of standardization, I don't think their alternative standard will succeed on the market."

"We're not interested in wasting our resources in what are wrongly perceived as battles," agrees AST's Bowers. "We want to get on with the business of selling hardware, and may the best man win. We're happy to compete with anybody, but, in my view, [Intel] is a beginning start-up. We wish them well, but I think they'll find there's more to bringing out a product than just designing it." □

New GraphOn terminals pursue DEC-Tek strategy

Mike Seither
Associate Western Editor

Having made a mark with its GO-100 line of terminals that emulate popular Digital Equipment Corp. and Tektronix Inc. units, GraphOn Corp. has stuck with that "DEC-Tek" strategy for its new range of GO-200 alphanumeric and graphics models. It is a strategy that has served the Campbell, Calif., company well, propelling it in just three years from nowhere to being the sixth-leading graphics terminal manufacturer.



GraphOn's target markets are DEC's VT100 and VT220 terminals and Tektronix's 4010, 4012, 4013, 4014 and 4015 models. Like its GO-100 line, GraphOn's four latest terminals are all monochrome.

GraphOn hopes its support of DEC's remote graphics instruction set (REgis), a graphics programming language, will leverage sales of the GO-200 terminals. DEC has promoted that language for some time, even though independent software developers have not been eager to write applications under it. The de facto standard for graphics software, many analysts agree, has been Plot 10 from Tektronix.

In any case, a number of REgis-based DEC programs are now available for creating graphics and supporting such output devices, says A. Mason Killebrew, GraphOn's director of sales and marketing. "DEC has bundled REgis with a lot of its VAX sales," says Killebrew. "People who've bought VAX 8600s have received it [REgis] gratis or at reduced prices. There's

Moving from obscurity *to the sixth-largest manufacturer of monochrome graphics terminals in three years, GraphOn also holds sixth place among shippers of color and monochrome terminals combined, according to Dataquest.*

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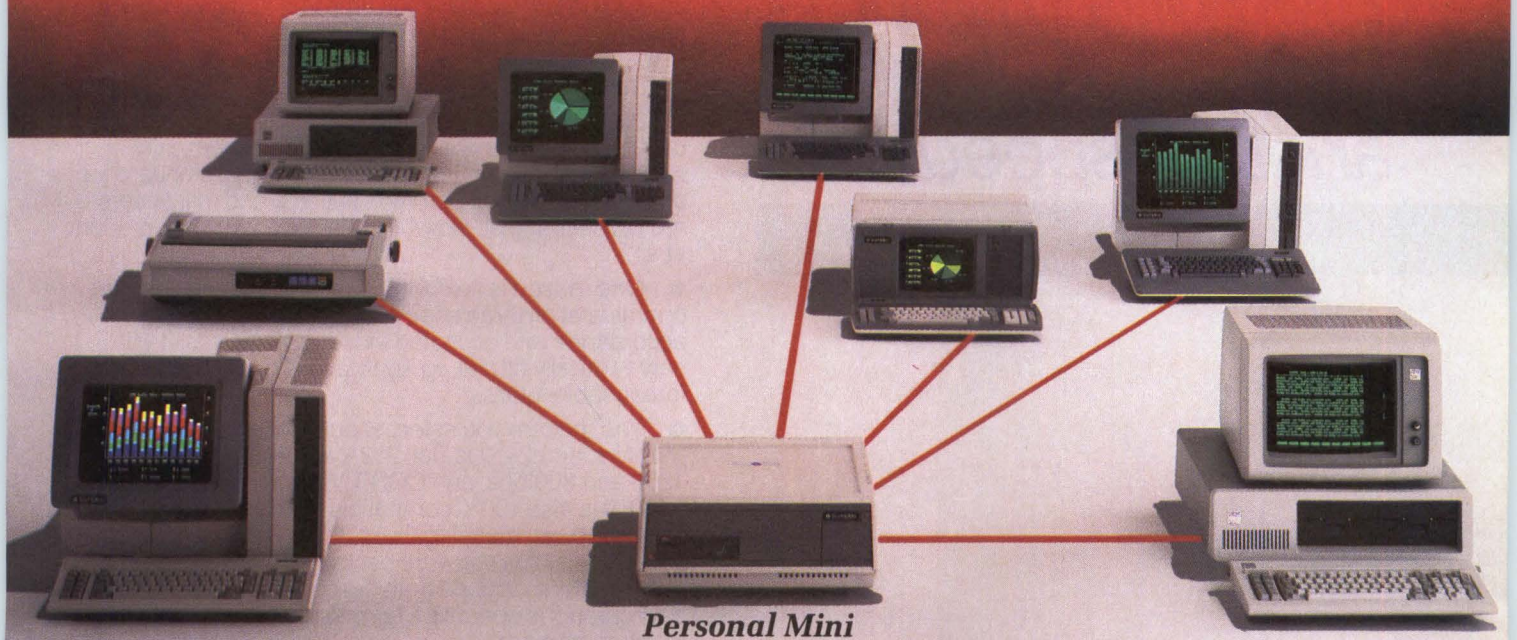

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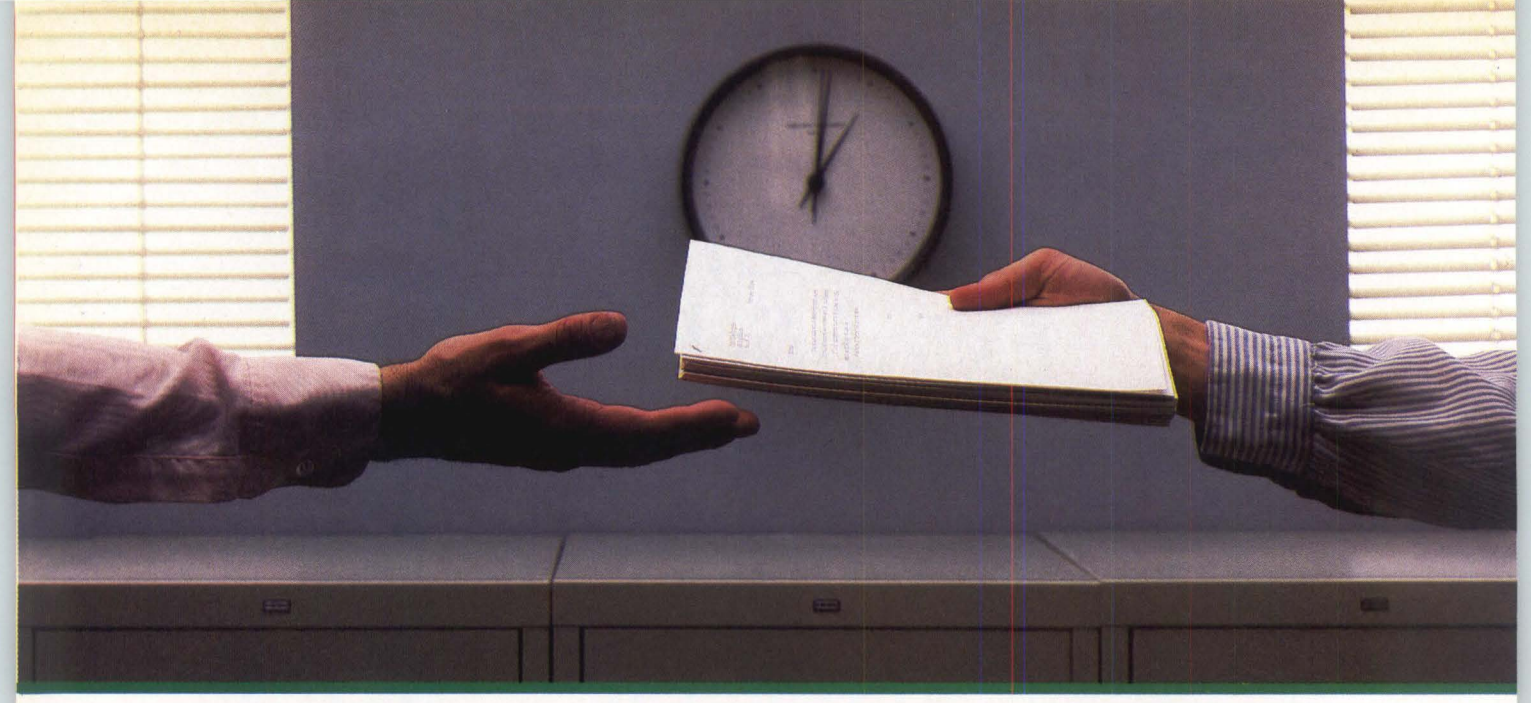

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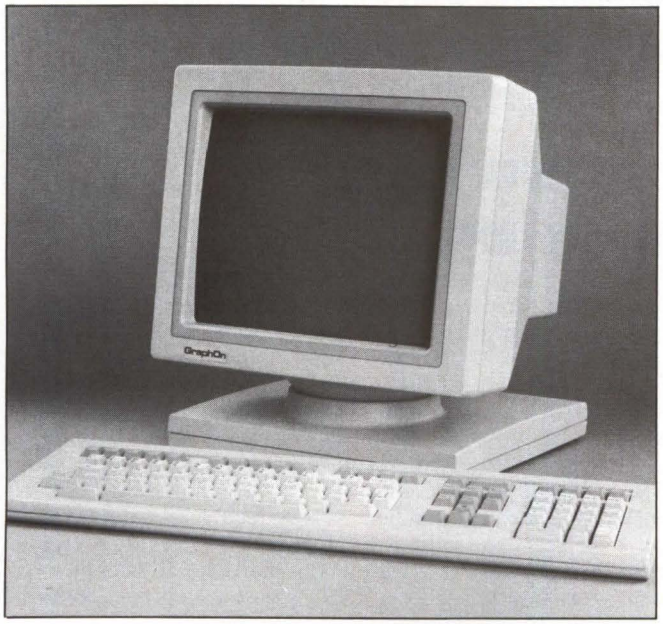

Providing resolution *of up to 1,056 by 782 pixels, GraphOn's GO-200 graphics terminals feature as many as 90 programmable function keys.*

really a large installed base out there."

With continued promotion and applications support from DEC, says Killebrew, REgis may attract new admirers. "REgis is more complex than Plot 10, but it's elegant," he says. "Text can be positioned vertically or even upside down. It's a more modern embodiment of what graphics should be."

Industry observer Lewis Brentano agrees that the installed base of REgis is substantial. And Brentano, director of graphics terminals for research company Dataquest Inc., San Jose, Calif., says those numbers should work in GraphOn's favor. There is another favorable factor: REgis was designed to operate on DEC's VT240 and VT241 terminals, which have screen resolutions of 800 by 200 pixels. GraphOn's GO-230, GO-240 and GO-250 do even better. The first two graphics terminals have resolutions of 1,056 by 391 pixels, and the GO-250 has a resolution of 1,056 by 782 pixels.

Changing style

In outward appearance, the new GraphOn terminals are radically different from their predecessors. The GO-200 line now stands on a 12-inch-square tilt-and-swivel base that takes up about 40 percent less desk space than the company's previous terminals. The screen has grown from 12 inches to 14 inches and has a fine etching on the CRT plate to reduce glare. The low-profile keyboard now complies with DIN ergonomic standards and offers from 30 to 90 programmable keys.

The GO-220, $995, is an alphanumeric-only terminal with a display size of 132 columns. To emulate personal computer programs, 24, 25 or 26 text lines are optional. It emulates DEC's VT100 and VT220.

The GO-230, $1,295, has bit-mapped graphics, as does the high-end GO-240 and GO-250. Resolution, as with the GO-240, is 1,056 by 391 pixels. And, like the GO-240 and the GO-250, it emulates the VT100, VT220 and Tektronix 4010-4015s. It stores a maximum of one page of graphics and eight pages of text.

The $1,895 GO-240 stores two pages of graphics and eight pages of text; features pan and zoom; and comes with up to 90 programmable function keys. REgis is standard only on this terminal.

With REgis as an option, the $2,495 GO-250 incorporates all features of the lines' other models, but boasts twice their vertical resolution (1,056 by 782 pixels) and more local storage: 20 pages of text and four pages of graphics. Other terminal manufacturers that support the REgis protocol include Qume Corp., with its QVT 311, and Visual Technology Inc., with its model 241. □

START-UPS READY OPTICAL DRIVES

Optical disk drives are expected next year from two start-up drive manufacturers Daisar Corp. of Boulder, Colo., and Laser Drive of Santa Clara, Calif. Daisar will introduce a 700M-byte, 8-inch erasable optical drive using thermo-magneto-optic technology and plans to have evaluation models ready by the end of 1986. Daisar's sister company, Kerdix Inc. of Boulder, has been developing the erasable media and is currently looking for manufacturing partners. Laser Drive is expected to have a 5¼-inch write-once, read-many drive ready early in the year.

DEC INTRODUCES TEMPEST LAN

Digital Equipment Corp., Maynard, Mass., has introduced an Ethernet local area network that DEC says has been accredited by the federal government in accord with the government's TEMPEST standards for secure communications. The network is priced at $2,995 for a single workstation connection and $5,800 for an 11/750 system connection.

DISK DRIVE USES STRETCHED-SURFACE MEDIA

Prototype models of a 3½-inch disk drive using 3M Data Recording Products' stretched-surface media have been developed by start-up company Ample Data Corp. of Newbury Park, Calif. Evaluation models of the drive, which range in capacity from 12M to 48M bytes unformatted and support data rates of up to 10M bits per second, are expected by the second quarter of next year.

HEARD ON THE HILL

Nippon Telegraph's open door demands patient knocking

Stephen J. Shaw
Washington Editor

Nippon Telegraph and Telephone Corp.'s (NTT) recent two-day seminar in Washington to alert U.S. companies to procurement opportunities with the "new" NTT was little more than a public-relations gesture, say many participants.

Recent sales of U.S. equipment to the telecommunications giant—bolstered, theoretically, by a 5-year-old trade agreement—underscore that skepticism. And even the most optimistic manufacturers say selling to NTT will take commitment, patience, persistence and a willingness to adapt products to fit the Japanese market.

On April 1, NTT was formally "privatized"—its monopoly on telecommunications services ended and ownership of stock supposedly opened to non-government sources. At the same time, new Japanese legislation opened all the country's telecommunications services to private ownership. The legislation also allowed foreign companies to provide various network services in Japan in joint ventures with Japanese companies.

"The Japanese market is really open," NTT president and chief executive officer Hisashi Shinto told some 300 seminar participants, most of whom were executives from U.S. companies. He explained that NTT's move would offer greater opportunities to foreign companies with "abundant experience and capabilities."

According to NTT, it bought approximately $3.4 billion worth of equipment in 1984. Of this, telecommunications equipment totaled $2.3 billion. During the past five years, NTT has purchased approximately $3 billion worth of equipment annually. With these numbers, Shinto and other NTT executives clearly had the attention of the audience.

During a panel discussion, several U.S. electronic industry executives recounted their experiences and offered some advice in selling to NTT. James Otis, president of Cray Research Japan Ltd., Tokyo, explained how the supercomputer manufacturer first established a Japanese subsidiary in 1979. It didn't make its first sale to NTT until late 1984. H.A. Hamilton, president of Northern Telecom Japan Inc., told how it took eight years to break into the Japanese market with its line of digital switches—"as long as it took us to sell to AT&T Co." Motorola Inc.'s executive vice president Stephen Levy recounted that the company first contacted NTT in late 1978 to sell pagers. Three and a half years later it was able to make its first delivery.

Northern Telecom's Hamilton suggested that manufacturers be flexible enough to modify existing products to fit the Japanese market.

Cray's Otis maintained, "I've found NTT to be open, reliable, pleasant to deal with, consistent and honest, but tough negotiators who insist on the highest quality goods and thorough after-sales service."

"Somehow, I feel I've been down this road before," commented one seminar observer acerbically.

The scenery looks familiar

U.S. companies, indeed, have traveled this route already. In 1980, the U.S. and Japanese governments signed the so-called NTT Agreement, in which NTT agreed to drop its favoritism toward domestic companies and provide U.S. companies with the chance to compete on an equal basis with their Japanese counterparts.

The bottom-line results of that agreement seriously undercut the initial optimism over selling to the "new" NTT. In 1981, the first full year after the NTT agreement went into effect, U.S. companies sold approximately $15.2 million worth of equipment to NTT, according to testimony given before Congress last year by former U.S. trade representative William Brock. In 1982, U.S. sales increased to $39.6 million and jumped again to $140 million in 1983. In 1984, the total dipped to $139 million.

In those four years, NTT procured approximately $12 billion worth of equipment. Of that total, only $333.8 million went to U.S. telecommunications companies.

Despite this imbalance in sales numbers, U.S. industry representatives continue to insist that NTT orders will be theirs, as long as they maintain their commitment to the Japanese market and try harder to understand the Japanese psyche.

"The structural impediments [to U.S. imports] have been essentially removed," remarked AT&T international vice president John Hinds, who added that AT&T had closed a deal with NTT for 61 3B minicomputers and a sophisticated network management system.

Said U.S. trade representative Clayton Yeutter, "I really believe NTT wants to do more business with Western firms."

But despite isolated successes in selling to NTT and the wishful thinking of U.S. government representatives, numbers do not lie. And one number has attracted the attention of the U.S. Congress—a $50 billion trade deficit with Japan. Inexorably, Congress is moving toward restricting the imports of Japanese goods into this country.

Against this backdrop of mounting deficits and a history of disappointing results in round after round of trade negotiations with the Japanese, both sides at the seminar expressed harmony and good feelings—a public show that struck at least one participant as incongruous. "There's a love-fest going on here," he said, "but across town on Capitol Hill there's a different message going out. I feel like Alice who's just stepped through the looking glass."

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IC HOUSE INTEGRATES THREE COMPUTER SYSTEMS

A semiconductor manufacturer combines DEC, ELXSI and Valid systems for computation-intensive tasks

Lawrence H. Goldstein and **B. Lee Jones**
Sierra Semiconductor Corp.

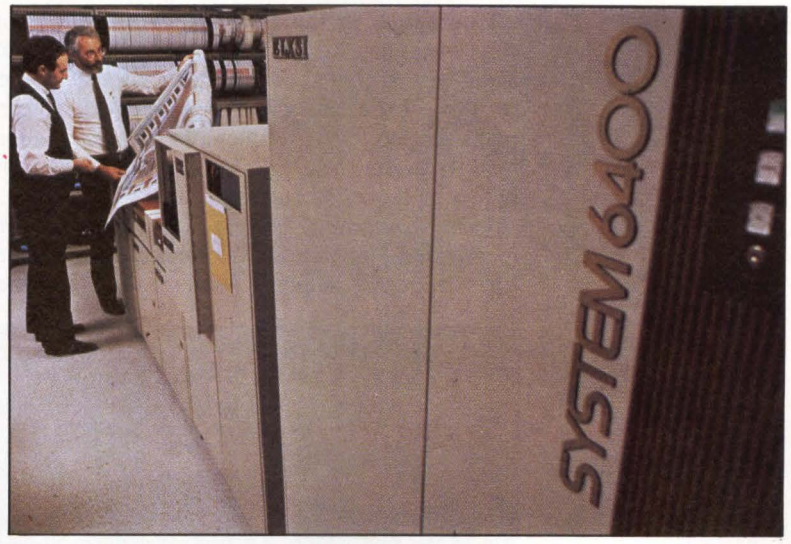
Custom VLSI design and other computation-intensive applications pose exacting requirements that cannot always be met by a single computer. For example, Sierra Semiconductor Corp., a custom integrated-circuit (IC) design start-up in Sunnyvale, Calif., wanted a system that combined the strengths of specialized computers with a flexible user interface.

Another important criterion was raw computer power to perform numeric computation. However, layout, schematic capture, simulation and design verification each demand a different mix of computer resources, such as CPU, disk I/O and terminal I/O. Therefore, Sierra chose a variety of computer systems, each selected for its ability to handle certain aspects of custom IC design and for its potential compatibility with the other selected systems.

Custom IC design requires CAD

IC design involves logic and circuit simulation, which, in turn, involve the simultaneous solution of thousands of non-linear differential equations over thousands of time points. Also, fault simulation for large logic circuits is analogous to running thousands of logic simulations. And design verification for handcrafted layouts involves ensuring that the circuit satisfies many geometric and electrical rules. Furthermore, unlike a standard IC producer, which may complete one design in several months, a custom IC design house like Sierra must generate several designs in one month.

To solve these problems, Sierra chose three computers: the VAX 11/780 minicomputer from Digital Equipment Corp., Maynard, Mass.; the



Sierra uses an ELXSI System 6400 *computer in circuit analysis to ensure that a circuit meets the desired specification and that the design is accurate.*

System 6400 computer from ELXSI, San Jose, Calif.; and the Scaldsystem computer-aided-engineering workstation from Valid Logic Systems Inc., Mountain View, Calif.

The company selected the VAX 11/780 for computer-aided design development within the Sierra network because many engineers are familiar with the VAX environment and because a large base of software exists for it. This allowed Sierra to implement many programs quickly without hiring a large staff of CAD developers. Another reason for choosing the VAX 11/780 was its maturity as a CAD system host and its flexible VMS operating system.

Sierra chose the ELXSI System 6400, a 32-bit

multiprocessing CAD system, for circuit and logic simulation and design verification. The system supports as many as 10 CPUs—five in the base cabinet and five in an expansion cabinet.

Valid's Scaldsystem provides the designer interface for schematic capture and offloads small jobs from the larger VAX and ELXSI computers. The system also automatically generates and transfers circuit netlists to more powerful computers for simulation. Sierra design engineers use the Scaldsystem with Valid's application software. However, Sierra plans eventually to develop software running under the UNIX operating system that can be ported to the Scaldsystem. The Scaldsystem also supports DEC DR-11 interfaces and a UNIX host kernel for communication with the ELXSI and DEC systems.

Computers in the Sierra network communicate with each other via DR-11 interfaces, and Valid workstations communicate with each other over an Ethernet local area network. Sierra plans eventually to implement Ethernet interfaces between the DEC, Valid and ELXSI computers as those interfaces become available.

Using equipment from various manufacturers means that Sierra must rely on multiple vendors for service. To help the vendors work together without finger-pointing, Sierra manages the multivendor project as if it were all in-house. The company created a project team composed of members from each vendor company and Sierra's own staff. This approach capitalized on each vendor's resources.

User interface is consistent

Another consideration in selecting hardware was compatibility among the various hardware components. Therefore, the company required a software interface that would allow each user to log onto any system in the network and to move data quickly and easily to another computer on the network.

Sierra also wanted to reduce the time it would take for new users to learn the system. To accomplish this, Sierra created a superset of commands on each computer that was compatible with the other computers' commands. For example, the company augmented ELXSI's EMBOS operating system command set with VAX VMS commands and extended the VAX

A design manager and a customer discuss the layout *of an operational amplifier and the capacitors comprising a portion of a filter.*

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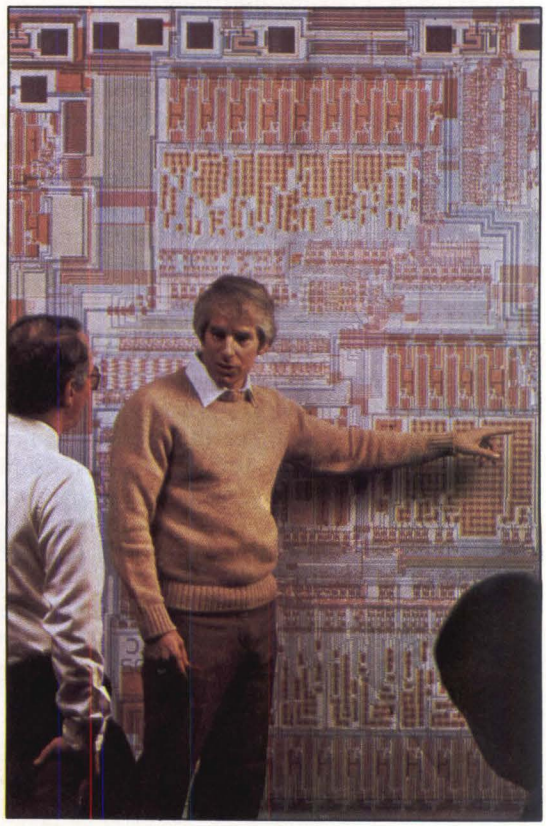

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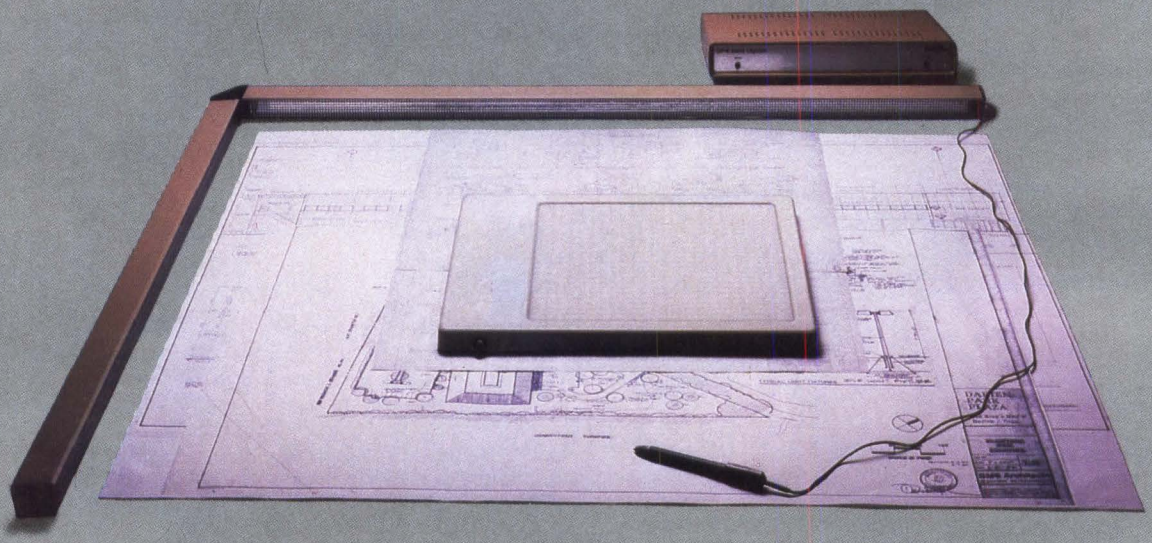
SETTLING FOR A TABLET CAN BE A SIZEABLE MISTAKE



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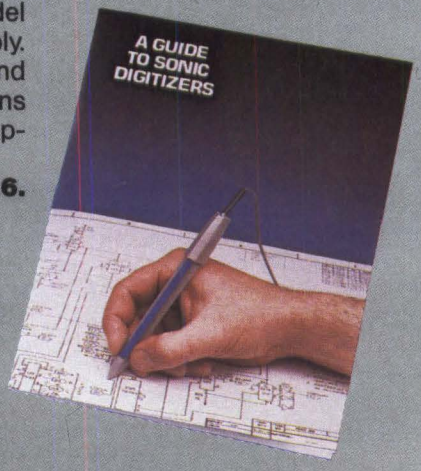

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command language to include EMBOS and UNIX commands. This enhancement allows users to employ whatever commands they are familiar with to accomplish a specific function on any computer in the network.

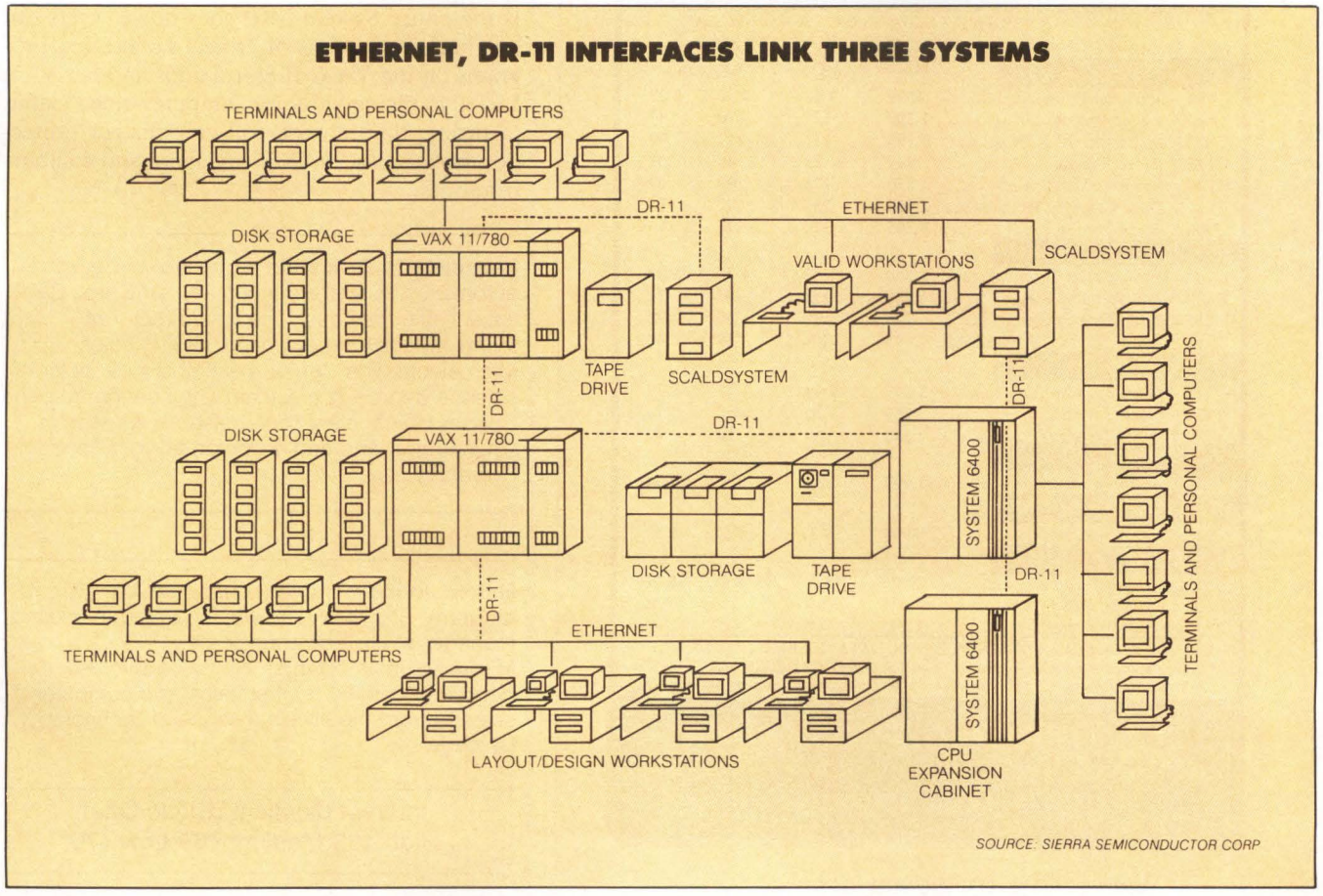
For example, the VAX command Type means to display the contents of a file on a screen. In EMBOS, the corresponding command is List; the Scaldsystem's UNIX uses More or Cat. A user familiar with the Scaldsystem can log onto a VAX and use a command that emulates the Scaldsystem command. Similarly, if the user moves from a System 6400 to a VAX, the VAX will recognize the List command.

In some cases, however, commands between different computers do not have a direct translation. For example, to authorize a new user on the Scaldsystem, a system manager would employ the command Mkusr (make user). But, on both the System 6400 and the VAX, the system manager must perform a sequence of tasks to authorize a new user. To solve the problem, Sierra automated the make-user functions to the point at which the system manager can use either Makeuser or Mkusr to add a user to the VAX or the System 6400.

Because Sierra's employees range in experience from novices to sophisticated CAD users, the company wanted the network to be easy to use for all levels of expertise. The company addressed this problem by using a multilevel menu structure. With this structure, a novice user does not have to spend hours reading manuals before logging onto the system. Instead, he can simply start with a menu that guides him through frequently performed tasks.

What's more, an intermediate-level user who does not require extensive on-line guidance can access application menus directly. For example, a design engineer can log on, directly access the circuit-simulation menu, run the application and log off without going through the more general menu structure. In addition, sophisticated users can directly invoke the command level of the computer without resorting to a menu for guidance. For example, an engineer could interrogate the system about the status of batch jobs through job-information and queue-status commands. The menu structure also allows users at any skill level to choose different levels of menu

Computers in the Sierra network *communicate with each other via DR-11 interfaces, and Valid workstations communicate with each other over Ethernet.*



When a disk failure occurs in either the drive or the media, an operator can simply mount a backup disk pack in a functioning drive and reassign disks.

support for different tasks.

Because fast turnaround is important, losing a key piece of hardware at a critical time can be a disaster. However, as a start-up company, Sierra could not afford to buy enough redundant hardware to guarantee near 100 percent uptime. Instead, the company aimed at minimizing downtime without buying additional hardware. For example, magnetic-tape transfer can be used to back up each inter-computer network link.

To achieve the benefits of redundancy, Sierra uses removable-pack disk drives instead of Winchester disk drives for the core VAX and System 6400 systems. When a disk failure occurs in either the drive or the media, an operator can simply mount a backup disk pack in a functioning drive and reassign disks. With this method, the system begins to operate again in minutes on one fewer drive. When the failed drive is repaired, the system returns to its normal configuration. In contrast, if the disk or media fails on a system employing Winchesters, the operator would have to spend hours rebuilding a Winchester disk from tape.

Although using removable pack drives rather than Winchesters provides device independence in the event of disk failure, the method has some drawbacks, including a sacrifice in disk storage capacity. However, the improved ability to recover from failures outweighs the reduction in available disk space. For instance, under normal conditions, data physically resides on a certain disk in a given drive. Although the system comes back up in minutes after a disk drive failure, the disk pack containing the data might be in a different place after the failure. However, the system and application software can find the data even if the user doesn't know the data's physical location. Despite improved failure recovery, the need for additional disk capacity will eventually mandate that Sierra add Winchester drives to its core systems.

In another move to improve system reliability and performance, Sierra plans to add CPUs to the System 6400, which will enable it to function in a degraded capacity should one CPU fail. In addition, the extra CPUs provide more processing power when all are functioning properly. If the entire System 6400 goes down, users can run backup versions of critical application programs on the VAX. If Sierra adds another VAX 11/780 to the network for computer-aided manufacturing, the network will gain further protection because the VAXes can share and combine resources. □

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Lawrence H. Goldstein is director of design automation at Sierra Semiconductor Corp., San Jose, Calif. Previously, he was director of technical planning at United Technologies Microelectronics Center. He holds a bachelor of science degree in electrical engineering from the Cooper Union, New York, master's degrees in science and arts and a doctorate from Princeton University.

B. Lee Jones is manager of computer systems at Sierra. Previously, he was strategic marketing manager at United Technologies Microelectronics Center. He has a bachelor's degree in applied mathematics and computer science from the Illinois Institute of Technology, Chicago.

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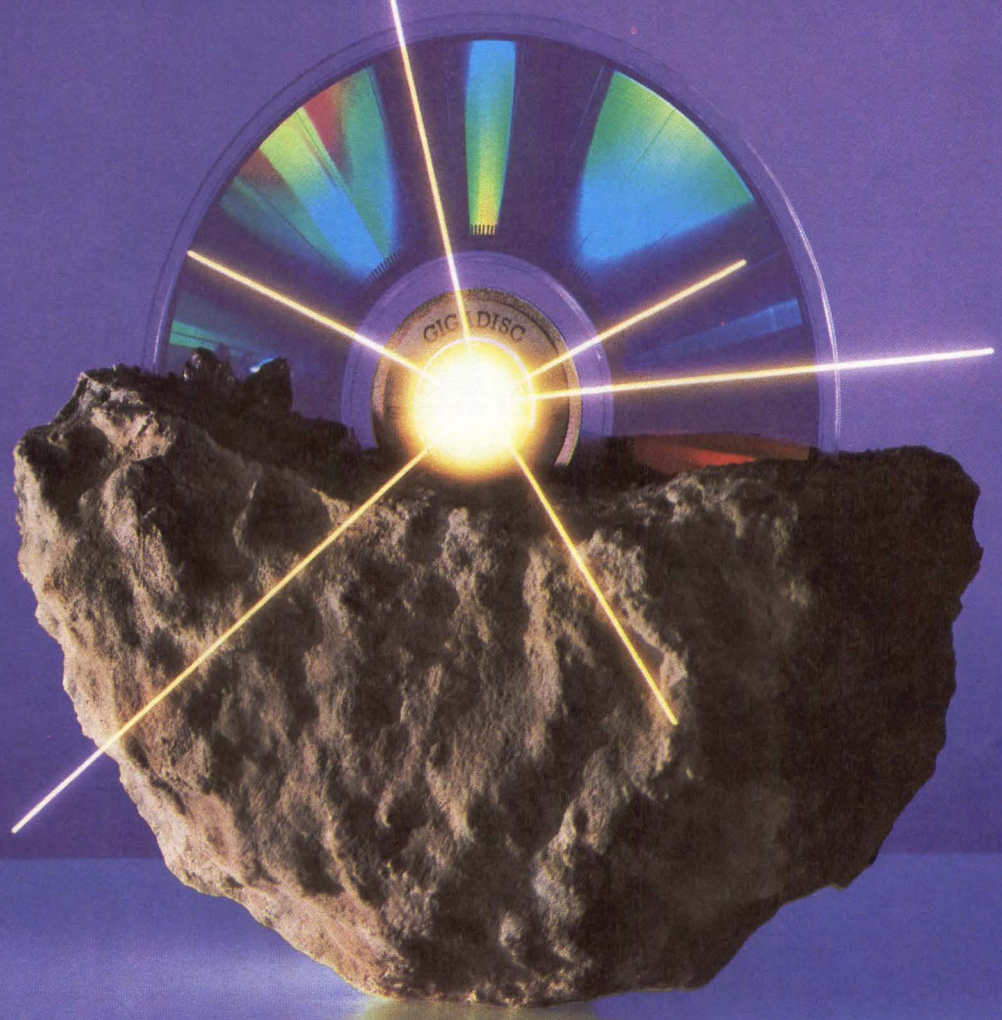

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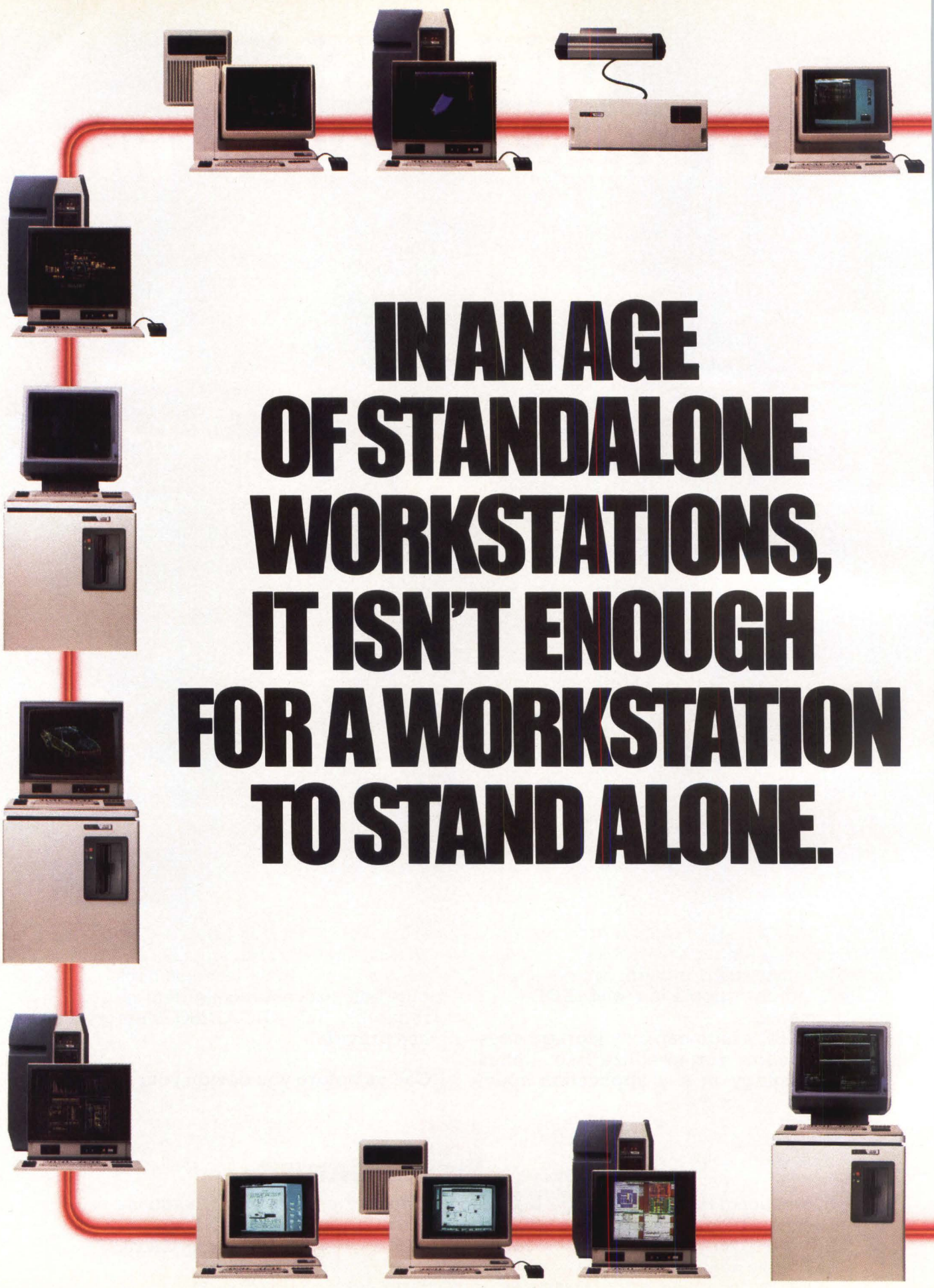

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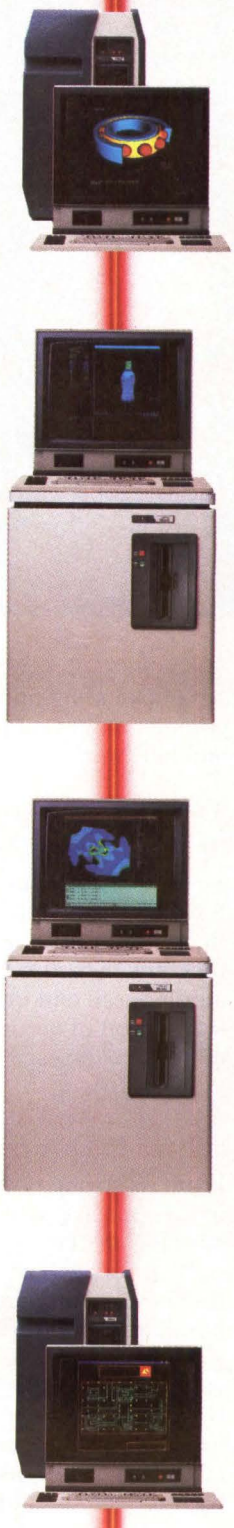

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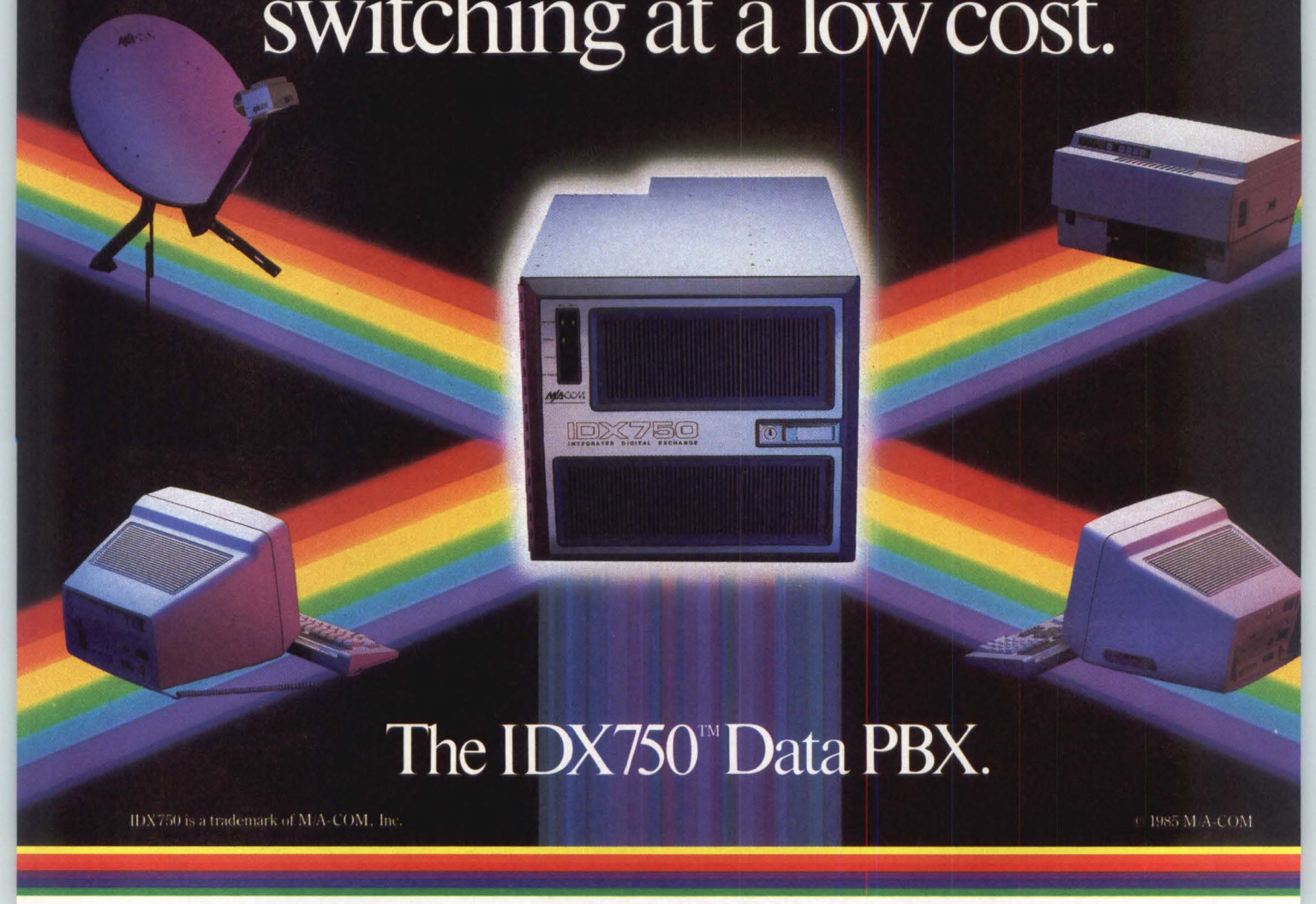

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DEC hardware and Venturcom UNIX-based software help Boston University manage its budget

Rick Friedman

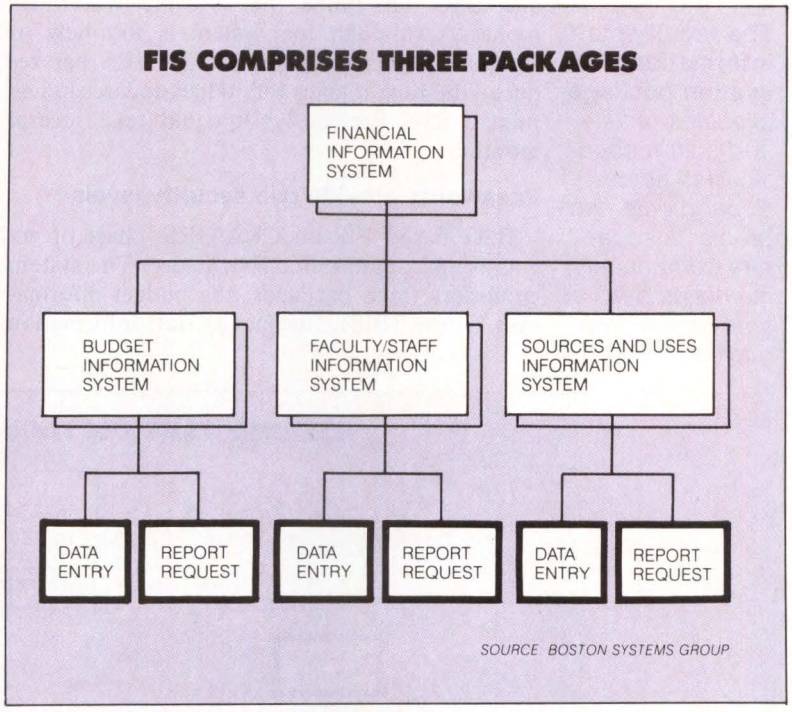
Until recently, the finance office of Boston University's College of Liberal Arts/Graduate School (CLA/GRS), Boston, tracked its multimillion-dollar budget mainly through manual methods. The budget covered approximately 40 departments and centers—each with its own budget line—and several hundred staff members. But, because of the time lag between actual events and official university budget reports, CLA/GRS decided to computerize its manual system.

CLA/GRS officials listed several goals they expected to achieve through computerization. First, they wanted to reduce the time required to provide updated information to personnel with budget-monitoring responsibility. In addition, CLA/GRS wanted to give its deans, financial managers and staff administrators more knowledge and control of their departments' expenditures.

CLA/GRS had tried to find an appropriate computer system on its own but had been unsuccessful. As a result, CLA/GRS turned to the Boston Systems Group (BSG), a Boston consulting company and developer of custom computer systems. Because it employed a former Boston University faculty member, BSG was familiar with the needs and procedures of the university.

BSG prepared a functional specification for a minicomputer-based budget-tracking and -control system. After reviewing the information needs of CLA/GRS management, the available resources and the organizational reporting lines, BSG developed a financial information system (FIS) to run on equipment from Digital Equipment Corp. The company chose the DEC hardware because it supports multiuser applications and because DEC has a reputation for successful installations and adequate customer support in academic environments. What's more, DEC offers an upward migration path should CLA/GRS want to upgrade its installation.

CLA/GRS based the FIS software system on Venturcom Inc.'s VENIX operating system, a



superset of UNIX. In developing FIS, BSG used the C programming language and Logical Software Inc.'s LOGIX relational database management system, which accepts and maintains files and prints reports.

The FIS installation at CLA/GRS includes a DEC PDP-11/73 minicomputer, a Shugart Corp. 20M-byte rigid disk drive, a DEC LA120 dot-matrix printer and three DEC VT102 terminals that provide on-line access to all system functions and that generate off-line reports.

FIS tracks budgets for all departments and centers, provides detailed financial records of all personnel, maintains records of all releases and uses of budgeted funds within the departments and prepares extensive reports on the expense status of all departments and centers for the division.

CLA/GRS reported no problems with implementing the DEC hardware. The FIS hardware was installed in the dean's office in three days, and BSG fine-tuned the software within six months. Although the system is too new to compute definitive savings, CLA/GRS has reduced the time it takes for budget updates to less than a day. Previously, it could take several months.

The faculty/staff information system package *allocates faculty and staff responsibilities across departments and grants. A separate component maintains part-time faculty information.*

Passwords provide two security levels

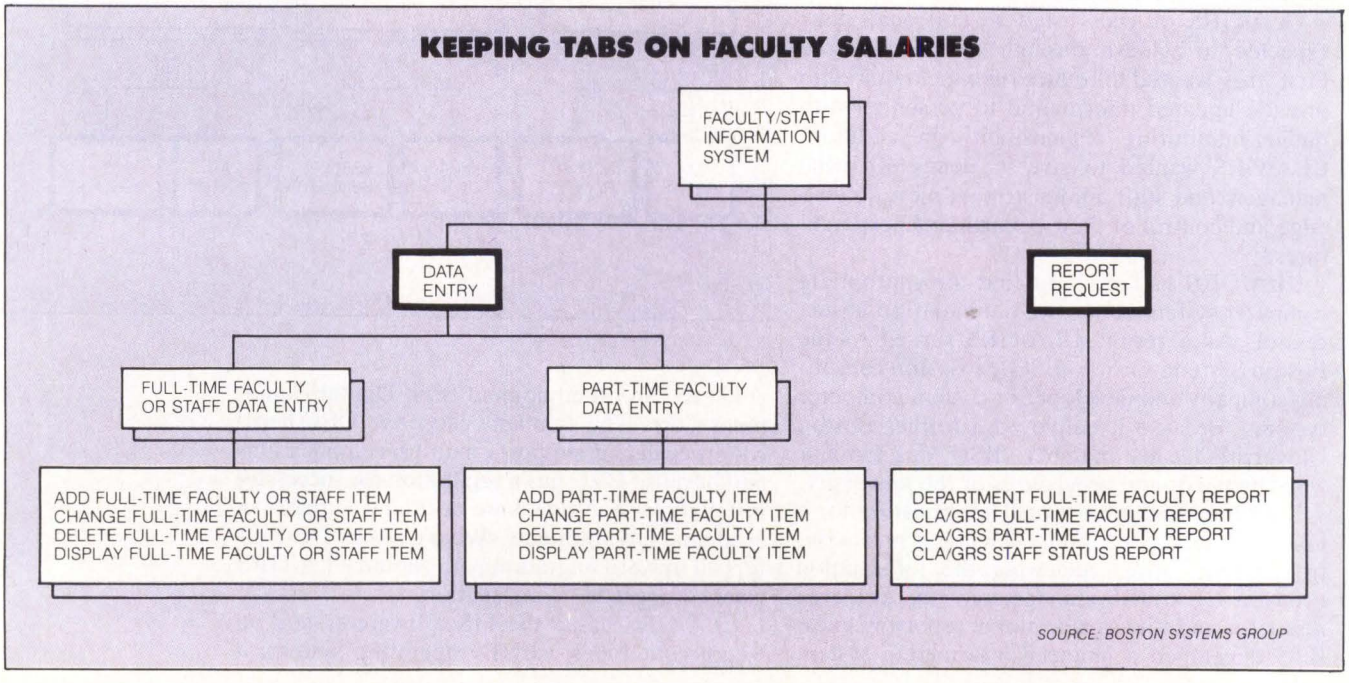
BSG based FIS on CLA/GRS' chart of accounts and organizational structure. The system comprises three packages: the budget information system (BIS), the faculty/staff information system (FSIS) and the sources and uses information system (SUIS). The three packages comprise seven program modules that in turn comprise 36 programs, each of which accesses one to eight data files.

FIS is menu- and command-driven for use by non-technical personnel. Users can access any of the three packages through menus. A main menu controls access to each package, and each package contains its own menu, which allows users to access data-entry, report-request and other functions. In addition, several lower level menus control activities within a function, such as adding a faculty or staff item.

CLA/GRS installed the FIS in the dean's office to ensure security. In addition, the software provides two levels of password security. To access certain critical functions of FIS, such as creating budgets, closing the books and recording budget adjustments, users must know a system password as well as their own personal passwords.

System tracks 40 expenses

In the BIS module, CLA/GRS uses more than 40 budget lines, or object codes. BIS tracks the expenses that are charged to every budget line for CLA/GRS departments and centers. For example, BIS can report on the totals of expenses and budgets for individual and groups of object codes. It also prepares reports listing the sum of all expenses to be charged to non-salary object codes, subdivided into individual depart-



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ments. For example, users can create expense reports to track office supply expenses for a department, for a group of departments or for the college as a whole. In addition, users can produce reports for a department according to a single expense line or a group.

BIS also tracks yearly budget adjustments, keeping an audit trail by department of encumbered and actual transactions compared with preset budgets. The system's transaction function mimics the CLA/GRS procedures of entering and updating encumbered expense transactions, and the budget-adjustment function allows authorized personnel to change the budget for a department and object code.

In addition, BIS provides a report-processing function, which allows users to request reports listing individual or aggregate expense and budget transactions for a department, an object code and for all of CLA/GRS. Users can view these reports on their screens or on printouts. BIS also includes procedures for closing the books at the end of a fiscal year and establishing budget amounts for the next fiscal year. It also permits users to establish a budget for a department or center created in the middle of a fiscal year.

The package produces 11 reports, of which nine record expenses and budgets at various levels, from individual transactions to sums across all object codes and departments. The other two reports present information on budget adjustments and encumbered expenses.

Package tracks faculty salaries

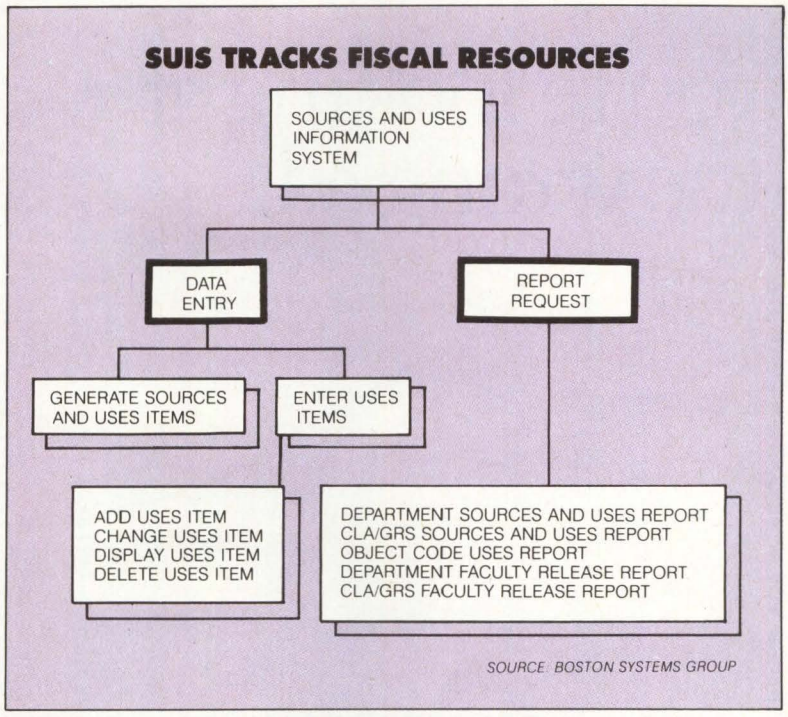
The FSIS package tracks faculty and staff personnel information, facilitating monitoring of teaching resources. For example, it allocates faculty and staff responsibilities across departments and grants.

FSIS also tracks encumbered salaries, such as contractual obligations to tenured faculty, while BIS processes these transactions. With FSIS and BIS, users can review and update information in either system by entering a staff member's name or Social Security number.

FSIS produces four reports, three of which list personal and salary information on full-time faculty and staff, including the object codes to which each salary should be charged. The fourth report lists part-time faculty by department, the courses they teach and the salaries they receive for each course.

SUIS records the sources and uses of budgeted funds within CLA/GRS in two ways. In one, it searches through faculty information for any member who has released part of his salary through grants, sabbaticals or leaves of absence. If the system finds any such faculty member, it records the source of funds in the SUIS database. It also places the total of released funds in a disbursement pool and provides a mechanism to distribute the moneys to departmental accounts. At the same time, the package identifies faculty members who have part of their salaries paid through a release of budgeted funds. The system then creates a record of this use of budgeted funds in the SUIS database.

SUIS produces five reports—CLA/GRS sources and uses, department sources and uses, object-code uses, CLA/GRS faculty release and department faculty release. These reports provide information at various levels of detail on the sources and uses of budgeted funds, based on information in the full-time faculty/staff database and on manually entered records of uses of funds. □



The sources and uses information system *tracks information on all budgeted funds released from faculty grants, sabbaticals and leaves of absence, and provides a mechanism for distributing the funds to departmental accounts.*

Rick Friedman is a Boston-based business writer. His column, "Spotlight on DEC," appears monthly in *Digital Review* magazine.

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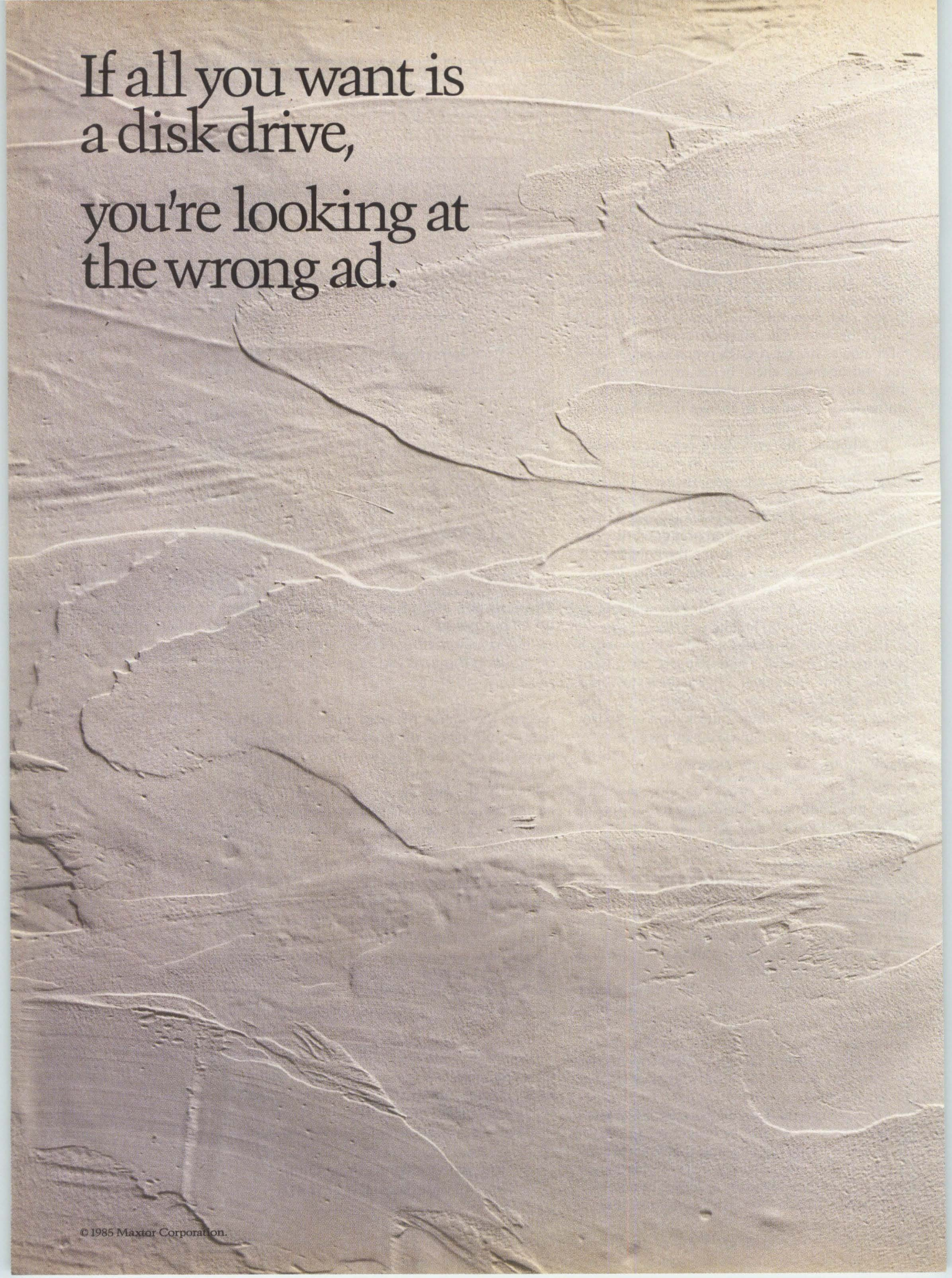
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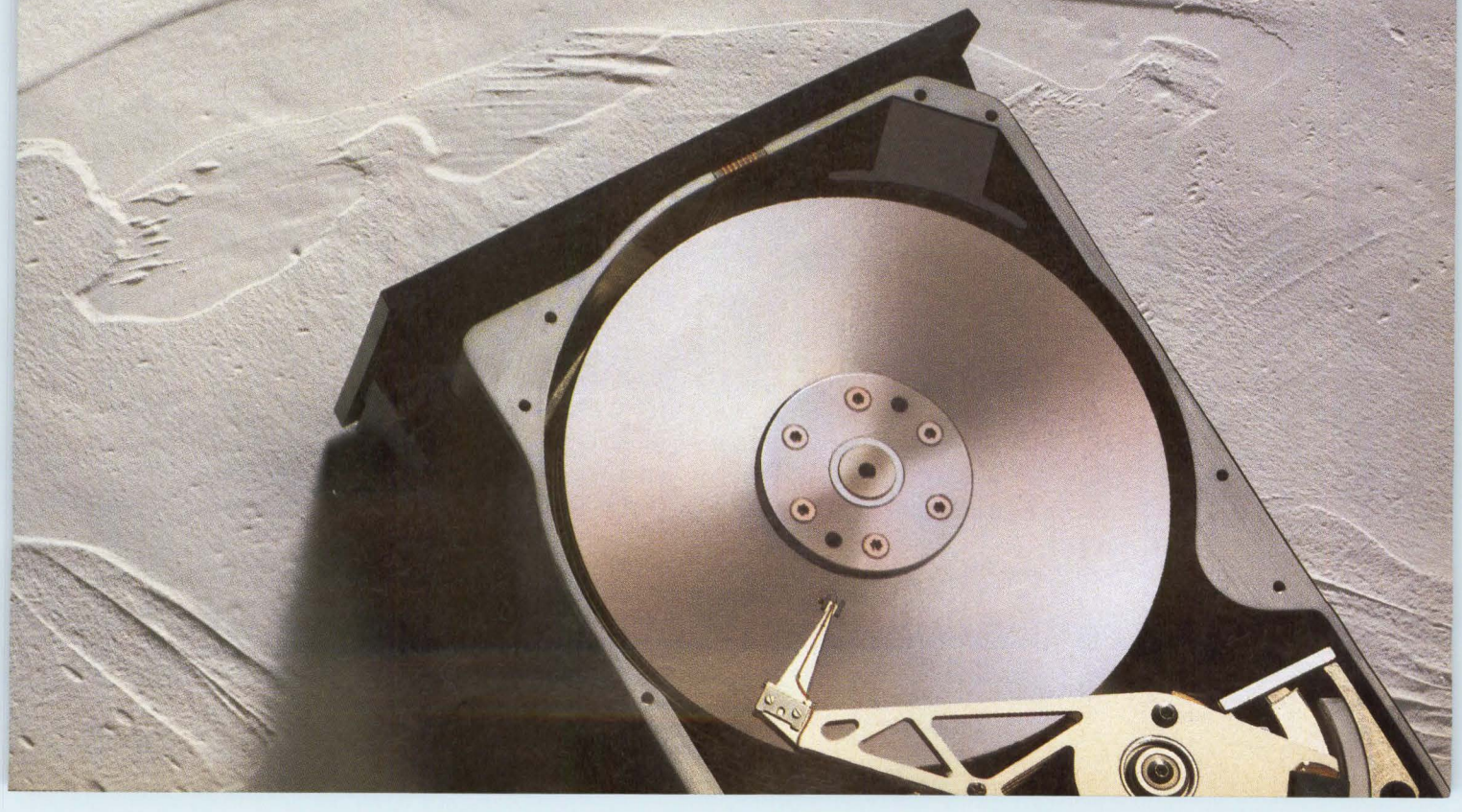

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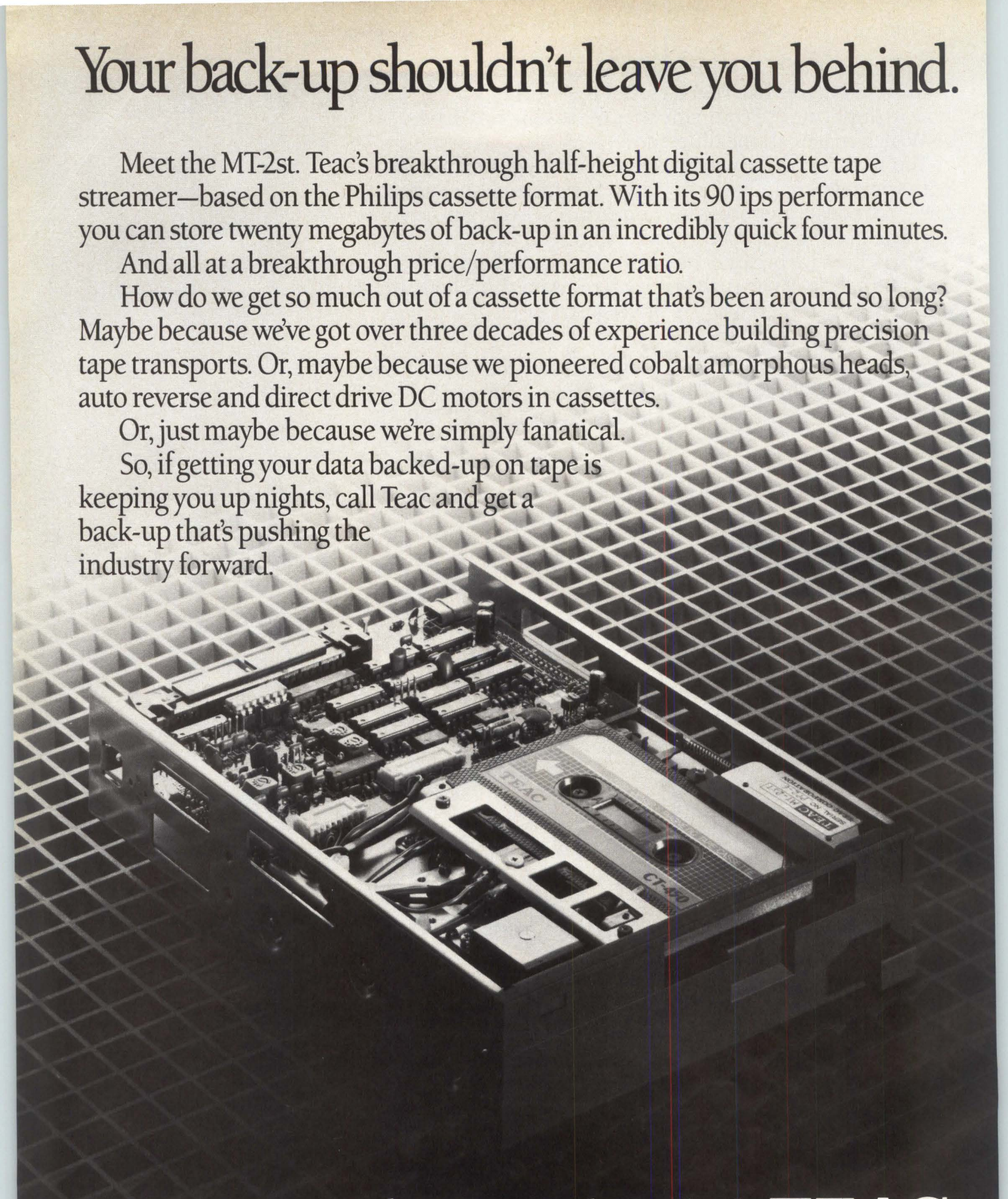

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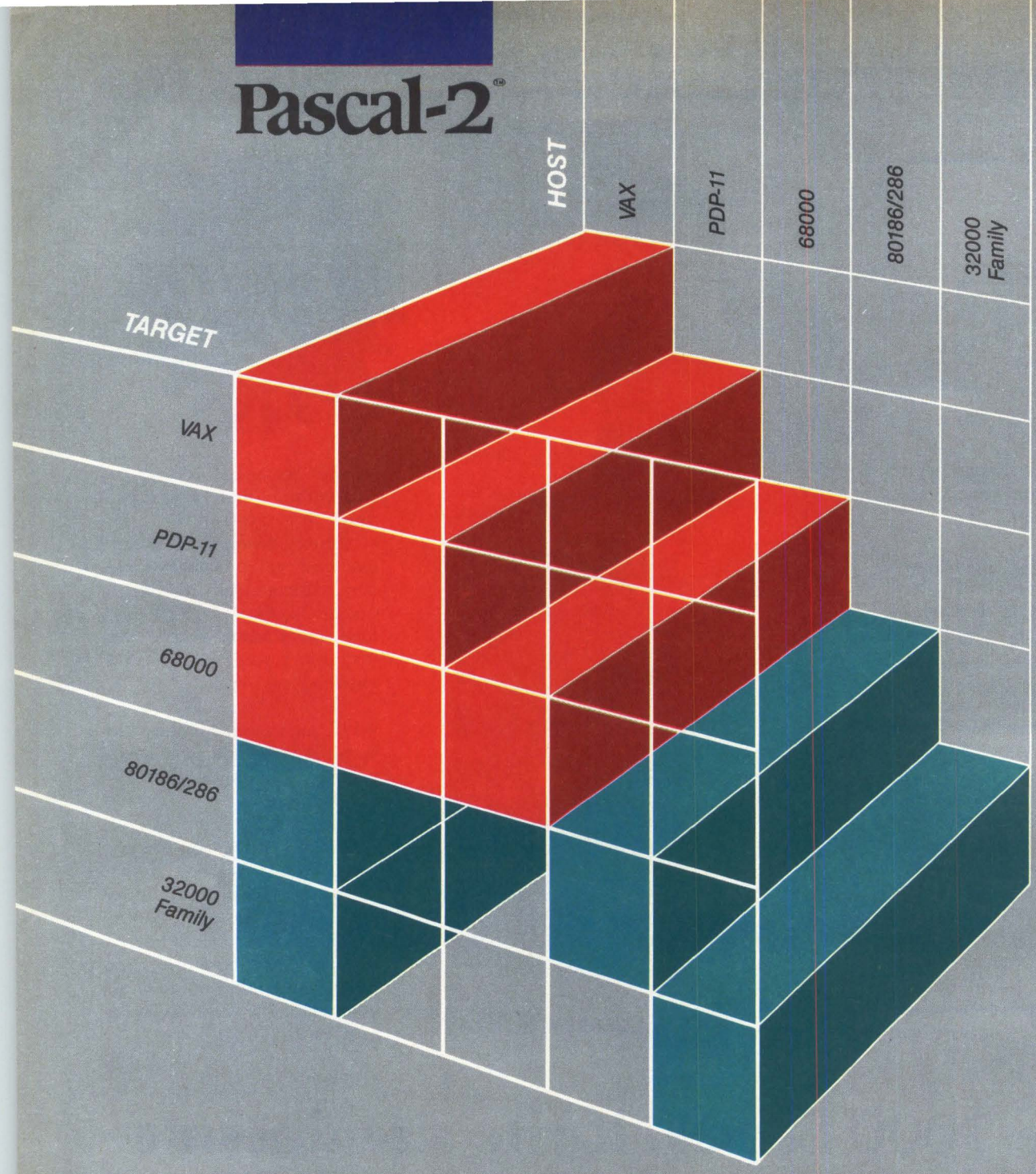

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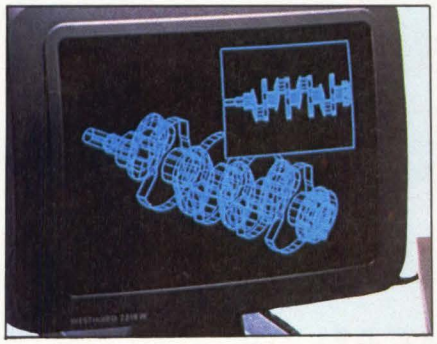
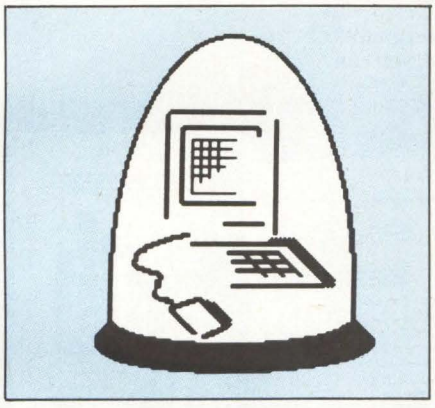
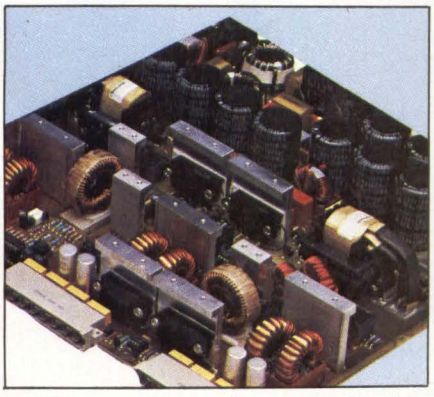


p. 107 . . . . . Get more for less



p. 119 . . . . . Providing novel integration



p. 128 . . . . . Slim equals flexible

APPLICATION GENERATOR SPEEDS DEVELOPMENT (Cover story) 93

Developers of multiuser business applications usually run into a variety of setbacks, such as insufficient programming time and development funds, non-integrated development packages, and long cycles of coding, compiling, debugging, revising and testing. However, a unified approach to application development promises to change all that: ACCELL, from a major DBMS supplier, combines the design concepts of application generators, windowing interfaces, relational DBMS and fourth-generation languages. Our exclusive look at the new package shows how you can eliminate applications-development headaches (and cut costs).

USERS GET MORE FOR LESS IN GRAPHICS TERMINALS 107

The major trends in graphics terminals are lower prices, higher resolution, increased product compatibility faster drawing speeds, larger display lists and a shift in color graphics to commodity-level status. Meanwhile, there's a new kid on the block: PC/terminal combinations.

TERMINAL EMULATION: ASCII SOFTWARE CLAIMS NEW MARKETS 119

Computer-system planners have long known that modem-based terminal emulation using ASCII characters offers an effective—if crude—means of allowing different computers to communicate. Now, system integrators are challenging the "crude mess" by making such emulation software a value-added feature.

POWER SUPPLIES SLIM TO SINGLE-BOARD SIZES . . . 128

The key word in switching-power supplies is "reduce"—the price, the size, the weight and, while you're at it, the emissions. One result of this trend—the single-board power supply—seems like a dream come true for system integrators, but don't expect a plethora of products in the near future.

VARs TAKE CENTER STAGE AT COMDEX/FALL '85 . . . 141

You either love it, hate it, or have to go to it, but Comdex remains a fact of life for many of us. This year, the emphasis seems to be on the changing role of the value-added reseller in the distribution-channel matrix and on survival tactics.

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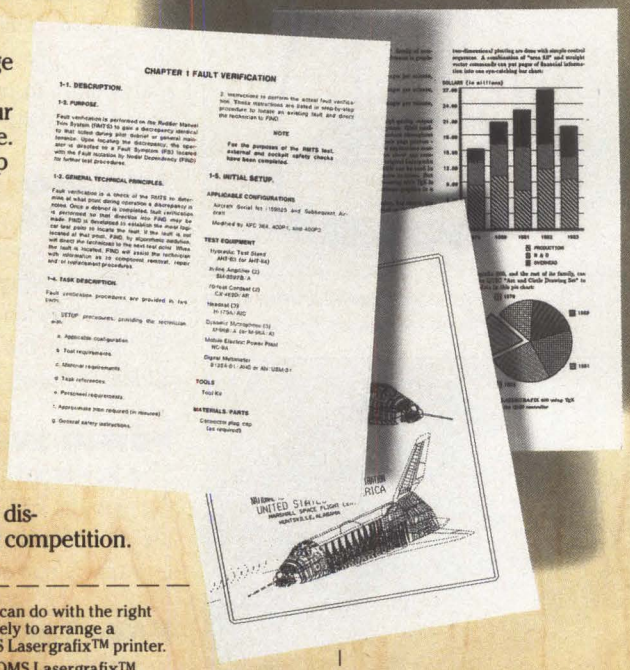

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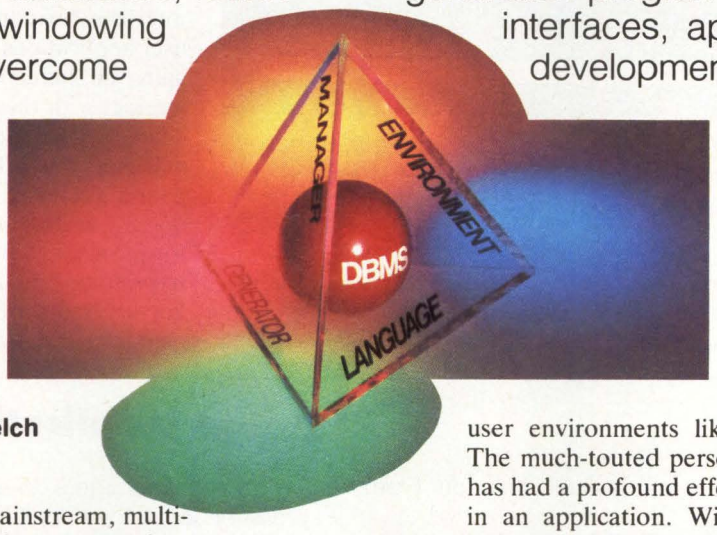
APPLICATION GENERATOR SPEEDS DEVELOPMENT

By combining databases, fourth generation programming languages and windowing interfaces, application generators overcome development pitfalls



Leigh Anderson and **Dan Welch**
Unify Corp.

Professional developers of mainstream, multiuser business applications (such as accounting, inventory, order processing) inevitably suffer scarcity in two resources: skilled staff time and development funds. They face numerous challenges on the way to a complete, well-done package. Typically, developers using traditional programming techniques endure long cycles of coding, compiling, debugging, revising and testing. And all this work must be done in a complex and error-prone environment.

Even if they clear these hurdles, developers still have to make the application user-friendly and also ensure it possesses multiuser information integrity, fast multiuser performance, security controls and fail-safe backup and recovery.

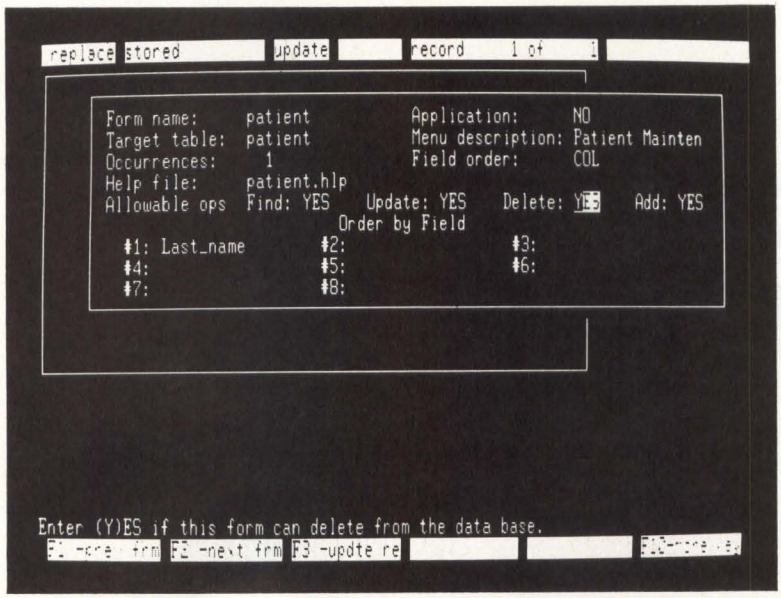
The barriers encountered are formidable. There are, of course, tools available to help the developer: third- and fourth-generation programming languages, canned application generators and database management systems (DBMSes). But each tool has so far been standalone, with little or no integration between them.

In addition, end-user expectations for multiuser environments like UNIX have changed. The much-touted personal computer revolution has had a profound effect on what users demand in an application. Windowing interfaces have been one of the most important developments in the personal computer world, yet minicomputer software has benefitted little from the trend. Microcomputer and mainframe users often seek the ability to "pop up" menus and help messages, and the ability to transfer data among windows while maintaining context.

The architecture of ACCELL *comprises four components that work closely with a fifth "core" DBMS component: ACCELL/Generator, ACCELL/Language, ACCELL/Environment and ACCELL/Manager.*

However, windowing interfaces have been limited to specific computers and operating systems, such as Apple Computer Inc.'s Macintosh, AT&T Information Systems' UNIX-PC, and Microsoft Corp.'s Microsoft Windows, or to personal productivity packages, such as Lotus Development Corp.'s Lotus 1-2-3 or Microsoft Word. Vertical applications have not, in general, supported windowing interfaces without extremely complex programming.

What developers have lacked is a single, unified development environment with personal computer capabilities—windows, pop-up messages, etc.—the power of fourth-generation programming languages (4GLS) and the ease of application generators. One attempt at such an environment is ACCELL, from Unify Corp.,



A developer can use *ACCELL/Generator to build a medical-records application. Here, he sees an empty default form overlaid by the first of several specification forms.*

Sacramento, Calif. ACCELL integrates the design concepts of application generators, windowing interfaces, relational database management systems and 4GLs.

ACCELL's high level of integration helps speed application development in three ways. First, the developer's apprenticeship is easy and short, which means that a new class of developer can become involved. A professional developer no longer needs to be a highly skilled programmer. Instead, someone with vertical-market expertise can become a hands-on developer, perhaps teamed with a system analyst.

Second, ACCELL helps developers quickly achieve a prototype, and then involves users to gain performance feedback. After initial testing, the prototype can be turned into a polished application.

Third, ACCELL uses the same windowing interface for applications development and for user applications. Because it does, the developer gains an immediate feel for how a user will interact with the application. This also gives the developer the same ease of use that the end user will experience. The developer can switch among painting screens, creating or modifying database design, writing application-specific screen logic for particular forms and running the application in prototype mode. When developers want to set key attributes of an application—such as video characteristics—they can simply pop up an "at-

Applications development:

Until recently, there were basically only four types of application tools:

- Third-generation languages (3GLs), such as COBOL or C
- Fourth-generation languages (4GLs), such as Martin Marietta Data Systems' RAMIS II
- Application generators, such as General Automation Inc.'s PRO IV or The Software Express Inc.'s APPGEN
- Database management systems (DBMSes), such as Unify Corp.'s Unify.

Of these, 3GLs such as BASIC and COBOL have the advantage of being well known by many programmers. But, unfortunately, they are known by few others. Even though 3GLs are easier to work with than second-generation assembly languages or first-generation machine codes, programming is still a tedious, expensive and time-consuming process. By some estimates, only about 20 percent of a typical 3GL program actually solves a problem. The remainder of the code controls program flow.

Third-generation languages are extremely flexible because they possess no "model" of what an application should do, and they also require a complex programming environment with editors, compilers, linkers and debuggers. In addition, they are error-prone because they don't begin with a preconception of what the developer wants to accomplish, and because of the heavy procedural burden placed on the developer. Third generation languages also lack the built-in data management capabilities commonly found in a database management system. Customization of 3GL packages also is difficult. A common guideline states that if more than 5 percent to 10 percent of the code needs to be revised, you would be better off starting from scratch.

On the plus side, a wide variety of 3GL-written applications exists for almost every task. They're a familiar tool for most developers. And, finally, they are usually compiled, which can enhance performance.

Fourth-generation languages don't necessarily require complex programming skills, because they have a stronger model of what an application does. But they still require some programming for all functions. Generally, because the functions are more powerful, fewer lines of coding are required compared with a 3GL. The development environment is simplified and coding is less error-prone. In addition, many 4GLs have access to some data-management capability.

Despite the benefits of 4GLs, they still have some

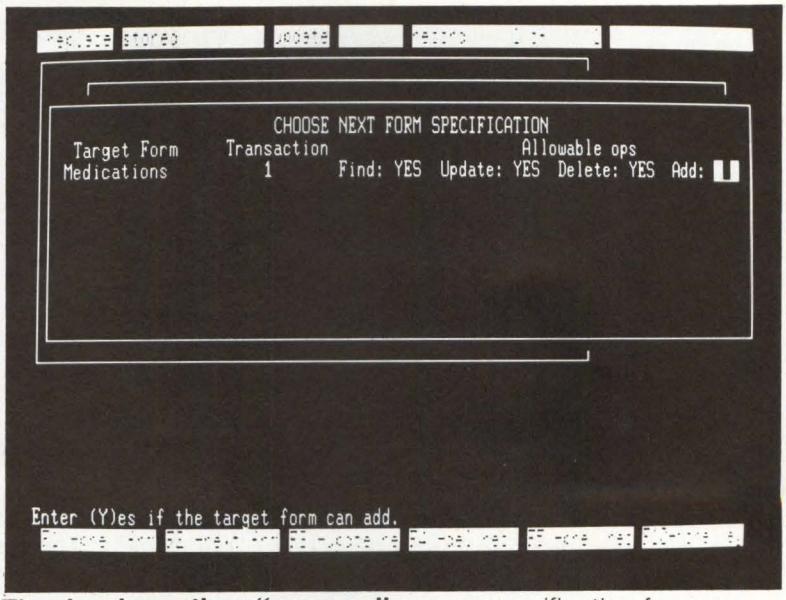
tributes window" next to a field that's just been painted, answer prompts in that window, press a key to "put away" the window and go on to paint the next field.

The benefit of windows to users is that they can maintain context—that is to say, they can see where they have been. They don't have to remember where they are in a series of tasks, nor do they have to make notes or a printout for later reference.

Users also benefit from the fact that they can instantly return data from one window-form to another without having to retype it. For example, in medical records, should a ward clerk need to enter a Dr. Smith's name on a particular patient form, he can pop up a doctor form with a keystroke, type in the first few letters, "Smi," to get a list of all the doctors in the database named "Smith," highlight the correct name and return it to the patient form. The data for the doctor selected is instantly inserted into the patient form.

ACCELL is made up of five modules based on the foundation of the Unify relational database. They are ACCELL/DBS, ACCELL/Generator, ACCELL/Language, ACCELL/Environment and ACCELL/Manager.

ACCELL/DBS works with the Unify relational DBMS to avoid the data management shortcomings of programming languages and applications generator products. Unify's capabilities are



The developer then "pops up" *a new specification form over the previous two forms. Its purpose is to specify "next forms." If two or more forms are specified, a menu is automatically generated by ACCELL/Manager.*

What are the alternatives?

drawbacks: performance is sometimes poor because little in the application can be optimized or compiled; the data-management sophistication is less than that found in a DBMS; and developers' common requirements—the structured query language (SQL), transaction logging and recovery and security—may be absent. Even a mainframe 4GL may lack sufficient concurrent processing controls to permit multiuser database updates. This deficiency is unacceptable for on-line applications.

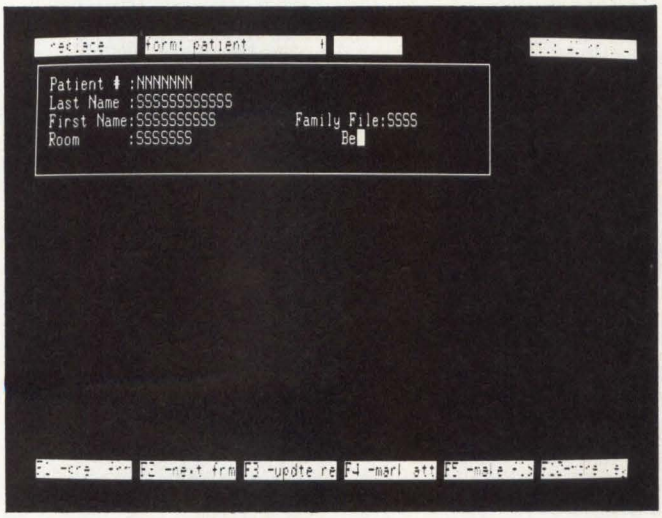
Application generators, such as APPGEN and PRO IV, provide the strongest model of what an application should do. They require no programming whatsoever, and development time can be short. Even inexperienced developers can create basically bug-free applications in a simplified design environment. They simply respond to menus or prompts that fill in the blanks. The generator then produces 3GL code, or tables that are interpreted at run time. Many application generators have access to a data-management component.

So why isn't everyone jumping on the application-generator bandwagon? Principally, because the application model is too strong, making it inflexible for many sophisticated applications. In addition, like 4GLs, the data-management component is generally weak compared to DBMS.

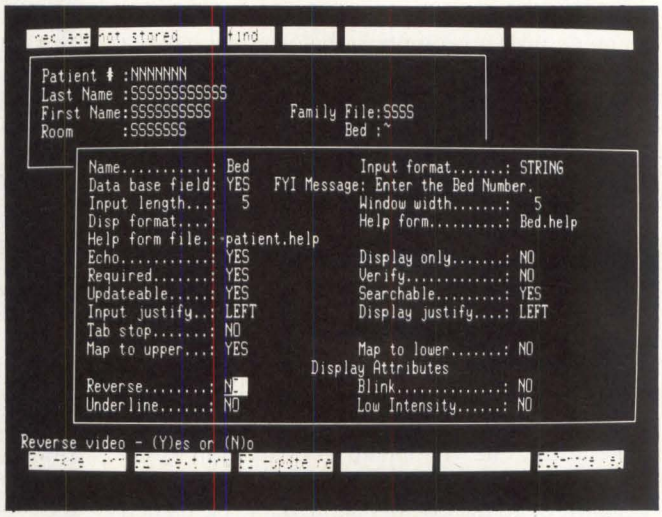
Commercially available multiuser DBMSes, such as Unify and Relational Technology Inc.'s Ingres, are combinations of previous tools built on top of much stronger data-management foundations. They commonly have screen-creation facilities and menu handlers that are best categorized as application-generator tools. DBMSes also often have fourth generation report-writer languages and query/data-manipulation languages such as SQL.

But these DBMS tools are usually lacking in application-development power and flexibility because they were designed for storing and retrieving data quickly and reliably—an important function, but only part of a developer's job. For more sophisticated applications, the developer is forced to abandon the DBMS application-generator tools and write much of the application in COBOL or C.

However, relational DBMSes remain in the forefront of application-generator development along with 4GLs. In fact, the flexibility and relatively automatic navigation of relational data structures have greatly enhanced the development of fourth-generation products.



Here, two specification forms *have been "put away" by pressing the previous form key, and the actual patient form is painted. The prompt for the field for "bed" is typed.*



The developer then goes *to a field-specification form, which allows selection from a wide variety of options for the "bed" field.*

already in place—such as relational flexibility, an integrated data dictionary, multiple access methods and transaction-logging. The developer doesn't have to program them into every new application.

The ACCELL/Generator module is a visual-development tool. With it, the developer paints screen forms; changes the size, shape and location of the screens' windows; defines and locates database fields or screen fields; sets attributes; creates default menus and describes the flow between forms. The module is highly interactive and follows the philosophy of, "What you see is what you get." With this generator, common requirements—such as multiple-table-form displays and multiple-table database updates, scrolling fields, scrolling multiple-detail line forms, master-detail relationships—can be achieved without resorting to third-generation languages.

The ACCELL/Generator is an application generator integrated with a fourth-generation programming environment. Its visual nature, windowing interface and integration with the ACCELL/Language greatly ease development. Many applications can be created with ACCELL/Generator alone, but, if more logic and computations are needed, the product also contains a programming language.

The ACCELL/Language module is a 4GL that integrates with, and complements, the ACCELL/Generator module. Its non-procedural core can be learned quickly and used within a few hours. Yet, if desired, it can replace third-generation languages. In keeping with an open architecture, however, an interface to third-generation languages is provided.

The language is intuitively structured. It "understands" forms and fields created with ACCELL/Generator, as well as concepts like "before," "on" and "after" applications, forms and fields. Variables are not typed and code sections can be in any order. It's high-level logic and computation ability can operate on multiple tables in the database, as well as on the screen.

Language is versatile

The language has a straightforward syntax and a rich, and readable, selection of keywords. For example, the keyword "enable zoom," carries a large set of options. The developer can specify the target form-window; choose a new target for the form-window; specify add, update, search and delete permissions; and instruct the system to return data to the original window by means of a user-selected key.

The language also integrates, or "embeds," the industry-standard structured query language (SQL). If developers already know SQL, they then know how to access and modify a database using ACCELL/Language keywords, such as INSERT or DELETE. Unlike some other implementations of SQL, these statements automatically execute compiled database access routines.

The ACCELL/Language has several options for transaction and concurrency control in an on-line, multiuser environment. It contains notions of "logical transactions" that aid development—such as requiring matching debits and credits in accounting applications.

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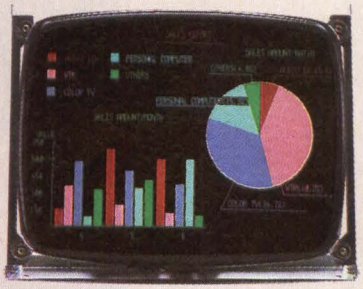

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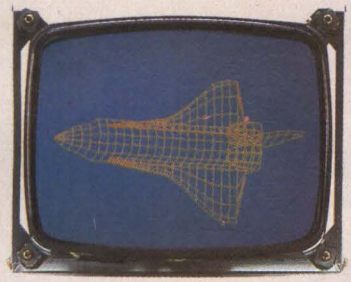

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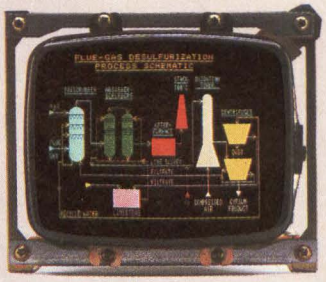

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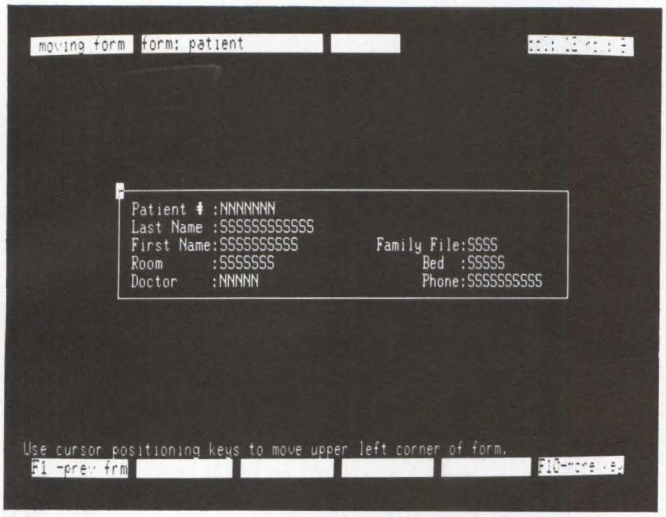
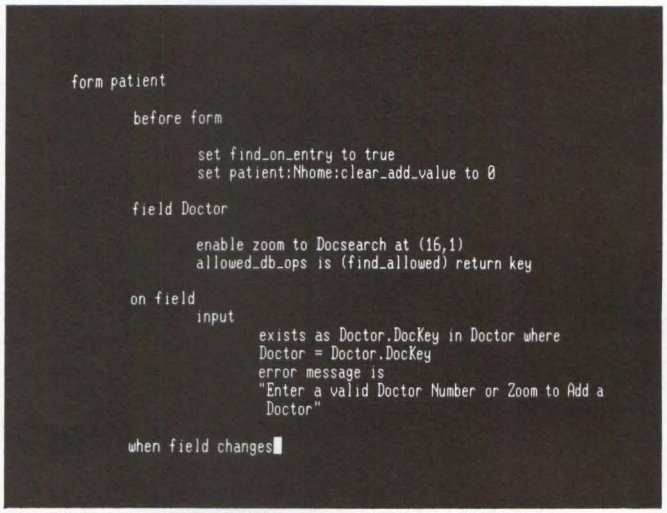


Here, the field specification form *has been put away and the patient form has been moved to its final location by pressing "move window" and arrow keys. Now, the patient form appears centered below the nursing home form at run time.*



Now that all the forms *have been painted and specified with ACCELL/Generator, some conditional and logical enhancements are added with ACCELL/Language.*

It also supports shared and exclusive locks at both the record and table levels. These locks are usually initiated automatically based on settings in the ACCELL/Generator, but, if more exacting control is needed, ACCELL lets developers take command via its programming language. Often, for example, an application has varying needs for restricting the set of records to be locked. So, three locking options are especially useful for multiple-detail line forms: the currently selected record, the currently displayed set of records, or the entire selected set of records, even the ones not displayed.

Need determines control

In an order-entry transaction, for example, the entire selected set of records for a current purchase order could have an exclusive lock (even including the order-items not currently displayed). In other applications, it may not be necessary to have such strict controls. Thus, the developer can fine-tune the trade-offs between users' needs for immediate access and business needs for concurrency control.

The ACCELL/Language, like the Generator, is capable of standing by itself, permitting the development of a complete application using only this tool. More typically, though, the advantages of the language's incremental nature means that most of an application can be done in the visual Generator. However, if some conditional or computational enhancements are needed, the developer can implement them with a few lines of code per form.

The ACCELL/Environment is the all-encompassing developer's environment. Through it, the developer can edit the ACCELL/Language, view the Generator forms and run the application in a special prototype mode—all in a single integrated environment. One component, preprocessor software, allows one-step processing or "merging" of forms and the language into a completed application.

The preprocessor, in turn, comprises an integrated precompiler, combiner and archiver. They allow the linking of previously defined forms, perhaps from other applications, into a new application. Over time, a library of "generic" forms can be accumulated and quickly integrated and modified to speed development.

When modifying an application during development, the developer simply initiates the preprocessor, and only the forms that have been modified with the new ACCELL code are processed. Consequently, the process is rapid and the ACCELL/Environment makes it simple to initiate.

The preprocessor helps balance the need for performance with the need for rapid prototyping. The preprocessor makes all the binding decisions it can before running the application. Thus, the part of ACCELL that the user sees—the ACCELL/Manager—has much less work to do at run time, and is faster than an exclusively interpreted product.

The ACCELL/Manager handles the run-time interaction between the ACCELL application and the user. It combines the strengths of table-

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CIRCLE NO. 46 ON INQUIRY CARD

driven, precompiled and interpreted approaches. It also incorporates the benefits of windowing interfaces for ease of use.

The developer has considerable flexibility in placing forms in different areas of the physical screen and overlapping them. After an application is complete, the ACCELL/Manager gives the user two basic ways to move from form to form.

First, the user can travel via the "previous form" and "next form" function keys. Second, the user can employ the "zoom" key. The former lets the user move serially through related forms, which can be side-by-side on the screen or stacked on top of one another in an overlapping manner. The benefit of overlapping is that the logical screen space is greatly expanded beyond the limitations of the 24-line-by-80-column physical screen.

The latter, zooming, gives the user more "random access" to forms that are needed on a more ad-hoc, less routine basis. For instance, it is the zoom feature that lets our ward clerk in medical records processing fetch the doctor form at a single keystroke. These zooms can even be conditionally based on a data value.

Developers see where they're going

In addition, the ACCELL/Manager's user interface includes help messages that can be set to suit both the neophyte and the more experienced user. What's more, help message levels can be set for the lifetime of the application or merely for one specific session. The keyboard can be remapped to different commands to suit user preferences. The interface also supports standard character-based terminals without special graphics requirements. Users simply select the proper terminal ID in the UNIX system's TERMCAP and Unify's UNICAP file. UNICAP handles the input side of the terminal characteristics: TERMCAP handles the output side.

In the ACCELL/Environment, the developer works visually and interactively. A typical implementation might proceed as follows:

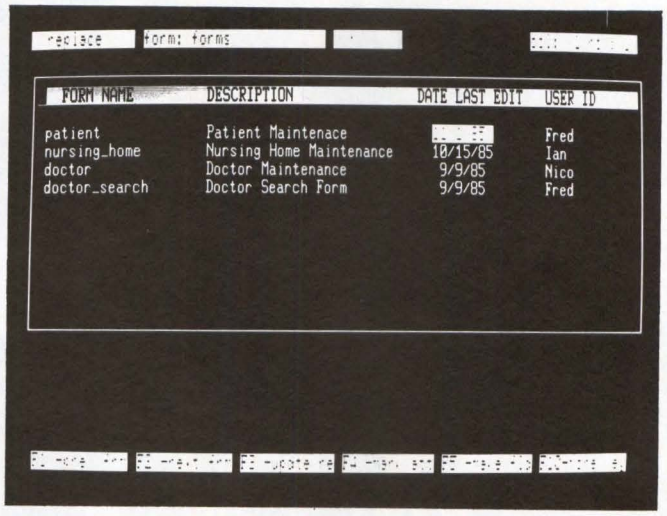
- From the ACCELL environment, open a window to the Unify database to define relational database structures and relationships
- Switch windows to ACCELL/Generator to paint forms, set the size and location of form windows, choose from among a large set of attributes and establish the flow between forms and menus
- Open a window to ACCELL/Language to enhance the flow of control between forms and add conditional logic and computations for forms and fields, if desired
- Merge ACCELL forms and language into a unified, windowing application with the one-step preprocessor in ACCELL/Environment
- Run the application in prototype mode to ensure correct function and validity
- As part of the prototyping process, beta test and collect input from end users
- Refine the application by quickly and easily modifying data structures, screen forms, and screen logic and reprocessing
- Quickly and easily respond to requests for enhancements from end users.

Once finished, developers can run completed applications in normal, end-user mode, or in the special prototype mode.

The prototype mode allows the developer to "look under the hood" of an application while it's running. With it, the developer sees the application as a user sees it, and has a prototype window that pops up to provide access to ACCELL/Language commands. These commands take precedence in controlling the application, set conditional or fixed breakpoints; set arbitrary variable values and attribute settings; and display retuned values in the window.

ACCELL has been in beta test since August 1985. It is currently being shipped to select accounts and will be available for general release by the first quarter of 1986.

In the short term, ACCELL will focus on portability. In 1986, it will be ported to at least 25 of the more than 100 machines from over 55 manufacturers that support the Unify relational DBMS. It will run on all major variations of UNIX, as well as most complementary, operating systems, particulary MS-DOS. □



Having completed the application, *the developer can withdraw into ACCELL/Environment and run the application in regular or prototype mode.*

Leigh Anderson is the marketing product manager for ACCELL at Unify Corp. He holds a master's degree in business administration from the University of Washington. **Dan Welch** is the engineering project manager for ACCELL at Unify. He is a graduate of Michigan State University.

Interest Quotient (Circle One)
High 474 Medium 475 Low 476

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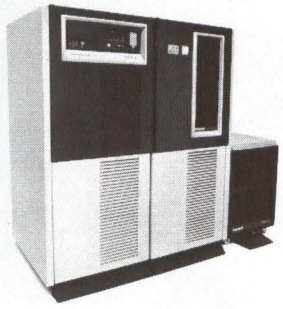

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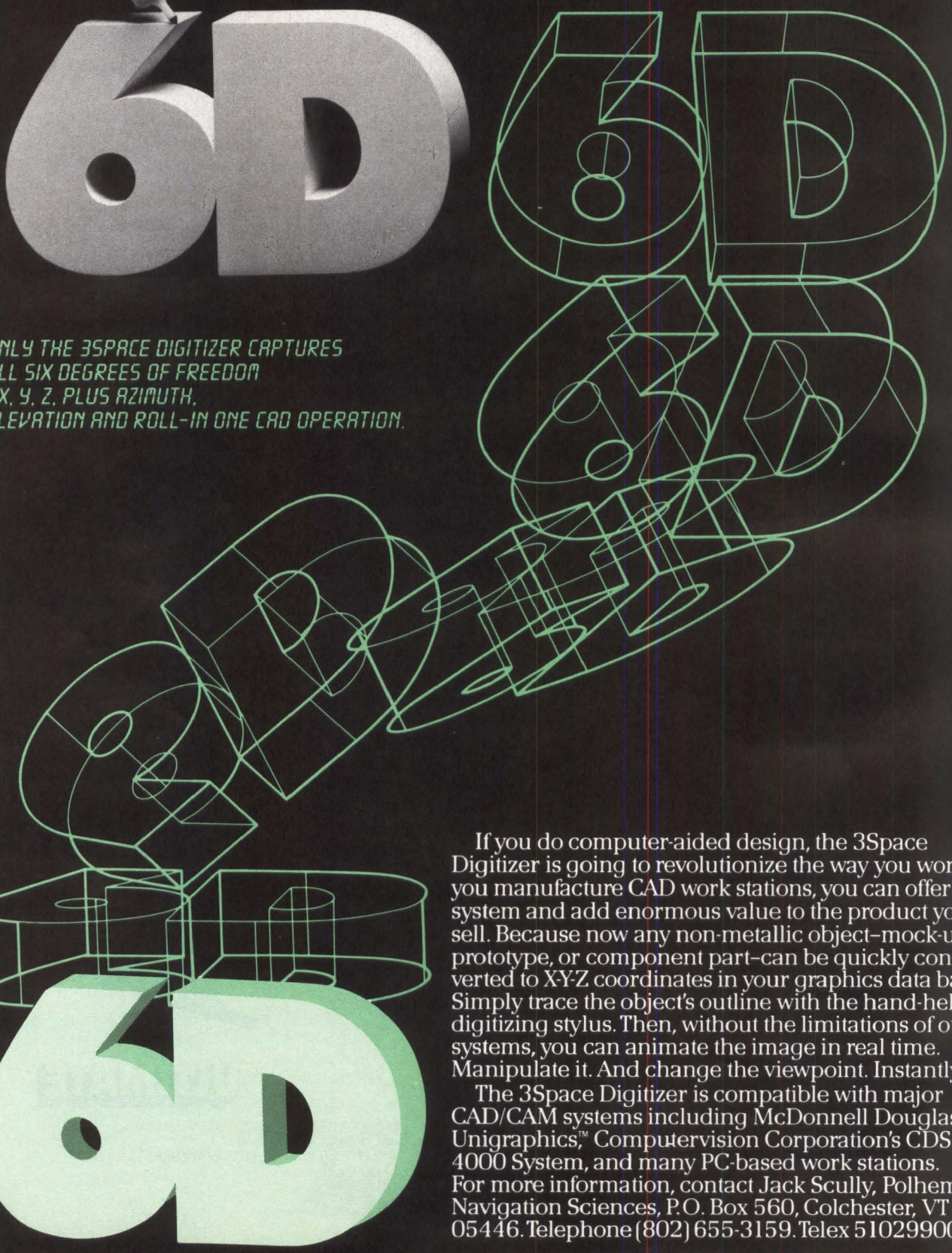

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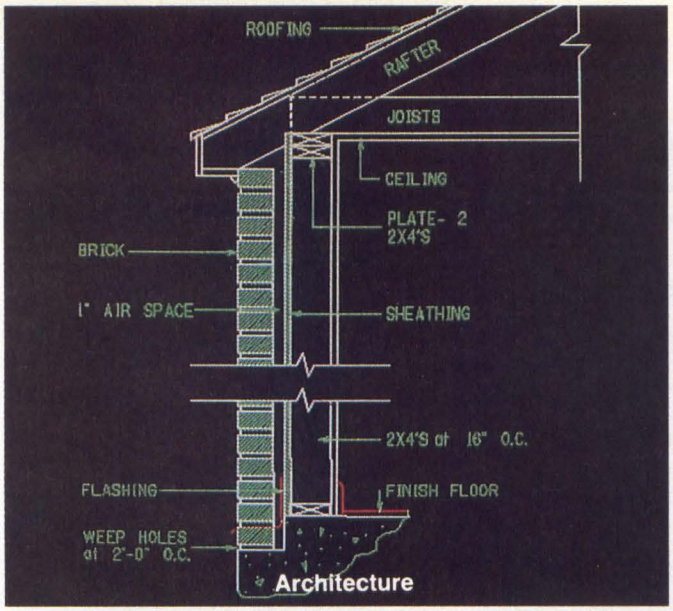

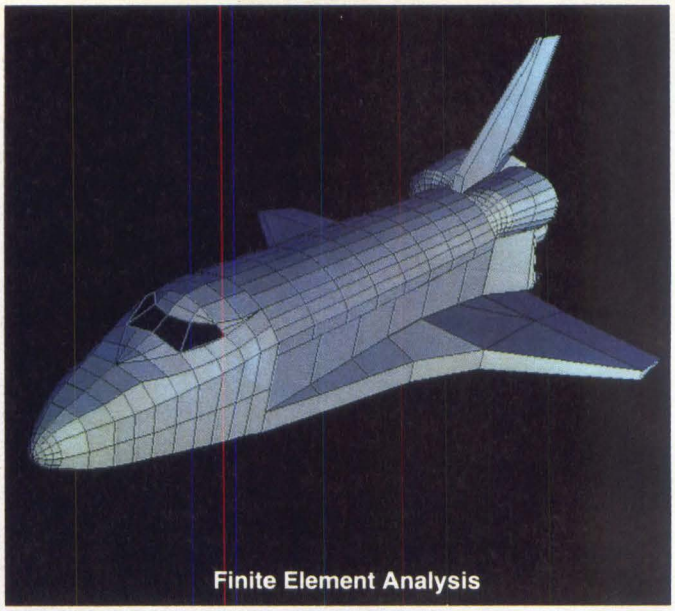

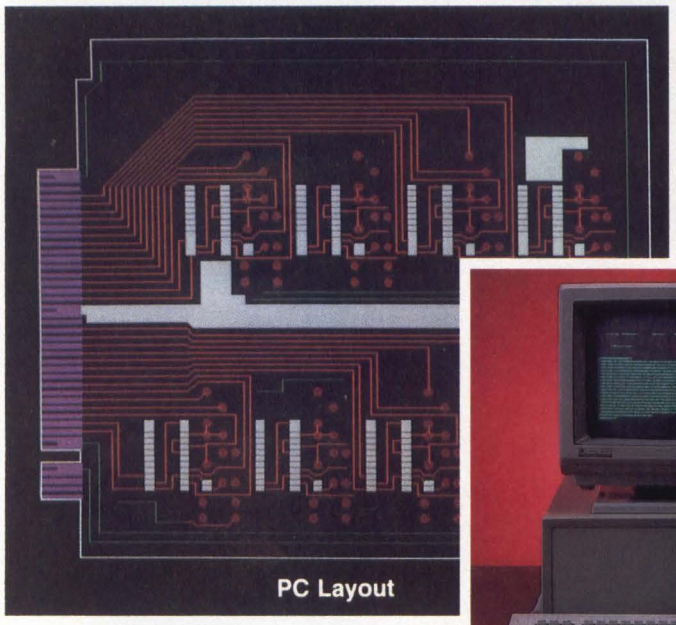

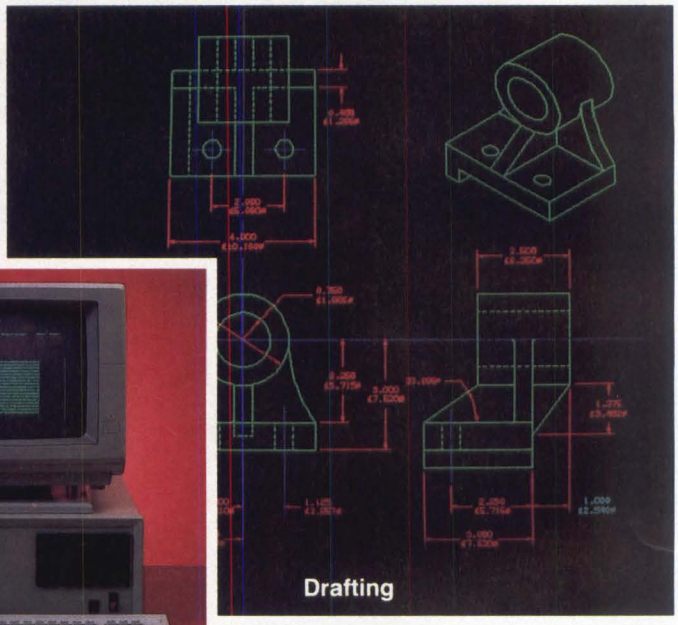

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USERS GET MORE FOR LESS IN GRAPHICS TERMINALS

In four major market segments, small graphics-terminal vendors compete with more performance and features at lower prices, while larger companies extend their product lines

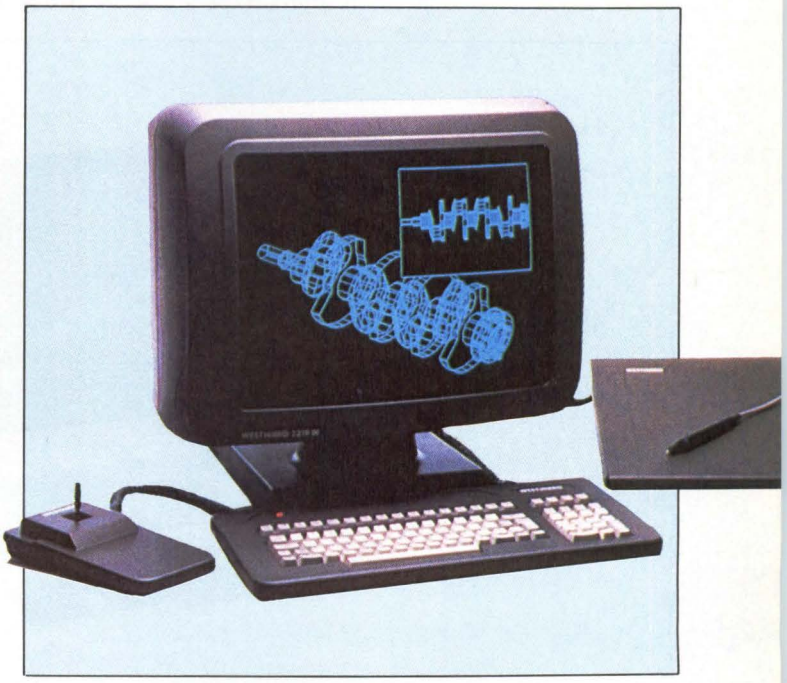
Jerry Borrell
Senior Western Editor

Two years of intense competition has matured the graphics-terminal industry. One result has been increased market segmentation into four major product categories: low-cost monochrome, low-cost color, high-performance 2-D and emerging personal computer-terminal combinations.

In general, monochrome terminals exhibit increasingly higher resolutions. Examples are Westward Technology Inc.'s products, which begin at 1,024-by-780-pixel resolutions and extend to 2,000 by 1,500 pixels. Its 3-D monochrome terminals have up to 2M bytes of display-list memory. The company primarily serves computer aided design, mapping and architectural markets.

Applied Digital Data Systems Inc., Cybernex Ltd., GraphOn Corp., Modgraph Inc. and Selanar Corp. compete with 1,024-by-780-pixel

Supporting 1,024-by-780-pixel *displays with six planes of colors, Intecolor's series has 250K bytes of display list plus DMA interface for $4,995.*



Offering 2,048-by-1,568-pixel *resolution, Westward Technology's 3219W monochrome graphics terminal costs $14,000.*

resolution products. Most of these companies have moved manufacturing to the Far East to reduce costs, mainly through cheaper labor.

Bob Varga, vice president of marketing for Selanar, spots a trend toward higher performance with the new de facto standard of 1,024 by 780 pixels. Varga points out that features once found only in high-cost terminals—such as hardware-implemented pan and zoom, display lists to support graphics manipulation and 5,000-vector-per-second drawing speeds—are now available for under $3,000. This price has become a benchmark for monochrome graphics terminals because of the great success of Digital Equipment Corp.'s VT240.

GraphOn epitomizes manufacturers' attempts to provide buyers with a growth path within product families. Its Motorola Inc. MC68000-based product family provides: emulation of DEC VT220, VT100 and VT52 (configurable at 1,056-by-391-pixel or 800-by-260-pixel resolution); Tektronix Inc. 4010/14 and DEC ReGis emulation; DEC VT220 and VT240 emulation with hardware pan and zoom; and 1,056-by-780-pixel resolution.

Although applications for monochrome terminals have not changed much over the last two years, one new and potentially lucrative application is electronic publishing. This market requires a black-on-white phosphor screen and, because of the need to display numerous typefaces, resolution of 1,024 by 1,024 pixels or better.

With its 4225 series, *Ramtek achieves a 1,280-by-1,024-pixel, non-interlaced display, 256 colors displayable and up to 2M bytes of display list for $14,000.*

Low-cost color terminals, more than any other area of graphics terminals, indicate the shift of graphics to commodity-level products. A benchmark price of about $3,000 for products with midrange-pixel resolution (e.g., 800 by 240, 512 by 380, or 640 by 480) has been established by terminals from DEC (VT241), Tetronix (4014A), Hewlett-Packard Co. (2397A), IBM Corp. (3179G) and Qume Corp. (QVT-511). Although DEC's VT241 is not the most profitable of the company's products, it has established a de facto standard with its four-color, bit-mapped graphics for less than $3,000.

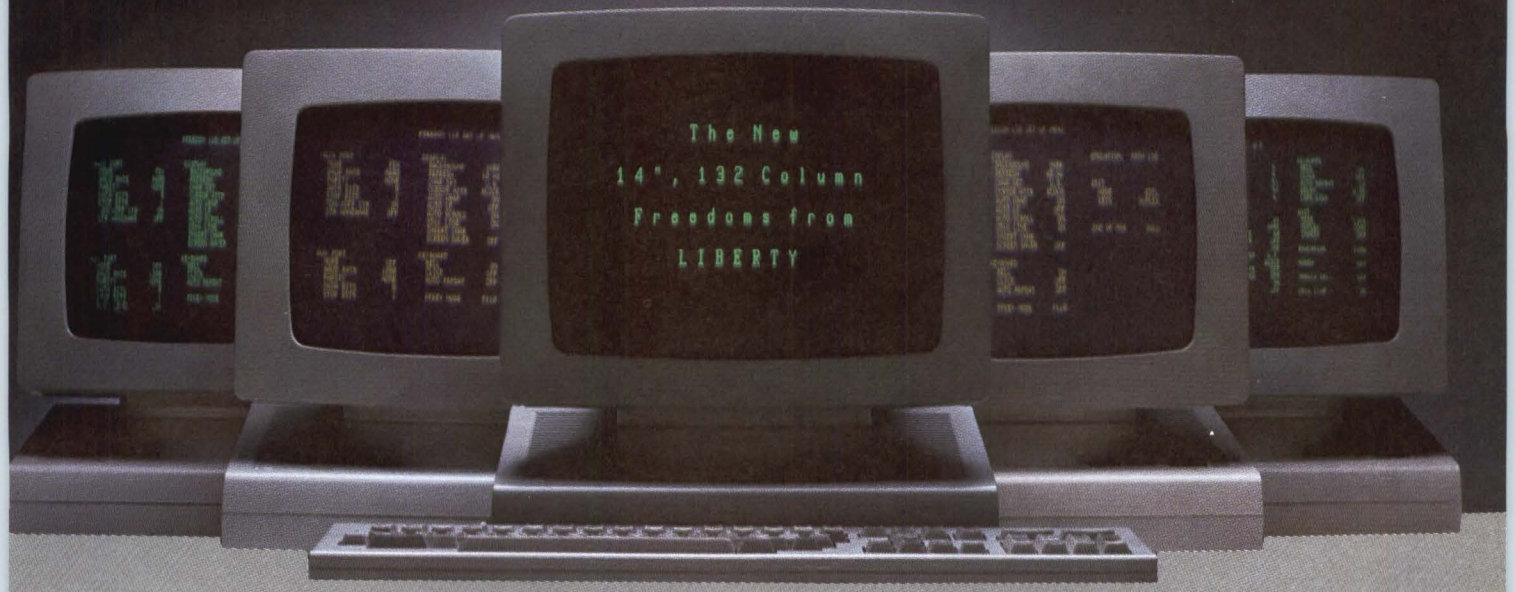
Large vendors offer market advantages not possible for small, independent manufacturers. For example, Dan Jorganson, product marketing manager at HP's Terminals Division, points to the modularity and upgrade capabilities in HP's product families. "A buyer of one of our terminals can simply add the system processor from the 300 series of workstations and upgrade to a 32-bit standalone device—the monitor, I/O devices and packaging are the same in both product families."

Tektronix offers six terminals for under $13,000. At the low end, the $2,995 4104A offers limited graphics for technical-data analysis. Prices on the older 4105A/06A/07A/09A terminals have dropped by $1,000, even though features have been added. For example, up to 1M byte of display-list memory (on the 4107s and 4109s), display-list editing and segment manipulation are available. Finally, the company introduced the 4111 terminal, priced at $12,550, to bridge the gap between the low-end 4109 and the high-end 4125.

Smaller vendors such as Selanar, CIE Terminals, Intecolor Corp., Lear Siegler Inc. and Pericom Inc. added color capability to distinguish their products and remain competitive. Patrick Struhs, director of marketing at Pericom, contends that, "Current users of monochrome graphics terminals costing about $5,000 expect color, with more functionality, for the same price."

"There is little doubt," says Nick England of Whitland Consultants, formerly vice president of graphics terminals at Adage Inc., "that the 1986 performance benchmarks for $3,000 to $6,000 terminals will include eight bit planes of color (256 displayable hues out of a palette of 16 million), local display list and editing, vector-writing speeds somewhere below 10,000 per second and resolutions of 1,024 by 1,024 to 1,280 by 1,024 pixels." Such systems will be shown at next year's SIGGRAPH show, he says. "What we will not see [in that price range] are such features

THE WISE ALTERNATIVES.



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as anti-aliasing, 3-D capability and shading."

2-D competition increases pace

As low-cost terminal vendors add performance and features, those who wish to stay at the cutting edge of technology face critical choices. Some vendors have made the transition to 3-D products; some have developed proprietary technology for better 2-D performance; still others have products that migrate toward vertical markets. And larger, well-financed manufacturers have the luxury of choosing combinations of approaches.

For example, providing high-performance 2-D, the Tektronix 4125 costs $28,000; supports eight planes of color, 1,280-by-1,024-pixel resolution, a non-interlaced display, and 800K bytes of display-list memory; and draws 50,000 vectors per second. The high vector-drawing speed is important "because it allows a complex object, say a 6,000-polygon object, to be rotated in a relatively smooth fashion," explains Steve Ross, product manager for the 4125.

Ramtek Corp.'s 4225 terminal has all of those features plus emulation of both the 4115 and 4125 Tektronix terminals but costs only $14,000. Insiders note that OEM discounts are already bringing the price well under $10,000.

Other manufacturers retain former prices while adding features. Common agreement exists about the need for eight planes of color, 1,280-by-1,024-pixel resolution, non-interlaced displays and 50,000-vector-per-second performance. However, the necessity of (and method of providing) certain features has been questioned. For instance, inclusion of display-list memory (which allows terminals to more quickly manipulate complex objects) and display-list editing capabilities have become hotly debated. Writable control stores, another desirable option, allow programmers to create programs or subroutines for specific graphics operations. Finally, some vendors choose to provide a parallel interface to reduce the communications overhead in host-to-terminal graphics operations.

Not surprisingly, vendors that target CAD applications support display-list memory and editing—Genisco Computers Corp. and Raster Technologies Inc. are examples. Jay Torborg, vice president of engineering at Raster, points to the company's model 175 and model 180 terminals. For $16,000, model 175 includes a 512K-

IBM plug-compatibles increase market share

During 1985, the sales of IBM Corp.-compatible graphics terminals will grow to about $300 million. This offers manufacturers potentially lucrative, but precarious, opportunities.

The best known of IBM's graphics terminals is the model 3255, a monochrome vector device that supports packages such as CADAM, by CADAM Inc., Burbank, Calif., for 2-D drafting and design. The 3255 interfaces to IBM mainframes in groups of four via a central cluster controller that arbitrates demands for communications and data with the mainframe. The drawback to this combination is slow response time. This weakness was seized upon by Adage Inc. and VG Systems Inc. (formerly Vector General) to provide monochrome terminals for CADAM with better performance.

In 1983, IBM introduced the model 5080, which was its first 3-D, color raster-graphics terminal. This unit elicited the current market announcements of companion products. CGX Corp. was among the best positioned to respond because its system architecture was one-on-one with the 5080 and similarly avoided cluster controllers. CGX has since extended its products to monochrome 2-D and 3-D in the 2020 series, and to color 2-D and 3-D with the 2030 series.

This year, Adage announced the 6080—which emulates the 5080—and the 6500 workstation products that unite VM (IBM) and VMS (Digital Equipment Corp.) architectures. For the first time, DEC-compatibles and IBM-compatible graphics terminals were wed in a single computer aided design environment.

Spectragraphics Corp. also announced an entire product family in 1985. Its 1080 has one-on-one architecture to compete head-on, and at a much lower price, with the 5080. And a new graphics workstation, the 3000, based on the National Semiconductor Corp. 32032 processor, has been announced. The 3000 runs UNIX System V, and has drawing speeds up to 300,000 vectors per second.

These competitors are not alone—both Silicon Graphics Inc. and Evans & Sutherland have announced that their graphics systems interface to IBM mainframes. Don Garner, manager of application engineering at Evans & Sutherland, says: "We're not strictly in the plug-compatible market, but want to allow users of our systems to have access to data or software they may be running on IBM machines."

Typically, most of the plug-compatible competitors anticipate IBM's long-awaited workstation announcement with trepidation. The question is, will it be as well-received by independent terminal vendors as was DEC's MicroVAX II announcement?

byte display-list memory and editing capabilities, as well as shading models (flat or Gouraud). The model 180 costs more but allows expansion of both color and memory, or display-list memory (up to 4M bytes).

Genisco's new distributed-graphics-station family incorporates a display list (up to 1M byte), a writable control store (256K bytes) and a proprietary "G-base" database manager, which utilizes the Programmers Hierarchical Interactive Graphics Standard approach. The HS-40, the baby in the family, is priced at about $15,000. Jack McCarthy, vice president of marketing, underscores the importance of users' ability to develop unique firmware options in the control store.

Megatek Corp., a leader in high-performance terminals, differs from the previous two manufacturers. Mark Reese, product marketing manager, concedes the validity of most 2-D benchmarks for performance but declares that, "If you add display-list editing and segment management, the terminal may only be competing with the host." He also asserts that, because of the complexity of the required programming, a control store of firmware operations "cannot be available in systems such as ours, where we support 100,000- to 175,000-vector-per-second writing speeds."

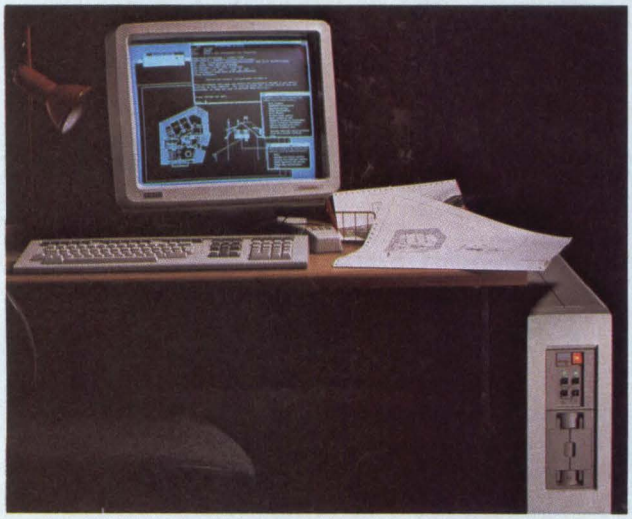
Advanced Electronic Design Inc. is another vendor that does not support display-list capability on a 50,000-vector-per-second terminal. Leon Drozdowski, national sales manager, observes that "electrical CAD [printed circuit and VLSI] does not have the interactive design requirements as do other applications, and the majority of designers do not need a display list."

At $18,500, AED's 1280 offers both direct-

MicroVAX II—the new host of choice

Turnkey system vendors and terminal manufacturers alike greeted Digital Equipment Corp.'s MicroVAX II with delight. Turnkey houses such as Applicon, Computer Graphics Laboratories Inc., Intergraph Corp. and McDonnell Douglas Automation Co. (McAuto) have already added the MicroVAX II to their product mix. Manufacturers such as Jupiter Systems Inc., Megatek Corp. and Ramtek Corp. have been equally enthusiastic.

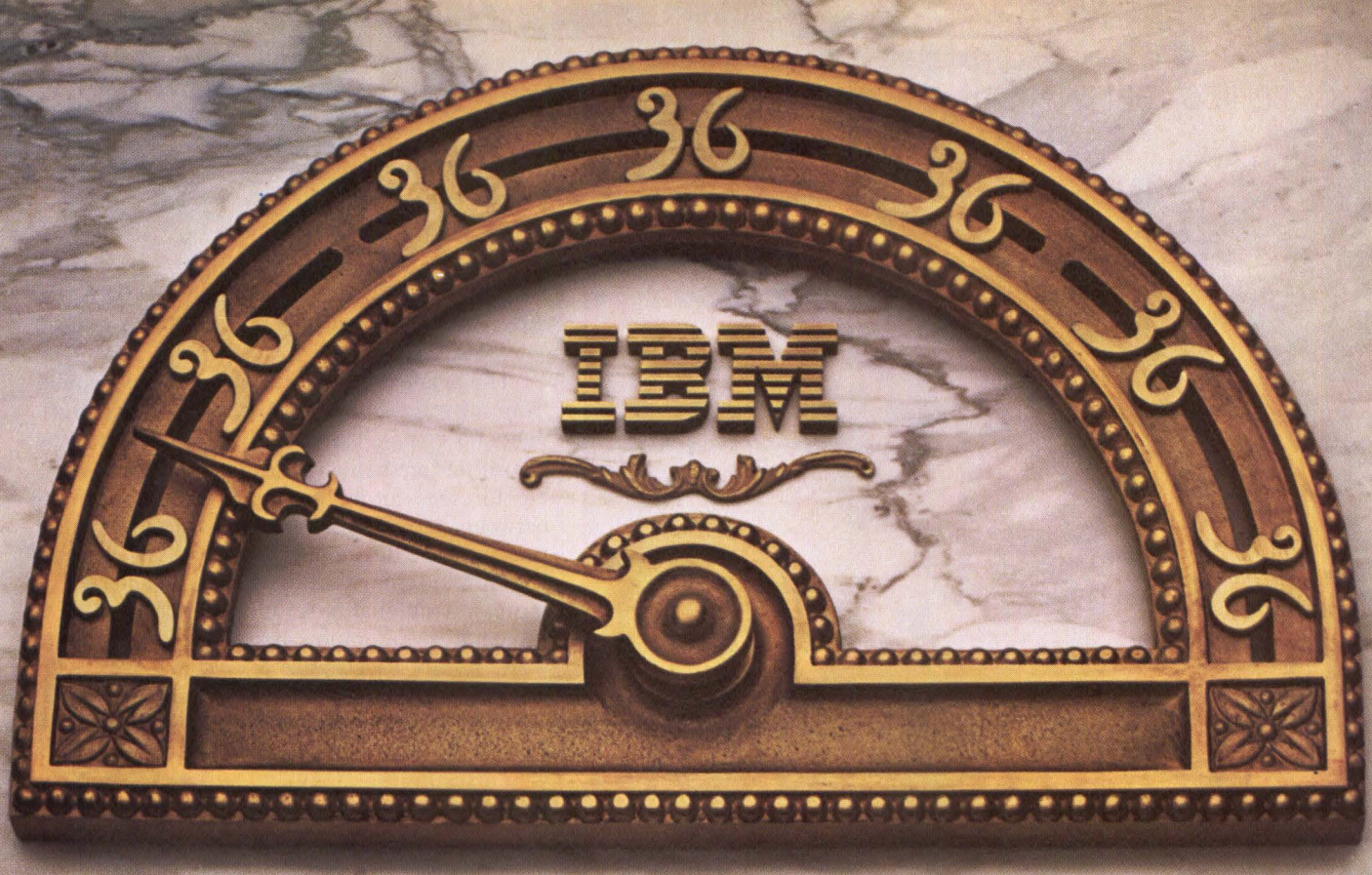
For turnkey vendors, the MicroVAX supermicrocomputer allows the cost of an engineering workstation to drop from the $45,000-to-$70,000 range to the $20,000-to-$40,000 range. McAuto's Jeff Barnell, hardware product manager, supports this type of price "because our internal benchmarks have shown that the MicroVAX II can support up to six McAuto workstations and show similar performance as if they were hooked up to a VAX 8600."



Terminal manufacturers are pleased because the MicroVAX II remains without integral graphics capability. Thus, there's a potential market gap to fill. Tektronix Inc. was the first to benefit, because DEC bundles the Tektronix 4125 to produce the VAXStation 520. Ronnie Morvay, product marketing manager for the VAXStation 520, comments that, "DEC has adopted the stance of developing its own products for the middle range of its customer base—leaving both ends of product performance to third-party vendors." Norman Tripp, product manager for worksystems at DEC, adds that more color products are on the way, "but are more likely [to be] in the VAXStation II product line," where DEC competes directly with Apollo Computer Inc. and Sun Microsystems Inc.

Praise arises from more than low cost. The MicroVAX II appears destined to free the scientific and technical workstation users—especially those with VAXes—from slow interaction in multiuser environments. Benchmarks from application software show the MicroVAX II running at a competitive 50 percent to 70 percent of VAX 11/780 superminicomputer speed.

Although DEC expects to sell over 30,000 MicroVAXes during 1985, the applications are not expected to evolve merely among existing VAX users. Rather, DEC sees the product as its golden opportunity to crack the top market dominated by IBM—the office. DEC's early announcement of its two key products for the office—All-in-1 and A-to-Z—on the MicroVAX II indicates the company's resolve is firm.



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The first company *to provide graphics subsystems for the MicroVAX II, Jupiter Systems renders 2-D or 3-D graphics with Gouraud shading (and the MicroVAX II itself) for $30,000.*

memory access and serial interfaces, which Drozdowski believes are important to users, especially in light of DEC's recently introduced MicroVAX II.

"The next evolutionary step in graphics comes from software," predicts Bill Swegles, vice president at Megatek. "Both graphics and application algorithms are being reduced to silicon in 1986." He foresees future products as joint ventures between terminal manufacturers and application-software developers.

Many terminal vendors have introduced PC-terminal combination products, including IBM, Intecolor, Modgraph, Tektronix, Aydin Controls, Lundy Electronics & Systems Inc., New GEA Corp. and Panasonic Industrial Co. PC-terminal combinations might be viewed as efforts to combat new competition arising from vendors offering graphics subsystems for the IBM PC.

Lundy Electronics, a manufacturer of high-performance 2-D and 3-D graphics terminals, offers the Lundy PC/2000. Morgan Death, vice

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CGX Corp.
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Circle 393

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Maynard, Mass. 01754
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Circle 398

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84108
(801) 582-5847
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Costa Mesa, Calif. 92626
(714) 556-4916
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Circle 401

Graphic Software Systems Inc.
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Wilsonville, Ore. 97070
(503) 682-1606
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president of marketing, suggests that, "People are buying PC-terminals as standalone devices but still have to connect them to a host computer. Their use among scientific and technical users will double over the next two years because the professional user finds the PC too slow."

Some problems with graphics on PCs include limited I/O and imaging capability, trouble with image manipulation and cost. A fully configured PC for graphics costs as much as a more powerful graphics terminal. The Lundy PC/2000, which sells for $10,000 to $15,000, offers MS-DOS, eight planes of color, a 20M-byte rigid drive, dual flexible drives and 1,536-by-1,024-pixel resolution.

IBM's 3270 PC and PC/GX graphics-terminal workstations have been criticized by some users as inferior terminals, but the units have been met with enthusiasm by users of mainframe-based business graphics software, such as that from UNIRAS Inc. and ISSCO, where they speed interaction time.

Hank Kunicki, vice president of marketing at Modgraph, stresses that, "Terminal manufacturers simply don't want to compete with the IBM PC," and that PC-terminals afford a solution. "People want value added," says Tom Clarkson, president of Graphic Software Systems Inc. "And PC-terminals seem a reasonable alternative." GSS has introduced "Grafstation," a software package that turns a PC into a virtual device interface-based terminal.

At the upper end of performance, PC-terminal combinations become graphics workstations —complex, multiprocessor display systems, many of which have standalone capability. However, "In the end," states Merle Smith, Tektronix marketing manager, "terminals will still be tied to mainframes, because it will never be practical to store all of the information needed for graphics in a local device." □

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

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Lundy Electronics & Systems Inc.
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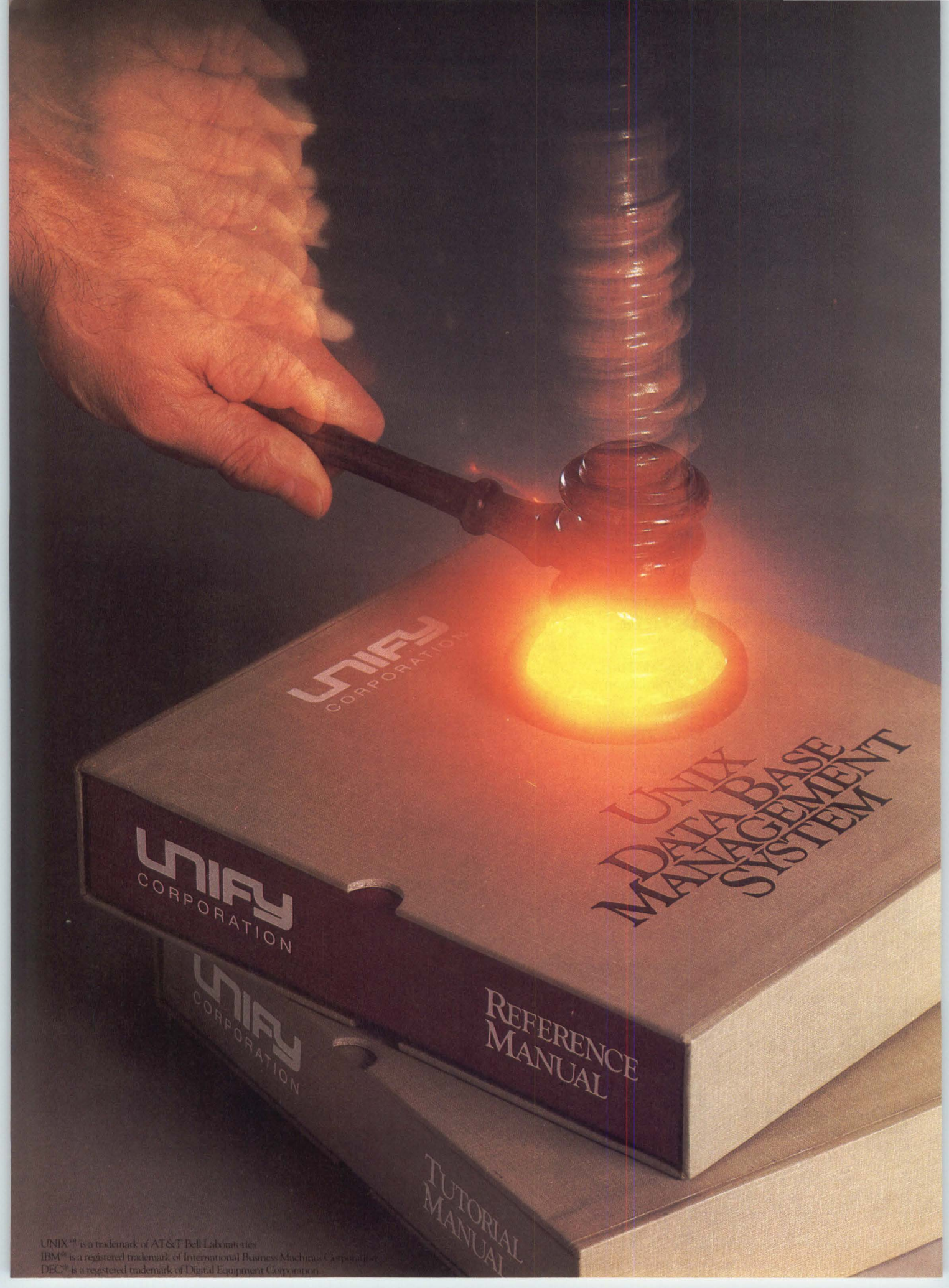

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CIRCLE NO. 54 ON INQUIRY CARD

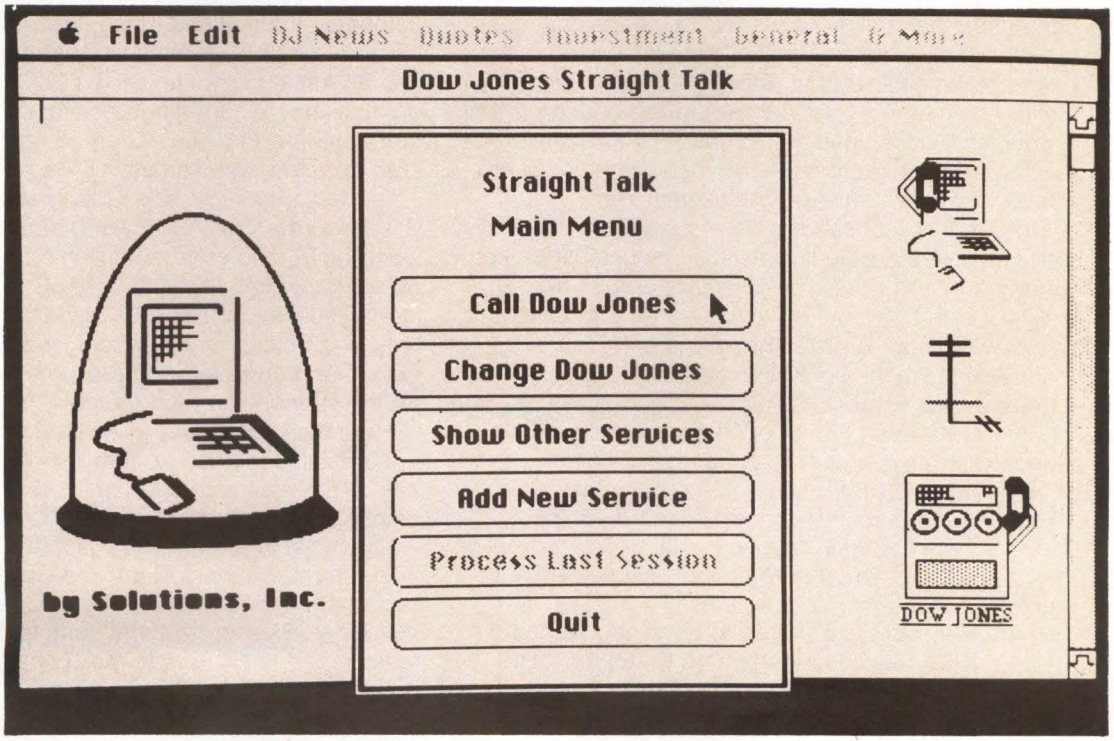
ASCII SOFTWARE CLAIMS NEW MARKETS

Terminal emulation and ASCII communication software provides novel ways to integrate diverse applications and machines

Michael Tucker, Associate Editor

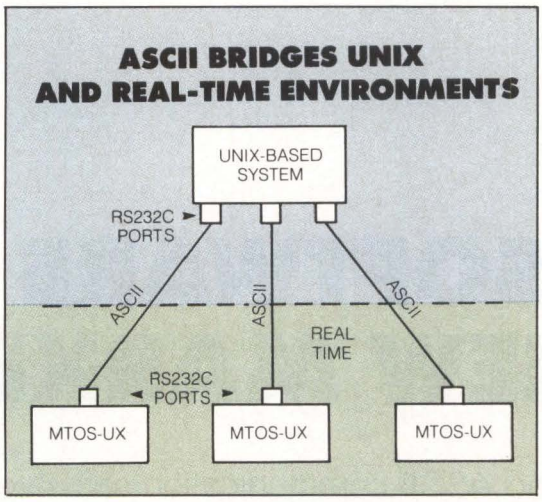
Computer-system planners have long known that modem-based terminal emulation using ASCII characters offers an effective and inexpensive—if crude—means of allowing different computers to communicate. Now, system integrators are challenging the "crude" part by making such emulation software a value-added feature.

Integrators use increasingly sophisticated emulation and communication software to link widely diverse operating systems, processors and applications. They're also using such emulators to make pure information a value-added offering sold directly to the end user. A few companies currently employing emulation software in novel and instructive ways include Dayna Communications, Dow Jones Information Services, Industrial Programming Inc. (IPI), Network Technologies International Inc. (NETI) and VM Personal Computing Inc.



Straight Talk, *from Dow Jones Information Services, is an ASCII-based communications package for the Apple Macintosh.*

IPI's MTOS-UX *uses ASCII to link UNIX into real-time operations for robotics and industrial applications. MTOS-UX contains software that makes it appear as a terminal to UNIX. The link between the two operating systems is handled via RS232C ports.*



For value-added resellers, the real news about ASCII is in marketing rather than in technology. Emulators that use ASCII involve mature and simple technology, and there's some question as to whether they're really viable products by themselves. At the moment, most are marketed as part of larger packages—ranging from integrated business software, like Ashton-Tate's Framework, to communications packages containing file-transfer facilities and microcomputer-to-minicomputer links.

"Two or three years ago, you could get something that did just terminal emulation," notes Kenneth Bosomworth, president of the market research company, International Resource Development Inc., Norwalk, Conn. "These days, you're more likely to run across software that lets you do something else as well...so-called communications packages...And that's become an increasingly competitive market. You can get more than 60 packages, all of them having some level of terminal emulation."

ASCII appears in various garb

In terms of ASCII technology alone, those "over 60 packages" are difficult to tell apart. But they're very different in the ways VARs can use them to address vertical-market applications.

VARs selling directly to end users in the business community, for example, can market ASCII emulation in its original form—as a means of achieving nothing more complex than dial-up communications. Dow Jones Informa-

ASCII in for the long haul

Currently, the office-automation market is dominated by a single factor—a vast installed base of personal computers that makes new sales of standalone, desktop machines difficult. Many system integrators have been able to sell into that nearly saturated market by making communications a value-added offering (MMS *Computer Digest,* June 14, Page 39). The question for most system integrators has not been whether to sell communications software, but of what sort.

Many industry observers have suggested that if system integrators are going to sell communications software, it ought to be something classier than simple ASCII—perferably something based on IBM Corp.'s Systems Network Architecture protocols. Their argument is that synchronous SNA has so many advantages over asynchronous ASCII—speed and IBM's infinite muscle—that in the end it will become a de facto standard for all microcomputer communications.

"Originally, ASCII terminals were much less expensive than SNA machines," notes Richard Amster, director of data communications research for the Yankee Group, Boston. "Today, that economic justification is much less real, if not non-existent."

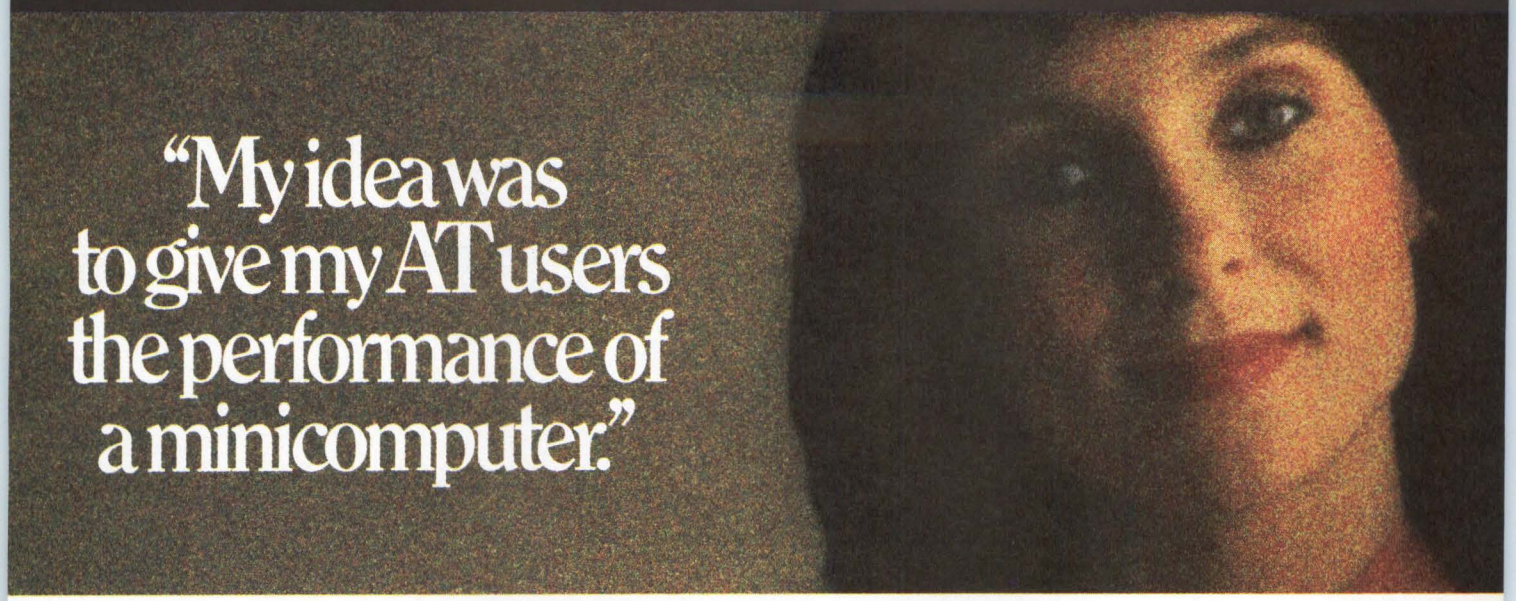
In addition, IBM is believed to be taking steps to include ASCII functions in the SNA protocols. "The plans that IBM has for SNA are generally expected to include more and more of the ASCII world," says Kenneth Bosomworth, president of the market research company, International Resource Development Inc., Norwalk, Conn. "It's unclear what the function of the non-SNA multicomputer will be [in the future]. It's dumb to buy a non-SNA machine if you then have to turn around and make it SNA-compatible, at considerable expense, with something like an IRMA board."

Yet, ASCII has lost little of its market. Notes Bosomworth, "The ASCII world outnumbers the SNA world by [a ratio of] about 10-to-1, at least in the business market...If anything, ASCII has gained ground at the expense of IBM over the last 10 years...The reason is, microcomputer users want dial-up access to private and corporate databases." Telephoning is for the moment, beyond the powers of SNA.

Moreover, according to Amster, "most minicomputers are still designed to deal with ASCII terminals...That means that ASCII terminals won't go away unless all the minicomputer vendors go away."

The result is a market in which the tail can effectively wag the dog. Sandra Gant, associate director of small systems for InfoCorp, Cupertino, Calif., says: "So many vendors are using personal computers on their systems as terminals, that terminal emulation has become a big part of the market for personal computers."

One great idea deserves another.



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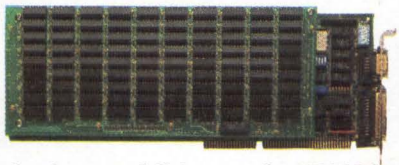

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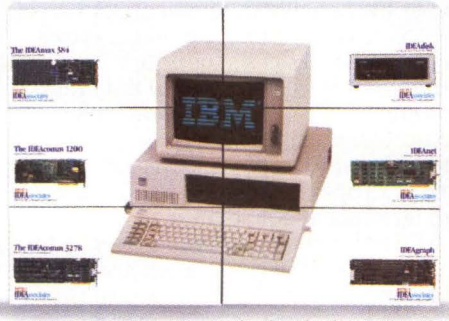

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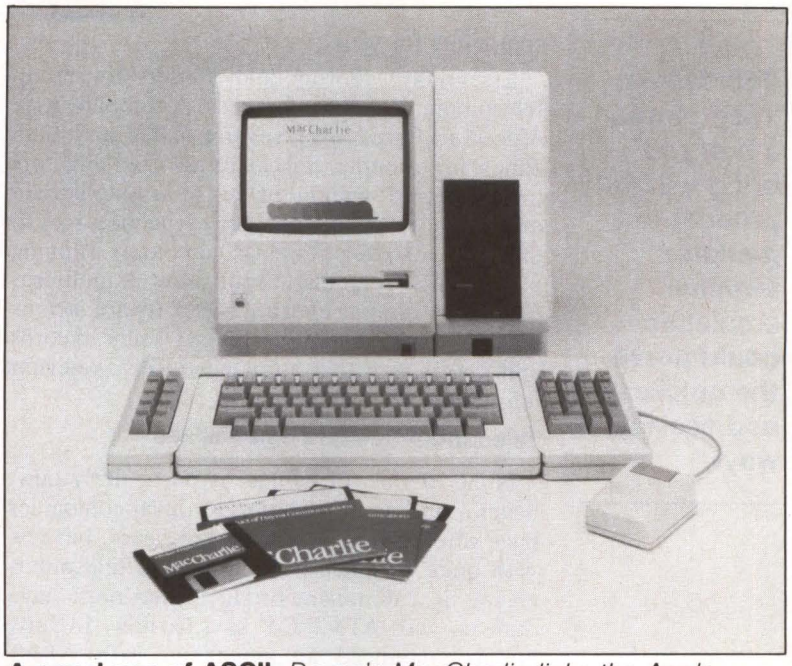
tion Services has recently begun remarketing terminal-emulation software for such popular personal computers as the Apple Computer Inc. Macintosh. Called "Straight Talk," the program is a product of Solutions Inc., Montpelier, Vt., and solely in terms of technology, it is hardly distinguishable from the legions of ASCII emulators that have graced the shelves of computer shops since the beginning of the personal computer craze.

What makes Straight Talk unique is that it makes dial-up access to the financially oriented Dow Jones News/Retrieval telecommunicated database particularly easy—even for inexperienced users. With little more than the click of a mouse button, the most computer-phobic businessman can enter the database, be guided through its labyrinthine intricacies, extract information and log off with a minimum of connect time.

A buyer could, of course, use Straight Talk to enter other database services than Dow Jones—like those of CompuServe Inc. or The Source Telecommunications—but the main menus are worded to constantly remind the user that Dow Jones exists. In effect, terminal emulation has become an advertising feature; an electronic billboard promoting Dow Jones' real product—pure information.

NETI takes a similar approach with its product, "eForum," except that here the real value is not information but communication. Introduced last April, eForum is a commercial version of the telecommunicated "special interest" discussion groups that hackers have been running on micro-



A novel use of ASCII, *Dayna's MacCharlie links the Apple Macintosh to an IBM PC- compatible microcomputer. The bridge between the two systems is Dayna's communications software.*

List of companies mentioned in this article

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Circle 430

Network Technologies International Inc.
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Ann Arbor, Mich. 48103
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Solutions Inc.
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Montpelier, Vt. 05602
(802) 229-0368
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VM Personal Computing Inc.
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SNA strikes from the skies

ASCII-based communication systems may rule the business world, but IBM Corp.'s Systems Network Architecture protocols are heading skyward—with a little boost from friends at Xerox Computer Services, Los Angeles.

In June, Xerox announced plans for a direct broadcast satellite system to link SNA-compatible devices. For $10,000, a customer receives one 4-foot dish antenna and access to three geosynchronous satellites located 22,300 miles above the Equator, roughly over South America, the Atlantic and Pacific oceans. With these, and the support of Xerox's large "data center"—the company's version of NASA's Mission Control—in Hawthorne, Calif., a user can beam data to IBM PCs, mainframes, or whatever, at similarly equipped "earth stations" across North America.

In effect, the Xerox satellite system lets users bypass land-based phone lines completely. With competition already heating up between IBM and AT&T Co., that could mean Xerox is about to bring a whole new meaning to the term "Star Wars."

For system integrators in a hurry to bring a 32-bit product to market, terminal emulation could prove the quickest and easiest way.

computers for years.

Essentially, eForum allows users to set up telecommunicated conferences. A company with offices scattered over several states and time zones, for example, can call its assorted directors to "a meeting" without having to assemble them at one place. Attendees simply type messages to one another over personal computers running eForum ASCII emulation software. A multiuser computer, running eForum host software, acts as the meeting's general secretary; keeps records and makes sure that attendees receive relevant information.

Teleconferencing is emphasized

None of this, of course, is particularly new. Several on-line information retrieval companies have offered similar services for years, but few with quite so much commitment to teleconferencing as a dominant product—and none have done so with AT&T Co. as a partner. In July, NETI announced an agreement with AT&T Computer Systems, a division of AT&T Information Systems, under which AT&T will remarket eForum.

On a more technical level, system integrators can use ASCII emulators as a cheap and simple, yet effective, bridge between systems that could otherwise only be linked via complex protocol converters. IPI, for example, has been selling a real-time operating system known as "MTOS" since the early 1970s. MTOS has been particularly successful in factory automation applications and early purchasers included several domestic and foreign automobile makers—notably Toyota and General Motors.

Early this year, IPI announced a UNIX-compatible version of the operating system, MTOS-UX, for Intel Corp. microprocessors. This version seemed like a contradiction in terms—UNIX is notoriously bad at real-time applications. In addition, real-time operating systems are notoriously impatient with the sort of system call-emulation schemes that operating system vendors usually tack on to their products to make them "UNIX compatible."

IPI's secret weapon is ASCII. MTOS-UX contains software that makes it look like merely another terminal to UNIX. The link between the two operating systems is handled via their respective computer's RS232C ports. Under MTOS-UX, if an industrial robot running in real-time meets a problem that requires more than its local intelligence can handle, it simply picks up a modem and places a call to a UNIX-based server—which might be next door or across the country. Thus, MTOS-UX makes widely dispersed manufacturing efforts possible, even relatively easy.

Similarly, if less dramatically, a host of communications products have recently come to market that combine ASCII, file-transfer functions, microcomputer-to-minicomputer links and a command language in what is effectively an inexpensive wide-area network. VM Personal Computing, for example, has just introduced "Relay Gold," which the company calls "concurrent PC communications software." The package can simultaneously send and receive files, and—rather than leave the personal computer's CPU dormant—run local applications.

Relay Gold also contains a programming language, "script language," which resembles a stripped down BASIC. With script language, a user can instruct the personal computer to handle its own communications tasks for hours at a time—perhaps phoning up a remote information service at 3 a.m., when phone rates are low, then dialing up a corporate mainframe across the country at 4 a.m., placing calls to the home computers of local sales representatives across several states at 6 a.m., and finally displaying its work to users who arrive at the office at 9 a.m.

ASCII makes 'single' system possible

The Apple Macintosh, meanwhile, may be the focus of one of the most novel uses of terminal emulation to date. In August, Dayna Communications introduced "MacCharlie," which it describes as a means of making the Macintosh IBM Corp. PC-compatible.

In fact, MacCharlie is an Intel 8088-based coprocessor cleverly designed to snap onto the side wall of the Macintosh. (If Apple had included expansion slots in its self-proclaimed "computer for the rest of us," MacCharlie would probably come as an add-on board.) For $1,750, the buyer receives what is effectively a half-size PC-compatible—which happens to use the Macintosh as a terminal. The link between the two machines is performed by Dayna's proprietary communications software, and ASCII files can jump easily between the two machines.

MacCharlie's method of joining two dissimilar computers could set important precedents. There have been several experiments recently in turning personal computers into workstations based on 32-bit microprocessors. For system integrators in a hurry to bring a 32-bit product to market, terminal emulation could prove the quickest and easiest way. □

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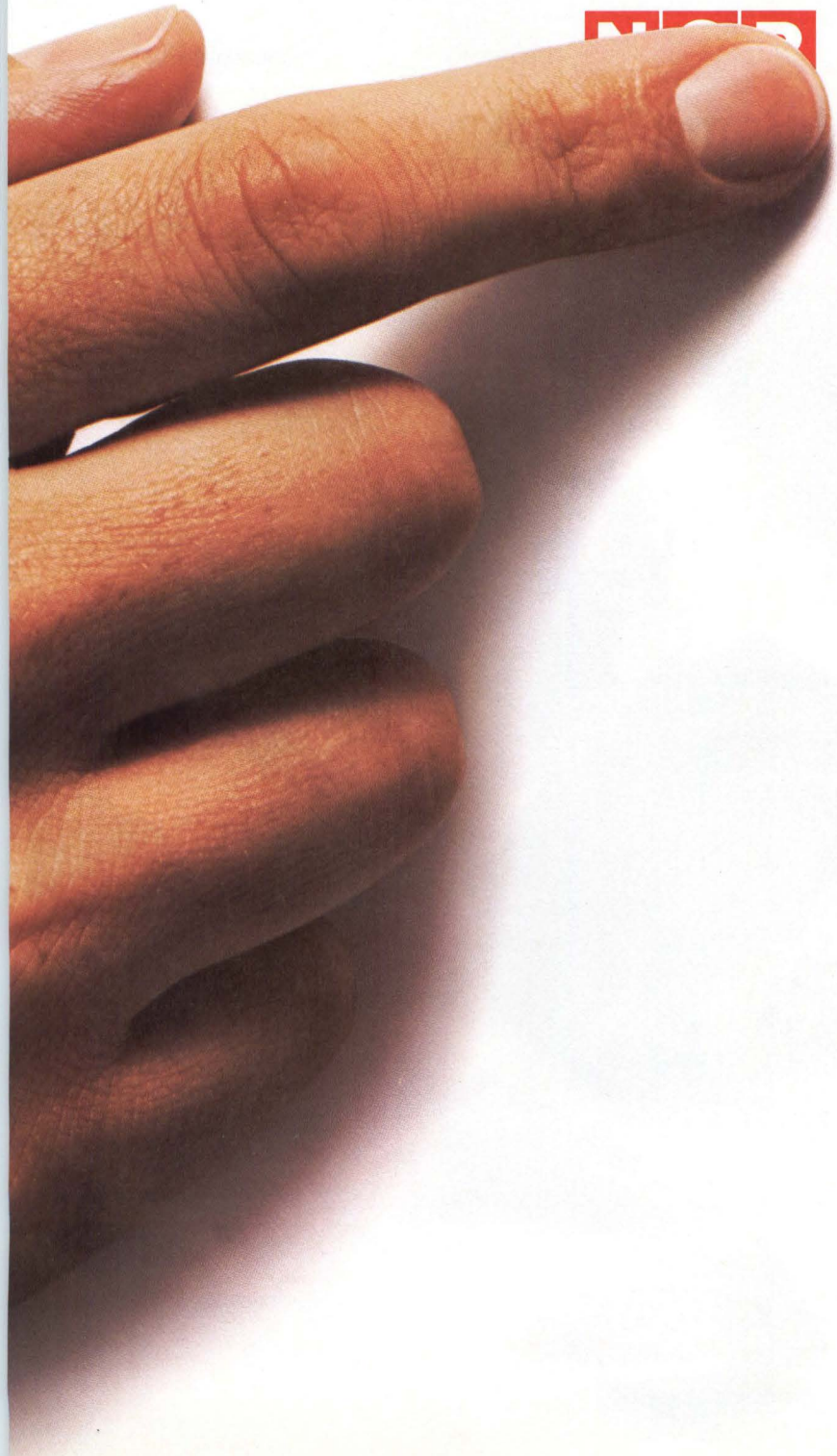

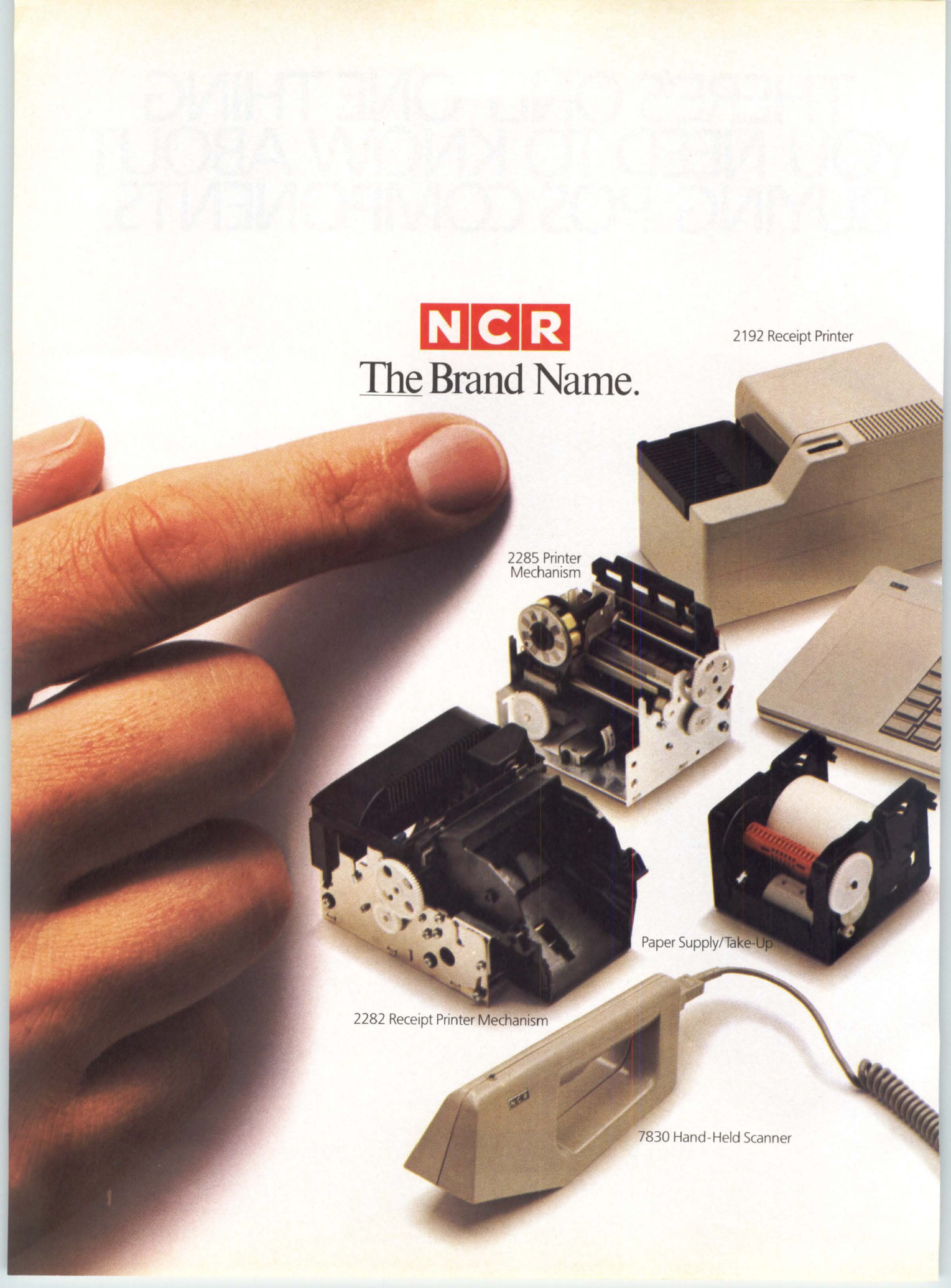
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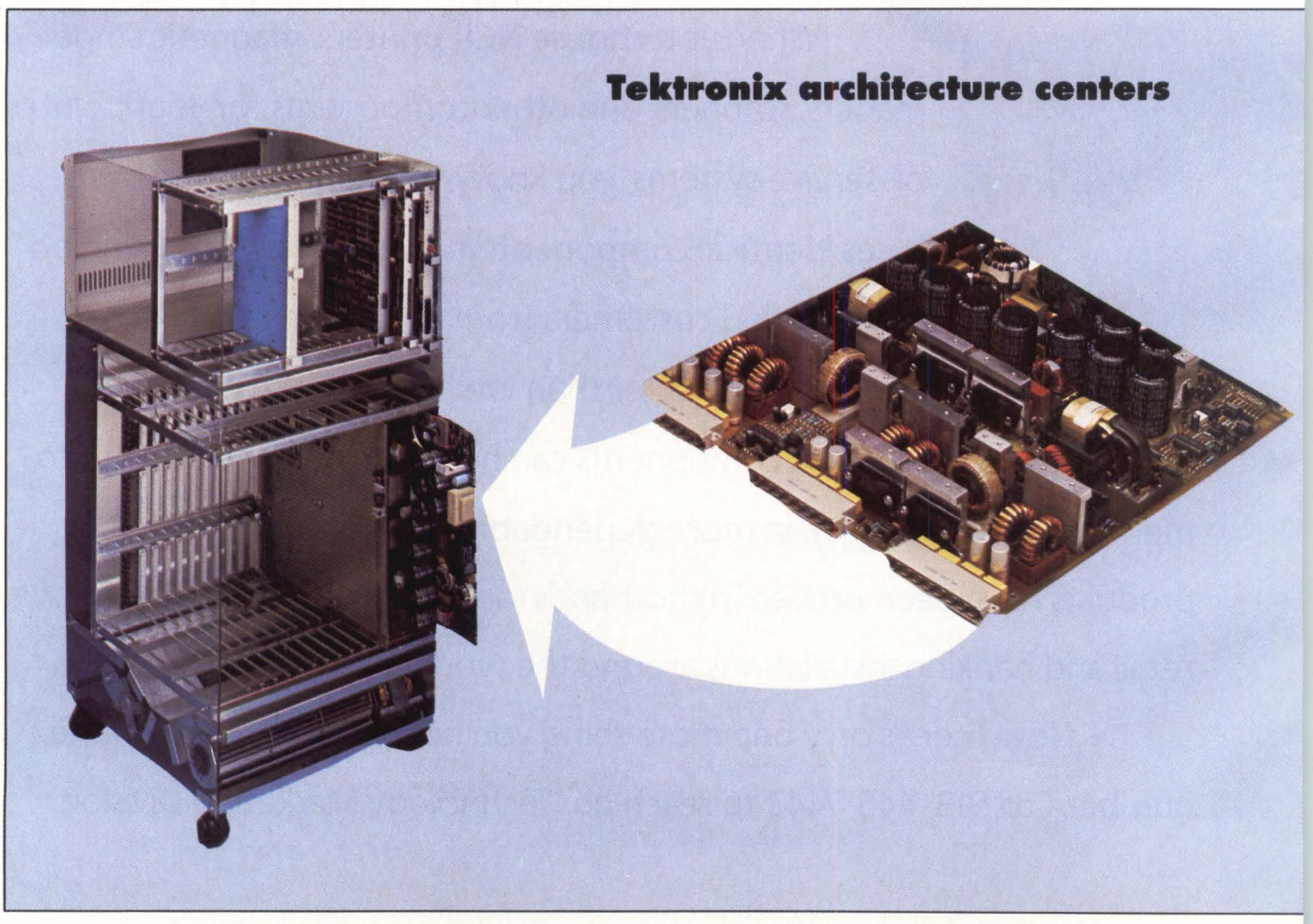
POWER SUPPLIES SLIM TO SINGLE-BOARD SIZES

Smaller, lighter switching-power supplies allow system integrators unprecedented mechanical-design flexibility

Rick Dalrymple, Senior Editor



The key word in switching-power supply design is "reduce"—reduce the price, reduce the size, reduce the weight and, while you're at it, reduce the emissions: electromagnetic interference (EMI), radio-frequency interference (RFI) and heat. Expect only two qualities to increase: efficiency and reliability. By taking this stern charter to heart, switching-power supply designers are creating products that offer system integrators new options in mechanical design.

Five years ago, the size and weight of switching-power supplies generally dictated their location be on the bottom of the enclosure. Thanks to new reductions in both size and weight, a few manufacturers are now finding it practical to turn out their products in dimensions that conform to the mechanical specifications of standard computer buses such as the STDbus and VMEbus. This means that system integrators can now buy switching-power supplies that plug into the backplane and, from a mechanical-design point of view, treat them as system modules like single-board computers or memory boards.

What are the major benefits of single-board-size switching-power supplies? First, the size reduction allows system integrators to use more compact enclosures. Second, the savings in space makes it more practical to fit in "fail-safe" power supplies. Third, the size facilitates fast and easy field installation and board swapping. Furthermore, it is attractive to distribute power throughout the system using AC-to-DC and DC-to-DC converter modules instead of a monolithic power supply.

Distributing power separates the functions of a monolithic, multiple-output supply into AC-to-DC and DC-to-DC modules (each of which could be mounted on separate printed-circuit boards). System integrators who employ this scheme distribute a high voltage from the AC-to-DC front end (located near the the AC line) to DC-to-DC converters (located near each point of use). At each DC-to-DC converter the voltage is stepped down to achieve the desired output. This scheme not only saves space, but also eliminates some isolation problems that can make multiple-output supplies expensive.

Two companies new to the switching-power supply business—Theta-J Corp. and Vicor Corp. —are betting that if the cost of power distribution can be brought down to that of existing multiple-output supplies, mainstream commercial customers will enthusiastically embrace the concept (see "Theta-J and Vicor bet on distributed power," Page 130).

Perhaps the most obvious benefit of single-board-size units is the freedom to move the switching-power supply to any location where system integrators can mount a printed-circuit board. With size and weight removed as mechanical-design constraints, only cooling considerations limit choice in locating the switching-power supply.

Because single-board-sized switching-power supplies are cooled by convection, a "chimney" effect is created on a side of an enclosure. In this arrangement, cool air is drawn in near the bot-

Five years ago, the size and weight of switching-power supplies generally dictated their location—on the bottom of the enclosure.

on single-board modules

Tektronix Inc., Beaverton, Ore., offers integrators of automated test systems an alternative to configurations based on several individual instruments, all using the IEEE-488 bus. Tektronix has instruments on printed-circuit boards and has extended the concept to include single-board switching-power supplies.

Both the power supplies for the instruments and the single-board instruments themselves, are built in triple-height extended Eurocard dimensions (13.4 inches by 14.4 inches). The Tektronix cabinet contains two separate card cages. The larger, bottom, cage holds the instrument boards as well as two 66OW power-supply boards. The smaller, top, card cage accommodates boards based on the double-height Eurocard-sized VMEbus. Tektronix provides a 230W single-board switching-power supply for this card cage as well.

Tektronix is promoting its computer-based instrumentation architecture as an open system. Specifications for the bus used in the larger card cage is available to third parties who wish to build instruments based on this architecture.

tom of the enclosure (in harsh environments, this may be through a filtered vent). The air then moves directly over the switching-power supply mounted at the end of the card cage and flows out through slots near the top of the enclosure.

Modules enhance flexibility

Single-board modules—including the power supply—are a key part of a new computer-based instrumentation architecture from Tektronix Inc., Beaverton, Ore., (see "Tektronix architecture centers on single-board modules," Page 128).

Tektronix chose to use single-board-sized switching-power supplies because they offer certain benefits. For one thing, board-level products are modular. For example, if only a few instrument boards are used in a configuration, one single-board supply will meet the power requirements. However, should more instrument boards be added, provisions exist to add another single-board power supply without modifying the cabinet or cooling system. Also, like all single-board products, a power-supply board can be quickly replaced in servicing.

Still another advantage is the option of installing two power supplies, using one as a "hot" spare. With this configuration, the power supply becomes "fail-safe."

Another single-board supply is offered by Power General Corp., a Unitrode Corp. subsidiary in Canton, Mass. The Power General 4045, a 40W quad-output, switching-power supply, weighs only 18 ounces and matches STDbus mechanical dimensions.

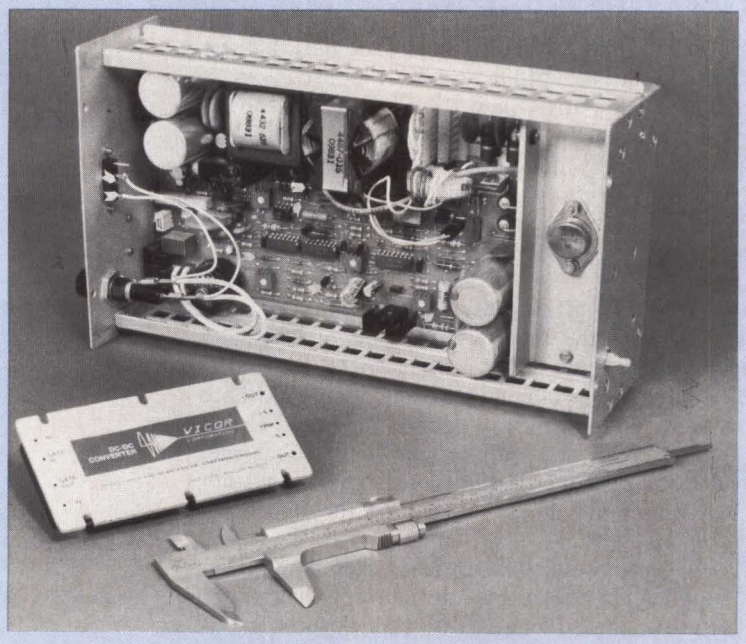
Although the products from both Tektronix and Power General are compact, they do not exhibit the dramatic size and weight reductions achieved by products that have increased the DC-to-DC switching frequency to 1 MHz and

Theta-J and Vicor bet on distributed power

Both Theta-J Corp. of Wakefield, Mass., and Vicor Corp. of Andover, Mass., want to woo system integrators away from monolithic multiple-output supplies.

Theta-J's line includes the Q100ADAD, a 100W, four-output, off-line, switching-power supply enclosed in plastic with a flat metal heat sink. It measures 7.8 inches by 3.54 inches by 0.8 inches. In DC-to-DC converters, Theta-J offers the Eagle series, also enclosed in plastic with a flat metal heat sink, ranging from 10W to 100W. Its dimensions are 4.6 inches by 2.4 inches by 0.8 inches.

Vicor does not as yet offer a fully integrated switching-power supply. Its VI-100 line of DC-to-DC converters are available in 50W, 75W and 100W versions, enclosed in plastic with a flat metal heat sink, measuring 4.6 inches by 2.4 inches by 0.47 inches. Vicor's 300W VI-200 is only slightly larger—0.3 inches thicker in the same footprint. Also, through the use of equally small booster units, a single VI-100 with 10 boosters can deliver up to 2000W.



Theta-J's Eagle series *of DC-to-DC converters range from 10W to 100W, using the same enclosed package.*

Vicor's 100W DC-to-DC converter *is much smaller and lighter than the 5-year-old 100W switching-power supply seen in the background.*

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raised efficiency ratings to around 90 percent. Three companies currently offer products that perform this feat—Theta-J, Vicor and National Semiconductor Corp.

For example, National Semiconductor has introduced a tiny, 15W, off-line power converter intended for products, such as portable medical instruments, where incorporating the switching-power supply function directly on a system's only printed-circuit board is desirable.

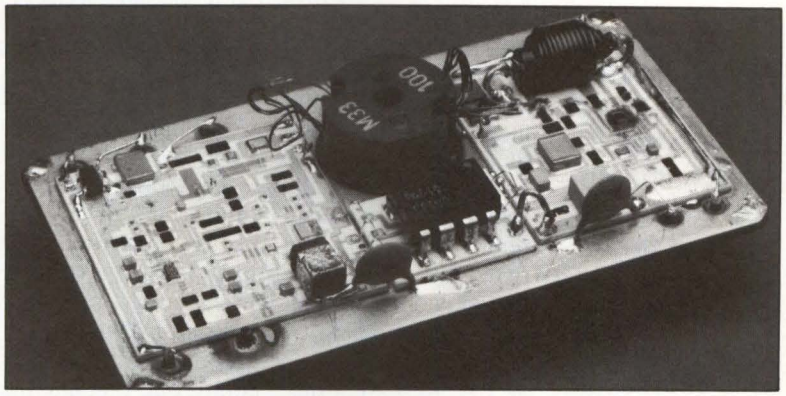
Size tied to frequency

Power-supply manufacturers have known for some time that increasing the switching frequency is key to reducing the size of a power supply. Typically, increased frequency means the supply can be built with smaller components. Over several years, the switching-power supply frequency has jumped from 20 kHz to more than 100 kHz. However, big jumps in switching frequency, up to 1 MHz, are moving from the laboratory into products introduced this year.

There are really two switching frequencies in a switching-power supply. At the front end of a supply (the AC-to-DC portion), the switching frequency must match the frequency of the AC line. Fixed by the power source, AC-to-DC conversion frequency is beyond the control of the switching-power supply designer. The choice of DC-to-DC conversion frequency, however, is under design control.

Moving to higher DC-to-DC converter frequencies allows the size of items such as drive and output transformers, along with output filter inductors and capacitors, to be reduced. That's the good news. The bad news is that the size of the electrolytic capacitor in the AC-to-DC front end cannot, with today's materials, be reduced. Tied to the fixed frequency of the AC line, the electrolytic capacitor tends to be the tallest component in a switching-power supply, which dictates power-supply height. Although this component can be horizontally mounted, its volume does not change. The designer thus trades a reduction in height for an increase in surface area. Even with these limitations at the front end, a large increase in DC-to-DC conversion frequency greatly reduces a switching-power supply's size and dramatically increases its functional density.

Given the advantages of single-board supplies as well as the size and weight reductions found in 1-MHz switching-power supplies, you might



National Semiconductor's HS9151 *operating at 1 MHz squeezes the bulk of a 15W power supply into a 3.5-by-1.5-by-.44-inch dual-in-line package. The off-line converter does not include external input and output filter capacitors, whose values ultimately depend on the application.*

Untangling the web of safety regulations

If you integrate a switching-power supply into your products, you are already aware of electrical safety standards. However, if your company is just beginning to market products on an international scale, you will soon encounter a new and bewildering array of electrical safety specifications. Fortunately for manufacturers in the United States, Underwriters Laboratories Inc. (UL), Melville, N.Y., offers a program called Technical Assistance To Exporters (TATE). The TATE program comes close to being the "one-stop shopping" center for certification and compliance testing.

A brand new development in the TATE program is UL's arrangement with West Germany's Verband Deutscher Elektrotechniker (VDE), which now offers U.S. manufacturers a faster and easier method to gain permission to use the combination VDE-GS mark. Under the new program, manufacturers may submit their products directly to UL, an independent not-for-profit testing organization. This group will then process submittals through the VDE certification systems. UL will conduct the VDE tests and prepare a report, which, in turn, will be thoroughly reviewed by VDE. VDE may also examine the product and conduct some check tests. UL will also conduct, on behalf of VDE, follow-up investigations. Like UL's own classification process, these follow-up investigations consist of unannounced visits to the manufacturer's factory by UL personnel to ensure continuing compliance. The frequency of these visits depends on the individual standards.

UL is also designated by Japan's Ministry of International Trade and Industry (MITI) as the authorized American inspection agency to perform MITI's Japan Industrial Standards factory reinspections. Although UL cannot provide certification services for all the nations of the world, it can, through its international programs, provide both technical information and testing services for more than 70 countries.

However, big jumps in switching frequency, up to 1 MHz, are moving from the laboratory into products introduced this year.

jump to the conclusion that the switching-power supply market will soon be flooded with single-board introductions. Chances are it will not.

Most industry observers note that traditional open-frame switching-power supply vendors see the single-board supply as a low-volume product —where customers buy a few thousand units a year, instead of tens of thousands. They also remain skeptical of products leaping to 1-MHz switching frequencies still being competitively priced and meeting all the regulatory, reliability and quality standards demanded by the market.

Chandra Mehta, vice president of technology at LH Research Inc., points out that all the components necessary for the switching-power supply industry to move to 1-MHz designs are not available today. "Although 1-MHz pulse-width-modulation controllers are now available," says Mehta, "most switching-power supply designers find today's power metal-oxide semiconductor field-effect transistors unsuitable for 1-MHz switching frequencies." Mehta contends that over the next couple of years, evolutionary rather than revolutionary improvements will characterize new switching-power supply products.

The designers at National Semiconductor, Theta-J and Vicor obviously agree with Mehta's view that off-the-shelf components are not available to fully support 1-MHz switching frequencies. The vendors, therefore, proudly cite the custom packaging and proprietary components used in their products.

Theta-J's chairman and chief executive officer, Edward Rodriguez, claims there is a fundamental reason why so few manufacturers are planning to move quickly to 1-MHz switching frequencies. According to Rodriguez, "Switching-power supplies used by computer manufacturers in the 1970s were designed by analog engineers at computer companies. Most power supplies introduced by vendors in the last five years have been modeled after these 1970s-era supplies. Only recently have switching-power-supply companies acquired the analog engineering knowledge to explore fundamental topology design."

So it seems that, instead of employing state-of-the-art techniques to increase switching frequencies, the vast majority of switching-power supply vendors will use what they consider to be "less risky" methods to increase switching frequencies; not to 1 MHz, say industry observers, but probably in the 250-kHz to 350-kHz range.

What can system integrators expect from traditional power-supply manufacturers over the next two years? A slow, but continous, trickle of new open-frame products touting smaller size and lighter weight. And, if small enough, these products will be optionally available in single-board formats.

Although switching-power supply prices have been falling over many years, manufacturers have witnessed particularly vicious price cutting during 1985. Their own cost reductions, however, have not kept pace with dropping prices in a soft market, leading to a dreaded form of shrinkage—smaller profit margins.

Moves to reduce costs, however, may not presage further price cuts for the buyer. When the demand for switching-power supplies firms up, manufacturers will be looking to prop up their sagging profits. Buyers, in a firm market, can expect prices to stabilize before they resume a downward trend. New price reductions, however, will be slower and in smaller increments until the cost structure of new products provide the margins necessary to re-engage the price war.

Is distributed power a concept whose time has come? How many vendors will offer single-board supplies? Will supply designers move more quickly toward 1-MHz switching frequencies now that products offering that feature are on the market? The questions have certainly become more interesting in a marketplace often thought to be unexciting. □

List of companies mentioned in this article

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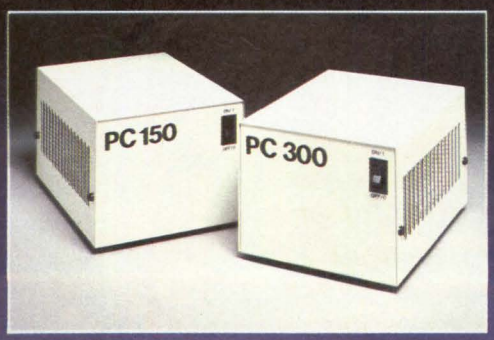

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CIRCLE NO. 60 ON INQUIRY CARD

The Power a

Introducing the 3280 MPS.

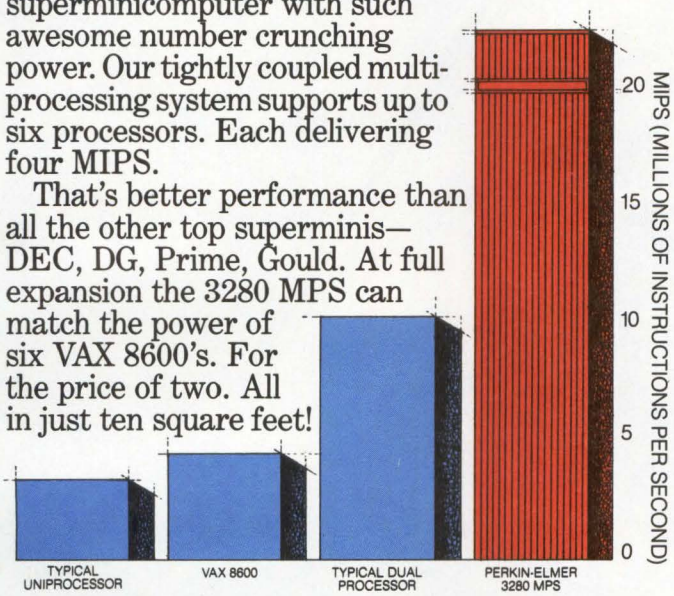
nd the Glory.

The power of six VAX 8600's for the price of two.

Performance by the numbers

It took Perkin-Elmer to create a practical superminicomputer with such awesome number crunching power. Our tightly coupled multiprocessing system supports up to six processors. Each delivering four MIPS.

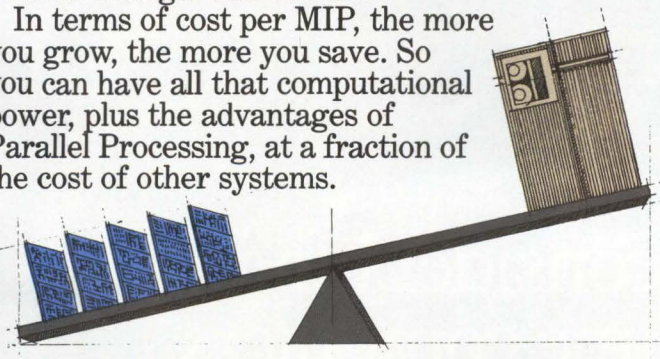
That's better performance than all the other top superminis—DEC, DG, Prime, Gould. At full expansion the 3280 MPS can match the power of six VAX 8600's. For the price of two. All in just ten square feet!



Growth: the bigger the better

With a 3280 MPS, expansion is easier than ever. Adding auxiliary processors is as simple as plugging in boards. And across-the-line software compatibility means you can grow from any of our 3200 Series superminis without having to rewrite a single line of code.

In terms of cost per MIP, the more you grow, the more you save. So you can have all that computational power, plus the advantages of Parallel Processing, at a fraction of the cost of other systems.



PERKIN-ELMER

Computers that take the pain out of growing.

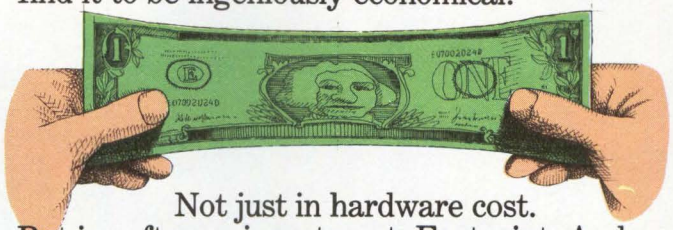
The glory of Parallel Processing

The 3280 is the culmination of Perkin-Elmer's decade-long experience and commitment to Parallel Processing, a computer technology that affords the ultimate in efficiency, throughput and sheer computational power.

In a Parallel configuration, each 3280 processor executes a related segment of your task simultaneously. Tasks run when they're ready. No bottlenecks. No waiting. So computing is far faster and more reliable than any kind of linear uniprocessing system.

Lowering the high-end cost

The 3280 costs less than other high-end systems to begin with. And as you grow, you'll find it to be ingeniously economical.



Not just in hardware cost. But in software investment. Footprint. And every aspect of overhead and operating expenses, including power consumption, air conditioning and maintenance.

There's nothing else like it. The 3280 MPS from Perkin-Elmer. For more information, mail the coupon. Or call toll-free: **1-800-631-2154.**

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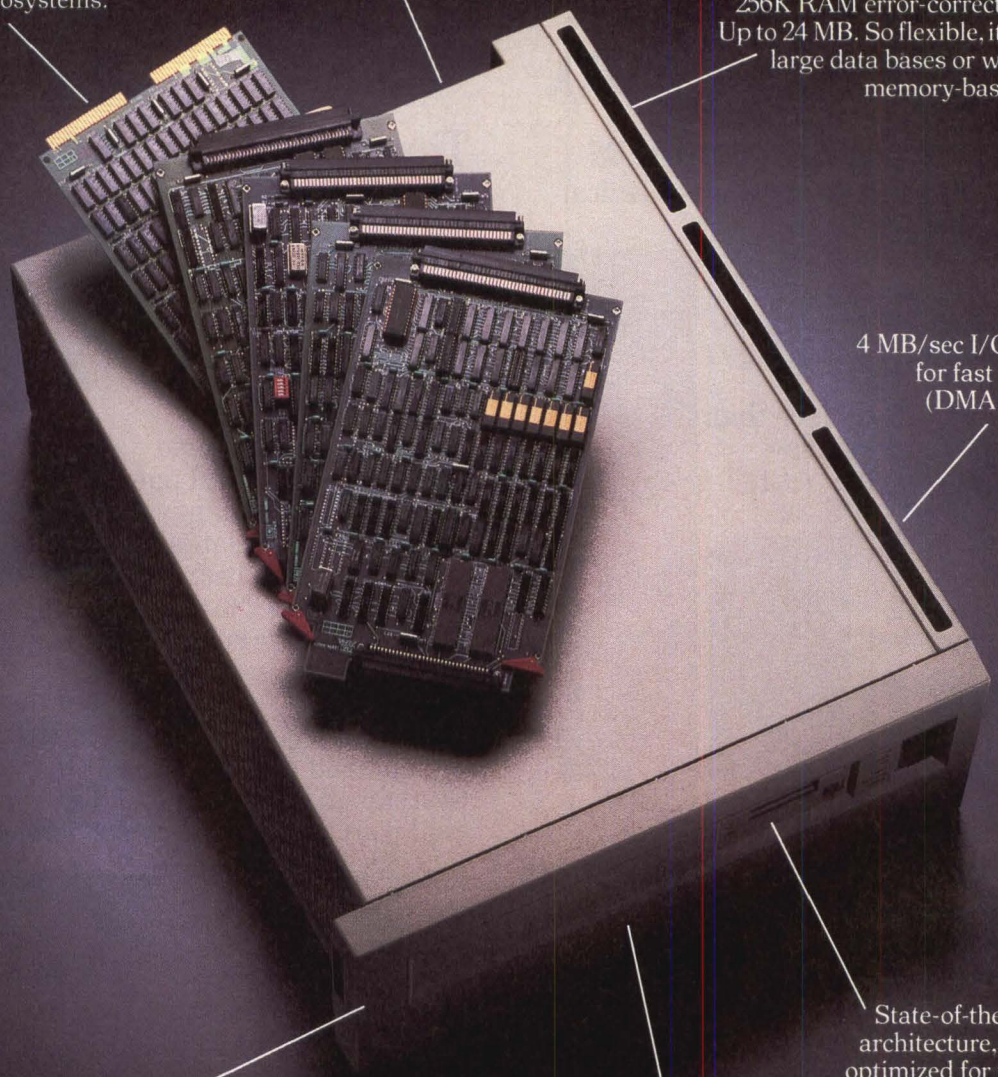
The Hewlett-Packard A-Series Automators: a rugged family of real-time computers with total software compatibility.

Available as boards, boxes, systems or microsystems.

256K RAM error-correcting memory. Up to 24 MB. So flexible, it can manage large data bases or work as a true memory-based controller.



4 MB/sec I/O bandwidth for fast performance. (DMA per channel).

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Why you should consider buying a lot of our real-time computers.

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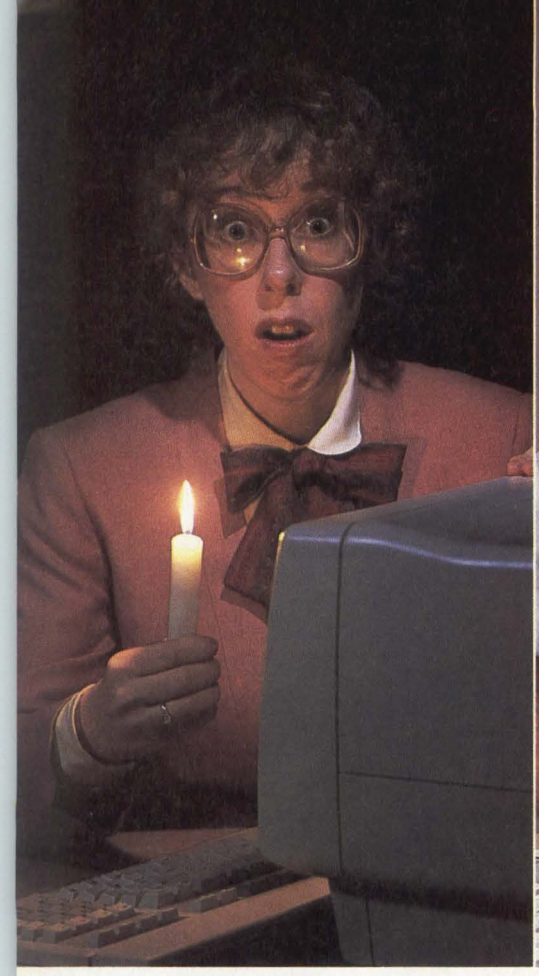
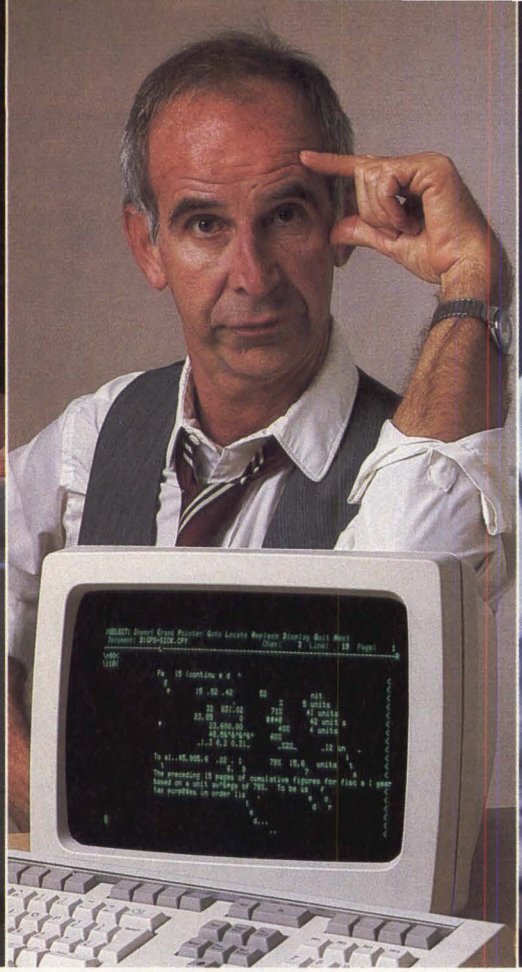
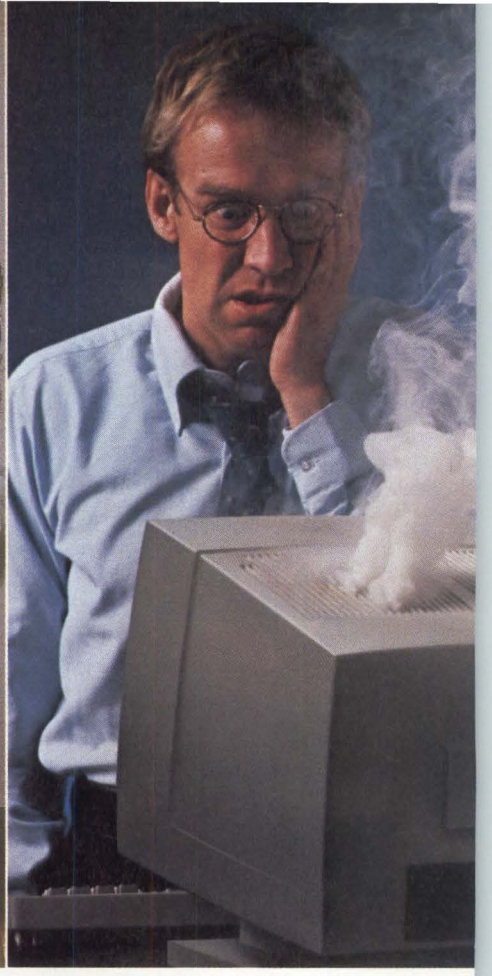
CIRCLE NO. 67 ON INQUIRY CARD



A. Once you're in the dark?



B. During a total memory loss?



C. After the smoke clears?

When is the right time to buy a UPS?

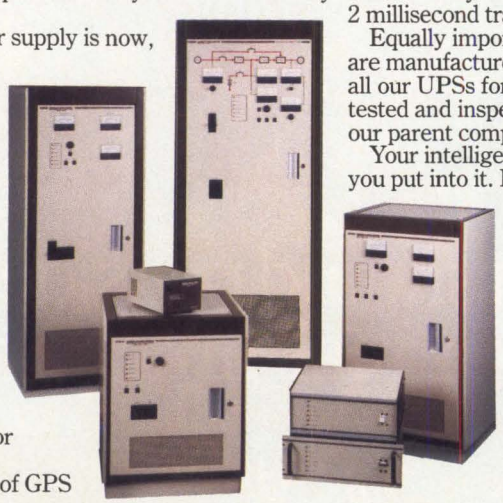
D. None of the above.

Don't wait for a power outage to blackout your vital system data—or high frequency noise to scramble your memory—or high line voltage or a sudden spike to blow your fuses or melt your wires!

The time to buy an uninterruptible power supply is now, before power problems cause inefficient, even catastrophic damage to your microprocessor-based installation. And the high-quality source for UPSs is General Power Systems, manufacturer of the industry's most complete line of uninterruptible power supplies.

GPS has the exact UPS you need to protect your data, your system and your production. On-line units range from 500VA to 50KVA and standby models from 100VA to 2KVA. Many features like battery backup, usually sold as extras, are standard on GPS models. Plus a wide range of options allows you to specify a virtually custom unit at an off-the-shelf price. In addition, GPS will tailor designs for OEM applications.

State-of-the-art operating characteristics of GPS systems give you the most for your money.



All-transistor technology, pioneered by GPS, means optimum reliability, control and ease of operation. Our on-line models are noted for their unusually fast transient response and excellent efficiency while standby units have set the industry standard with fast 2 millisecond transition time.

Equally important, UPSs from General Power Systems are manufactured to unmatched quality standards. In fact, all our UPSs for commercial users are designed, produced, tested and inspected to the same stringent standards as our parent company's line of defense products.

Your intelligent system is only as reliable as the power you put into it. Don't wait for a catastrophe. This is the time to call or write for full information. General Power Systems, 1400 N. Baxter St., Anaheim, CA 92806-1201, (714) 956-9321, (800)854-3469, in California (800) 824-8912, TELEX 182283.

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See General Power Systems at Comdex/Fall 1985, Booth 630

CIRCLE NO. 58 ON INQUIRY CARD

VARs TAKE CENTER STAGE AT COMDEX/FALL '85

Concentrating on value-added resellers' market influences, Comdex/Fall offers strategic guidelines

Lynn Haber, Associate Editor

The changing role of the computer industry's independent value-added resellers and their impact on the maturing small-computer marketplace will dominate Comdex/Fall '85. The seventh annual industry conference takes place Nov. 20 to 24 in Las Vegas.

About 11,000 exhibitors will display diverse computer-related wares. Also scheduled are 32 conference sessions on relevant business, marketing and finance issues. These conference sessions divide into six tracks: "Industry Issues," "Survival Strategies for Tough Resellers," "Caterpillar to Butterfly: Retailers Become VARs," "Comdex Forecasts '86," "Sales and Marketing" and "Product Trends."

John Young, president of Hewlett-Packard Co., Palo Alto, Calif., will deliver the keynote address. Young will look at the evolution of the marketplace, focusing on what vendor's must do to survive rapid technological innovation within a fickle market environment.

VAR discussions are key

Three sessions of special interest to VARs under the heading of "Survival Strategies for Tough Resellers" are: "The Use and Abuse of the Distributor Channel," "How VARs Can Achieve Self-Funding" and "Survival Strategies for VARs: Joint Ventures, Mergers and More." The third session features David Gold as session chairman. Gold is an investment manager with the IndoSuez Technology Group, a venture capital company in Menlo Park, Calif. He notes that the industry is in a period of consolidation. He plans to outline a few strategies for vendor survival, which include finding a specific market focus, raising capital as a pre-emptive survival measure and the pros and cons of mergers and joint ventures.

Jack B. Smyth, vice president of Software Access International, Mountain View, Calif., will coordinate "The Use and Abuse of the Distribution Channels." Two hardware and two software companies are represented on the four-member panel. According to Smyth, some obvious concerns are: how to market via distribution channels, how to get maximum use from them and under what circumstances they are beneficial and why.

Computer-industry consultants Paul Conover and Richard Brown of Conover-Brown Inc., Sudbury, Mass., will co-chair a session on "How VARs Can Achieve Self-Funding." At a time when traditional financial channels such as venture-capital and commercial-loan sources are

Although product introductions at trade shows this year have been disappointing, attendees this fall can expect at least a few noteworthy items.

reluctant to back computer-equipment resellers, it is important that the VARs learn how to fine-tune their own operations, says Conover. Quoting his partner, Brown, Conover says, "It's better to be a profitable $18 million business than to lose money on sales of $28 million." According to Conover, because most dealers sell commodity products at commodity prices, there's not enough margin for survival, let alone growth.

New products inspire hope

Although product introductions at trade shows this year have been disappointing, attendees this fall can expect at least a few noteworthy items.

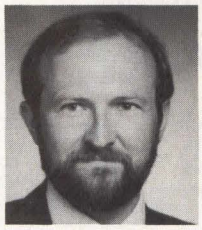
For one, L/F Technologies, Carson City, Nev., formerly IMS International, will exhibit a family of multiuser microcomputers. Called the 1600 series, the units can be ordered in four multiuser, multiprocessor configurations, handling up to 16 users. Each system utilizes an Intel Corp. 80186, 8-MHz CPU with up to 1M byte of RAM. An 85M-byte Winchester is also included. A fully configured system sells for $8,620.

Retix Inc., Santa Monica, Calif., will introduce software and hardware products, all of which conform to open systems interconnection protocol specifications that enable users to link Retix systems to others that implement standard protocols. Licenses for both source and binary code are available.

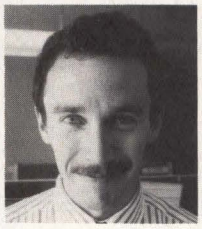
Retix hardware includes three network controller cards for AT&T Co.'s StarLan network. The PC-10 is a non-intelligent network controller for IBM Corp. PC and compatible computers, the PC-20 is an intelligent network controller for PCs and compatibles and the MB-20 is Retix's intelligent controller for a Multibus StarLan connection. According to a company spokesman, Retix will introduce in early 1986 a Unibus card for StarLan, to support large computers such as Digital Equipment Corp. VAXes. Prices for the hardware range from $300 to $800. □

Interest Quotient (Circle One)
High 489 Medium 490 Low 491

Concurrent™ PC DOS Works For These People



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



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

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

"I couldn't live without the product. Time is money and the ability to switch consoles and run more than one program has been a great time saver."
Joe Capp
Project Engineer
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"We have created a menu driven system that is totally transparent to our customers. By utilizing the menu system and 4 consoles concurrently we are able to fully utilize Concurrent PC DOS"
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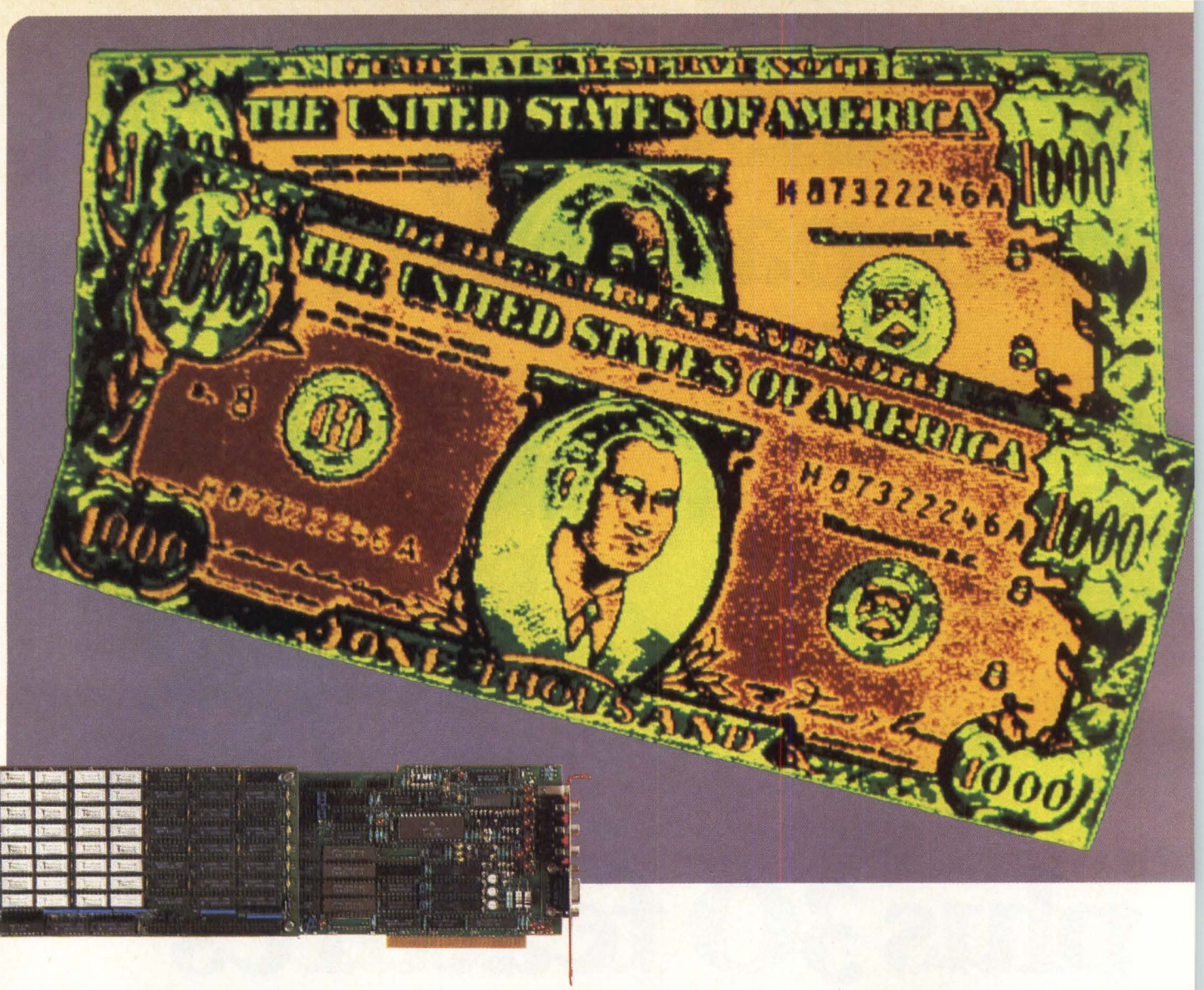

PC Imaging ... $1995.00

- 512 x 512 x 8 frame buffer (PIP-512)
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- 256 colors/gray shades
- 16.7 million color output lut
- Real-time 8-bit frame grab
- DMA image transfer — IM pixels/sec.

Matrox now offers two new image processing boards, th PIP-512 and PIP-1024. The PIP series of boards provide complete 8-bit image acquisition, frame buffering, and display capability for the IBM PC. A PIP board upgrades t PC, XT or AT into a LOW COST, PROFESSIONAL image processing workstation.

The PIP boards have all the high performance features characteristic of top-of-the-line image processing system with one exception: price.

The PIP-512 sells for only $1995.00 in single quantity.

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CIRCLE NO. 79 ON INQUIRY CARD

NEW PRODUCTS

SYSTEMS

Eileen Milauskas, Assistant Editor

Digitizing system converts graphics, text

- Nine-track tape
- 19-inch display
- Scanner unit

The series 3000 Scanning and Conversion System converts a large inventory of existing drawings into a computer database for use in CAD/CAM systems. Scanning the drawings, the system captures graphics and text. The system consists of two components: the scanner unit and the drawing processing station. The scanner unit contains a document-transport mechanism and multiple electronic cameras. The drawing-processor station consists of the processor; 30M-byte fixed and 1.2M-byte, 5¼-inch, flexible disk drives; keyboard; mouse and a nine-track magnetic tape unit and a 19-inch, color graphics display terminal. A dynamic image memory holds the raster image for a large-size drawing. The system provides formatted raster and/or vector data for transfer to host systems. **Optigraphics Corp.,** 9339 Carroll Park Drive, San Diego, Calif. 92121, (619) 292-6060.

Circle 300

Supermicros serve networking applications

- UNIX System V
- Eight to 16 users
- 2M- to 3M-byte memory

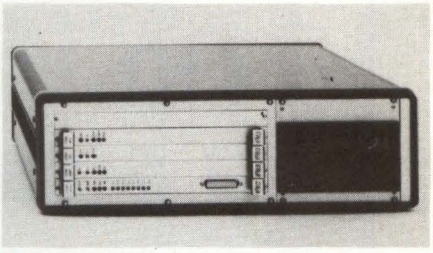
Suited for data-based transaction and network applications, the DataSeries family of supermicrocomputers is based on the Multibus architecture. The systems use UNIX System V as the standard operating system and employ the MC68010 CPU running at 12.5 MHz and supporting 1M to 4M bytes of memory and up to 8M bytes of Multibus memory. The eight-user DataMate system comes with 2M bytes of main memory; 96K bytes of Multibus memory; a 72M-byte, Winchester disk drive with a 30-msec average access time; a 1M-byte flexible disk drive; 10 serial ports; and a Centronics parallel port. The system will also support a 45M-byte, quarter-inch, cartridge-tape backup unit. Configured similarly to the DataMate, the DataManager connects up to 16 IBM PCs or PC-compatibles. It is an expandable system with space for up to three 5¼-inch Winchester disk drives or two drives and a 45M-byte cartridge-tape unit. The system also supports a half-inch, reel-to-reel, external tape drive and a 474M-byte, SMD disk subsystem. Networking up to 32 systems, the DataMaster stores 3M bytes of memory and 512K bytes of Multibus memory. A 334M-byte, 8-inch, SMD disk drive operating at a 25-msec average access time provides internal storage. Equipped with a 1M-byte, flexible disk drive, the system can add another drive or a 45M-byte, quarter-inch cartridge tape. An Ethernet controller board, two serial ports, one parallel port and a 15-slot, Multibus card cage are standard. $11,750, DataMate; $15,995, DataManager; $28,995, DataMaster. **CYB Systems,** 2215 W. Braker Lane, Austin, Texas 78758, (512) 835-2266.

Circle 301

Development system is VMEbus-based

- 1M-byte main memory
- 22M-byte Winchester
- Two users

A two-user, VMEbus development system, the microFORCE-1 implements AT&T's UNIX V, Release 1.0 on the Motorola MC68010 microprocessor. It



comes with 1M byte of main memory, four serial I/O channels, one printer and one communications port. A 32K-byte static RAM with no-wait states allows high-speed operation of the UNIX kernel. Mass memory includes a 5¼-inch, flexible disk and a 5¼-inch, 22M-byte, Winchester disk. One open slot for the user application board accommodates additional memory. $5,995. **Force Computers Inc.,** 727 University Ave., Los Gatos, Calif. 95030, (408) 354-3410.

Circle 302

Business system supports four users

- 20M-byte, rigid disk
- 1.2M-byte, flexible disk
- 512K-byte RAM

The Cado Tiger AT/4 four-user system utilizes the 80286 microprocessor and contains 512K bytes of memory, expandable to 3M bytes. It comes with a 20M-byte, rigid disk drive and a 1.2M-byte, flexible disk drive. A second 20M-byte rigid disk and a second 1.2M-byte or 360K-byte flexible disk drive can be added. Compatible with the IBM PC/AT, the system utlizes the proprietary Cados operating system, which runs coresident with DOS. Both color and monochrome monitors, displaying 25 lines by 80 characters, are available with the system. Monochrome monitor graphics resolution is 720 by 348 pixels; the color monitor's two-color graphics resolution is 640 by 200 pixels. $6,165. **Cado Systems Corp.,** 2055 W. 190th St., P.O. Box 3759, Torrance, Calif. 90510, (213) 323-8170.

Circle 303

Parallel processing offered by 32-bit system

- 4 to 22 MIPS
- Control/diagnostic system
- 16K-byte cache

The 3280 multiprocessor, 32-bit system optimizes transaction-processing, data-communications, software-development and number-crunching applications. Based on a 3280 CPU, the asymmetric system supports up to five attached processors, which perform I/O operations or computation. The CPU includes a 64-bit, integral floating-point processor and a control/diagnostic system (CDS). The processor is rated at 4 MIPS. A fully configured, six-processor system performs at 22 MIPS. Memory capacity begins at 2M bytes, expandable to 16M bytes. Each composite memory module (CMM) has its own on-board controller, supporting two- or four-way interleaving among multiple CMMs for concurrent memory access. A four-stage instruction pipeline overlaps the execution of four consecutive instructions. Up to four 10M-byte-per-second direct-memory interface units, capable of suppporting up to eight selector channels each, allow for 32 concurrent block transfers of data. Two 8K-byte cache memories reduce data traffic. Running the proprietary OS/32 operating system, the system supports the FORTRAN VII, COBOL, C, RPG II, Pascal, CORAL 66 and BASIC II. $250,000. **Perkin-Elmer Corp.,** Data Systems Group, 2 Crescent Place, Oceanport, N.J. 07757, (201) 870-4712.

Circle 304

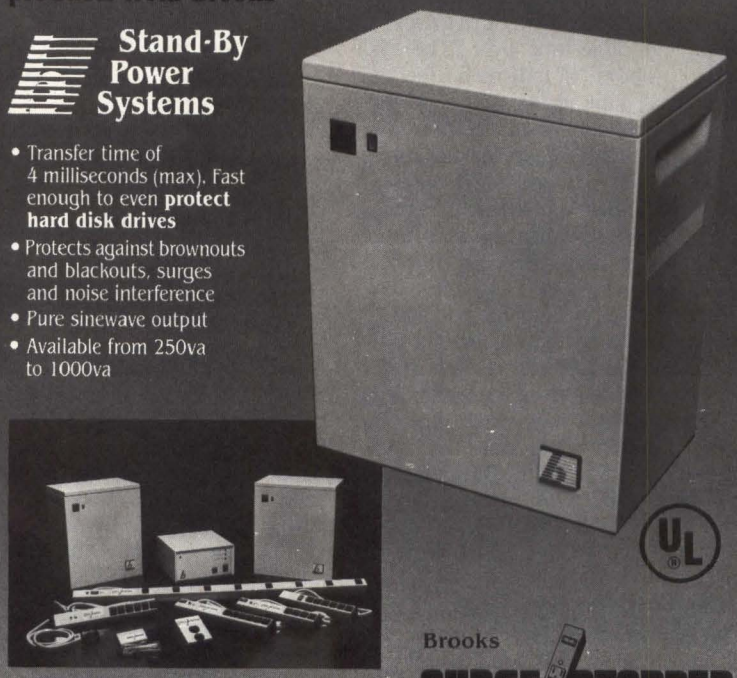
Do you have a solution for power problems?

You work hard to find the right hardware and software to satisfy your client's needs. But if you don't include power conditioning, your efforts can be destroyed. After installation, your system can be plagued by software "glitches", RAM "wipeouts", and system "crashings" caused by electrical surges and/or power failures. Worst of all, clients lose confidence in you.

Protect your reputation with dependable power conditioning products from Brooks

Stand-By Power Systems

- Transfer time of 4 milliseconds (max). Fast enough to even **protect hard disk drives**
- Protects against brownouts and blackouts, surges and noise interference
- Pure sinewave output
- Available from 250va to 1000va



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See us at COMDEX/Fall '85

Booth #3021

Workstation provides two emulation modes

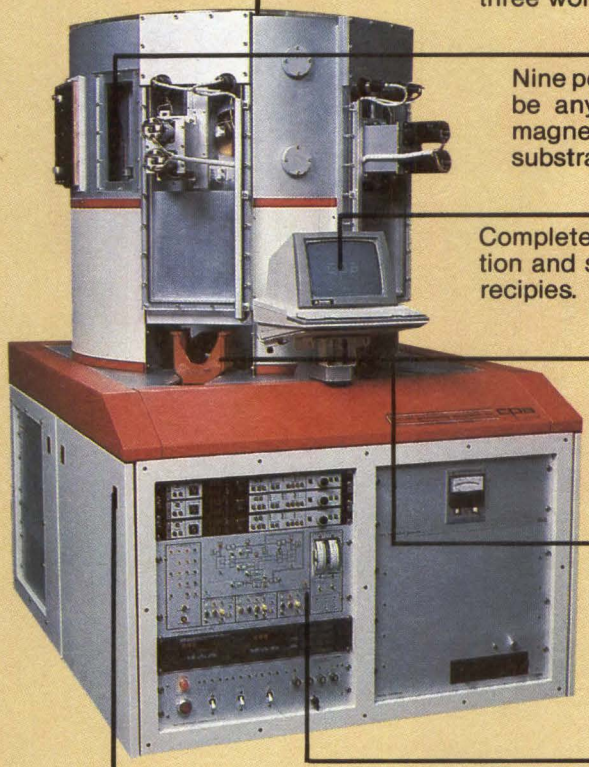
- IBM 5080, 3250 emulation
- 2-D, 3-D transformations
- Real-time clipping

Handling up to four users, the DS 1500 offers multiple operating personalities. The system switches from IBM 5080 terminal emulation to IBM 3250 emulation or to the proprietary Prism mode as well as between IBM and DEC hosts. While operating in 5080 mode, the system performs at speeds up to eight times faster than the IBM system and comes with up to eight times the display list memory as the 5080. Performing 2-D and 3-D transformations in hardware, the system can scale, translate and rotate a 3-D vector in 1 msec. Other capabilities include real-time clipping, depth cuing and backface test. The system incorporates a graphics-processing and a display-generation subsystem for graphics. The display generator performs vector-to-raster conversion at 12 million pixels per second. Four 1,024-by-1,024-pixel planes are standard with the system, permitting as many as 16 colors. Containing as many as 8K bytes of display-list memory, the workstation comes with 512K bytes of dual-ported memory, expandable to 4M bytes. With a DMA interface, the system transfers data at a rate of 2.5M bytes per second. $17,150. **Spectragraphics Corp.,** 10260 Sorrento Valley Road, San Diego, Calif. 92121, (619) 450-0611.

Circle 305

Compare the quality, throughput and reliability of the C/C 100

The C/C 100 started with the same commitment to quality workmanship and reliabilty built into CPA's other sputtering systems. CPA then depended on 25 years of in-field experience to guide every aspect of design. Using proven components, CPA has obtained the maximum throughput and up-time.



Sputter etch capability for use in up to three work stations.

Nine potential work stations that can be any combination of RF or DC magnetron sputtering targets or substrate heaters.

Complete computer controlled operation and storage capability for various recipies.

Cassette-to-cassette single wafer loading and unloading to handle 4", 5", or 6" wafers.

Throughput of 120 wafers per hour based on depositing 1 micron of aluminum using 4 targets.

CPA controllers have been field proven on previous systems.

Wall-mounted option so footprint in clean room is only 6" x 4½'.

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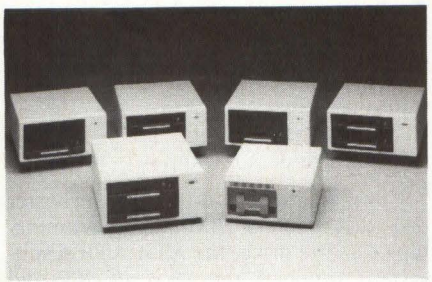

Half-height drives complement IBM PC/XT

- 10M to 40M bytes
- 35-, 38-msec access time
- 1.13M-bps transfer rate

Four half-height, Bernoulli Box subsystems with a data-transfer rate of 1.13M bps match the IBM PC/AT and complement the IBM PC/XT. The 10M-byte, single-drive and 20M-byte, dual-drive subsystems achieve an access time of 35 msec. The 20M-byte, single-drive and 40M-byte, dual-drive subsystems offer a 38-msec average access time. The Bernoulli Box, combining Winchester drive and removable-media features, resists head crashes and problems caused by vibration and contamination found in rigid disk drive systems. $2,695, 10M-byte version; $3,695, 20M-byte version; $3,295, 20M-byte version; $4,495, 40M-byte version. **Iomega Corp.,** 4646 S. 1500 W., Ogden, Utah 84405, (801) 399-2171.

Circle 306

Compact disk drive stores 600M bytes

- 120-mm disks
- Optical data recording
- 150K bytes per second

Accessing up to 600M bytes of digitally encoded data on 120-mm, single-sided, compact disks, the CM 100 ROM drive works with minicomputers. One single-sided compact disk stores the contents of 1,200 flexible disks and provides an average access time of 1 second. Errors occur less than once for every 10^{16} bits read. Optical data recording permits the storage of 230,000 text pages—accommodating the entire contents of the *Encyclopedia Britannica.* Track-to-track access time is 1 msec; data-transfer rate, 150K bytes per second. $1,500. **Philips Subsystems and Peripherals Inc.,** 100 E. 42nd St., New York, N.Y. 10017, (212) 850-5125.

Circle 307

Tape subsystem supports IBM PC

- Nine tracks
- 130M-byte storage
- Half-inch tape

A 9-track, half-inch magnetic tape subsystem for the IBM PC, PC/XT and

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CIRCLE NO. 83 ON INQUIRY CARD

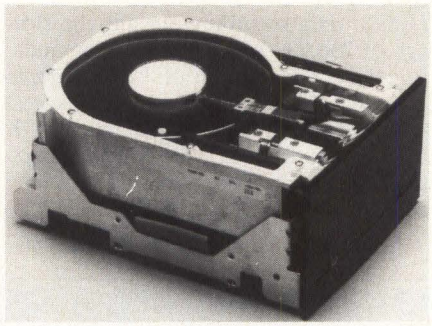
PC/AT, the TS-100 consists of the proprietary PCT-1000 Mainstreamer Tape Transport and the PCI-100 interface. The interface plugs into a PC expansion slot and addresses up to eight tape-transport units. Storing 130M bytes of data on a 10½-inch reel, the unit transfers data at 160K bytes per second. Recording formats available are 1,600 and 3,200 bpi and IBM- and ANSI-compatible. $5,950. **IBEX Computer Corp.,** 20741 Marilla St., Chatsworth, Calif. 91311, (818) 709-8100.

Circle 308

Winchesters store 117M, 160M bytes

- 20-msec access time
- ST412/506 interface
- 10,924 bpi

Employing the ST412/506 interface, the models 514 and 519 5¼-inch, half-height Winchester disk drives store 117M and 160M bytes, unformatted. They access data in 20 msec, use carbon-over-



coated, thin-film, metallic media, and employ modified frequency modulation data recording. For data protection, the drives utilize linear, voice-coil technology; a full-track servo system; dedicated head landing zone; and internal self-test capability. Incorporating 1,224 cylinders, the drives offer 1,070 tpi and 10,924 bpi. Data-transfer rate is 5M bps. $1,910, model 519; $1,750, model 514. **Priam Corp.,** 20 W. Montague Expressway, San Jose, Calif. 95134-2085, (408) 946-4600.

Circle 309

Subsystem works with IBM PC/XT

- 10M-byte disk
- 20M-byte tape
- Automatic data backup

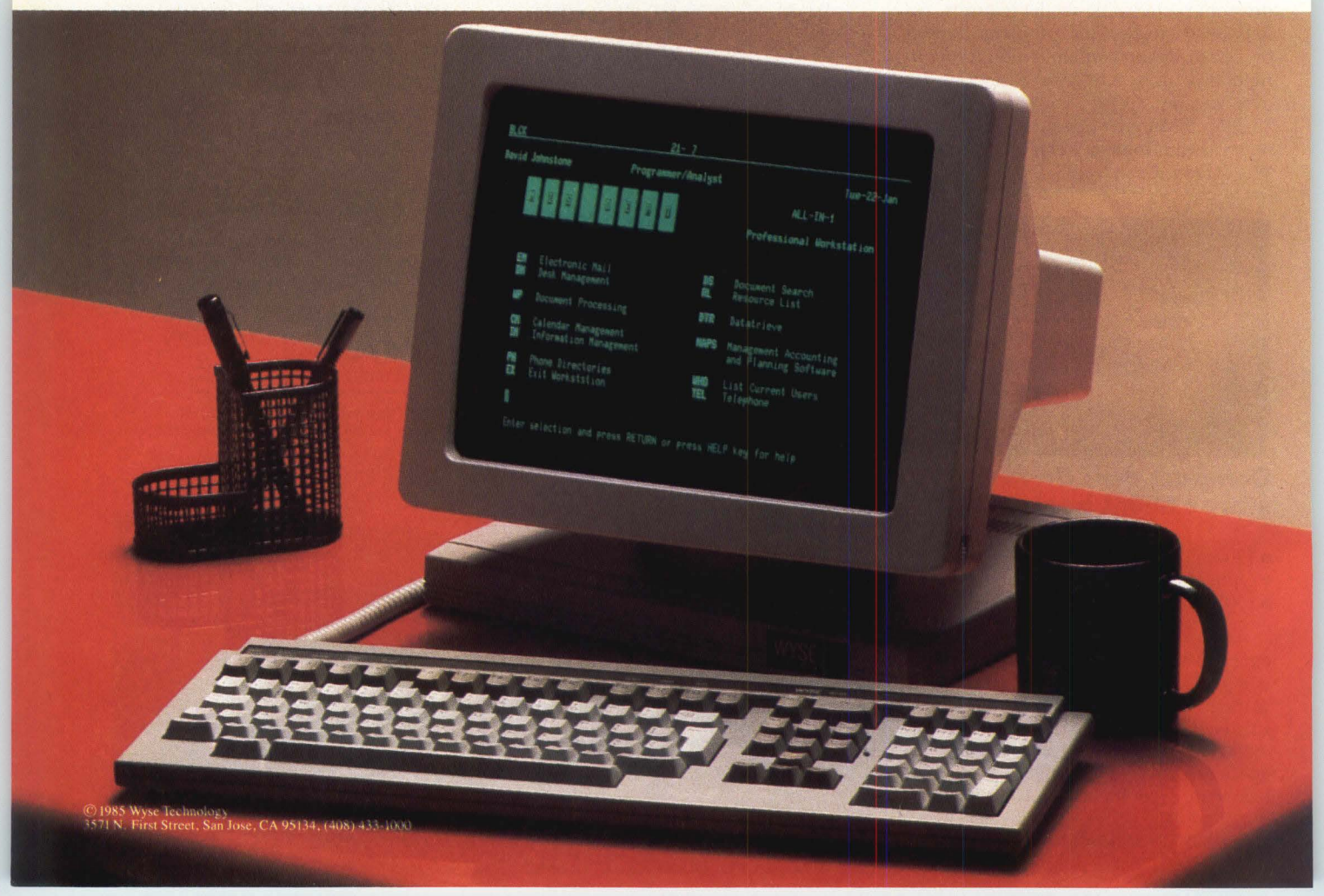
Consisting of a 10M-byte Winchester disk drive and a 20M-byte, streaming-tape cassette drive, the XT-EXTRA subsystem supports the IBM PC/XT and compatibles. Features include verification-on-the-fly, automatic data backup, both mirror-image and file-by-file backup and the capability to restore data to a different disk. $1,395. **Sysgen Inc.,** 47853 Warm Springs Blvd., Fremont, Calif. 94539, (415) 490-6770.

Circle 310

Tape backup holds 30,000 DOS files

- 134M bytes
- 32 tracks
- 140,000 addressable blocks

Capable of storing 30,000 DOS files,



© 1985 Wyse Technology
3571 N. First Street, San Jose, CA 95134, (408) 433-1000

the Data Library file-addressable, tape-cartridge backup system for networked personal computers emulates a hard disk, utilizing MS-DOS commands. Cartridges for the unit offer a formatted capacity of 134M bytes, 32 tracks and 140,000 addressable blocks. Internally certified and verified tapes provide data integrity. An error correction/detection feature reduces errors to less than one in 100 billion bits. The system interfaces to Novell's "Netware" software. $4,495. **Advanced Digital Information Corp.,** P.O. Box 2996, Redmond, Wash. 98013, (206) 881-8004.

Circle 311

Storage unit supports eight IBM PCs

- 8-inch disk drive
- 160M, 292M bytes
- ¼-inch tape drive

Supporting up to eight IBM PCs or PC-compatibles from 125 feet away and up to two Centronics-type printers or plotters, the ClusterTower mass-storage unit also provides shared access to software programs and electronic mail capabilities. The unit consists of a proprietary 8-inch Winchester disk drive in formatted capacities of either 160M or 292M bytes, a ¼-inch streaming tape drive, power supply, eight workstation connectors, two printer connectors and two IBM PC interface cards. The hard disk can be partitioned into 24 volumes per user with a maximum of 33M bytes per volume. Volumes are defined as private, shared or commmon. $10,995, 160M-byte version; $13,995, 292M-byte version. **Priam Corp.,** 20 W. Montague Expressway, San Jose, Calif. 95134, (408) 946-4600.

Circle 312

Tape drive stores 60M bytes

- 2M bytes per minute
- Error correction
- Image copy, restore

Meeting backup requirements for database and spreadsheet applications, the

HP9142A ¼-inch, streaming-tape drive stores 15M to 60M bytes of data per cartridge at 2M bytes per minute. Each tape cartridge can be partitioned into one, two or four volumes, each accessible by a separate directory. The drive provides image copy and restore, selective file-by-file copy and restore and file-by-file restore from an image copy. The unit emulates a hard disk using PC-DOS commands and accesses files from tape. Features include off-line tape formatting and media monitoring. $1,690. **Hewlett Packard Co.,** 1820 Embarcadero Road, Palo Alto, Calif. 94303. Phone local outlet.

Circle 313

DEC VT-220 compatibility, Wyse-style.

At $799 our WY-85 gives you complete DEC VT-220™ software compatibility in function and fit, plus a form that beats all, for a price that beats all.

Like all our terminals, the WY-85 packs all the ergonomic features you want into an unusually small footprint. The generous 14″ non-glare screen tilts, swivels, and handles a full 132-column format. Even the sculpted, low-profile keyboard adjusts for perfect fit and easier function.

So you get not just emulation, but the full operational compatibility you're looking for, including keyboard layout. For a lot less money, in a lot less space, with a lot more style.

No wonder Wyse terminals are now on more than 250,000 desktops worldwide.

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CIRCLE NO. 85 ON INQUIRY CARD

Comdex Booth #1516

Dot-matrix printer achieves 200 cps

- Seven colors
- Automatic sheet feeder
- Three font styles

Using a 12-needle printhead, the Office Systems Printer (OSP) runs at 200 cps, draft quality and 100 cps, near-letter quality. Three resident font styles use the 0-225 addressing structure for 7- and 8-bit data. Eight- and 12-pin, bit-image modes execute graphics output and seven-color printing. Up to 136 columns can be printed on cut-sheets or tractor-fed paper when using the 12-cpi compression. An automatic sheet feeder is standard. $800. **Newbury Data Recording Ltd.,** 20 Vernon St., Norwood, Ma. 02062, (617) 551-0280.

Circle 314

Printer offers eight print modes

- 270 cps, draft
- 60 cps, letter-quality
- 226 columns

Achieving a 4,500-hour MTBF, the Companion 34LQ dot-matrix printer is IBM PC-compatible with RS232C and RS422A interfaces. It prints in draft mode at 270 cps and letter-quality mode at 60 cps. With a column width of 132 at 10 cpi and 226 columns at 17.1 cpi, the printer uses a nine-needle printhead and a 9-by-11-dot matrix conformation. Eight print modes include pica, elite, elongated, compressed, underlining, emphasized, double-strike and letter-quality. Bit-image, software-addressable densities are 60, 72, 80, 90, 120 and 240 dpi. The printer emulates Epson and Diablo graphics modes, performing line graphics and mosaic graphics. Providing an original and up to four copies, it accommodates multipart forms and invoices. A 1K or 4K buffer is standard. Paper width is 3 to 15 inches, continuous fanfold, using friction or tractor feed with top or bottom feed. $1,599. **Diablo Systems Inc.,** 901 Page Ave., P.O. Box 5030, Fremont, Calif. 94537, (415) 498-7000.

Circle 315

Daisywheel printer runs at 35 cps

- Diablo 360 emulation
- 2K-byte buffer
- Path-seeking logic

The Alphapro 401, a 35-cps, daisywheel printer, emulates the Diablo model 630 printer protocols and includes a bidirectional forms tractor that speeds document handling. Providing path-seeking logic and a 2K-byte, memory buffer, the unit supports proportional spacing, boldface, overprinting, superscripts and subscripts, and single-pass underlining. It accommodates paper up to 15.7 inches wide and includes both Centronics and RS232C interfaces. Operator controls consist of line and forms feed, self-test and top-of-form. $599. **Alphacom Inc.,** 2323 S. Bascom Ave., Campbell, Calif. 95008, (408) 559-8000.

Circle 316

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TCP/IP for VAX/VMS™
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for $8,795

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Excelan also offers similar packages for DEC PDPs, UNIX supermicros, and the IBM PC, XT and AT.

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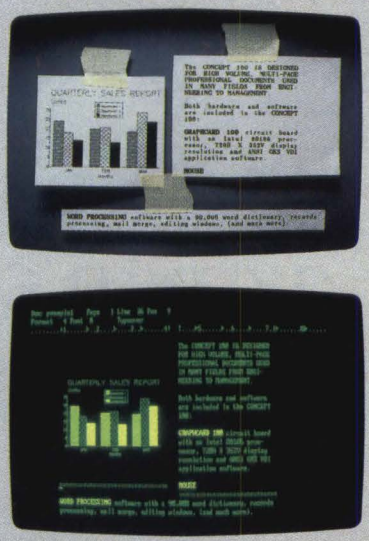
CONCEPT 100™ is based on the ANSI GKS* standard



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CIRCLE NO. 87 ON INQUIRY CARD

Terminal generates 1,024 by 780 pixels

- CAD applications
- 256K-byte RAM
- Four bit planes

Suited for such CAD applications as electrical engineering, mechanical drafting and structural analysis, the model 4111 display terminal provides 1,024-by-780-pixel resolution and a set of graphics functions such as multiple views, segments, surface support and local zoom and pan. Graphics functions such as rubber-banding, gridding, inking and a user-definable cursor are supported. RAM capacity is 256K bytes for temporary storage of picture elements; 1M byte of RAM may be added. Offering a 19-inch, color raster display with an in-line gun CRT, the unit operates at 60 Hz, non-interlaced. A 32-bit virtual graphics space provides access to 4 billion by 4 billion addressable points. Four bit planes allow simultaneous display of up to 16 colors from a palette of 4,096 separate shades. Layers may be added, subtracted or rearranged. Advanced firmware routines include segment editing, segment subroutine commands, Pick operations, host window management and pop-up menus. The keyboard contains thumbwheels for cursor control, a numeric keypad and eight dedicated, programmable function keys. A mouse, joystick or proprietary 495X series graphics tablet can be attached. $12,950. **Tektronix Inc.,** P.O. Box 500, Beaverton, Ore. 97077, (503) 644-0161.

Circle 317

Graphics terminal presents 256 colors

- 1,280 by 1,024 pixels
- 60-Hz refresh rate
- 19-inch screen

The Colorware model 1280 graphics terminal provides a viewable resolution of 1,280 by 1,024 pixels and a 60-Hz, non-interlaced refresh rate. There are nine memory planes; the ninth permits either graphic overlays or text window viewing. The graphics processor includes a palette of 16.7 million colors, of which any 256 can be simultaneously displayed. The hardware is based on a refresh buffer featuring a proprietary, bit-slice drawing accelerator, enabling drawing speeds of 50,000 short vectors per second. The pixel write and vector draw speeds are 327 nsec per pixel, with multiple write rates of 36 nsec per pixel. A 16-bit microprocessor is used for graphics processing and communication control.

A graphics protocol command set offers an additional 16K bytes of RAM for macro programming. DEC VT100 and Tektronix 4014 compatible, the terminal

ANSWERS TO OCTOBER'S PUZZLES

P	R	O	M	P	T		P	H	R	O	G	S
A		V	A		R	O	M		E		R	H
T	H	E	R	M	A	L		M		P	I	E
C	A	R		A	C		C	A	N	A	D	A
H		L	I	N	K		H	I	E	D		
I	R	A	T	E		L	I	N	E		U	P
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G	M		F	L	A	G		S	P	O	O	R
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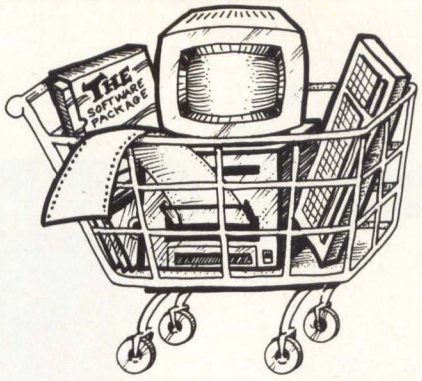

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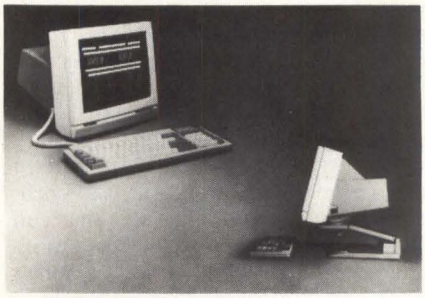
CIRCLE NO. 88 ON INQUIRY CARD

NEW PRODUCTS
TERMINALS

offers standard RS232C communications capability of 300 to 56K baud. The monitor measures 19 inches. Device drivers include RT-11, RSX-11M and VMS. Features include a screen saver, DMA port, programmable cursor, 255 user-definable symbols, RGB video output, alphanumeric fonts and hardcopy, color printer port. $18,950. **Advanced Electronics Design Inc.,** 440 Potrero Ave., Sunnyvale, Calif. 94086, (408) 733-3555.

Circle 318



ASCII terminal sends data at 38.4K baud

- 80-column display
- 41 functions
- Smooth scrolling

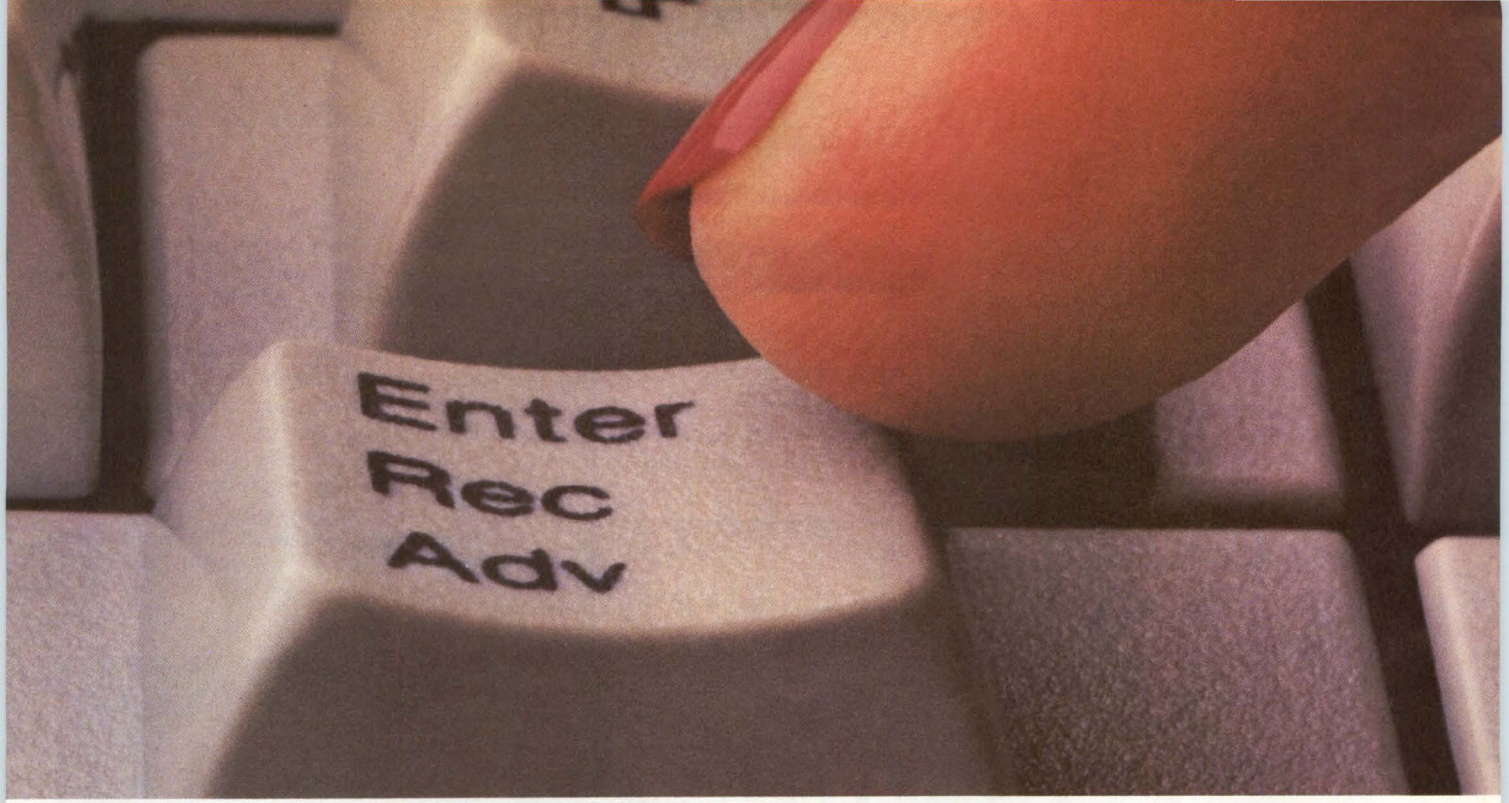
Meeting the needs of the entry-level market, the model WY-30 ASCII terminal offers a 14-inch, flat screen. The terminal is compatible with the Lear Siegler ADM 3A/5, the ADDS Viewpoint and the Televideo 925 and 910+ terminals. Communicating at 38.4K baud, the unit provides a mechanical-switch keyboard, four dedicated function keys, 41 programmable functions, 80-column display, a printer port, smooth scrolling, horizontal split-screen capability and a touch-tilt screen-tilting mechanism. $399. **Wyse Technology,** 3571 N. First St., San Jose, Calif. 95134, (408) 433-1000.

Circle 319

Terminals display 1,024 by 780 pixels

- Tektronix 4014-compatible
- Block mode
- 60-Hz refresh

The MG-600 monochrome terminal, compatible with DEC VT220 and Tektronix 4014 terminals in graphics mode, produces 1,024-by-780-pixel resolution. Its 15-inch screen uses short-persistance phosphor and offers 60-Hz, non-interlaced refresh. Features include mouse and digitizer support, block-mode trans-



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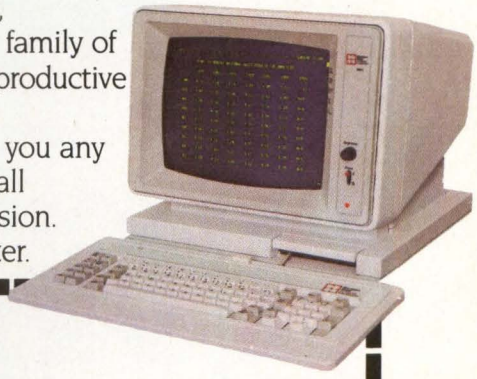

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DECIDEDLY BETTER

CIRCLE NO. 89 ON INQUIRY CARD

mission and multihosting capabilities. The model MG-420, suiting CAD applications, provides the same features as the model MG-600 but comes with a 20-inch screen. $2,895, MG-600; $4,995, MG-420. **Pericom Inc.,** Suite 100, 51 Digital Drive, Novato, Calif. 94947, (415) 382-8800.

Circle 320

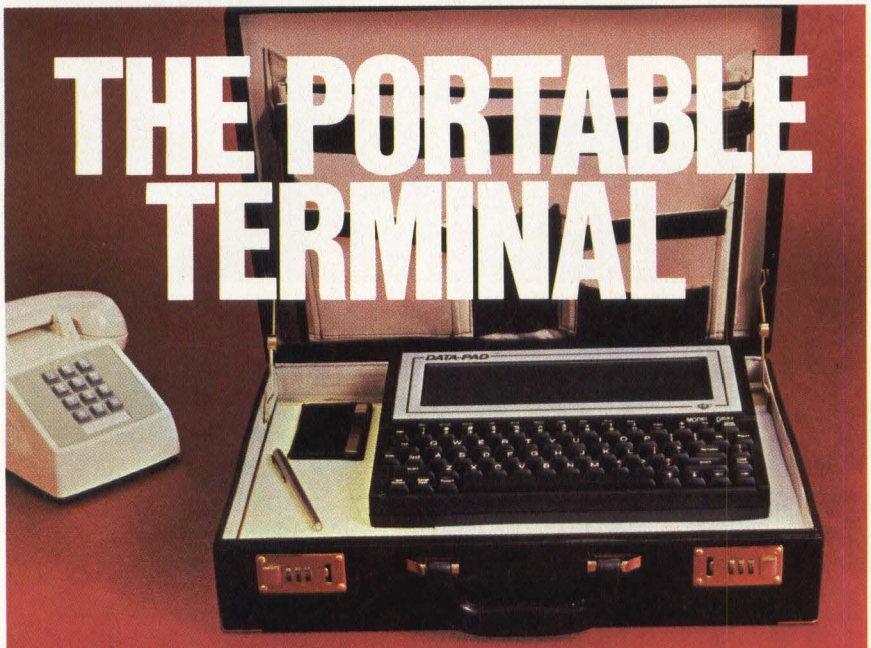
Terminal provides digital voice capability

- 19.2K-bps speed
- Full-duplex
- Keyboard dialing

The model 7404 digital voice terminal provides simultaneous voice/data transmission through one digital port in the PBX. Six multifunction buttons can be programmed for multiline appearances or repertory dialing. Four fixed-feature buttons provide hold, transfer, conference and drop functions. A Digital Data Module allows asynchronous data transmission at 19.2K bps for an associated EIA data terminal. Features include full-duplex data transmission, keyboard dialing and data metering. $700. **AT&T Information Systems,** 100 Southgate Parkway, Morristown, N.J. 07960, (201) 898-8000.

Circle 321

THE PORTABLE TERMINAL



NEW, NOTEBOOK SIZE TERMINAL PACKS MAXIMUM COMMUNICATIONS FEATURES IN MINIMUM SPACE

If you ever find yourself pushing or carrying around a desk top CRT terminal, you need a DATA-PAD™ Portable LCD Terminal. It's a terminal that's small enough to fit in your briefcase but big enough to do everything a full sized terminal does.

Perfect for factory floor applications, programmable controllers, or anywhere that portability is required.

The DATA-PAD is compatible with DEC VT100 (optional numeric keypad allows it to work with most DEC programs) and others can be customized to your preference. The adjustable viewing angle lets you read the big 80 character by 16 line display easily. And it's easily scrollable to 132 characters by 24 lines. Yet it's only 12.3″ wide by 8.9″ long by 1.5″ high.

WEIGHT: 3.25 lbs.
COMMUNICATIONS: RS-232-C, 50 to 19.2 k.Baud, 300 Baud acoustic built-in modem (optional), compatible with most external modems.
EDITING: erase to BOL/EOL, BOP/EOP; double high/ double wide characters.
EMULATIONS: (keyboard selectable) DEC VT100/VT52*, Televideo* TV910, Lear Siegler ADM 34/5, Hazeltine 1400/10, ADDS 20/25.
OEMS: Inquiries welcomed. TEC has been manufacturing for OEMs since 1958. The DATA-PAD can be customized to your exact needs.

* DEC VT100/VT52 are Trademarks of Digital Equipment Corporation. Televideo is a trademark of Televideo Systems, Inc.

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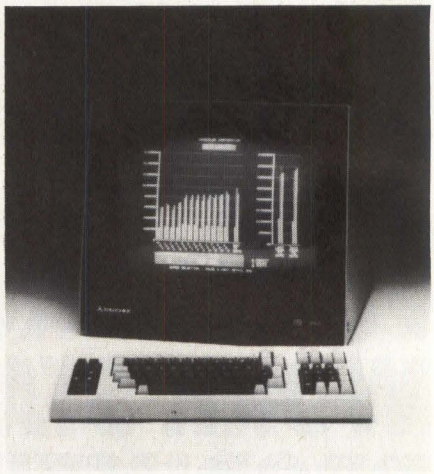

Color terminal includes one-page screen memory

- 19-inch screen
- 480 by 384 pixels
- Industrial uses

Providing one page of dot-addressable screen memory, with three additional pages available, the 8820 color graphics terminal accommodates industrial-control applications. Its 19-inch screen format is 80 characters by 48 lines with 480-by-384-pixel resolution. The terminal offers a rapid polygon-fill capability and a choice of one of eight foreground colors and one of eight background colors. Communication rates reach 38.4K baud. The preconverged CRT with auto-degaussing has a screen-saver feature selectable from an English language menu. Process symbols or full upper- and lower-case characters are selected either locally or from the host. Up to four additional user-defined character sets are available. $2,695, Q100. **Intecolor Corp.,** Intecolor Drive, 225 Technology Park, Norcross, Ga. 30092, (404) 449-5961.

Circle 322

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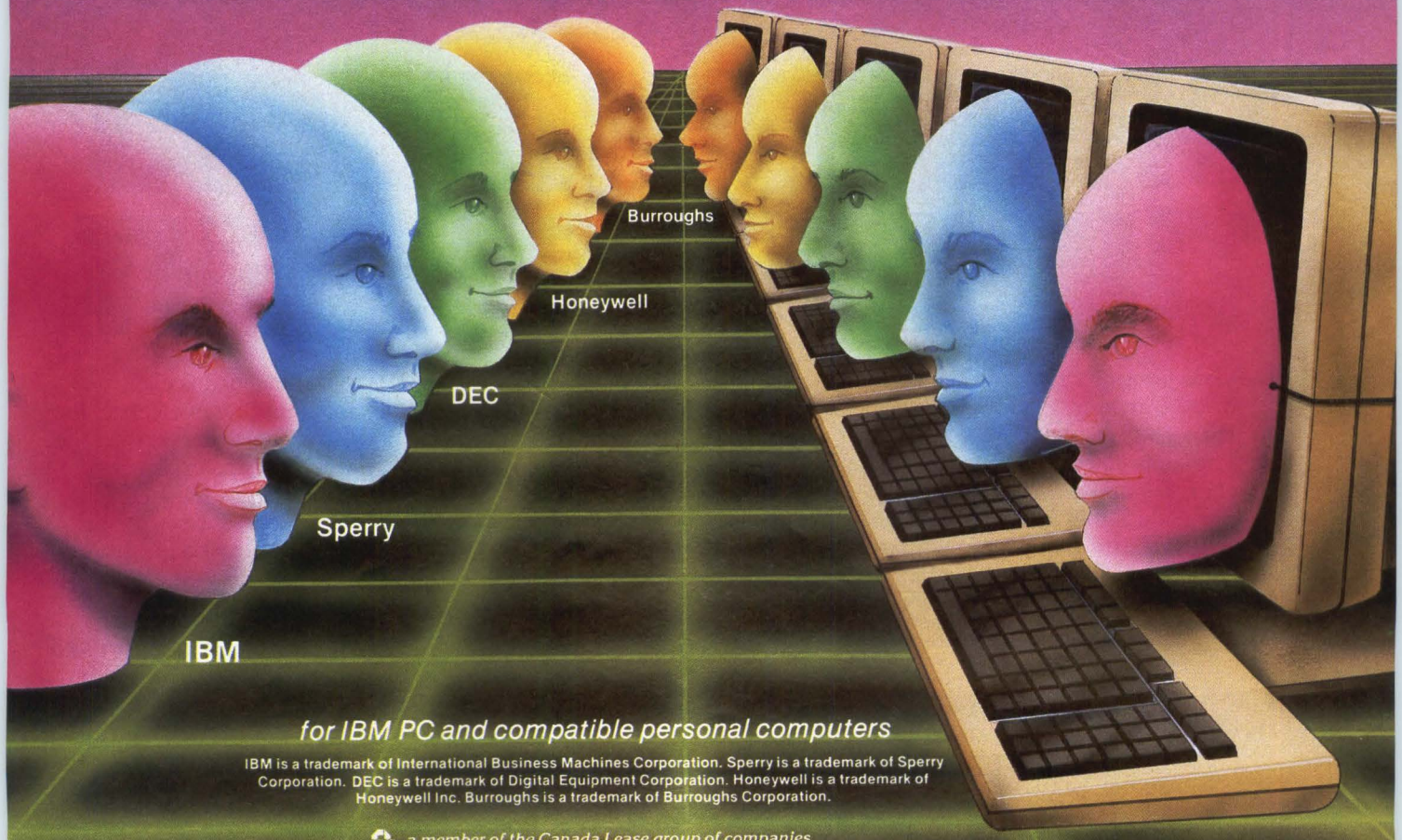

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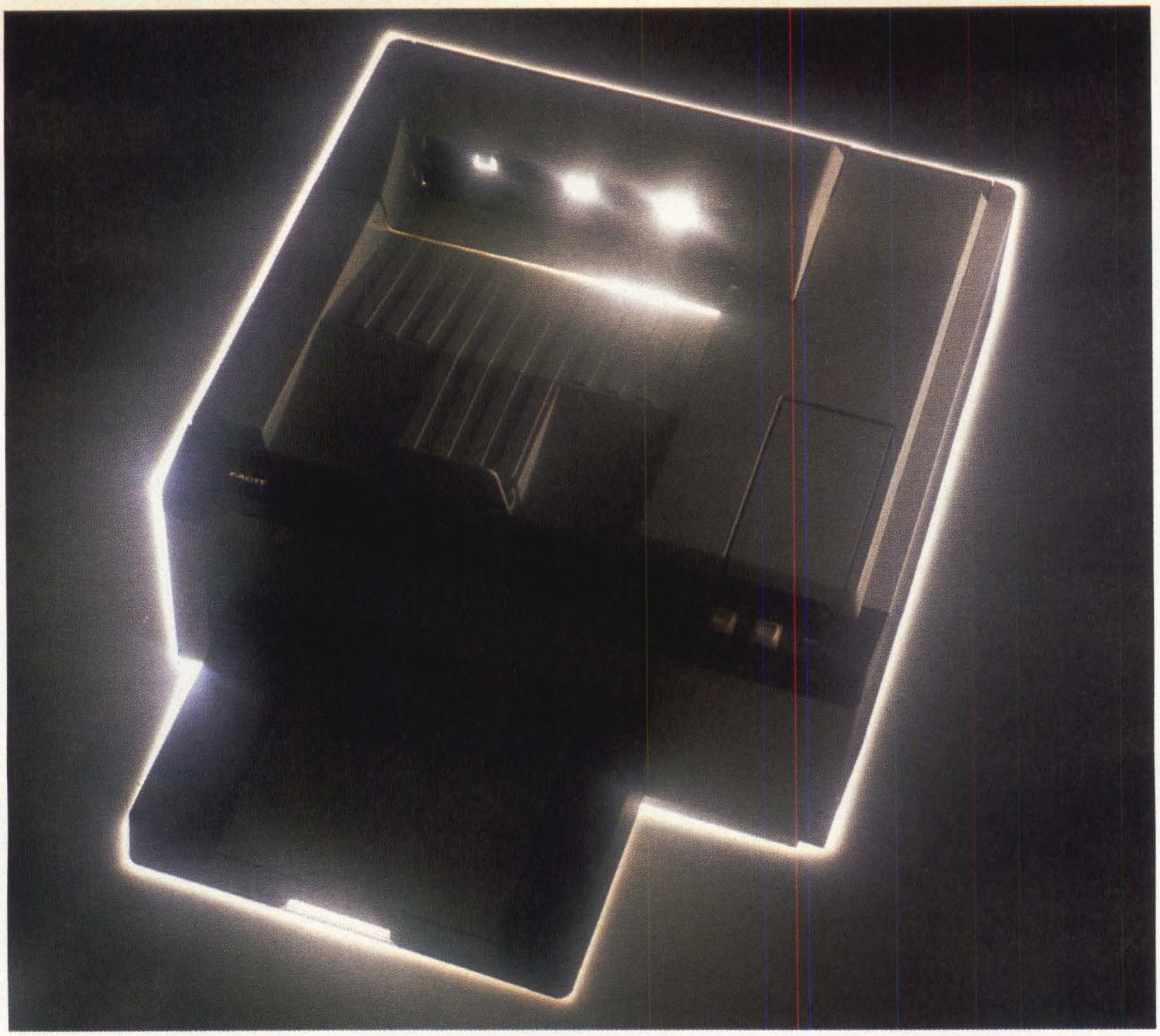

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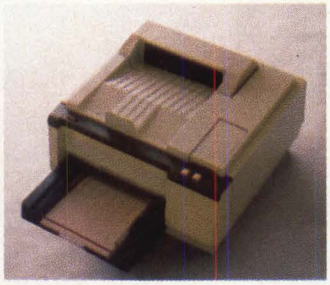

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AUSTRALIA: EAI Electronics Associates Pty Ltd., 427-3322. *AUSTRIA*: Ericsson Information Systems GmbH, 0222-613641. *BELGIUM*: Ericsson S.A., 02-243821 1. *CANADA*: Facit Canada Inc., 416-821-9400. *CYPRUS*: LBM (Lillytos) Ltd 516463 4. *DENMARK*: Facit A/S, 02-92 24 00. *FINLAND*: OY Facit, 90-420 21. *FRANCE*: Facit S.A., 1-780 71 17. *GREAT BRITAIN*: Facit, 0634-40 17 21. *GREECE*: Computer Application Co., Ltd., 01-671 97 22. *HONGKONG*: Gilman & Co. Ltd., 5-893 00 22. *ICELAND*: Gisli J. Johnsen HF, 354-17 31 11. *INDIA*: Forbes Forbes Campbell & Co. Ltd., 22-26 80 81. *IRELAND*: Ericsson Information Systems Ltd., 753093. *ITALY*: Facit Data Products S.p.A., 039-63 63 31. *JAPAN*: Electrolux (Japan) Ltd., 03-479-3411. *KOREA*: K.D.C. Corporation, 723-8555/8236. *THE NETHERLANDS*: Ericsson Information Systems B.V., 03480-709 11. *NEW ZEALAND*: Northrop Instruments and Systems, 501-801, 501-219. *NORWAY*: Ericsson Information Systems A/S, 02-35 58 20. *PORTUGAL*: Regisconta Sarl, 1-56 00 91. *SINGAPORE*: Far East Office Eqpts Pte Ltd., 745 82 88. *SPAIN*: Facit, 91-457 11 11. *SWEDEN*: Ericsson Information Systems Sverige AB, 08-28 28 60. *SWITZERLAND*: Ericsson Information Systems AG, 01-391 97 11. *WEST GERMANY*: Ericsson Information Systems GmbH, 0211-61 090.

File-transfer software offers terminal emulation

- Zoom facility
- Trace mode
- 132-column display support

SmartTerm 4014, a multifunction communications software package, enables an IBM PC to be used as a Tektronix 4010, 4012 or 4014 graphics terminal, or as a DEC VT100, VT102 or VT52 intelligent text terminal. TTY mode is included. A zoom facility supports CAD/CAM applications that require the ability to resolve Tektronix points. A picture-playback feature saves graphics to disk and redraws them off-line. A Branch-to-DOS key interrupts an ongoing terminal session and branches to DOS. Other features include 132-column display support, auto jump and trace mode. File-transfer features include capture mode, optional file-overwrite protection, directory list option, binary file receive mode, and error-free transmission. The package requires an IBM PC or compatible with 384K bytes of memory and an IBM Color/Graphics adapter. $225. **Persoft Inc.,** 2740 Ski Lane, Madison, Wis. 53713, (608) 273-6000.

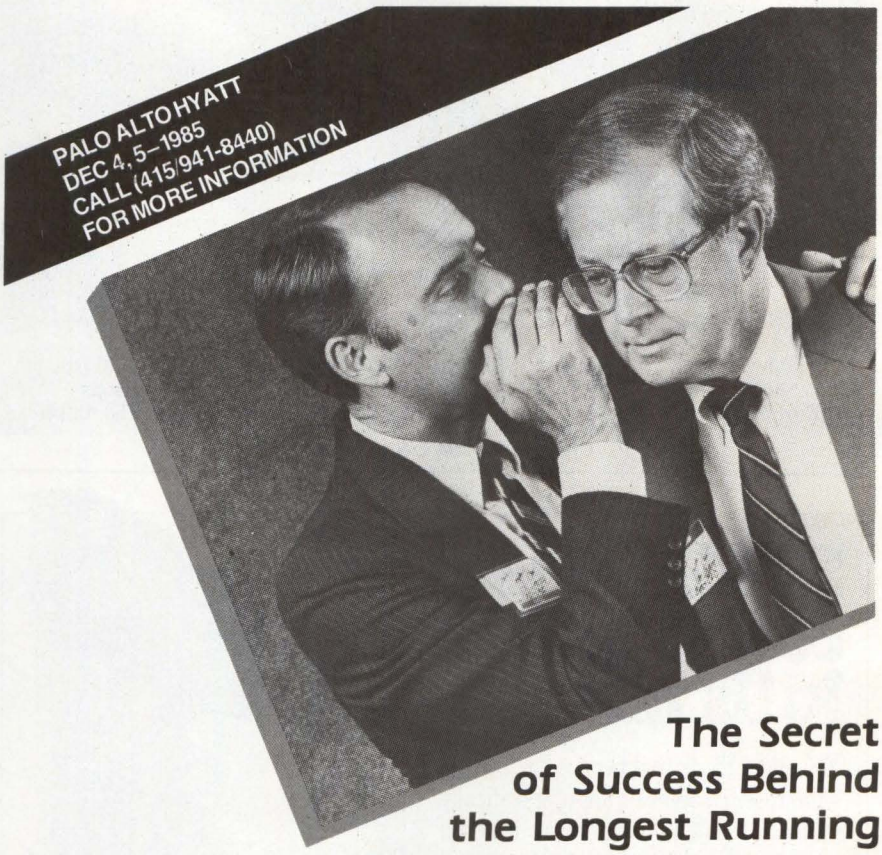
Circle 323

Software system suits IBM PC, PC/XT, PC/AT

- Four modules
- Rule-tool methodology
- ICON graphics

An engineering software system for the IBM PC, PC/XT and PC/AT, Design Graphics Software (DGS) combines expert system methodology and interactive computer graphics. The system consists of four modules. DGS/Sketch processes the design via mouse and keyboard. The screen presents facilities such as the Drawing Region, the ICON DRUM, the Navigation Region and the Function Drum. DGS/Schematic Design combines the programmer's rules with symbols and performs interactive rule checking. These include object, attribute, connect-point and text-syntax rules. DGS/Schematic Verify applies global properties to various factors. The verification process looks for errors and inconsistencies that become apparent only when multiple rules and requirements are compared. The DGS/Rule Tool module tailors the DGS system to the user's discipline. It creates symbols and methodologies and defines icons, rules and attributes. $3,500. **The Cadware Group Ltd.,** 869 Whalley Ave., New Haven, Conn. 06515, (203) 397-2908.

Circle 324



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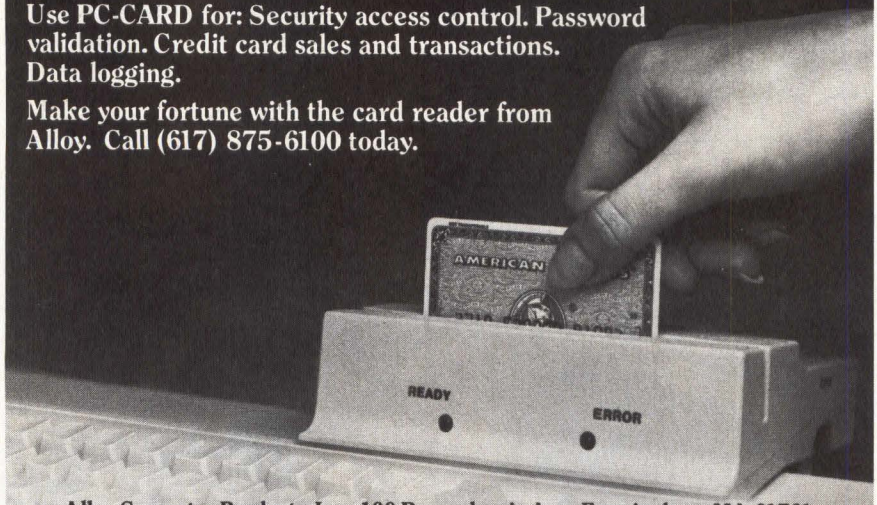

Alloy Computer Products, Inc., 100 Pennsylvania Ave., Framingham, MA 01701, (617) 875-6100, TWX: 710-346-0394; Europe: Alloy Computer Products (Europe) Ltd., Cirencester, Gloucestershire, England, Tel: 0285-68709, Tlx: 43340

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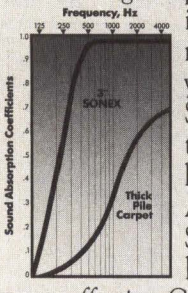

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NEW PRODUCTS
SUBASSEMBLIES

UPS suits CAD/CAM applications

- 600W
- 0.5 percent regulation
- 90 dBa

The Model 750RM uninterruptible power source protects critical loads from blackouts, brownouts, sags in voltage, overvoltage, spikes, surges, radio-frequency interference and electromagnetic interference. Its applications include single-user and multiuser systems, CAD/CAM and communications systems. Providing up to 600W or 750 VA of low-distortion, sinewave power to AC loads of any power factor or waveform, the power source incorporates a phase-locked loop for synchronized transfer and retransfer. Features include sine wave output with 0.5 percent voltage regulation; a 90-dBa, audible alarm, isolated low-level outputs for remote status display, internal self-test and over-temperature protection. $3,000. **American Power Conversion Corp.,** 89 Cambridge St., Burlington, Mass. 01803, (617) 273-1570.

Circle 325

Board provides image processing

- 8-bit, A/D converter
- 30 frames per second
- 512 by 512 pixels

Compatible with the IBM PC/AT, the FG-100-AT image-processing board digitizes analog video from RS170 video sources, processes the images in real time at 30 frames per second and displays the stored image in monochrome or pseudocolor (up to 4,096 colors). Images are combined arithmetically or logically, allowing subtraction of two images or averaging. Containing 12 bit-planes of frame memory with a spatial resolution of 512 by 512 pixels, the board offers CMOS gate arrays and an 8-bit, analog-to-digital converter for digitization of up to 256 levels of gray. Features include a dual-stage, phase-locked loop for synchronizing with video tape recorders; zooming by two, four or eight times; and single-pixel pan and scroll. $3,995, monochrome version; $4,495, pseudocolor. **Imaging Technology Inc.,** 600 W. Cummings Park, Woburn, Mass. 01801, (617) 938-8444.

Circle 326

PROVEN!

PC/FOCUS outloads, outruns, outperforms and outreports dBase III™ and R:Base™ 5000.

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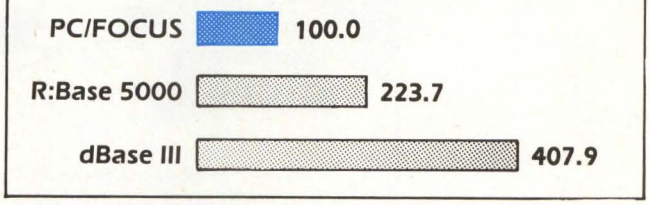
Database Loading:

In this test series, database loading time for each DBMS was measured by loading three transaction files. Eight separate test runs were conducted, with PC/FOCUS averaging 20.2% faster than dBase III,™ and 37.3% faster than R:Base™ 5000.

Database Reporting:

Report requests of various levels of complexity were run against single and multiple databases. Eighteen separate test runs were conducted, with PC/FOCUS averaging 45.2% faster than dBase III,™ and 40.0% faster than R:Base™ 5000.

REPORTING FROM DATABASES
AVERAGE ACROSS 18 TEST RUNS



There's more to the study than can be described in this ad. Lots more tests...and much more proof. So, we've reproduced the NSTL Performance Comparison in full. To obtain your free copy, just fill out the coupon and mail it to Donald Wszolek, Dept. R3 , Information Builders, Inc., 1250 Broadway, New York, NY 10001.

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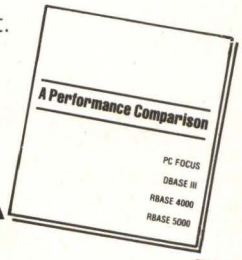

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R:Base 5000 is a trademark of Microrim.

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CIRCLE NO. 98 ON INQUIRY CARD

NEW PRODUCTS
SUBASSEMBLIES

Controller offers multiported memory

- 1,280 by 1,024 pixels
- Four bit planes
- 100-MHz bandwidth

A single-board, color graphics controller for the IBM PC, PC/XT and PC/AT, the Revolution 1280 x 4 supports raster graphics in both pixel and plane modes of buffer access. It comes with 1M byte of multiported display memory configured to an addressable window of 2,048-by-2,048-pixel resolution and a viewable, non-interlaced window of 1,280-by-1,024-pixel resolution, four bit-planes deep. Offering a 100-MHz bandwidth, the controller supports vector drawing at 17,000 color vectors per second. Bus speed is 125 nsec per pixel. Features include absolute and relative coordinate addressing, solid and patterned polygon fill, windowing, independent zoom on x or y coordinate, pan and scroll. $3,995, 1,280-by-1,024-by-4; $2,995, 1,024-by-768-by-4; $1,995, 832-by-624-by-4; $1,495, 640-by-480-by-4. **Number Nine Computer Corp.,** 691 Concord Ave., Cambridge, Mass. 02138, (617) 492-0999.

Circle 327

Controllers support VMEbus

- 12.5 and 200 ips
- 2K-byte buffer
- 32-bit addressing

The model 751 single-board disk controller supports two SMD disk drives, including the 2.4M-byte-per-second HSMD interface. Achieving a DMA speed of 10M bytes per second, the controller provides 8-, 16- or 32-bit, VMEbus addressing and data support. Features include a 2K-byte, command buffer; an 8K-byte, FIFO buffer; overlapped seeks; a command caching scheme; and a run-length, limited code-compatible error detection and correction scheme. The model 772 tape controller for the VMEbus works with reel-to-reel, streaming and ½-inch cartridge tape drives, including 12.5-ips, phase-encoded models and 200-ips, GCR models. $1,600, model 751; $1,300, model 772. **Xylogics Inc.,** 144 Middlesex Turnpike, Burlington, Mass. 01803, (617) 272-8140.

Circle 328

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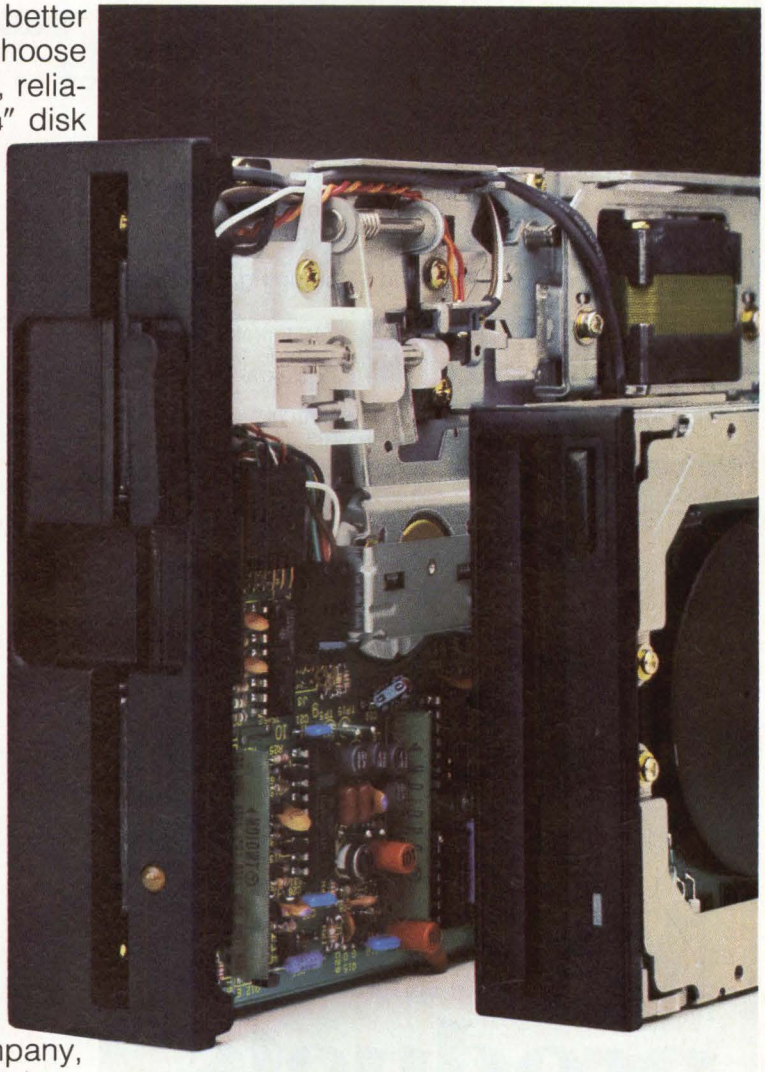
When you're ready to make a choice, just contact: Panasonic Industrial Company, Memory Systems Division, 1731 Technology Drive, San Jose, CA 95110. (408) 294-5888. Or any Hamilton-Avnet location.



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2 **"The IBM PC Data Communications Survival Course,"** Boston, sponsored by Data-Tech Institute. Contact: Data-Tech Institute, Lakeview Plaza, P.O. Box 2429, Clifton, N.J. 07015, (201) 478-5400. Also to be held: Dec. 3, New York; Dec. 6, Philadelphia; Dec. 13, Atlanta; Dec. 16, Orlando, Fla.; Dec. 17, Cincinnati; Dec. 18, Kansas City, Mo.; Dec. 20, San Francisco.

2-3 **Integrated Services Digital Network Seminar,** Phoenix, Ariz., sponsored by IGI Consulting Inc. Contact: IGI Consulting Inc., Suite 200, 214 Harvard Ave., Boston, Mass. 02134, (617) 738-8088. Also to be held Dec. 5-6, Dallas; Dec. 9-10, Tampa, Fla.; Dec. 12-13, Atlanta.

3-6 **Knowledge-Based Systems and Artificial Intelligence Course,** Los Angeles, sponsored by Integrated Computer Systems. Contact: Integrated Computer Systems, 6305 Arizona Place, P.O. Box 45405, Los Angeles, Calif. 90045, (213) 417-8888.

3-6 **North American Telecommunications Association (NATA) 1985 Convention & Exhibition Showcase,** Infomart, Dallas, sponsored by NATA. Contact: NATA Convention Department, Suite 550, 2000 M St., N.W., Washington, D.C. 20036, (202) 296-9800.

4-5 **California Computer Show,** Hyatt Hotel, Palo Alto, Calif., sponsored by Norm DeNardi Enterprises. Contact: Norm DeNardi Enterprises, Suite 204, 289 S. San Antonio Road, Los Altos, Calif. 94022, (415) 941-8440.

4-6 **Second Southwestern State of the Art Conference and Exhibition on Computer Graphics, CAD and CAM,** San Diego State University, San Diego, offered by the Department of Mathematical Sciences, San Diego State University. Contact: Professor Nenad Marovac, Department of Mathematical Sciences, San Diego State University, San Diego, Calif. 92182, (619) 265-4345.

5-6 **Graphics Applications Seminar,** Holiday Inn at Fisherman's Wharf, San Francisco, offered by U.S. Professional Development Institute. Contact: Conference Manager, U.S. Professional Development Institute, 1620 Elton Road, Silver Spring, Md. 20903, (301) 445-4400. Also to be held Dec. 12-13, Shoreham Hotel, Washington.

8-11 **Fall Industrial Engineering Conference,** Hyatt Regency, Chicago, sponsored by the Institute of Industrial Engineers (IIE). Contact: IIE Registrar, 25 Technology Park/Atlanta, Norcross, Ga. 30092, (404) 449-0460.

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9-10 Managing the Data Center Seminar, New York, sponsored by the Data Processing Institute, New York University School of Continuing Education. Contact: The New York University School of Contintuing Education, Seminar Center, 575 Madison Ave., New York, N.Y. 10022, (212) 580-5200. Also to be held Jan. 27-28, Washington.

10 Communications and Local Area Networks Seminar, Helmsley Place, New York, offered by Rensselaer Polytechnic Institute. Contact: Lee Burgess, Seminar Coordinator, Rensselaer Polytechnic Institute, Troy Building, Troy, N.Y. 12180-3590, (518) 266-6589.

10-11 Database Managment Systems and 4th-Generation Languages for Personal Computers Seminar, Springfield Hilton, Washington, conducted by Digital Consulting Associates Inc. (DCAI). Contact: DCAI, 5 Kimberly Terrace, Lynnfield, Mass. 01940, (617) 470-3870.

10-11 Using dBase III to Manage Information Seminar, The Computer Forum, Newton, Mass., presented by Boston University Metropolitan College. Contact: Joan Merrick, Seminar Coordination Office, Suite 415, 850 Boylston St., Chestnut Hill, Mass. 02167, (617) 738-5020.

10-12 1985 Videodisc, Optical Disk and CD-ROM Conference, Wyndham Franklin Plaza, Philadelphia, sponsored by Meckler Publishing. Contact: Jean-Paul Emard or Marilyn Reed, Meckler Publishing, 11 Ferry Lane W., Westport, Conn. 06880, (203) 226-6967.

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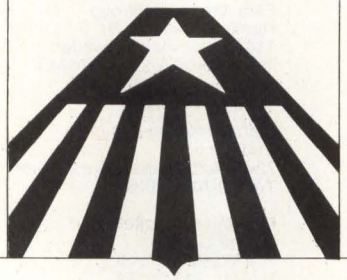

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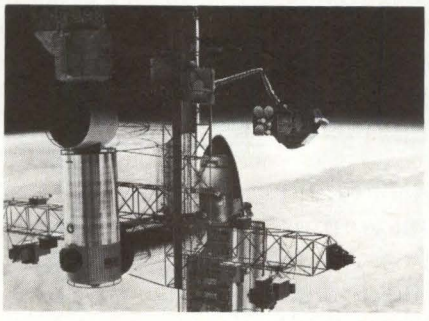

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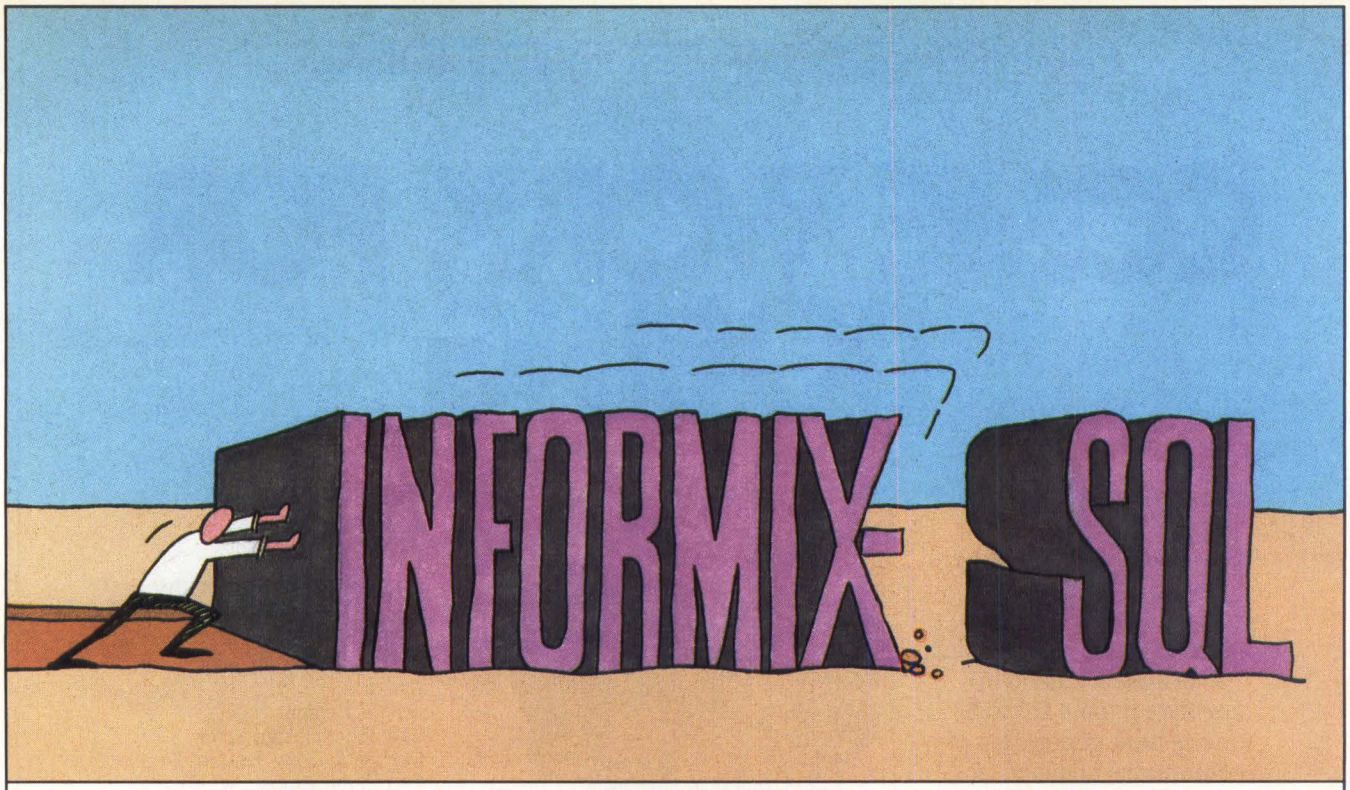

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SYSTEM INTEGRATORS' NOTEBOOK

Tips that make dollars and sense

DATABASES SOLVE INTEGRATION PROBLEMS

Carl Warren, Western Editor

Configuring and integrating complex computer systems becomes even more difficult with the addition of peripherals and special-function cards. Each new device adds another level of complexity, making it harder to locate, then resolve, problems.

Most problems arise primarily from I/O conflicts. For example, two cards might address the same I/O port at the same time. A message such as "Error 8" might appear on the screen. The question is, however, where did the problem originate? To avoid such a conflict, mapping the system is a proven solution. Mapping can be done graphically, by using data kept in a database file.

Creating the database is easier than you might expect. One solution, offered by Richard Steincross, president of RMS Laboratories, Long Beach, Calif., is to employ a word processor to create an ASCII text file that can be read by a BASIC program. The BASIC program searches for conflicts based on information about the ports and memory locations. For example, a typical file entry would look like this:

CARD NAME	ADDRESSES	PORTS
MEM BD 1	0000 to A000	none
MEM BD 2	A000 to F000	none
CTRLR 1	E800	INT 13

In this example, two memory boards with memory boundaries are entered. The controller board, however, overlaps on the second-board memory space and a potential conflict exists. Such a system initially appears to function until the memory area of E800 is used, which causes a locked-up condition. However, the BASIC program uses IF THEN ELSE statements to compare each memory location addressed and prints a list of potential conflicts based on the memory list.

Although this solution is workable, it does require first, using a word processor, then creating a database manager in BASIC. Of course, a quicker method is to use an off-the-shelf database manager such as Ashton-Tate's dBASE II or dBASE III.

Using a commercial database manager allows you to establish the type and order of data you want to enter and compare. Plus, employing the command language creates programs that look for conflicts, plot the map and print a memory-use map on the printer. For example, the following elements are entered for an IBM Corp. PC system: board type, addresses and ports used and interrupts employed (for instance, a disk controller uses interrupt 13).

You can create another file that provides information about the basic system. This file includes: ports available, critical basic input/output system memory locations, interrupt structure and usage, and memory boundaries. The file is then joined to the device file for comparison. The application program then compares these values and looks for conflicts.

BASIC and database managers aren't the only ways to map a system, however. You might consider using a spreadsheet for the same thing. Mapping a system lends itself to rows and columns, and most spreadsheets allow for logical comparisons. Moreover, conflicts are displayed dynamically because the comparison is immediate. For example, entering the same address for a card in a cell will signal a conflict upon entry.

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Difficulty with disk I/O on an IBM PC or compatible may be the fault of the direct-memory access (DMA) chip. If your system contains an Advanced Micro Devices (AMD) 9517, the PC might lock up when multiple operations occur on the bus simultaneously. This lockup happens because the AMD chip operates about one cycle time faster than the bus. Thus, when a bus request is made to the disk system via an interrupt, the AMD chip grabs the bus before the processor finishes with a cycle. This situation often results in lost data, or the bus reverts to a lockup, which requires a reset. In this case, replace the AMD device with an Intel Corp. 8237 chip or an equivalent NEC Corp. part. □

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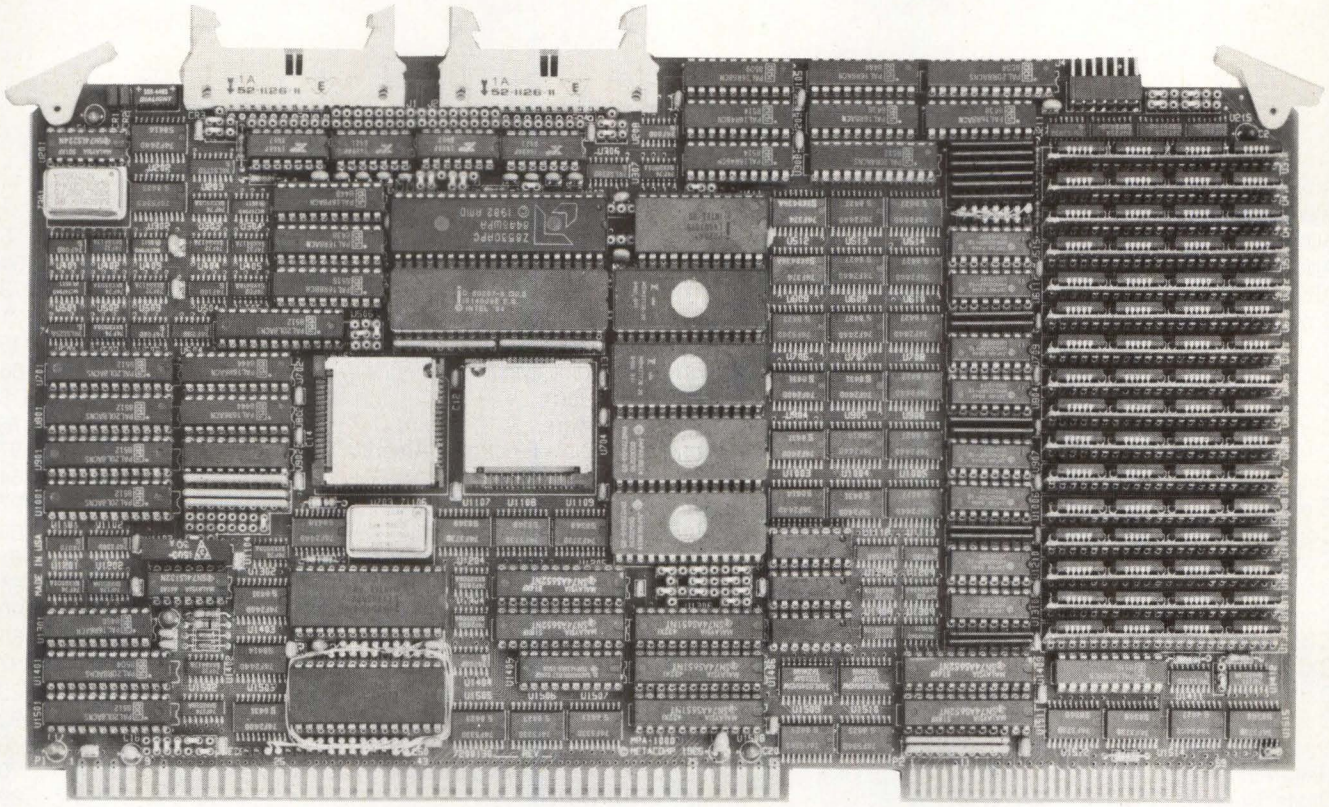

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Advanced Matrix Technology Inc. . . . 17-19
Alcatel Thomson Gigadisc . . . 75
Alloy . . . 83, 162
Apollo Computer Inc. . . . 76-77
AT&T . . . 71
Brooks Marketing . . . 146
Bull . . . E2, E4
Cahners Exposition Group . . . 22, 78
Cartrex Corp. . . . 32-33
Central Data Corp. . . . 118
CIE Terminals . . . 24
Circuits Processing Apparatus, Inc. . . . 147
Clear Point . . . D7
Communications Solutions Inc. . . . 148
Compaq Computer Corp. . . . 47, 49, 51, 53, 55, 57-58, 59
Computer Logics . . . 159
Concept Technologies . . . 154
CTS DataComm . . . 4
CXI . . . 12-13
Data Products Corp. . . . 31
Dataram . . . D15
Decision Data Computer Corp. . . . 157
Delta Airlines . . . 180
Digital Research . . . 142
Digital Sound Corp. . . . 98
Elgar . . . 178
Emerson Electric . . . 131
Emulex Corp. . . . 5
Excelan . . . 153
ExpoConsul International . . . D11
Facit . . . 160
General Power Systems . . . 140
Genicom . . . 105
Hamilton Standard . . . 132
Hewlett-Packard Co. . . . C2, 138-139
Houston Instrument Div. of Bausch & Lomb . . . 84
Human Designed Systems Inc. (HDS) . . . D16
IBM Corp. . . . 14-15, 113
IDE Associates . . . 121
Illbruck/USA . . . 162
Information Builders Inc. . . . 163
Innovative Data Technology (IDT) . . . 110
Inspiration Systems . . . 164
Intel Systems . . . 6-7
International Data Corp. (IDC) . . . 156
International Federation for Information Processing . . . 34
Keytronics . . . 28
Kimtron . . . 79
Liberty Electronics USA . . . 109
Lundy Electronics . . . 106
Macom . . . 80
Masscomp . . . 8-9
Matrox Electronic Systems Ltd. . . . 144
Maxtor Corp. . . . 86-87
MCG Electronics . . . 16
McDonnell Douglas . . . 104
Metacomp . . . 173
Micom Sales Div. . . . 20-21
Microdesign International . . . 10
Microplot Systems . . . 166
Micro-Term . . . D8
Microware . . . 175
Mitsubishi Electronic America . . . 97
Multi-Tech . . . 64
NCR Technology . . . 125-127
NEC America . . . 68
Norm DeNardi Enterprises . . . 161
Olivetti . . . E1
Oregon Software . . . 90
Panasonic . . . 165
Perkin-Elmer Corp. . . . 136-137
Pioneer Research . . . 122
QMS Inc. . . . 92
Quadram Corp. . . . 176
RDS-Relational Database Systems . . . 170
RTE Deltec . . . 89
Santa Cruz Operations . . . 27
SBE Inc. . . . 164
Science Accessories Corp. . . . 72
Seiko Instruments USA . . . 100
Selanar Corp. . . . D13
Shape Magnetronics Inc. . . . 149
Simpact Assoc. Inc. . . . D3
Software AG . . . 1
Sola Electric . . . 135
Tab Products . . . 143
TEAC Corp. . . . 88
Tec Inc. . . . 158
TeleVideo Terminals . . . 63, 152
Texas Instruments Inc. . . . 23, 35-40, 67, C3
Topaz Electronics Div. . . . 60
TransNet Corp. . . . 74
Ultimate Corp. . . . 102-103
Unify Corp. . . . 116-117
Universal Data Systems Inc. . . . C4
U.S. Design Corp. . . . D4
Viking Acoustical . . . 155
Wyse Technology . . . 150-151

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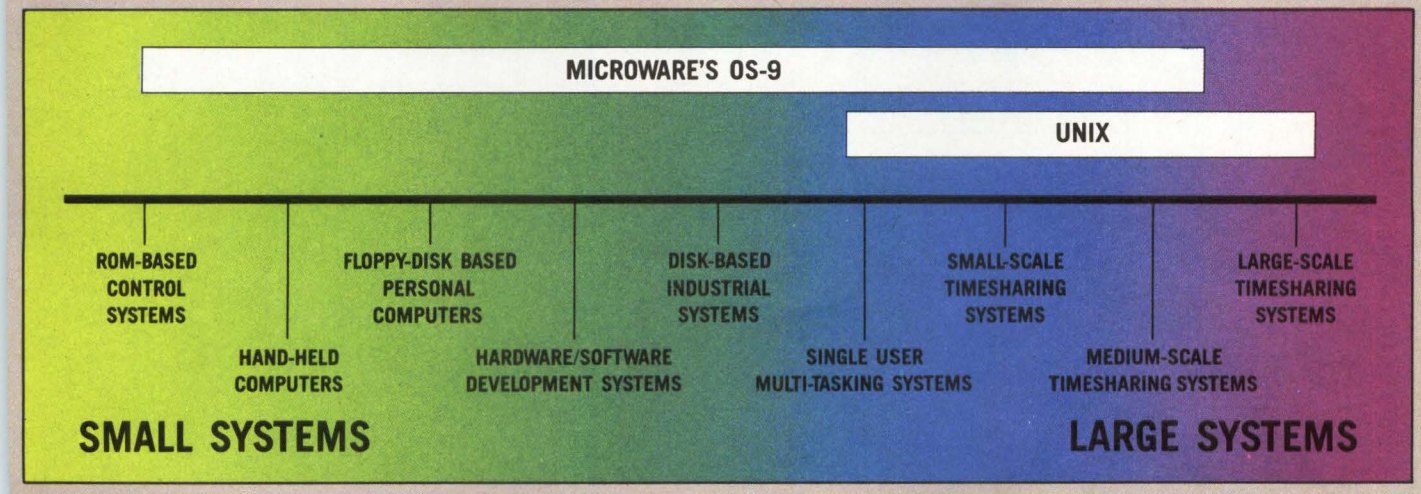

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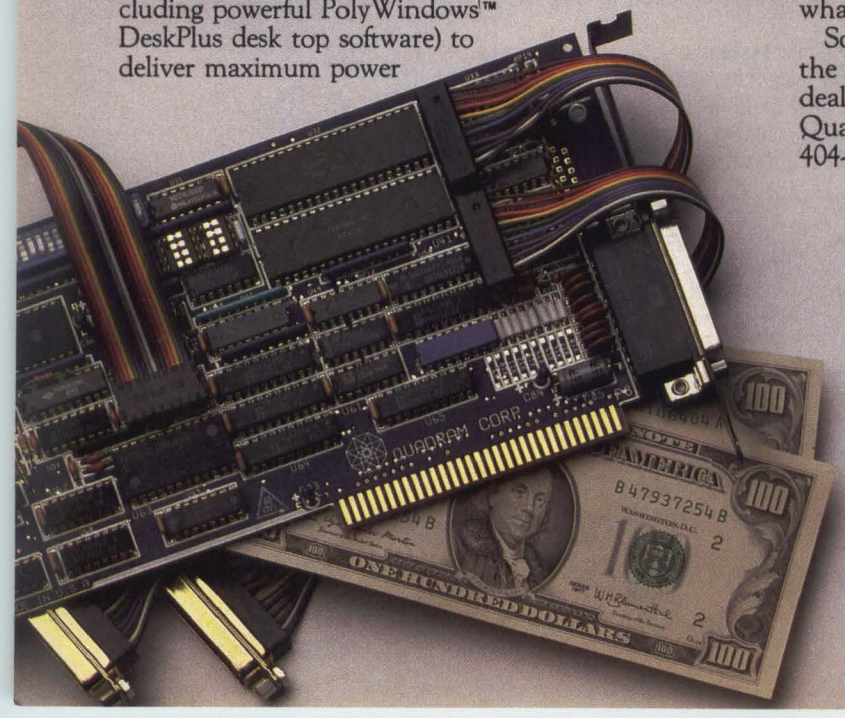

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Silver Quadboard: Memory expansion in 64K or 256K increments, two serial ports, parallel port, game port, clock/calendar, QuadMaster III with RAM drive and spooler software, PolyWindows DeskPlus software.

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CIRCLE NO. 104 ON INQUIRY CARD

MARKET TRACK

Sharon Hassell, Assistant Editor

Software aftermarket can boost revenue in tightening market

"Aftermarket" sales will offer software companies in specific vertical markets profit opportunities that will surpass those of initial software package sales. That's according to a recent report by International Resource Development Inc. (IRD), which defines the aftermarket as training, consulting, enhancements and supplies. The research company predicts that, by 1995, software aftermarket sales in banking, insurance, investment, real estate and law will reach $803.8 million. That will account for 84 percent of total software sales in those markets, according to IRD.

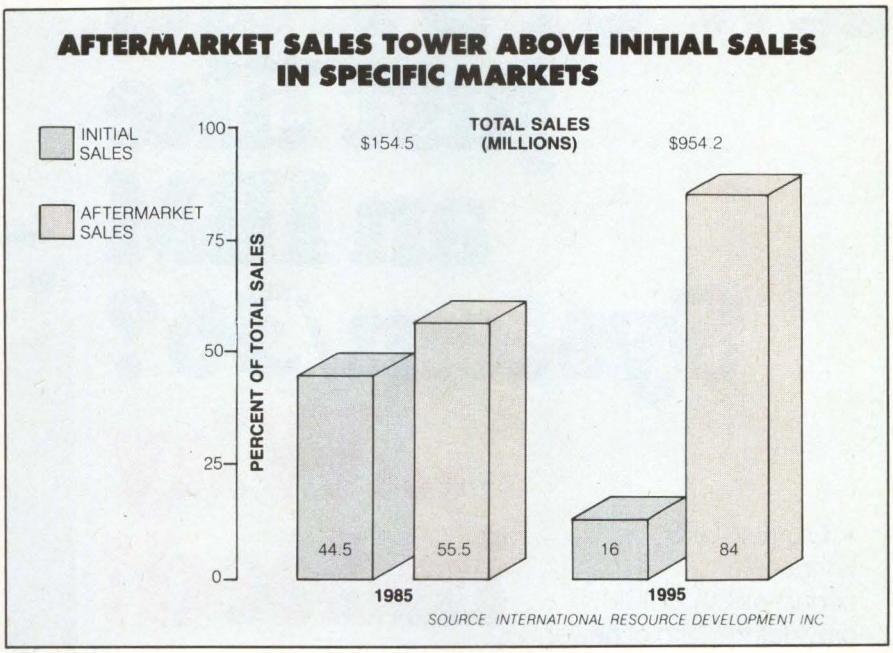
IRD says the emphasis on the software aftermarket is particularly strong in vertical markets where vendors provide software directly to end users, or specific hardware companies, rather than distribute them through retail channels.

Since these products are usually more complex, development costs are higher, resulting in a higher price for the user. Therefore, the report says, vendors must provide high-quality support services as well. By providing these high-quality services, vendors increase revenue while creating their aftermarket.

The report notes, however, that many software vendors are ignoring aftermarkets as ongoing sources of revenue, choosing instead to concentrate on initial sales. But, due to an expected decline in initial software sales in the industries highlighted in the report—from a current 44 percent share of the market to a 16 percent share in 1995—software vendors will find more room for growth in these aftermarkets.

The price of the report is $1,600 and is available from **International Resource Development Inc.,** 6 Prowitt St., Norwalk, Conn. 06855.

Circle 329



Aftermarket sales *in the banking, insurance, investment, real estate and law industries are expected to reach $803.8 million and claim 84 percent of total software sales in those areas by 1995.*

Unit sales surge seen for personal printers

Sales of more than 15 million printers will total $33.5 billion by 1995, according to a recent report by market researcher Business Communications Co. Inc. Of these, almost 13 million will be personal printers, with a value reaching $16.1 billion.

Although personal printers will dominate unit sales, other types—such as printer systems, distributed printers and office printers—will generate more money, totaling $17.4 billion in sales by 1995.

According to Business Communications, the expected printer market growth is a reflection of the growth in CPU sales. Moreover, the high demand for printed output, rather than for technical innovations, will spur the rapid growth.

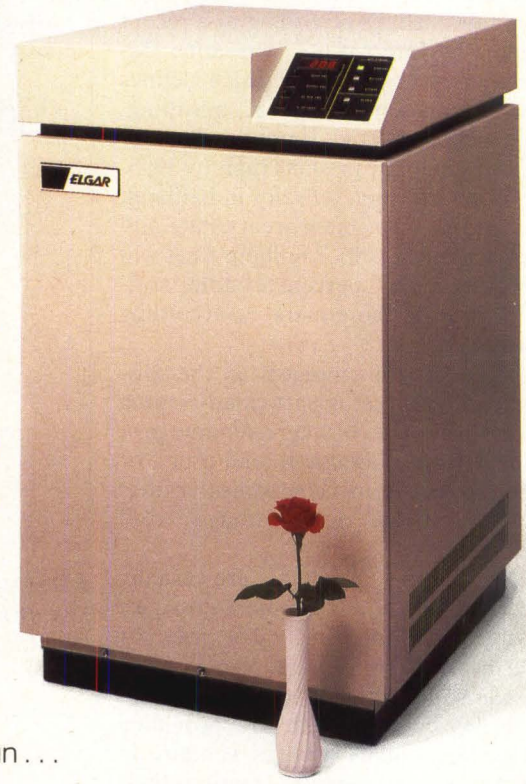
The $1,500 report is available from **Business Communications Co. Inc.,** 9 Viaduct Road, Stamford, Conn. 06907.

Circle 330

Interest Quotient (Circle One)
High 495 Medium 496 Low 497

You may ask why Elgar's new UPS looks just like an IBM System/36?

...Why indeed!



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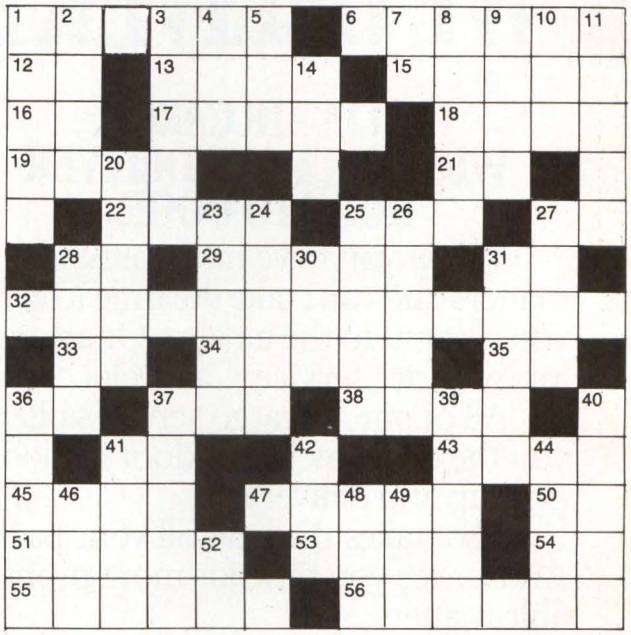
ARTFUL INTELLIGENCE

By John K. Young

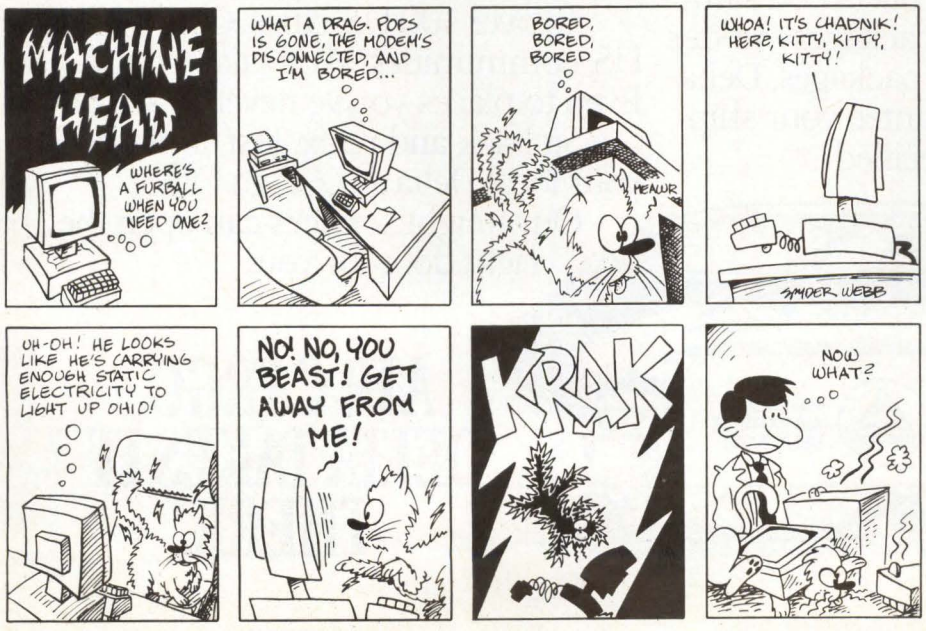


ACROSS

1 Organization of data
6 Computer trespasser
12 Within the walls (Abb.)
13 Sixth month of Jewish year
15 Controlled by the master
16 Printer's measure
17 Storage place
18 Lyric poems
19 One who reclines
21 Nickel (abb.)
22 Enter program
25 Whiz
27 Pronoun for "technostress"
28 Yours truly
29 Things on which programs are stored
31 Street (Abb.)
32 Complete computing system
33 Nutmeg state (Abb.)
34 Printer
35 Exist
36 Compass direction of Portland, Maine from Montreal
37 Pure honey
38 Magnetic storage medium
41 Combining form meaning "animal"
43 Do-it-yourself robot from Heath
45 Secondhand
47 Produce single sequence from two or more
50 River in West Siberia
51 Gets stuck
53 Radix in numbers scale
54 Special function
55 A>, e.g.
56 Was in home computer market

DOWN

1 Set of columns in punch card
2 Combining form meaning "everywhere"
3 Machine code
4 Programming language
5 An Air Force command (Abb.)
7 At the time that
8 Computer duplicate
9 Minor Moslem magistrate
10 Night before
11 Start-over button
14 Seventeenth Greek letter
20 Given preference
23 Root of plant used as soap substitute
24 Paper design stuck on glass
25 Directed efforts
26 Island near Bay of Naples
27 Entry in account
28 Apple controllers
30 Disk operating system (Abb.)
31 What an investor in computer business has
36 Computer business status in 1985
37 Modulator-demodulator device
39 Fed into printer
40 Business language
41 Less than one
42 Network
44 Seemed to be floating in space
46 Respectful term of address
48 Random access memory
49 General Services Administration (Abb.)
52 Specialist (Abb.)



Solution will be printed next month.

Answers to October's puzzle can be found on Page 155.

Interest Quotient
(Circle One)
High 498
Medium 499
Low 500

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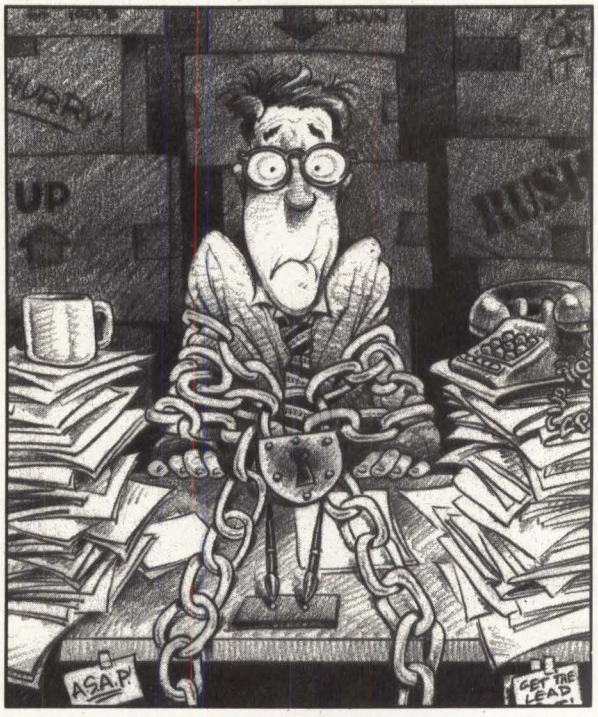

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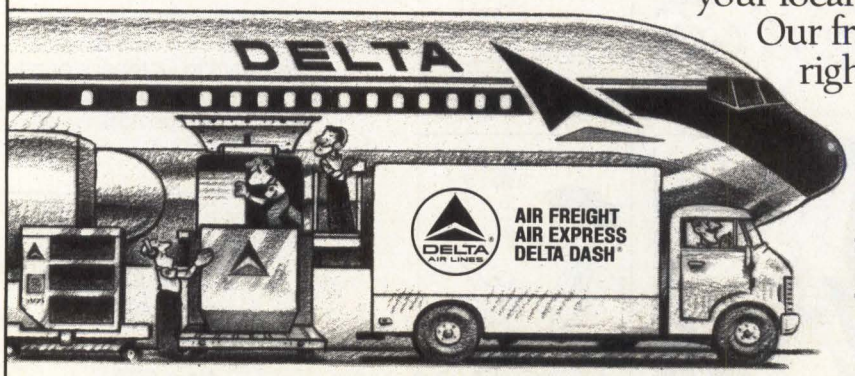

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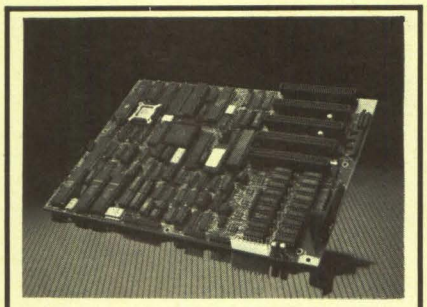

8088 SINGLE BOARD COMPUTER IS IBM PC compatible in form and function. 4.77 MHz Intel 8088 CPU, 8087 socket, 64K to 640K bytes RAM with parity, two 28 pin EPROM sockets, 4 DMA channels, 2 software controlled timers, 5 user available interrupts, floppy controller for up to 4 drives, TTL compatible video output, IBM PC compatible keyboard port, 2 RS-232 serial ports, Centronics printer port, speaker & reset ports, 5 IBM PC compatible I/O expansion slots. BIOS ROM supports MS-DOS, PC-DOS, CP/M-86, Concurrent CP/M, PC-iRMX. DAVIDGE CORP., PO Box 1869, Buellton, CA 93427 (805) 688-9598.

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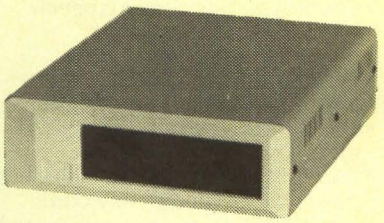

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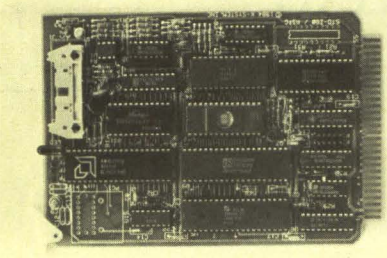

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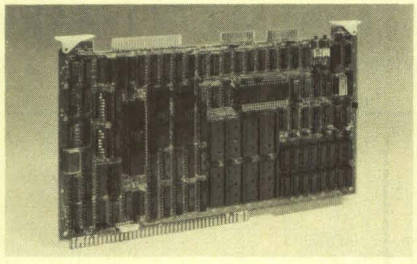

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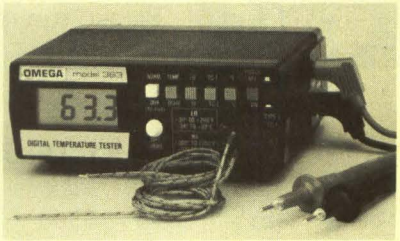

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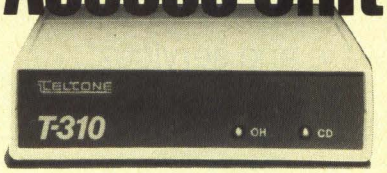

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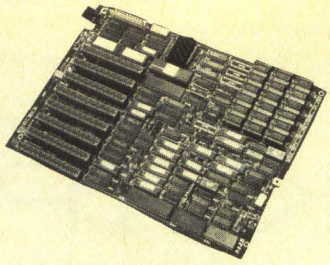

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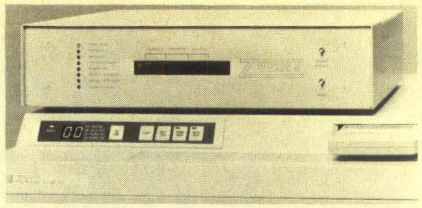

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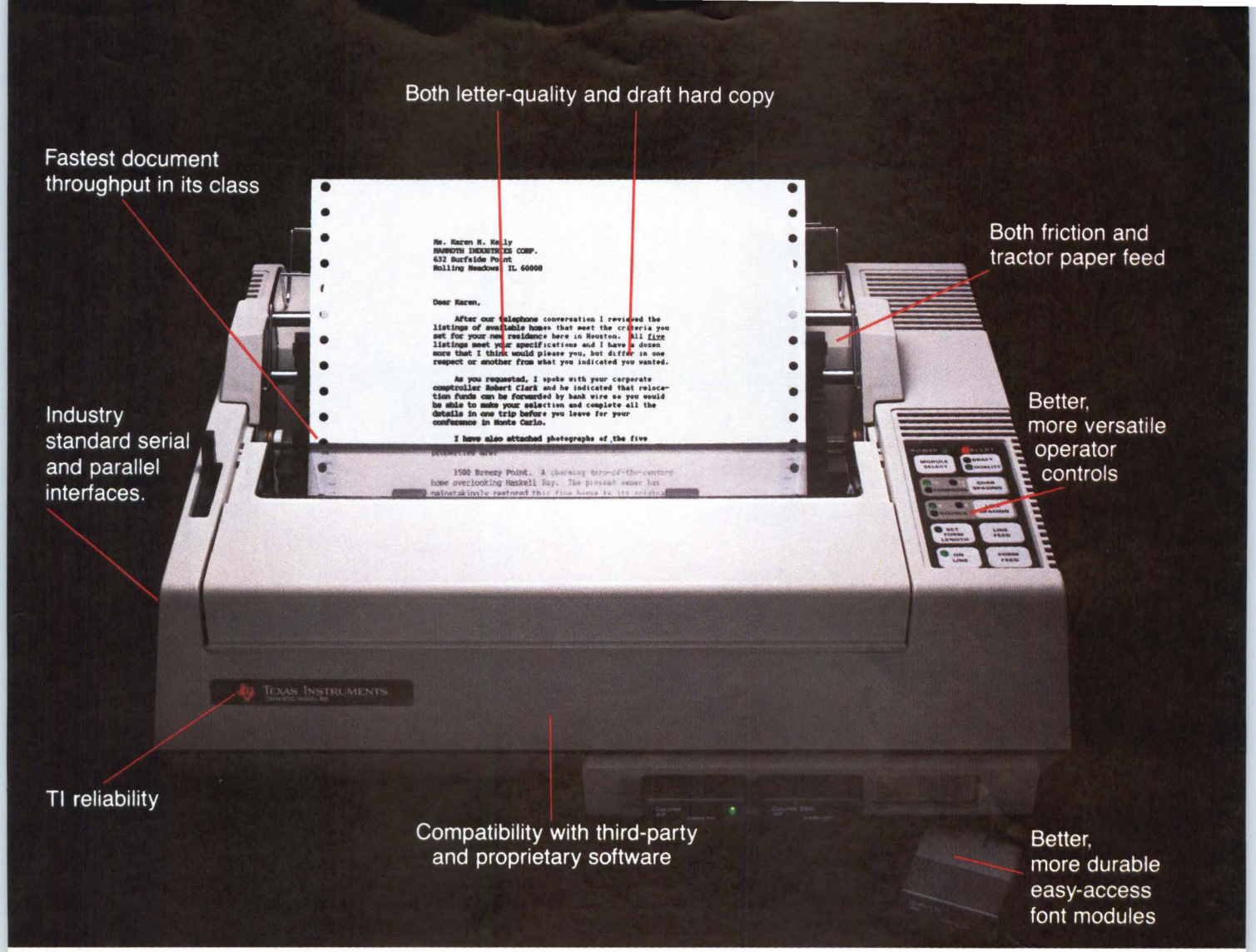

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