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DECEMBER ■ 1986 VOL. 5, NO. 12 ■ $4.00

DEC PROFESSIONAL

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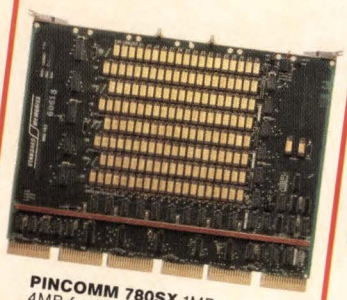

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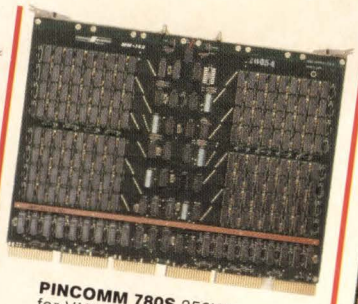
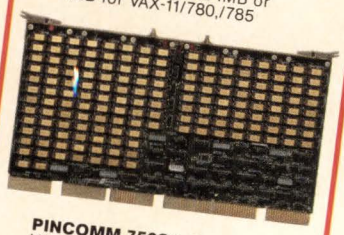


PINCOMM 780S 256KB for VAX-11/780,/785



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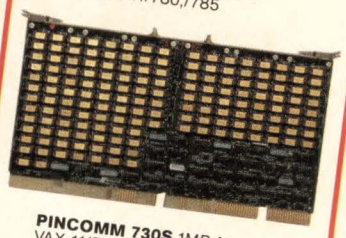

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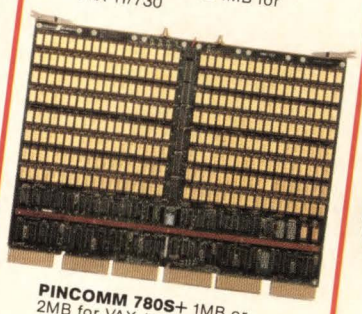

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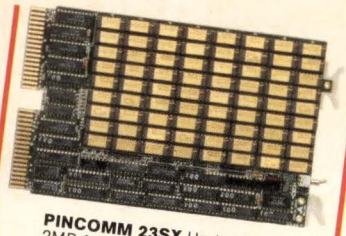

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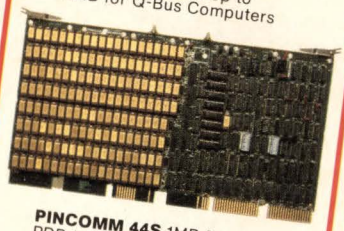

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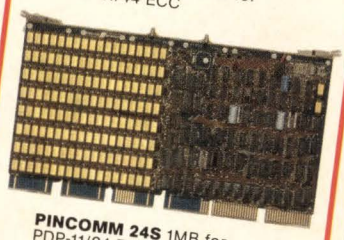
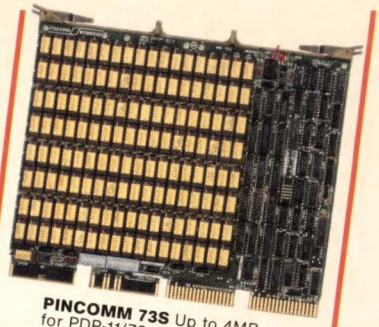
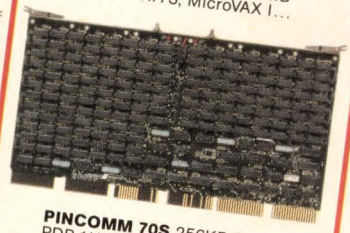


PINCOMM 24S 1MB for PDP-11/24 Parity Checking

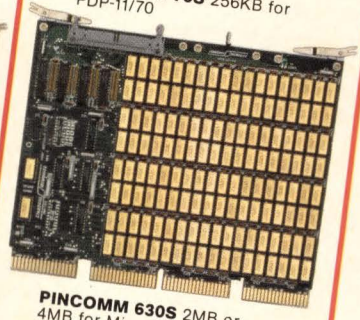
PINCOMM 750S 256KB for VAX-11/750



PINCOMM 73S Up to 4MB for PDP-11/73, MicroVAX I...



PINCOMM 70S 256KB for PDP-11/70



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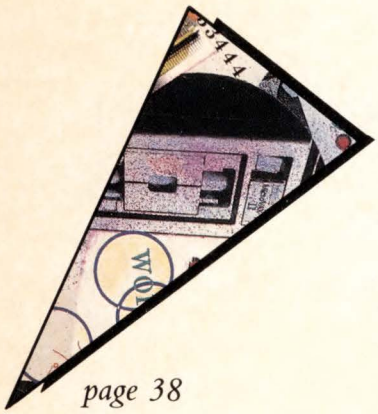

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ON THE COVER:
This month's cover image was designed by Boston-based artist Karen Watson.

Portions of this collage, Watson's specialty, have illustrated our features throughout the last half of 1986. They come together here to complete her view of 20th-century computer technology.

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The ARIS symbol on an article indicates that the program segments are available electronically on our Automated Reader Information Service. Dial (215) 542-9458.

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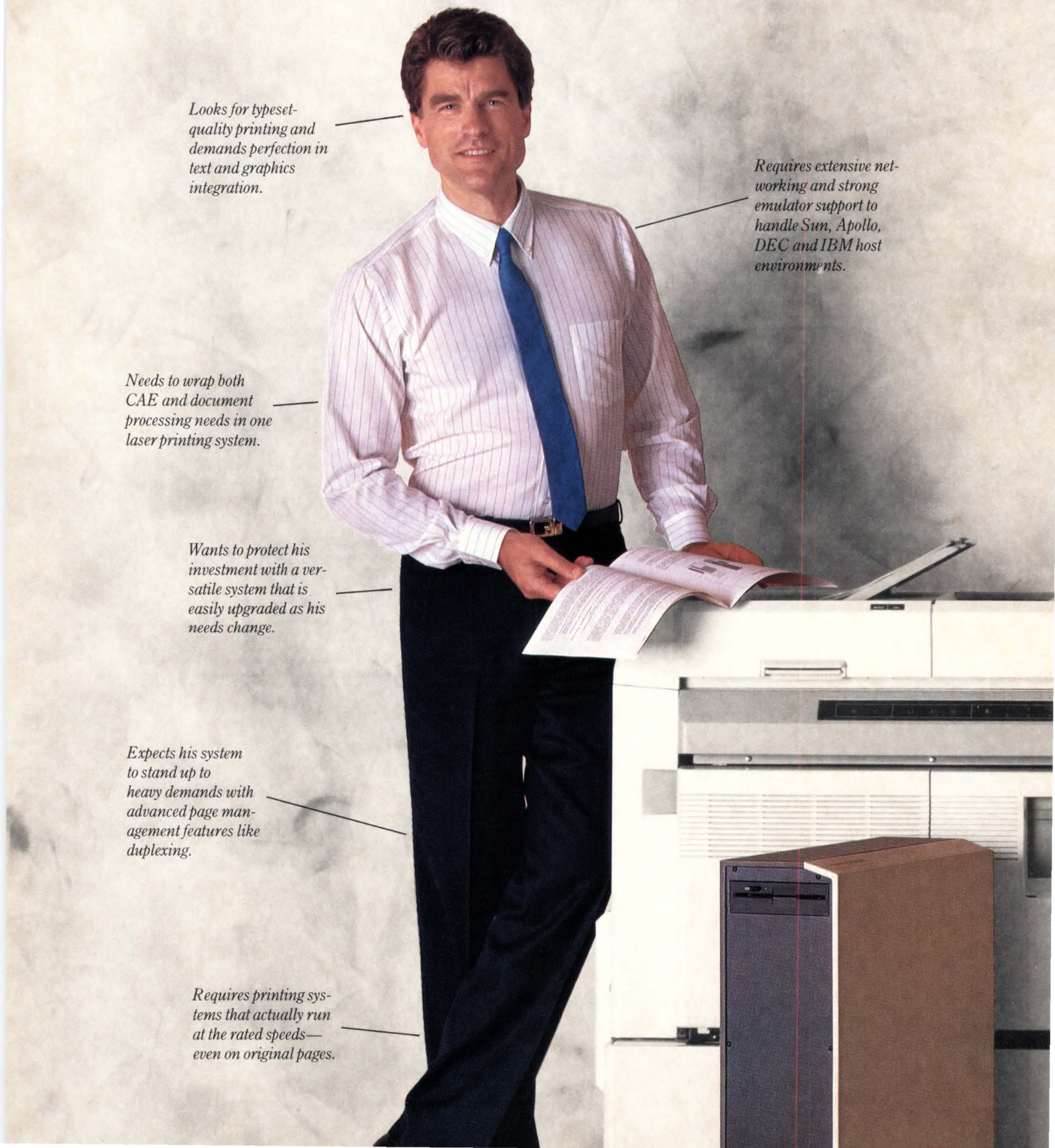

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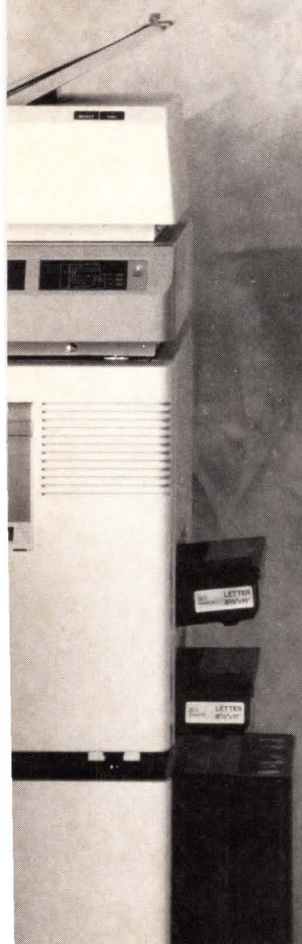

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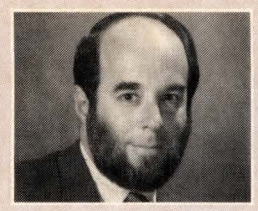


PUBLISHER

Carl Marbach

It's Time To Catch Up

Digital has become very aggressive in the past year. It has squeezed OEMs and system integrators by lowering discounts and raising quotas, filed legal actions against third-party memory suppliers and mass storage providers, locked up the 8000 series VAX computers by protecting the BI bus and, finally, notified the user community that their software licenses are no longer transferrable as of January 1, 1987.

As we previously have said, the end user is the injured party in all these actions. A secondary loser will be DEC itself. Why then, is DEC doing these things? Dogs of the financial community just a few years ago, Digital is now the focus of Wall Street and the business publications. Most periodicals are falling over themselves to do a portrait of the company and President Ken Olsen. Why, with all this success is it dumping on its "loyal customer base?"

In war, as in business, you exploit your strength. In strong times you become aggressive. DEC is strong now and is trying to fix some of its past problems.

In the mid '70s when DEC needed the OEMs to move equipment and sell to places it couldn't, anyone could have become an OEM. "Brokers" sprung up and sold Digital Systems without adding any value; they even undersold the local DEC salesman (their overhead was smaller). Two men and a small boy operating out of a garage sold DEC computer systems and competed with DEC in the marketplace. "Someday we will fix this wrongful use of the OEM agreements," was heard in the halls of Maynard.

In 1985 and 1986 when DEC didn't need the OEM channel, it tightened the screws. Supply and demand. We don't need you *now*, so we're going to make it harder for you to do business and compete with us. Many good OEMs have left the DEC market (stranding customers) because it is very difficult to make enough money with DEC's current OEM policies and stay exclusively in the DEC market.

Third-party hardware suppliers always have added to the value and "bang for the buck" of almost all DEC systems. You can buy smaller, faster, cheaper and more functional controllers and peripherals outside the DEC umbrella. The plain vanilla, all-DEC computer system is unusual; most users opt for at least some hardware from outside vendors. Ken Olsen has said that in the '70s we needed the third-party suppliers so that we could sell computers into certain areas that we did not have the products for; today we don't have that problem. What you should be asking is not why we won't let people in (to our bus), you should want to know why we *EVER* let anyone use our bus. The hard fact is that DEC can sell as many computers as it wants, even if it closes the architecture and freezes out foreign peripherals.

In the past, DEC would transfer licenses as a courtesy to its "loyal customers." The practice was time consuming and, DEC believes, led to software piracy. The new policy, while making it economically hard on the user community, will reduce DEC's time and effort spent on license transfers. DEC can afford to lose some old customers in this hot market because it knows that it can fill those slots with new ones.

DEC's plans are incredibly short-sighted. For a company whose long-range commitment to VAX architecture and communications has made it the top technical computer company today, hurting its OEMs *and* the third-party community *and* its own users is a mystery.

For Digital to become the number one computer company will require better relations with its users, add-on value from third-party manufacturers and a happy and satisfied user community. In this hot time for DEC, reversing this course will result in a flatter growth curve which will remain strongly positive, regardless. But when times toughen, and they always do, who will DEC have to rely on?

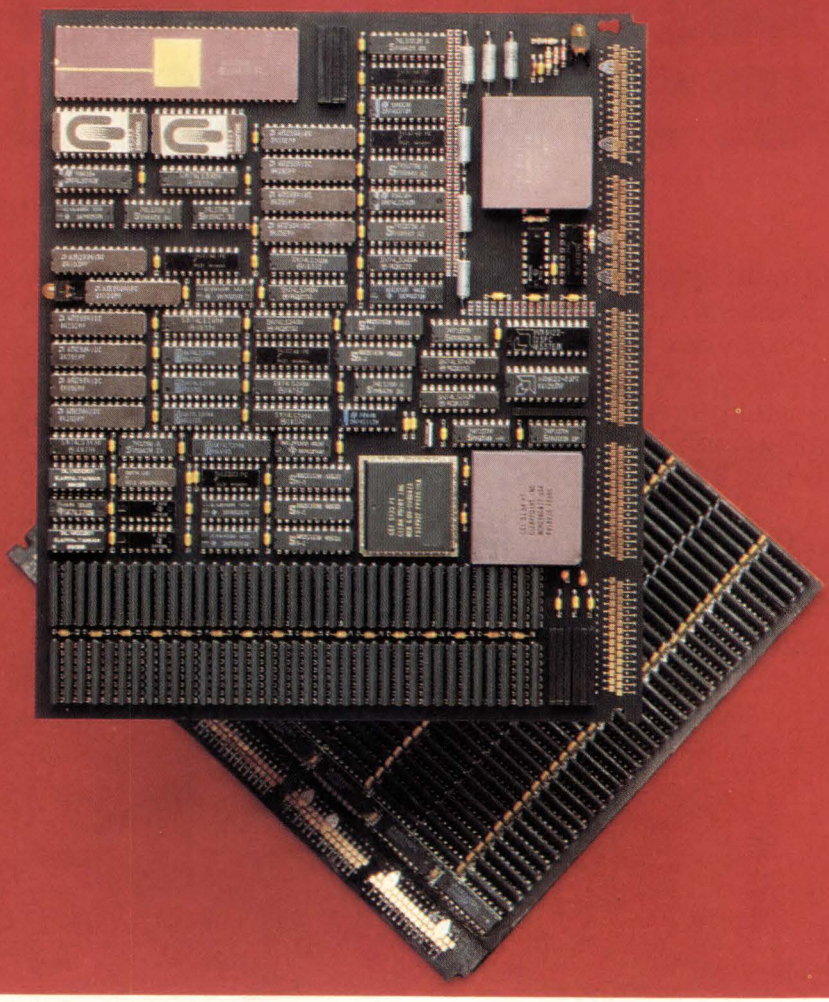
A loner can not be a winner. In the field of computing it is partnerships that make the winners. Bullies have a way of getting theirs, and make no mistake: DEC is bullying us now.

It is never too late to change your ways. How about a New Year's resolution from Digital to form a partnership with the community to become the biggest and best company that it can be? You can help this happen. Why not let the people at DEC know what you are thinking. It might help.

Carl B Marbach

Publisher

VAXBI-Compatible Memory
32 MB in 5 Slots with Maximum Performance



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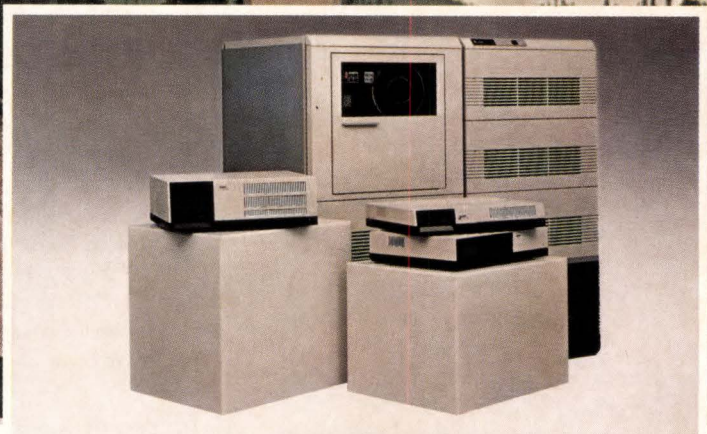

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3B2/310. Supports up to 14 users, 18 RS232C ports. Speed: 1.1 MIPS, 32 bits at a time. *All* 3Bs are 32-bit machines. Storage: 86MB internal hard disk; up to 516MB with Expansion Modules.

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3B15. Serves 16 to 60 users, 128 RS232C ports. Speed: 1.6 MIPS. Supports 8 drives, with maximum storage of 2.7 *giga*bytes.

Not shown: Other members of AT&T's 3B computer family serve up to 100 users, across a wide range of business needs and environmental conditions.

systems—without forcing users to give up the applications they know and trust.

In most offices, the effect on productivity is electric.

"THESE GUYS THINK OF EVERYTHING."

The 3B's role in a distributed data processing environment can grow and change as your business evolves. For starters, UNIX™ System V permits the same software to run on a variety of machines, protecting your investment in applications and user training.

On the hardware side, the whole 3B family is like a big set of building blocks. Everything is modular. A system of feature cards and interfaces makes it easy to add functions or peripherals. Or add users. Or boost performance. Or all of the above—in any order, at your own pace.

Example: A 3B "starter" system that is cost-efficient for 6 users can easily grow to serve 60 users—and more—with the same efficiency. By networking 3B to 3B you can support *thousands* of users—like adding beads to a string.

Whether those "beads" are down the hall or an ocean away, AT&T's networking tools can swiftly unite them all into a single, flexible, responsive system.

WHERE ARE YOU GOING?

AT&T's 3B family was created *as a family* to enhance the systems you have today, without imposing limits on where you can go tomorrow.

You can start with the pieces you need to solve today's problem: linking mainframe and desktop, say; or pulling together a department. As your needs and ambitions change, so can your system. AT&T makes the pieces fit.

To learn how much we can do for your company today, and how far we can take you tomorrow, please contact your AT&T Account Executive, authorized supplier, or telephone 1 800 247-1212.

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**MS-DOS is a trademark of Microsoft Corporation.

AT&T
The right choice.

EDITORIAL

Linda DiBiasio

Coming Attractions

This year we tracked DEC's progress as it became the darling of Wall Street. We reported to you first hand on DECWORLD, where we saw the BI bus in action. We were there when DEC announced its latest products and services, from the VAX 8500 to the newest VAXmate. We participated in the year's DECUS Symposia and accompanying DEXPO shows. And through it all, we've kept pace with the DEC world by bringing you special issues on UNIX and OEM/VARs.

So, what's in store for *DEC PROFESSIONAL* in 1987? Plenty!

As we look toward the new year, we are more excited than ever about some of the new products, emerging technologies and industry trends that we plan to share with you. Among the topics we'll be featuring in upcoming issues are networking and connectivity, disk storage technologies, third-party vendor offerings, programming productivity tools, graphics and computer integrated manufacturing, distributed processing and much more.

These are just some of the topics you've been telling us you want to know more about. After all, its you, the readers, who make *DEC PROFESSIONAL* unique in the industry. Your comments, suggestions and requests, your participation in reader surveys, your phone calls, letters, and personal visits, have guided us consistently in the past, and will continue to help direct us in the future.

It's our interaction with you that makes being a part of this magazine so much fun. Yes, fun! It's what allows us to bring you the kind of insightful, technical material you've come to expect from our top experts across the country. We have enlarged our staff to include two new editors: West Coast Editor Phil Naecker, keeping an eye on the ever-changing California scene; and East Coast Editor Chuck Connell, reporting on DEC and its surrounding industries.

These two new editors bring with them a fresh look at the DEC industry; and already they have become an integral part of our Lab staff. Remember, when you see our Laboratory and Testing Center stamp on any product review — hardware or software — you'll know that it was done independently by a member of our staff of experts, in our in-house Lab of VAXs, PDP-11s and IBM computers. You won't see products reviewed by marketing managers in our magazine.

However, we do want to encourage those of you working in the DEC market to submit technical articles. You, as software developers, hardware manufacturers, and product and marketing managers, are in the best position to share your expertise, and *DEC PROFESSIONAL* always has been your DEC forum. That's why we established the Message Center as an integral part of ARIS, our Automated Reader Information Service. It's our way of saying thank you to the many of you who enjoy sharing your ideas with us, with our advertisers and with each other. (Be sure to read some of the ongoing conversations in *ARIS*TALK on page 150.)

So, it's on to '87 and what lies ahead. We've told you some of the things we think you might expect to find in "Coming DECisions" on page 30. But, within this uncertain business of forecasting, we see one constant: We are certain that you're going to enjoy the slate of features we have lined up for you in the new year.

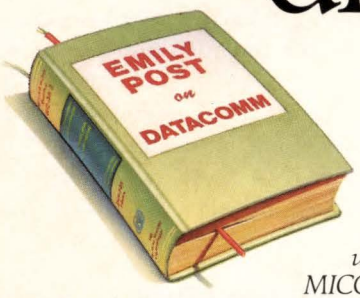
Thanks for being supportive and vocal readers.

Linda Di Biasio

Managing Editor

Introducing MICOM MODEM Dial Series.

Stop your computer from making dirty phone calls.



Dirty communications don't just upset networks, they upset people. MICOM's Dial Series modems keep data transmissions clean and error-free thanks to MNP,™ Microcom Networking Protocol.

Automatic flow control and data buffering means your MICOM MODEM will always interface at 2400 bps, regardless of its real operating speed.

The only thing dirtier than the communications transmitted by some modems is the language used by datacomm managers who have to use them.

Not to worry. MICOM can give you leased line quality and performance in a 2400 bps dial-up modem.

So if you're looking for reliable modems that speed data transfer between PCs, terminals, and host systems, look no further.

MICOM's Dial Series is compatible with all popular standards, including Bell 212/103 and CCITT V22/V22bis. And since they include the Hayes AT Smartmodem™ command set, they're also compatible with virtually all popular communication software.

But that's just the beginning. Each call can be monitored via status messages on your PC or on an integral speaker. Automatic data-to-voice switching eliminates repetitive dialing. Data disruption on multiline phones is automatically prevented. And all configuration data is safeguarded in non-volatile memory.

That all adds up to the fact that MICOM understands what datacomm managers go through every day. To see what we mean, just call us toll free for applications assistance.

We know you don't need headaches. So we don't cause them. Clean and simple.

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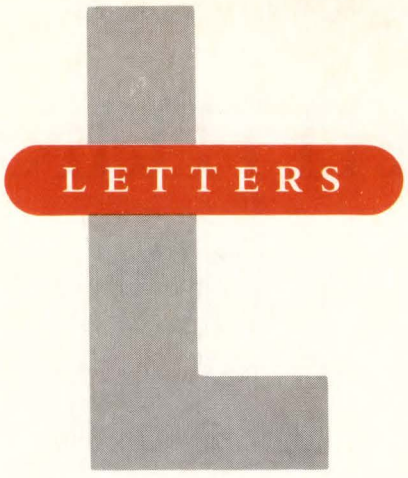

Address letters to the editor to *DEC PROFESSIONAL* magazine, P.O. Box 503, Spring House, PA 19477-0503. Letters should include the writer's full name, address and daytime telephone number. Letters may be edited for purposes of clarity or space.

WARUG

In response to the letter by Mr. Alec Greenfield printed in the September 1986 issue, I would like to inform him, and others, of the availability of screen dump programs for GW-BASIC. There are two public domain programs that dump medium res, high res graphics (GW-BASIC) to the printer, and one program, JOBSDUMP, that dumps whatever is in graphics memory to the printer. (You can reset the computer after displaying the picture on the screen, then load JOBSDUMP to print the picture. Resetting does not erase graphics memory.) These are available on Rainbow FIDOs. To learn more about these programs and other Rainbow-related items of interest, contact:

Washington Area Rainbow Users Group (WARUG)
P.O. Box 1940
Vienna, VA 22180

Alok Kapoor
Mt. Joy, Pennsylvania

FUTURE CONTRIBUTOR

This magazine is extremely valuable to me. Perhaps one day I will reach the level of your contributors.

Kristen Zapisek
Buffalo, New York

REFUTED RUN TIMES

In the September issue you listed run times for the KDJ11-AA chip ("From The Lab," p. 106). We're running V8.0 of RSTS, have a KDJ11-AA CPU and get 4.1 CPU secs for your benchmark, not 7.7 CPU secs as you state. The run time reduces to 3.7 CPU secs if one multistatement line is used.

Scott R. Derenne
Sturgeon Bay, Wisconsin

BETTER RESULTS

With regard to Dave Mallery's article in the September 1986 issue ("From The Lab," p. 106), we got much more clear-cut results with FORTRAN 77 under RT-11, VAX FORTRAN on VAXs and MICROVAXS, and the following program:

```
      program speed_test
      read*8 x,sum
      do 10 i = 1,10000
      x = i
10    sum = sum + 1.0d0/(x + dsin(x))
      end
```

Results:

LSI-11/73	9.66 sec
LSI-11/73 with FPA	1.70 sec
VAX-11/730 with FPA	11.11 sec
VAX-11/750 with FPA	4.23 sec
VAX-11/780 with FPA	2.37 sec
VAX 8600	0.69 sec
MICROVAX II	3.2 sec

(Also: 68020 (16 MHz) + 68881—either SUN or MASSCOMP: 0.6 to 0.7 sec.)

We have run these tests numerous times with repeatable results.

Dr. Jonathan D. Melvin
Pasadena, California

MOST INFORMATIVE

Thank you for providing what I consider to be the most informative magazine available in the DEC world.

Daniel Bochlke
Mankato, Minnesota

SOLUTIONS ON THE WAY

I saw Joseph P. D'Allatore's article, "*MacsnVAX*," in the August issue, and would appreciate any help you could give me.

I have a VAX ll/750 running VMS and several (12) Macintoshes with Apple HD20 hard disks. I'd like a way to back up the HD20s onto the VAX by clicking the disk icon — not clicking each file to back up individually.

Mark Senn
Lafayette, Indiana

Since Joseph P. D'Allatore's article was published, a few third-party vendors have announced disk server software that allows a disk on a VAX to appear on a Mac finder to be a locally connected disk. If such server software is "complete" enough (only the vendor can answer this question), HD20 files can be backed up to the VAX by click-

ing and dragging entire folders rather than individual files.

One vendor you might want to contact is Kenetics, Inc. of Walnut Creek, California. They have announced a product that works by bridging Ethernet with Apple's Appletalk network.

Incidentally, we plan to feature articles in the future that will further examine the DEC/Apple world, should you, the readers, indicate that these technologies are of interest to you. So, please let us hear from you.

MORE ON *DATATRIEVE*

I read with interest the excellent article by Robin C. Johnson on *Datatrieve* (July 1986) and the further comments of Joe H. Gallagher (September '86).

Johnson regrets that commands like READY cannot be used in REPEAT loops, and Gallagher answers, "While this is correct, it indicates a lack of understanding of *Datatrieve*. He also says, "There is no reason to READY a domain within BEGIN-END block; it can always be READYed before one enters the block."

I disagree with this statement: For operations implying a search through the data file like FOR, there is no comparison in execution time if you perform it on a domain readied for WRITE or for READ.

My experience is limited to the Professional 380 under P/OS. Perhaps the results are substantially different under RSX or VMS, but I noticed that a search (either FIND or FOR . . .) through a 750 records indexed file takes 12 seconds in READ mode and 3.5 minutes in WRITE mode, which makes its use simply impossible.

I agree with Johnson that it is a severe restriction not to use certain commands like READY in BEGIN-END blocks. On the other side, Gallagher is right when he says that a command like FIND can always be replaced by a FOR statement, allowed within BEGIN-END blocks.

I would appreciate receiving further comments of readers on the subject.

J.P. Vuille
Switzerland

ARIS (US) A BOON

Congratulations! Your used equipment (US) feature that was added to the Automated Reader Information Service (ARIS) described in your October issue will be a very valuable tool for a variety of reasons. Users that have a need to buy equipment for planned expansion or upgrades will have instant access to what is available. Another valuable aspect of ARIS (US) may be a little more subtle. ARIS (US) will be a boon to any company or government computer installation that is developing contingency disaster plans. It would certainly be advantageous to be able to locate a replacement for damaged equipment within minutes of the actual occurrence of the disaster.

The ARIS system is quite easy to use and the support offered is as advertised. Ms. Mary Browarek answered my questions and accepted my suggestions in a very professional manner.

As soon as more suppliers provide the essential product information ARIS will satisfy the needs of both private industry and government for normal replacement and disaster recovery replacement of computer-related equipment.

Frederick G. Bowman
Huntingdon Valley, Pennsylvania

We appreciate your enthusiastic support of our new used equipment feature. We agree that any company developing a contingency disaster plan could benefit greatly from the ability to have instantaneous access to up-to-date equipment, 24 hours a day, seven days a week.

So, here's a word to suppliers. Be sure to provide your product information to us for inclusion in our ARIS used equipment section. If you need more information on how to participate, call Mary Browarek at (215) 542-7008. ■

FINALLY, A MICRO-TO-MAINFRAME PIPELINE THAT LETS YOU PLAY WITH A FULL DEC.

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INTRODUCING DATABILITY'S *RAF REMOTE ACCESS FACILITY.*™

IT BRINGS DEC MAINFRAMES DOWN TO MICRO SIZE.

What if you could use spread sheet programs, like Lotus 1-2-3, Multiplan or Symphony, on your PC to directly access, retrieve and update worksheet files stored on a VAX or DECSYSTEM-20? Or edit DEC mainframe files direct from your PC.

What if you could extend the reach of your PC so that ANY PC program you use or develop could transparently manipulate data stored on VAX's or DECSYSTEM-20's?

FREEDOM'S JUST ANOTHER WAY OF SAYING RAF

RAF combines the capabilities of your PC with those offered by DEC mainframes setting a new standard for all communications products. The RAF approach: Allow PC users to remain PC users.

FREEDOM TO ACCESS REMOTE DATA

RAF provides you with the freedom to access actual DEC mainframe files directly from the PC programs you use today. Even MS-DOS commands can manipulate remote files. Imagine having the freedom to back up your PC onto the mainframe with a standard COPY command.

THE FREEDOM TO ACCESS REMOTE COMPUTERS

What's more, RAF provides you with other freedoms. Like automatic access to remote computers through a scripting mechanism that allows you to define each step of an automatic login. Or if you prefer, a complete VT100 terminal emulator unlike any other software system. Enjoy the freedom to instantly jump from a PC program to your DEC mainframe as a VT100 terminal and return to your PC exactly as you left it.

THE FREEDOM TO USE MAINFRAME POWER DIRECTLY FROM PC PROGRAMS.

For the first time, programmers can develop PC programs that call remote subroutines or entire programs to solve problems. Imagine accessing mainframe data base software DIRECTLY from the PC, WITHOUT user involvement.

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Phoenix-PMS is an integrated decision support system that helps you plan, analyze, forecast, budget, and schedule. It runs on DEC VAX, MicroVAX, and Professional computers and includes four packages: Network Analysis, Milestone Tracking, Milestone Plotting, and Financial Analysis.

You enter the information—such as a change in the price of steel. The Phoenix-PMS Project Management System can plot its effect and generate plans, graphs, charts, and progress reports. Simply. Automatically.

Best of all, the system is easy to learn and backed by reader-friendly documentation. So everyone who *needs* to use it *can* use it.

Find out how the Phoenix-PMS Project Management System can make project management as simple as it used to be.

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DATELINE DEC

VAX 8650 Brought To 128 MB

Most Capacity Possible

EMC Corporation recently announced that, with the addition of eight EMC 16-MB memory arrays, Reynolds + Reynolds' VAX 8650 computer is using 128 MB of memory. Reynolds + Reynolds is a leading software and hardware supplier based in Dayton, Ohio.

EMC's 16-MB memory board uses 1-Mbit chip technology and allows 16 MB of memory to be placed in all eight memory slots in the VAX 8650 computer. DEC's 16-MB array uses 256K RAMs that are surface-mounted on eight daughter boards using two memory slots and limiting the user to a 68-MB capacity.

EMC's memory is compatible with the VAX 8600. It is the only independent manufacturer to use gate array design in VAX 86XX products.

Contact EMC Corporation at 12 Mercer Road, Natick, MA 01760.

DEC Launches VPOS

Designed To Help DP Managers

DEC's VAX/VMS Performance Optimization Service (VPOS) is the first in a series of system performance enhancement services based on the company's VAX/VMS operating system. VPOS is designed to help data processing managers maintain top system performance from their systems.

DEC's latest offering provides VAX customers with an accurate measurement of system use while identifying performance bottlenecks. It maximizes a customer's hardware and software investment by ensuring systems' best possible response times. Given certain system parameters, VPOS also can afford opportunities to add both applications and users while providing system managers with a sound basis for capacity expansion.

The VPOS method of ensuring that a VAX/VMS system is operating at maxi-

Control Data, EMC Sign Maintenance Services Agreement

ES To Service Memory, Disk Products

Control Data Corporation and EMC Corporation recently signed an agreement in which Control Data's Engineering Services Division (ES) will provide maintenance services for EMC's memory and disk products. The new service capability, which also covers disk subsystems sold by EMC, complements Control Data's existing third-party maintenance offerings for DEC and IBM products.

The maintenance offering is targeted at DEC and IBM customers who want the ability to choose between standalone EMC product maintenance or full-system maintenance. It will allow these users to benefit from EMC products, as well as from Control Data's experience as a leading supplier of maintenance services for DEC and IBM products.

Additional information on maintenance for EMC Corporation products can be obtained by contacting Control Data Corporation Engineering Services Marketing, ESHQ4C, P.O. Box 0, Minneapolis, MN 55440; or by calling 1-800-828-8001 (in Minnesota, call (612) 921-4400).

Gary Mertz, vice president of Sales and Marketing for Engineering Service at Control Data (left) and Jack Egan, EMC's vice president of Marketing.

mum efficiency includes an extensive, comprehensive system analysis. "Tuning" the system may include activities such as adjusting system parameters, resetting user authorization quotas and redistributing workloads or files. DEC's performance consultants then deliver a detailed report describing the improvements made and offer specific suggestions on ways to gain better system performance.

VAX/VMS Performance Optimization Service is priced at $9,000 per initial CPU; $7,500 for each additional system in a cluster configuration.

DEC PRO To Give Hardware Seminars At DEXPO East 86

R.D. Mallery Among Featured Speakers

The editors of *DEC PROFESSIONAL* magazine are participating in a series of public seminars for attendees of DEXPO East 86 in New York City, December 17-19, 1986. This is the first time such a series will be offered at DEXPO, and preparation is being made for a large attendance.

DEXPO East does not coincide with a DECUS Symposium this year, therefore, *DEC PROFESSIONAL* and others from the DEC computing world are joining together to fill the gap.

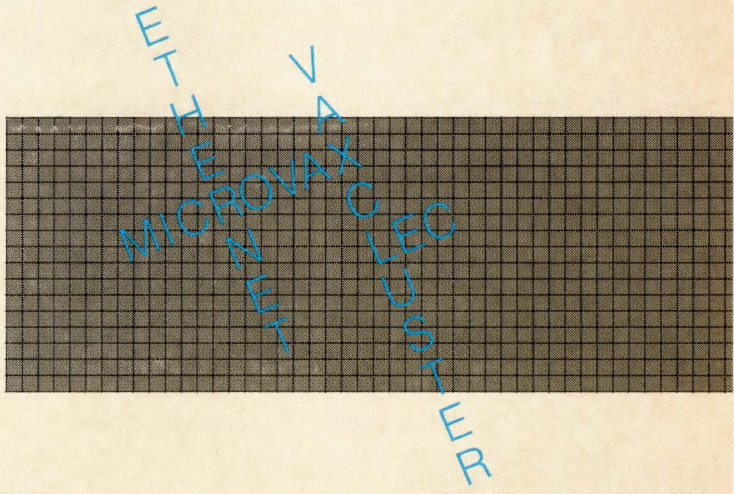
Featured speakers from the Editorial Department of *DEC PROFESSIONAL* include Editorial Director R.D. Mallery, Senior Technical Editor Al Cini, Networking Editor Bill Hancock, and MICROVAX Editor David Bynon.

The *DEC PRO* scheduled seminars will be held on Thursday the 18th, and include the following topics: "Digital's Memory Interconnect Strategy," "Digital's Bus Structures," "The Impact of Digital's BI Bus Strategy on Users and Vendors," and "Managing Multiple VAXs in a Unified Environment."

For more information, contact DEXPO East '86 at Expoconsul International, Inc., 3 Independence Way, Princeton, NJ 08540 (609) 987-9400; or call *DEC PROFESSIONAL* at (215) 542-7008.

DEC Announces Low End Cluster

Brings Together Two Hottest Products



In November, DEC announced the Low End Cluster (LEC), an Ethernet-based VAXcluster configuration. The LEC brings together two of DEC's hottest products — the MICROVAX systems and VAXclusters. It also will support the long-awaited VAXstar and TEAMMATE (VAXstation 2000 and MICROVAX 2000).

Until now, VAXclusters were restricted to the Computer Interconnect (CI), a high-speed, dual-path bus system. CI hardware is not available for MICROVAX and other low-end VAX systems.

Using the LEC software, MICROVAX II-based systems and other low-end VAX systems with Ethernet may join or form a cluster. Each member of the LEC must be connected by a common Ethernet network (thin wire or standard). The MICROVAX DEQNA (Ethernet interface) must be at revision level "E."

The LEC will be sold as a layered VAX/VMS product. This is due, in part, to the fact that no special hardware (HSC, Star Coupler, CI, and so on) is required to use the system. However, a full version of VAX/VMS will be required. The LEC will be fully supported by VAX/VMS Version 4.5.

LEC systems will use the same software components as their CI-based counterparts. This is made possible by the layered (modular) design of the VAXcluster software. To implement the Low End Cluster, a port driver was developed to support the DEQNA Ethernet interface.

The LEC can support up to 13 nodes (members). As many as five MICROVAX II systems, or other LEC systems, may use a single MSCP served device as a system disk (boot device). This frees local disk storage for page and swap file use and user data.

A serious limitation that exists in the initial release is the inability to interconnect the two VAXcluster bus systems, CI and Ethernet. This means that LEC members can't take advantage of HSC served storage devices.

DEC To Service Vendors' VAXBI-Licensed Equipment

Part Of New Vendor Partnership Program

DEC now is providing service on selected DEC-based products manufactured by VAXBI-licensed vendors. Under the company's new Vendor Partnership Program (VPP), DEC will provide full hardware installation and ongoing hardware support on participating vendors' equipment that uses DEC's VAXBI technology.

Currently, more than 70 vendors have applied for VAXBI licenses for DEC-compatible products including array processors, high performance graphics, and high-speed I/O systems. However, while the greatest interest in VPP is expected to come from these vendors, DEC also expects the program to attract manufacturers of high-volume UNIBUS and Q-bus system products.

Through the Vendor Partnership Program, DEC acts as the participating vendor's service agent, offering these vendors' customers the same level of hardware installation and ongoing maintenance support as it provides its own customers. DEC's service and support will be provided through DEC's standard service agreements and will be delivered from more than 200 service locations throughout the United States. Participating vendors also receive permission to advertise DEC service, within certain guidelines.

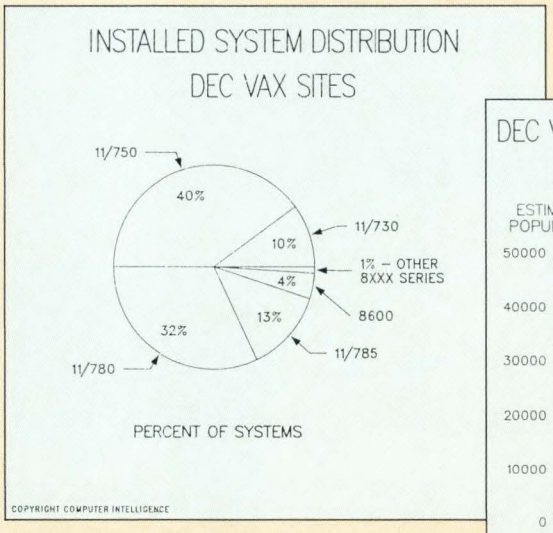
In addition to customer documentation, the vendor commits to furnishing DEC with the necessary spare parts, training, product documentation and support to ensure quality service on its equipment.

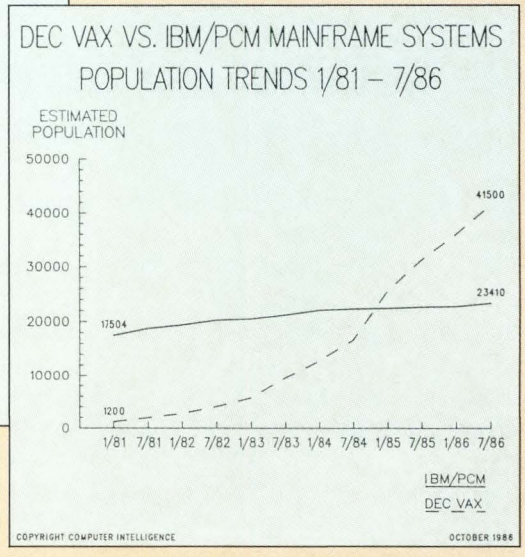
CI Evaluates VAX Market

Study Shows Rapid Growth

Computer Intelligence (CI), a computer industry market research firm based in La Jolla, California, recently released a study that evaluates the VAX market.

CI found that the current status of the VAX market can best be characterized by the continued rapid growth of the system population, introduction of new systems covering the spectrum of processing power (MIPS), and a new commitment by DEC to the commercial aspects of the marketplace. These and other factors add up to a segment of the computer industry that offers significant opportunities to third-party suppliers of peripheral devices, software, or services. A recent analysis of the CI Data File of U.S. DEC VAX sites confirms some of the activity and opportunity that exists in this market today.

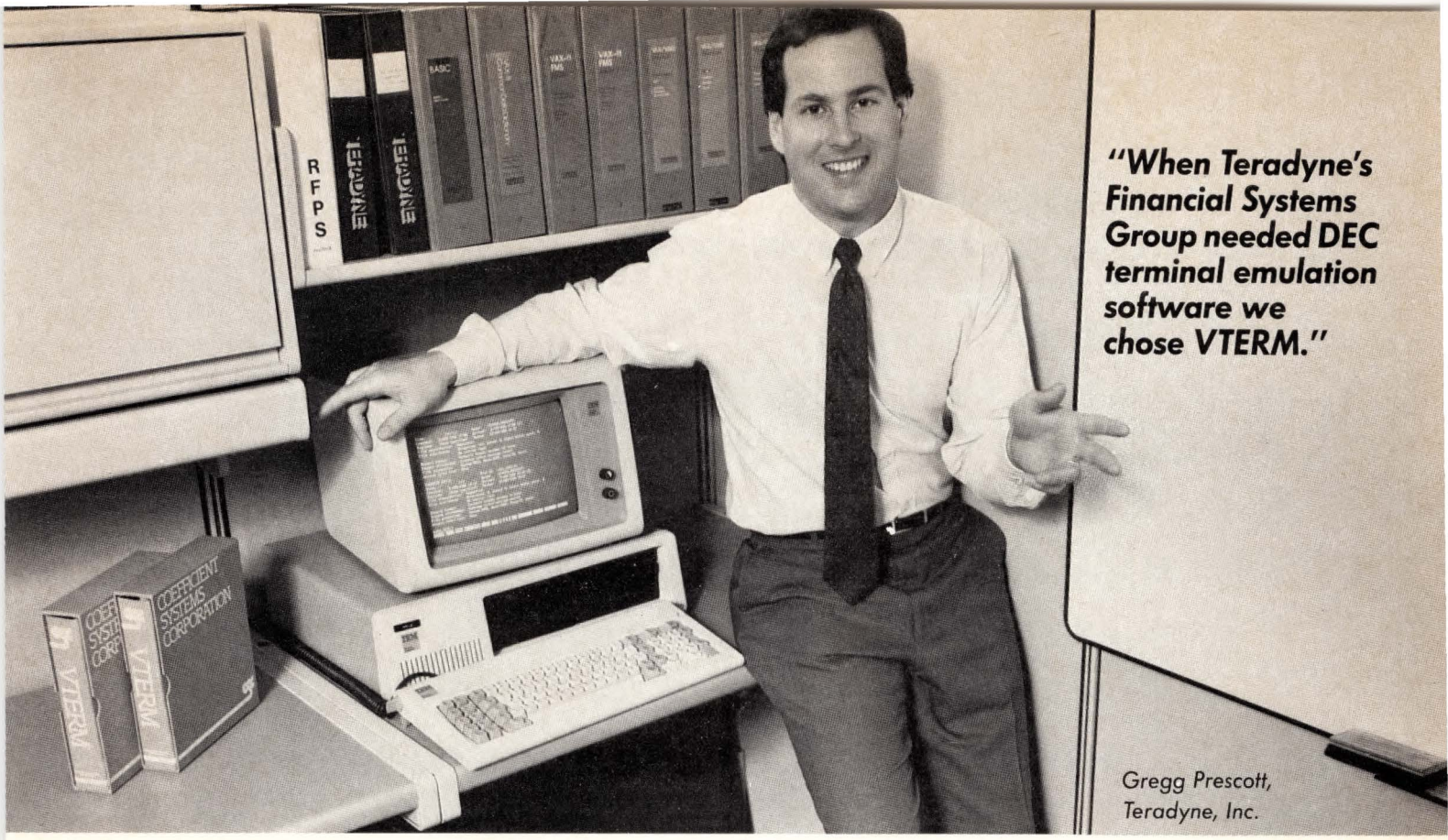




Current CI estimates place the U.S VAX population at 41,500 systems within more than 20,000 sites. The growth of estimated U.S. VAX systems (MICROVAX not included) is provided in the graph "DEC VAX vs. IBM/PCM Mainframe Systems — Population Trends." For comparison purposes, the growth of the IBM/PCM Mainframe market is shown for the time period noted. The graph shows that the market for VAX equipment in the United States has grown at a very rapid pace over the past three years, while the IBM/PCM Mainframe systems base has grown slightly during the same period.

The graph "Installed System Distribution" shows the distribution of major VAX systems within CI's U.S. site base. This presentation indicates the popularity and mix of the current VAX system base (MICROVAX II not included). However, with the considerable number of new systems announced this year, the mix undoubtedly will undergo changes within the next year.

Computer Intelligence Corporation is located at 3344 North Torrey Pines Court, La Jolla, CA 92037.



VTERM/220 Quality makes all other DEC terminal emulators obsolete

Over 35,000 VTERM users, like Teradyne's Financial Systems Group, recognize the importance of critically evaluating a DEC terminal emulator. Demanding professionals require high quality, reliable DEC terminal emulation. After painstaking evaluation, Teradyne's Gregg Prescott said, "With VTERM's speed, ease of use, hot key and host control of file transfer, we can build systems around VTERM utilizing distributed PC applications."

Coefficient's VT100 terminal emulator, introduced in 1981, was the first in the industry. Our thorough attention to detail at every stage of the design, development and testing process has won us more satisfied users than all our competition combined. Now, a new more powerful VTERM supports VT220 terminal emulation. Powerful features include:

- Plug compatible VT220 and VT100 video and keyboard emulation with customizable key mappings.
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- Powerful file transfer including the most thorough implementation of KERMIT available on the PC, plus XMODEM, and our proprietary protocol VTRANS with complete host-side software for VMS,™ RSTS/E,™ RSX11 M/M+™ and UNIX.™
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- 132-column display via horizontal scrolling or optional video board.
- Scrollback buffer for redisplay of up to 2,000 lines (80 screens!).
- "Hot Key" toggle between host session and PC DOS.
- Programmable softkeys with script-like capabilities.
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Call 212-777-6707 ext. 602, to get the best there is in DEC terminal emulation and communications software.

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Coefficient
The Leader in DEC Emulation Software
Coefficient Systems Corporation
611 Broadway, New York, N.Y. 10012

MAPS Line To Supplement Common Financial Systems Software Portfolio

Accounting, Financial Packages To Be Used In DEC Sites Worldwide

As part of its effort to develop a standard portfolio of accounting and financial software for use in its sites worldwide, DEC has selected several products from Ross Systems' MAPS line.

DEC will implement the MAPS/FA package as its worldwide Fixed Assets system standard, installing it in U.S. and international locations.

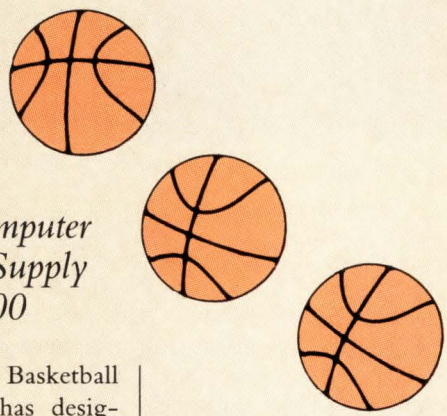
Ross Systems' MAPS/AP package was selected by DEC to supplement its own internally developed accounts payable system for use in U.S. and foreign sites. DEC's U.S. sales areas have been using MAPS/AP in a distributed environment for the last year.

Similarly, DEC has selected the MAPS family of financial applications products for use in sites that need an easy-to-use, but full-featured system.

DEC's Common Financial Systems organization was established to provide its internal organizations with a portfolio of common accounting and financial software to be used worldwide.

The common systems approach is used to ensure consistency and integrity of the fiscal data being gathered by corporate headquarters, with worldwide support and training provided under the direction of DEC's Common Systems support organization in Acton, Massachusetts.

NBA Drafts DEC



'Official Computer Vendor' To Supply A VAX 8200

The National Basketball Association has designated DEC its "official computer vendor." The announcement was made at INFO '86 in New York City by NBA commissioner David Stern and Craig Zamzow, corporate manager of DEC's Office Information Programs. The agreement calls for DEC to supply the NBA with a VAX 8200 to meet the league's immediate need for a sate-of-the-art accounts receivable/payable system, and for more efficient recording and analysis of gate receipts. The VAX is to be installed at the league's New York City headquarters.

Future plans call for DEC to provide the NBA with the ALL-IN-1 integrated office automation system for word processing, electronic mail, office scheduling and other business applications. The NBA already maintains an extensive database of player statistics and contract information. The new installation will facilitate more easily the storage, updating and distribution of the data to and from the league's 23 team franchises across the continent.

DEC will use its new designation in advertising scheduled to appear in NBA publications and on cable television during the current basketball season.

8300, 8200 Expansion Capability Doubled

Memory Increased 33 Percent

New configurations of the VAX 8300 and VAX 8200 systems provide double the expansion capabilities of the entry-level versions in only 30 percent greater floor space. Additionally, these configurations can support up to 32 MB of memory, a 33 percent increase.

The new Configuration 2 implementations are targeted for applications where larger systems are required, either initially or for future expansion. The new configurations are the third enhancement to the VAX 8300 and VAX 8200 computers since they were introduced in January.

The higher-performance VAX 8300 systems especially are suited to the Configuration 2 packaging. The new implementations incorporate a 24-slot VAXBI-bus backplane that enables them to support as many as 16 disk drives, four disk controllers, three tape drives, 48 asynchronous communication lines, and six synchronous communication lines. The new systems have

an integral Ethernet networking interface, and a UNIBUS adapter is available as an option. VAXBI-bus interfaces developed by licensed third-party manufacturers also can be used in these systems.

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18. I don't think the on-line HELP would be that helpful.
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22. I don't want it if it can't do database operations.
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28. It wouldn't let me point to formulas like my PC spreadsheet does.
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30. It wouldn't consolidate financial statements across my organization.

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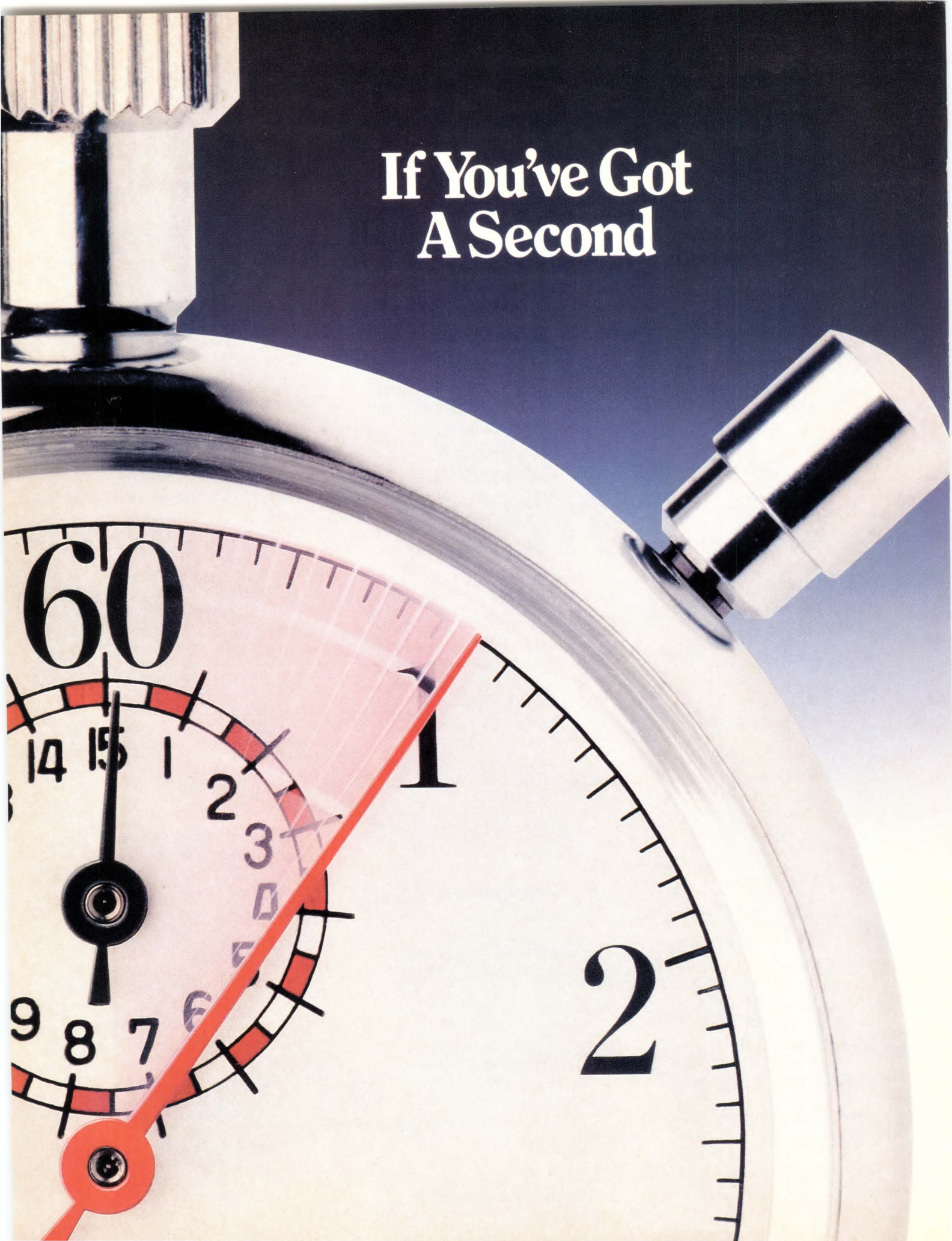
Computer Model_____

DPA126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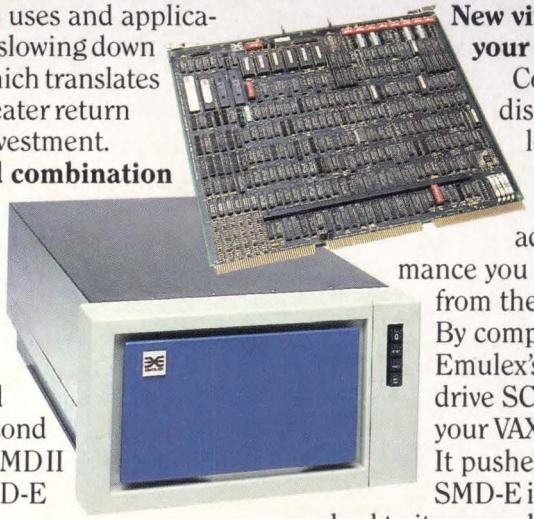

In fact, speed is only one of the many impressive benefits that this storage subsystem package from CDC and Emulex offers you. The 14-inch XMD II drive also gives you a space-saving, energy-conserving 858 Mbytes of storage on a single spindle—twice the capacity of the biggest drive DEC can supply. Plus an astonishing 16-millisecond average access time—nearly twice as fast as the best DEC can offer. And reliability: 30,000 MTBF and a 3-year warranty on the HDA—without any preventive maintenance.

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Conventional disk controllers would limit, however, the added performance you could expect from these features. By comparison, Emulex's new eight-drive SC7003 gives your VAX new vitality. It pushes the new SMD-E industry standard to its upper limits—without losing any of the software transparency, processor compatibility, and extra performance features you've learned to expect from Emulex.

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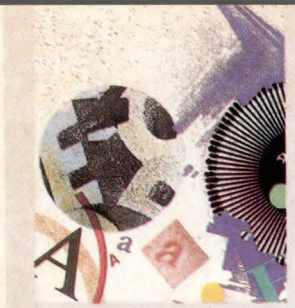


FORECASTING

COMING DECisions

By Philip A. Naecker

What To Expect From DEC In The Year Ahead.

Now that DECUS and DEXPO West have come and gone, it's time to gather our thoughts and commit to paper a few guesses as to "what might be" during the next year or so. I've picked the brains of my most forward-thinking colleagues and filtered their input into the following conjectures. Some of these already may be reality by the time this issue hits the streets, so fast is the pace of technology. But other ideas never will see the light of day, so it probably all balances out in the end.

Where We've Been

Looking back at the last two or three years, DEC made the following DECisions:

1. To extend the VAX architecture both up and down, being careful not to step on the price/performance space of any other VAX processor. It's clear that VAX architecture is king. There have been noises of other architectures in the offing, but those seem distant now.
2. To permit users to hook everything together as seamlessly as possible. Use DECnet if you have to, clusters and common file systems if you can.
3. To keep those announcements coming; not just once or twice a year, but four or five times a year, with a few nice products dribbling out in between.
4. To price aggressively, only if really necessary. DEC calls this "pricing on functionality," but the result is the same. After all, someone has to pay for all the engineering that went into the MICROVAX memory controller.
5. To hail the standards. Let's face it — DEC machines aren't always found in an all-DEC shop. The company intended to make it easy for folks to migrate applications to (or through) its machines. DEC chose to support OSI, IEEE 802.3, FORTRAN 8x, X.400, COBOL 85, GKS, X-Windows, and any other standard that looked reasonable (as long as it didn't fly in the face of Big Blue compatibility).

'The Network Is The System'

It's a bit strange to hear that refrain these days — but it makes good sense because DEC is starting to open up a new toy box full of things that work together on the network. There are two levels of networking going on here, LAN-based workstations and LAN- or WAN-based servers of various flavors.

LAN-Based Workstations

DEC has been using the catchy term "worksystems," the idea being that these are full-fledged computer systems, specially designed for the needs of a single user or small department. There are two flavors: VAX-based and non-VAX based.

In the VAX-based worksystems area, you can expect to see DEC continue to push down the cost of entry to a VAX. Most DEC watchers expect the long awaited VAXstar (a.k.a. TeamMate), to be out by the end of this month (perhaps even by the time these bits turn to ink). To avoid eating into the MICROVAX and 8200 lines, the VAXstar will have to be a tightly bounded configuration. I expect the

DEC is trying to break the "clone" pattern set by the VT100 and VT200 series terminals, and is likely to introduce a closed-architecture box for the next series . . .

following three systems to be announced within a year:

1. "THigh-End."

A multiuser MICROVAX-II class processor, with a small disk, Thinwire Ethernet connection, four ports, and a two-user license. Use the other ports for printers or whatever you want.

2. Low-End

A single-user workstation using the Dragon chip and a Thinwire connection. Look for a 19-inch monitor, even in this price range. No disk or media at all. DEC has to solve the problem of booting diagnostics over the network to make this work, but they've done that before.

3. In-Between

Same as the low-end, but with more disk and memory; possibly even a two-headed workstation with two 19-inch monitors using Dragon technology.

I predict that none of these systems will have a real bus to speak of, so don't expect to use your old Q-bus peripherals. On the other hand, what do you want for $5000 to $15,000? Since most of the memory control functions already are on the MICROVAX CPU board, I suspect that the open PMI memory architecture will remain, at least in some of the configurations. But most of the rest of the functions will reside either on the main CPU board, or just on a single additional board. And they might be convection-cooled too, like the VAXmate, although that's going to be tough to do if they use the same chipset as the MICROVAX and VAXstation/GPX.

There of course will be some new non-VAX worksystems coming out, too. Many of them will be variants on the VAXmate theme, with disk-less systems and loaded systems and such. It's a good bet that one will offer color, and there well may be a bigger monitor, too. I expect the same windowing software, the same file-server software based on MS-Net, and the same mouse as the VAXmate.

One smart move for DEC would be to bundle a low-end VAXstar and an Intel 80386 processor into the same box, with a nice bit-mapped display and mouse. The next year or so will tell whether DEC has the skill to build such a beast in the seamlessly integrated fashion to which DEC users have become accustomed.

I think you also can expect to see the VT300, or "Panda" terminals during the next year. Although the name would imply that the VT300 is just another terminal, one rumor holds that they will be "smart," and might just be smart enough to blur the boundaries between terminal, PC and workstation. DEC has made moves into the On-Line Transaction Processing (OLTP) market, and one thing it needs to achieve significant ground against IBM is a smart terminal to handle the front end for forms-oriented applications. This would allow the host to off-load the character I/O, and perhaps much of the validation overhead.

DEC is trying to break the "clone" pattern set by the VT100 and VT200 series terminals, and is likely to introduce a closed-architecture box for the next series, in an attempt to break that pattern. Look for a larger display, bit-mapped, some heavy-duty VLSI inside, and a mouse or other pointing device.

LAN- And WAN-Based Servers

Servers have just started to hit the streets over the last couple of years. The first was the DECnet Router Server. Next, was the SNA Gateway, really just a PDP-11 or VAX sitting on Ethernet and talking to SNA via a synchronous interface. Nothing fancy, except the name. You can expect a MICROVAX-based ver-

sion of the same box out soon, given DEC's concern with penetrating Blue markets.

The PrintServer recently has hit the streets, too. I'm told it's a MICROVAX running ELN and driving a Ricoh laser engine. The ELN operating system is likely to turn up in even more places, since it's just perfect for a diskless VAX talking to the network. DEC likes to use it's own products internally, even when they haven't been a big hit in the outside world.

FILE SERVERS DON'T look like they're in the cards, except to service PCs, in which case DEC spells fileserver: M-I-C-R-O-V-A-X. File servers aren't necessary in the distributed VAX file system, because the distributed lock manager allows *any* node in a cluster to serve files for the rest of the cluster. The MICROVAXs serving files to the PCs will become more distributed themselves, with PC files residing on a heterogeneous mix of big VAXs, little VAXs, and VAX workstations. Look for some modest price concessions as DEC attempts to penetrate previously PC-only sites with MICROVAXs disguised as servers.

Currently (or, at least as of VMS V4.5), VAXclusters come in two flavors — high-end and low-end. The high-end clusters are CI-based, run only on the 750, 78x, and 8xxx series VAXs, and may have an HSC. The low-end clusters use Ethernet, and can have any mix of VAXs in the cluster. However, because of the ROM needed to boot VMS over Ethernet, only the MICROVAXs currently are supported in diskless configurations over Ethernet.

Partially because of the rather clever slight-of-hand used to implement low-end clusters (they replaced the PADRIVER talking to the CI, with a PEDRIVER talking to Ethernet), it's an either/or situation, currently — a VAX may be a member of a low-end cluster or a high-end cluster, but not both. I'll go out on a limb, though, and say that by this time next year, there will be an announcement to remove that restriction, allowing clusters of all flavors to intermix freely. There is more than a little work to be done, including getting a little more clever in dealing with state transitions, but I think it's coming.

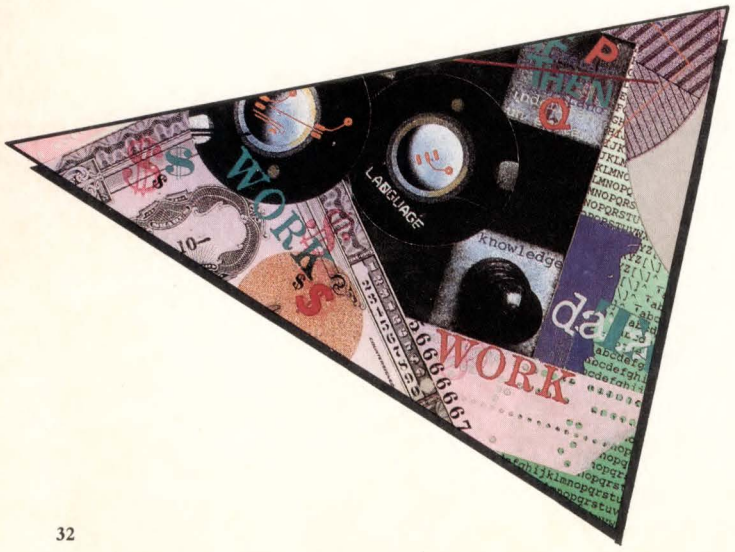
The HSC

The HSC is a disk server and tape server in a high-availability environment, and is likely to continue to hold approximately the same position. Wouldn't it be nice, though, if there were a version of the HSC that would talk to the Ethernet and serve disks and tapes for low-end clusters? I also think we can expect this in a little more than a year.

Of course, you can hang any kind of box off an Ethernet or DECnet and call it a server, but a true server has some sort of performance (or at least price/performance) win over a general-purpose solution. One way that DEC will differentiate a server box from a general-purpose box is by adding hardware on the BI. I don't think this is coming in the next year, but eventually I expect special-purpose boards on the BI to do sorts, searches, array processing, and similar tightly coupled tasks.

Database servers are a little further off. To be truly effective and have a good price-performance position, database machines require a great deal of parallelism. But parallel computing is not DEC's strong point right now, and I think they'll take the time to develop that capability before trying to put out a database server in the high-end market. There may be some low-end database machines, but those are more likely to be vanilla VAXs getting a hardware assist with sorting and searching.

THE DECSERVER SERIES already is providing the terminal server function, but I think we'll begin to see more communications servers within a year. The new low-end clusters of MICROVAXs and VAXstations and such, will



How Wall Street Sees DEC

While DEC's financial performance — judged on its stock price and quarterly reports — obviously has been good, it may not be obvious just how remarkable that performance has been.

Over the 12 months ending September 30, 1986, the Standard and Poor's index of 500 stock prices rose 26 percent. During this period, their index of 12 computer manufacturer's stocks (excluding IBM) rose 35 percent. Over this time, DEC's stock rose 67 percent.

Over the 24 months ending September 30, 1986, the S&P 500 gained 43 percent and their 12 computer stocks rose 46 percent. For these two years, DEC's stock posted an 80 percent increase.

By combining the revenues of 37 major computer and peripheral manufacturers, excluding DEC and IBM, we can compare DEC's performance to the rest of the industry. The 1986 revenue of the 37 manufacturers was 8.4 percent greater than two years ago. DEC's revenue rose 36 percent over this time. (Figures are based on each company's fiscal year as compiled by Value Line Investment Survey, New York, New York. Some 1986 data are estimated.)

Using the same method, but looking at net profits, the 37 computer and peripheral manufacturers made 3.8 percent more money during 1986 than 1984. DEC increased profits by 88 percent in these 24 months.

Comparisons with IBM are even more dramatic.

DEC made 61 percent more money in fiscal year 1986 than it did during 1985. IBM's net profit probably will decline about six percent in 1986 from 1985 (based on Value Line estimates). This will mark the second consecutive year that IBM's profits have fallen, while DEC has out-performed the industry average.

As DEC's stock was rising 67 percent and 80 percent over the last 12 and 24 months respectively, IBM's gained only 6.2 percent and 8.8 percent.

Will the next few years be as good as the last two for DEC? IBM's recent announcement of an expanded product line using the 370 architecture strikes at one of DEC's major selling points over Big Blue, compatibility over a wide price/performance range. On the other hand, IBM is in the unfamiliar and uncomfortable role of playing catch-up with a competitor to some extent.

Kimball Brown, a computer-industry analyst at Dataquest, San Jose, California, is confident about DEC's future. "DEC will be an extremely profitable company over the next 24 months, and probably beyond that." He notes, however, that the new mid-sized computers in the IBM 370 line will make some work for the DEC salesforce. "Every potential sale that is a competition between DEC and IBM is on hold for now, while the customer sizes up IBM's new products. IBM also is strengthening their data communication capabilities and machine interconnectivity, two other areas where DEC is strong."

Value Line analyst George A. Niemond, writing about DEC in their August 8, 1986 report, also sees a rosy future for the company. "We expect a gain (in share earnings) . . . in fiscal 1987, and double-digit share earnings growth into the next decade. . . . New products are a plus, too. . . . A VAX-compatible product that's also IBM PC compatible should aid in penetrating the office market, and a low-cost engineering workstation should solidify DEC's hold on that market."

The feelings of many DEC-watchers probably are summed up by Charles T. Casale, executive director of Yankee Group Financial, Boston, Massachusetts. "DEC has a challenge ahead if they want to continue their stellar performance. Looking at their history, however, you can see the determination with which they have approached other challenges."

—Charles Connell

DEC has implemented two-processor configurations on the BI, but the bus architecture certainly can support multiprocessing.

require some way to connect islands of processors (perhaps branch offices in a large corporation) into the rest of the network. A communications server that can manage simultaneous connections with several different communications systems, and also route traffic, would fit right into this picture.

One thing that DEC obviously needs in order to address this market is a combination communications board. Imagine a low-end VAX (such as a VAXstar) with an Ethernet interface; a couple of megabytes of memory; and a single board containing an X.25 interface, a synchronous interface at, say, T1 speeds (1.544 megabits), and a couple of lower speed synchronous interfaces. Put VAX ELN on it, plunk it down in the telephone switchroom, and Voila! — a communications server is born. Such a box would have the smarts and power to balance traffic, the failover to backup communications paths when primary paths go down, and also would act as a gateway node between public and private communications networks. The market may not be there in a year, but I think eventually such a tool will be needed.

To manage all these little VAXs running around serving you, look for extensions of the Remote System Manager software announced last summer. Although currently limited to certain hardware and communications configurations, I expect the RSM style of software distribution and remote management to be the way a lone system manager supports dozens of VAXs, workstations, and VAX-based servers. RSM uses VAX ELN to do things remotely — a trend I expect to continue in other server-type products.

Other Hardware To Look For

To keep buyers of DEC equipment from looking too hard at their options, DEC will have to keep pace with the industry in a number of areas where DEC engineering is not the standard setter.

The RA81 is practically venerable by now, and there have been rumors of an RA82 "just around the corner" for over a year. It sounds like DEC has had to scale back the disk's capacity because of reliability problems, and the current gossip is that the RA82 will be a 600-plus megabyte drive using the same form factor as the RA81.

Another mid-range or high-end processor is not really required at this time, so I don't look for any significant announcements in this area over the next 12 months. There is talk of a high-end machine (8900?), but for a couple of reasons I don't think it will be announced this year: First, there is only a narrow market for such a processor, which cannot be met by clustered 8800s. Only those applications that need absolute speed (as opposed to clustered capacity) could use the new processor.

Second, the next processor needs to be at least twice as fast as the 8800. That kind of technological jump doesn't come easily in a couple of years, so I'm betting that DEC will wait for '88.

One of the beauties of the BI is that it straightforwardly supports multiprocessing. So far, DEC has implemented two-processor configurations on the BI, but the bus architecture certainly can support multiprocessing. I think there is a good chance that VMS V5 will provide support for parallel multiprocessing,

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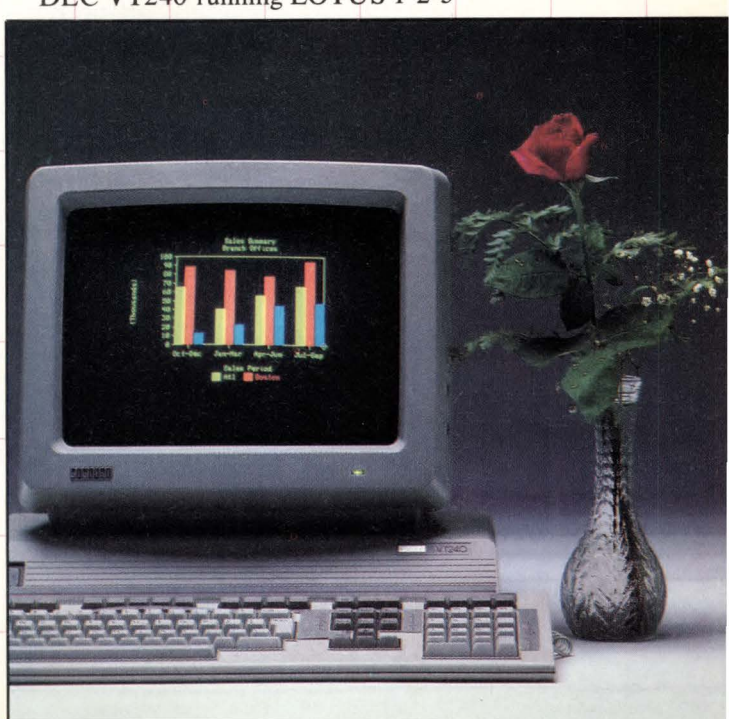
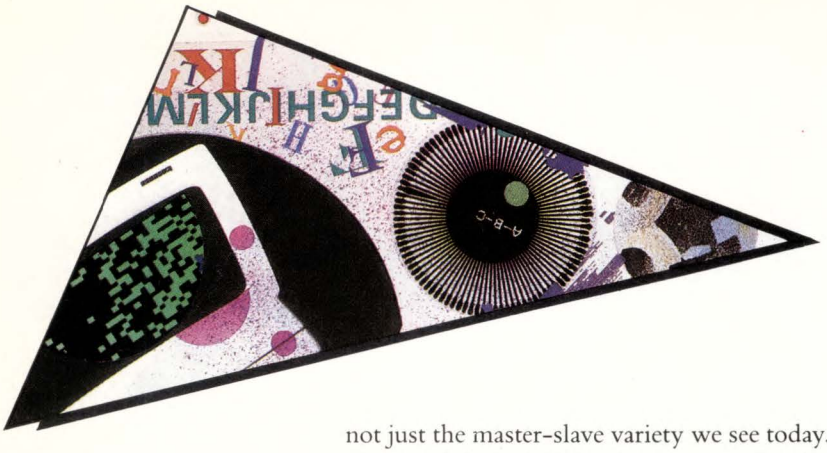




not just the master-slave variety we see today. If so, look for a BI-based CPU (CPUs?) with several peer processors.

VAX Software Futures

Since the VAX is the keystone in DEC's computing strategy in the near-term, the directions for VAX/VMS are of central importance. However, I don't think we should anticipate radical changes in VMS during the next year or so. The lesson from the V3 to V4 upgrade tribulations was that moderate, incremental changes in the operating system are the least disruptive. They also are the most conducive to layered products incorporating those changes into their designs. We will see a few significant changes with just about every new release of VMS.

In VMS V4.5, the big story seems to be low-end (MICROVAX) clusters. But I've heard there also is likely to be support for RMS journaling. Journaling would allow database-like operations on RMS files, letting users restore files to a previous state if processing terminated improperly — for example due to a system crash.

V4.6 IS SAID TO BE primarily a maintenance release, but I'm sure we can expect some new features as well. I think the pattern of incorporating significant operating system functionality into layered products is likely to continue. Instead of including new features as part of the VMS license, DEC bundles it as a layered product that is shipped as part of VMS. When you purchase the layered product, you get a software key that "turns on" the feature. This technique has been used with DECnet for years. It also was used with HSC-based volume shadowing, and is to be used with RMS journaling and low-end clusters.

One feature that already is present in VMS and may be documented in V4.6, is support for user-written mail gateways. Currently, VMS MAIL has a little-known hook for dynamically linking user-written mail gateways into the image, thus allowing a user to send mail from within the VMS MAIL interface, but have it be delivered via a foreign protocol. This interface currently is used to support VAX PSI mail and the VMS MAIL gateway.

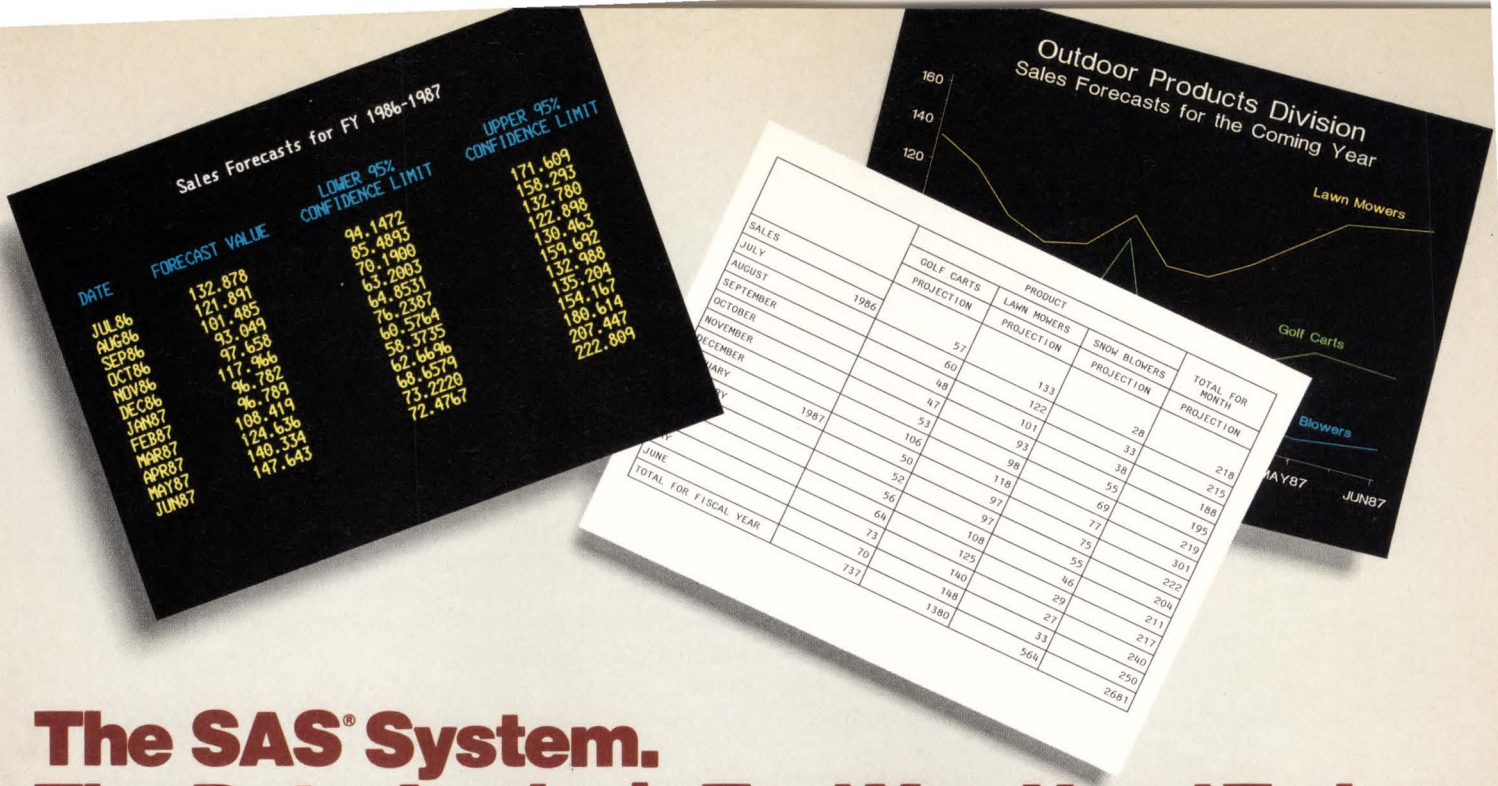
In fact, one good candidate for substantial enhancement over the next year is the VMS MAIL utility itself. Several VAX System Improvement Requests from DECUS have revolved around enhancements to VMS MAIL, including support for "Carbon Copies," a username lookup function, and making MAIL callable from high level languages. DEC may elect to form these features into a layered product and charge extra for it, although that probably would generate a great deal of unhappiness among dedicated users of VMS MAIL.

MAKING OTHER UTILITIES callable also seems a likely V5 enhancement. Considerable benefit could be gained by using a callable version of BACKUP, for instance. Other candidates include callable SEARCH and MONITOR utilities.

For creating new user interfaces to VMS, making utilities callable also will be an aid to DEC. This is true since, in future versions of VMS, as well as in the layered products, DEC will have to address the needs and capabilities of bit-mapped terminals and workstations.

Last I heard, there were two schools of thought about this subject in DEC Software Engineering: The first holds that the capabilities of VMS and layered products should be extended to incorporate the capabilities of the new human interfaces. These folks would like to see capabilities, such as extensions to the VAX Screen Management (SMG) Interface, to handle a mouse, puck, or stylus pointing device.

These extensions would allow software like the VAX Debugger to use the new interface and provide much richer options for windowing, identification of breakpoints and watchpoints, and the like. Via the layered SMG mechanism, products that already use SMG, such as the Debugger and TPU, could use the new pointing mechanism almost "for free." (Oh, how I would like to be able to use the



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* Computer Intelligence, January 1986.

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mouse on my VAXstation as I sit here writing this. (One gets spoiled so easily.)

ANOTHER SCHOOL HOLDS that extending keyboard- and syntax-oriented systems via enhanced display handling and fancy pointers, is really missing the boat — what is needed is a rethinking of the approach. Rather than just "hanging a bag on the side" of VMS, an entire new layer of software must be created. These folks would "chop the head off" the Debugger, for example, and support two separate interfaces into a common library — one for old character-oriented terminals, and another for bit-mapped and mouse-driven workstations. The bit-mapped interface would support an icon-based representation with a more spatial and object-oriented view of the world.

Instead of selecting an icon for a watchpoint, then, typing in the variable name to be watched, a user of this new interface would pick up the variable from a list displayed on the screen, then, drop it onto a watchpoint icon.

It isn't likely that we will see a clear selection between these two approaches in the next year, but I think this year will mark the beginning of the face-off between the two approaches. For example, in a separate but related scuffle, it looks like VAX UIS (User Interface Services) has died a premature death at the hands of X-Windows. UIS has been under development for a couple of years, as the new programmer interface to VAXstations. It has enough flexibility to support any new workstation that might come along. Already in its third major release, V3.0, UIS had reached a high level of functionality. (V1 was for internal use only, and V2 was a stop-gap to provide support for OEMs and the few users developing VAXstation applications but unable or unwilling to use the device driver interface.) It is via UIS that most of us thought we would be developing future VAXstation applications.

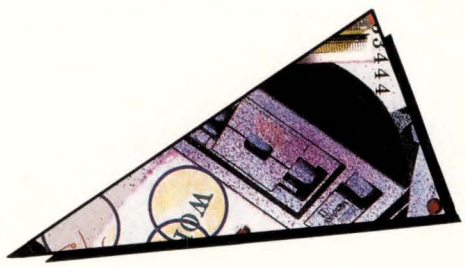
UIS is a beautiful VMS run-time library. It provides an interface familiar to anyone who's programmed under VMS for very long. And UIS is very rich in features, giving access to the full power of the hardware, without requiring program development at the device level. However, most workstations are in the UNIX environment, and some of the ideas used heavily in UIS (such as ASTs for delivery of mouse events) are alien in that environment. In UNIX workstations, X-Windows is king, and I think it is about to kill off UIS.

X-WINDOWS ALREADY is running under ULTRIX, and I doubt that it will require much work to make the port to VMS. Probably, most of the effort will revolve around writing jacket routines to impart a VMS flavor when calling X-Windows from a language other than C, and by providing documentation that gives warm fuzzies to a VMS programmer. By this time next year, I expect that those of us using VAXstations will be reading from a manual entitled "Guide to Using X-Windows/VMS," or something close.

Bitmapped screens are going to require some additional support from non-graphics software, as well. At recent DECUS Symposia, members of DEC's Software Engineering Group have given talks describing a proposed CODASYL standard for a new forms interface. The new standard explicitly includes provision for distribution of the forms engine to a different CPU than the one running the application. If DEC develops software to support this standard, there is a good chance it will be distributed onto a "smart" terminal or workstation, perhaps like the new VT series. Since there isn't even an approved standard yet, it's a little early to say how long it will take to create a product, if ever. But this is clearly an area of concern to support a thrust into the OLTP applications mentioned earlier.

How Long Is A Year?

The problem with making projections in print is that everyone can read them a year later and see how well (or poorly) they're matched by reality. Some of the above products may be reality by the publication date, and some may take longer. But DEC certainly is on a roll right now, and they'll be introducing new products and enhancements at an unprecedented rate. The next year is going to be exciting for users of DEC products, even if none of these things comes to pass. ■



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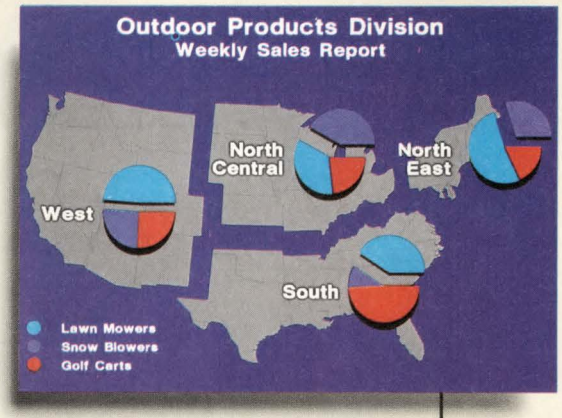

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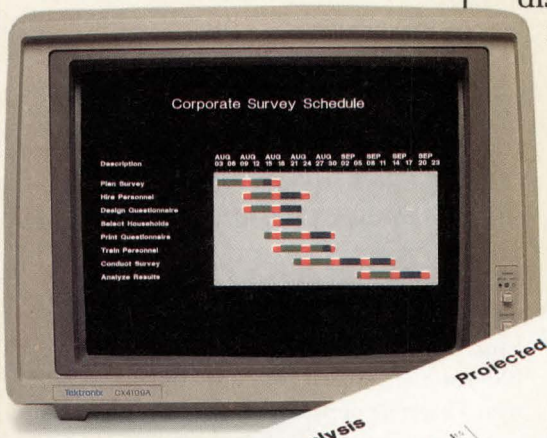

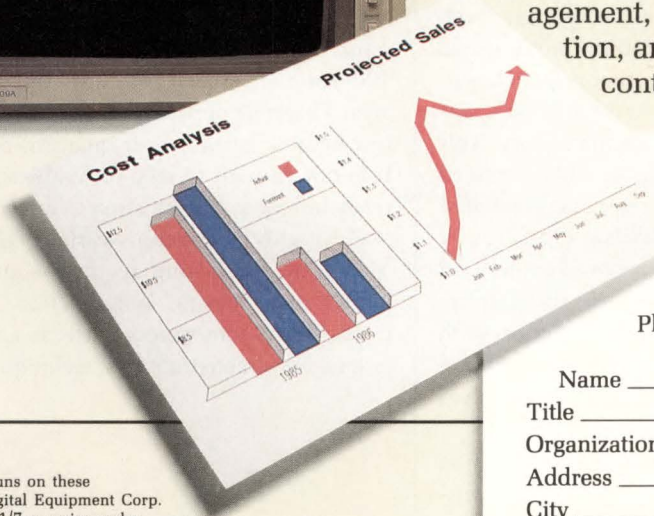

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FORECASTING

WEATHER ARE WE GOING?

By Bruce Feldman

Profs Weather Prediction Network Provides The Answers.

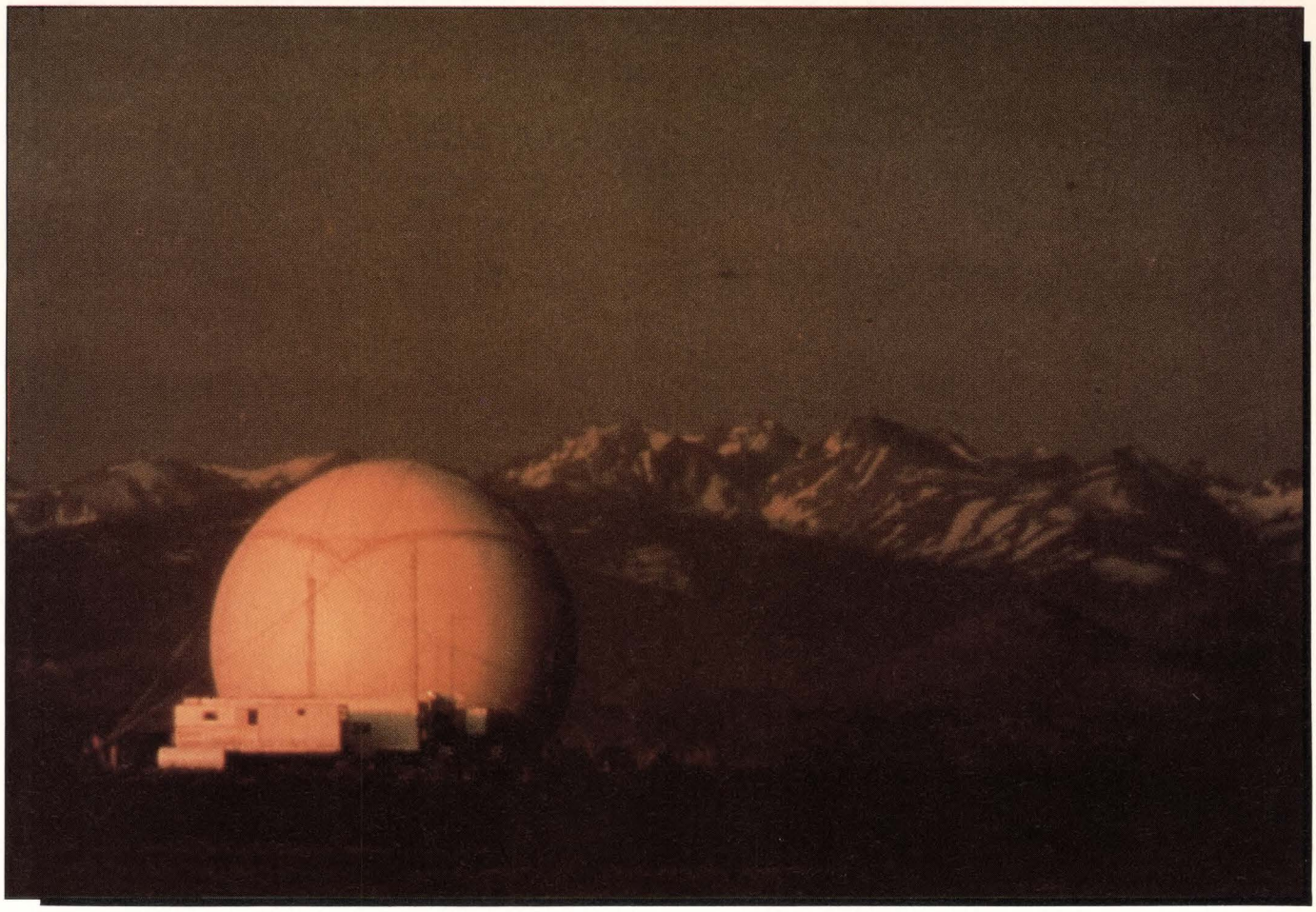
Weather remains a vast frontier to 20th century science, but there have been some important inroads toward the apocolyptic goal of one day understanding and controlling it. Through the analysis of new and important data, DEC is contributing to the conquering of this frontier.

The science of meteorology is plagued with problems of scope. The weather cannot be isolated easily and studied in the laboratory; there simply are too many variables. Nor can it, as a continuing process, be stopped long enough to analyze. Many of the most interesting aspects are invisible to the eye and even to sophisticated instrumentation.

Meteorologists traditionally have been forced to project future weather conditions on the basis of past patterns rather than to logically deduce specific conditions based on scientific laws and elaborated scientific theory. This projection, or forecasting, has been refined continually through the years and takes into view far more factors now than it previously did, but is no replacement for prediction based on theory. However, it is also true that a strong foothold has been gained in prediction with sophisticated scientific modeling techniques based on elaborate equations, themselves derived from physical laws.

With such modeling techniques, scientists can anticipate with some confidence, macroscopic weather patterns affecting large areas, in a certain general time frame, and under certain conditions. But, what is often most interesting and important about the weather are the radical discontinuities — the area and time-specific, discrete and powerful phenomena such as tidal waves, tornados, hurricanes or floods. It is these brief, capricious events that account for the loss of from 300 to 400 lives per year and millions of dollars in destruction in the U.S. alone, not to mention the people left homeless, the losses of sentimental and cultural value, and the vanishing means of livelihood.

WEATHER IGNORES political boundaries — it does not change at the state line. Meteorologists, however, are increasingly turning their attention to regional (mesoscale) weather patterns; those patterns taking place within a 100-Km radius, such as within a metropolitan area. This type of data is more difficult to collect because of the sheer quantity necessary. It is not enough to rely on wide-scale, relatively infrequent information to forecast small-scale, highly transient weather conditions. Mesoscale forecasting requires significantly higher data density, and the lead time for forecasting is sometimes as little as a half-hour or less. New meteorological techniques had to



A Doppler radar dome in Adams County, Colorado.

be developed and refined to collect and analyze this type of data.

That is where the Program for Regional Observing and Forecasting Services (Profs) came in. At Profs, synoptic data is first studied carefully to create a context in which to view and guide the collection of regional data. It is a process of moving from the general to the specific, of taking wide scale data and adding regional data to create an accurate picture of the weather on the local scale.

A System Overview

Profs is designed to improve operational weather forecasting through the development and distribution of the latest scientific and technological innovations in the field. The operation includes a staff of over 60 specialists, including 20 meteorologists and 10 engineers, in addition to numerous mathematicians, programmers and technicians. These individuals perform tasks from the design of field sensors for data collection, to the development of techniques for communicating the data to recipients.

THE FACILITY FOCUSES on a region approximately 125 miles in diameter, surrounding Boulder, Colorado. Within the region, data is amassed from 22 automated weather stations and fed into VAXs located in Boulder. At the remote data collection sites, instruments measure such variables as temperature, barometric pressure, precipitation, wind speed and direction and solar radiation. Data is collected from the sensors on a Z-80 chip, every 10 seconds, then averaged over a five-minute period.

The VAXs task the remote stations for data which then is formatted and transmitted by the microchips, back to the central facility. Data also is collected by radar and satellite, and

To experiment with a wide variety of meteorological techniques, a computer network was needed that was exceptionally versatile. Profs looked to DEC for the answer.

combined to form a highly detailed picture of the current weather situation.

To experiment with a wide variety of meteorological techniques, a computer network was needed that was exceptionally versatile. Profs looked to DEC for the answer. The major function of the Profs network is to collect, reduce and transmit the data from the sensors in the field; store the data in a central computer file, and summarize and display it in various ways. Since Profs is a test and evaluation facility, it must collect more data than may be necessary for forecasting. The site handles from between five and 10 MB of data from its collectors during each hour of operation.

THE PROFS COMPUTER CENTER contains a VAX 11/785, two 780s, and three 750s which all are clustered. The facility also has several LSI 11/23s, PDP-11/23s and 24s, and MICROVAX Is and IIs involved in various functions. One of the VAX 11/780s acquires and manages the central meteorological data files and performs several functions to convert raw data sets in the central files into meteorological display products, usable by forecasters. Meteorologists can write application programs that generate analyzed fields without detailed information about the central data file format. One of the VAX 11/750s generates the display results.

There are PDP-11/24s at work as workstation control processors in remote locations. The 32-bit virtual memory VAXs are required to manipulate the large amounts of data in the form of radar and satellite images. The compatibility of the 16- and 32-bit DEC hardware and communications components of the system has enabled the synchronous serial transmission of all data transfers between the computers using DECnet.

Data arriving from the subsystem preprocessors is transferred to the VAXs and stored on two DEC RM05 disk drives with a storage capacity of 256 MB each. Happily, the entire network has the same topology and requires the same hardware and software support, a situation that is ideal from the standpoint of operations and maintenance.

The VAXcluster permits the rapid transfer of large volumes of data at a rate of up to 70 MBPS. The cluster has enhanced system availability and processor utilization significantly. Virtually all computer communications in Profs are handled through a 10 MBPS Ethernet LAN. The Ethernet is equipped with terminal servers that give each of the 100 terminals direct access to each of the VAXs without spaghetti wiring. To transfer the external communications responsibility from the computers, the Ethernet is equipped with a communications server. Data communications also were improved recently by the installation of interconnect and switching hardware, test apparatus for digital and analog telephone lines, and separate cabinets for components. As a result, maintenance time for the Profs 22-node network has been reduced substantially.

Observer, a network monitoring system from DEC, was installed to provide Profs with a continuous measure of DECnet traffic, events, and errors, but proved inadequate. The facility currently is without a suitable alternative. DEC's SPM (Software Performance Monitor) greatly helps in system management, however, by providing the VAX system

A Ramtek graphics workstation with touch-screen feature.

The Profs computer room.

The impressive amount and type of data collected at Profs would mean little if they were not able to be summarized in meaningful ways.

manager with essential data on memory utilization, disk space use and fragmentation, and distribution and prioritization of processes. As the technology of data acquisition and analysis is refined, the people at Profs hope to be able to transfer the necessary technology to a less complex, lower-cost system.

Seeing The Wind

The impressive amount and type of data collected at Profs would mean little if they were not able to be summarized in meaningful ways. And, one of the most meaningful ways is through static and animated visual displays that place the data into an easily understood, spatial and temporal context. In meteorology, graphic display is not merely an embellishment or a luxury; rather, it has real significance. The sheer amount of data amassed from diverse types of instrumentation on land, in the oceans and in space, measuring a diverse array of variables, necessitates a visualization that is simple without being simplistic. Additionally, the focus of study for Profs is a very visual one: thunderstorms, flash floods, tornados, etc.; the viewable manifestations of subtle and intricate physical processes that lend themselves best to a visual summarization.

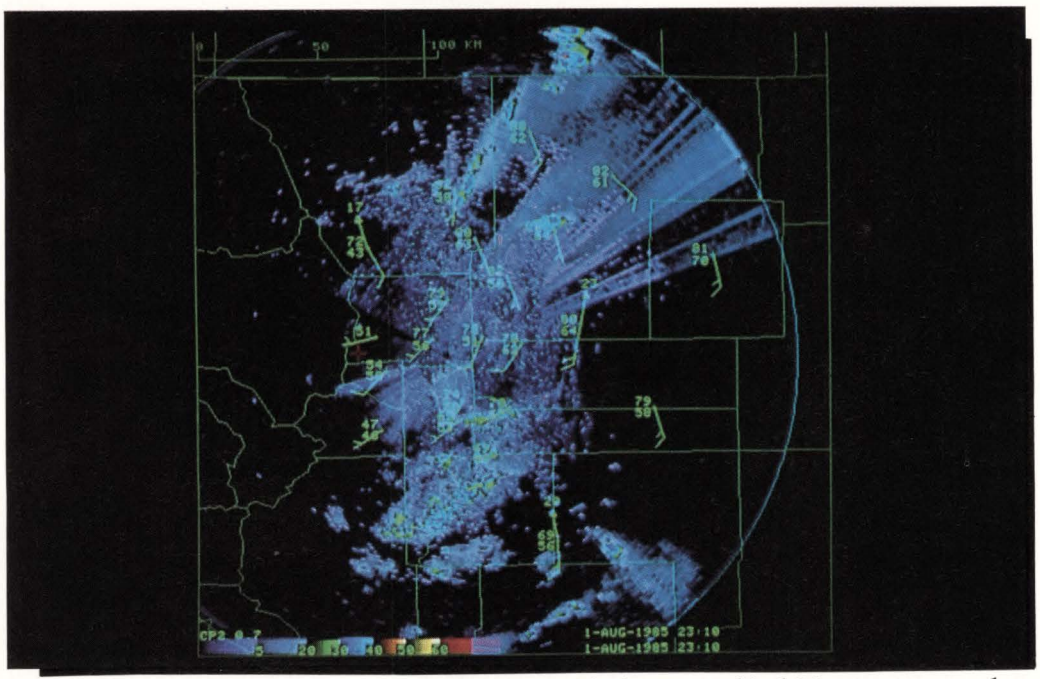
At Profs, the data is fed to a system of five workstations where it takes on its full elaboration. Profs maintains two VAX 11/750-based workstations with Ramtek 9460 graphics terminals. Three MICROVAX II-based versions of the above also are up and running, each with Ramtek 9465 graphics terminals. Profs is looking to upgrade this system in the future to VAXstation GPXs along with a new Ramtek terminal, or possibly to VAX 8300-based workstations.

WITH THE CURRENT apparatus, researchers have the capability to create sophisticated animation sequences of weather patterns to assist in forecasting. The weather forecasting process can be characterized as a "tree search." A weather system may consist of over a thousand data images, with perhaps five percent of them relevant to the current weather problem being assessed. Each relevant image usually is equipped with a choice of branches in other relevant directions. The time needed to pursue a line of inquiry concerning an impending disturbance can be seen as equal to the number of images examined, multiplied by the "product availability time" — the time it takes to load the image from disk to display — plus the perusal time. In forecasting violent weather patterns, time of forecast is crucial to allow sufficient preparation to meet the challenge.

It generally is true that a meteorologist can see far more in a loop than in a static image; hence, the importance of animation at Profs. The process of animation begins with data collected from weather satellites, which is fed to the PDP-11/24s where it is processed into raw data files. The VAX 11/780s process these files into images, essentially large arrays of data.

In this form the data is stored on the workstation computer and then loaded into parallel link to the display apparatus. The meteorologist at the controls uses a mouse to select and manipulate the images and to change the pseudo-color enhancement to best display the patterns created. For instance, a meteorologist desiring to see infrared satellite images

A Colorado tornado.



A radar image with the geographical Mesonet-area overlay.

It is possible to display up to 90 different colors at once on the system, making it possible to visualize a large dynamic range of data.

at full video rate, and using a specific color table and map of the U.S., can set these parameters and have them saved. The data then is formed into an animation loop of eight frames and displayed as an animated sequence.

The value of the animation to the staff definitely has grown. Profs now is seeking to greatly increase the speed of animation, and the length of the sequences that the system can handle, to 64 frames. The creation of the animated loops takes a lot of disk space and loop setup time, and longer loops result in slower data loading. All images and graphics automatically are loaded with multiple frames for animated viewing. Profs is considering the attainment of real-time high-speed Digital disk drives together with enhanced graphics displays to extend the success of the animation.

THE PROFS MENU itself makes use of a diversity of graphics techniques. Color codes, blinking characters and alphanumerics are used to show system states. It is possible to display up to 90 different colors at once on the system, making it possible to visualize a large dynamic range of data. An important aspect of the graphics system is the capacity to display different types of data from different sources.

One of the questions for investigation is just how frequently the data collection activity should be to elicit the most accurate forecasts. Clearly, for efficient use of computing resources, it is desirable to collect data only as often as necessary. The question of optimal spatial resolution in summarizing the data also is a trade-off.

A typical image of the kind useful to Profs researchers consists of approximately 500 x 500 pixels, characteristically eight bits deep. Each image is received, processed and stored on disks, usually more than once. To accommodate twice as many images necessitates a doubling of the communications capacity, computer power and disk storage. Thus, observational frequency is an important factor to consider. In general, it was discovered that the more frequent the data collection, the greater the validity of the weather warning issued.

To meet the constantly increasing demand by worldwide constituents of Profs for current meteorological data, software was developed to archive and output the data and enable recipients to access it through virtually any computer with a standard nine-track, half-inch tape drive.

Because the data developed by Profs emanates from many sources, it is especially important that the combined results be displayed in a way that is free from confusion and overcomplexity, while at the same time is able to take advantage of the visual richness obtainable through a large amount of data.

Profs has developed a successful system allowing the display of continuous-tone (quasi-photographic) images and line drawings that visually summarize data combined from several sources into a coherent, graphically meaningful statement of conditions.

The Profs Operational Weather Education and Research system provides the meteorological community with software, archived and real-time data, and communications capabilities at low cost — a major objective since its inception — and able to be realized with the use of sophisticated hardware from DEC. ■

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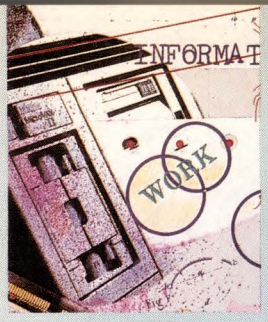

VAX

DEBUGGING REAL-TIME SOFTWARE

By Robert P. McCaskey

VMS Provides A Real-Time Tool To Examine Problem Areas.

During the past few years of a consulting assignment for the Naval Air Development Center, Warminster, Pennsylvania, I often have had to debug VAX real-time simulation software. Although the VAX debugger and FORTRAN debug lines serve a preliminary function of program cleanup, they fall short of giving you a real-time tool to examine problem areas.

The obvious solution to this problem is to use a separate process or window to examine and/or modify selected variables in the problem task.

VMS supplies you with an ideal tool — shared global commons — to develop such a window, and has little or no affect on the "real-timeability" of the offending task. To develop such a window using shared global commons, place a group of variables in a common area, install the common, link the window program and the bug-filled program to the common, and run both programs. The window program wakes every second (or other convenient time) and displays the values of the real-time program's variables on your terminal or checks a range of values and flags only bad ones (saving precious I/O time). If you are fortunate enough to have shared memory (as we do), the common can be installed in shared memory and a second CPU used for the window.

Programs 1 through 4 should be all you need to get started in this concept. Program 1 is a FORTRAN sample real-time program (bug-filled) that loops through an array doing I/O to a tape logging device, waiting for the common variable (terminator) to be set to cause the program to exit. We use the window program (Program 2) to look at the loop counter and data block. When the one variable (terminator) is modified by the window program, bug-filled will stop. Program 3 is the required FORTRAN code to establish the common block; Program 4 is the com file to link, install everything, and run the window (the bug-filled code should be run from another terminal). Carefully read the com file to understand that a logical assign should be made so that the programs know where the common is located. This common also can be examined after job completion by accessing the disk file. With a little imagination you easily can see how a few modifications to this code can fit many application problems, including device driver debugging. Note that when running real-time, many other problems such as priorities and page faulting must be considered.

Robert P. McCaskey is a consultant for Pacer Systems, Inc., of Horsham, Pennsylvania. He currently is assigned to the Naval Air Development Center where he is a VMS systems programmer.

PROGRAM 1.

```
      PROGRAM BUG_FILLED

C     THIS SAMPLE PROGRAM RUNS IN REAL TIME TO LOG GATHERED DATA TO TAPE


      BYTE IO_BUFFER(65535) ! AREA WE WISH TO EXAMINE
      INTEGER*4       COUNTER,TIME_DELAY(2),sys$schdwk,sys$qiow,sys$assign
      BYTE TERMINATOR ! COMPLETE FLAG
      INTEGER*4       MAG_TAPE
C     OUR BLOCK OF DATA
      COMMON /DEBUG/IO_BUFFER,COUNTER,TERMINATOR

C     NEEDED I/O PARAMETERS
      INCLUDE '($IODEF)'
C     SET OUR PRIORITY UP  ... WE SHOULD ALSO LOCK PAGES ... NEXT ARTICLE
      CALL SYS$SETPRI(,,%VAL(30),%REF(I_OLDPRI))
C     OPEN THE TAPE DRIVE
      I=  SYS$ASSIGN(%DESCR('MFA0:'),%REF(MAG_TAPE),,)
            if (.not.i) call exit(i)

      TERMINATOR=0

C     set up time delay quad word for .5 seconds
      time_delay(1)=-5000000
      time_delay(2)=-1


C     GO INTO LOOP UNTIL KEY IS STRUCK FROM WINDOW!
      DO WHILE (TERMINATOR.EQ.0)
      COUNTER=COUNTER+1
C     COMMENT OUR SPECIAL DATA GATHERING ROUTINE
C     CALL PROBLEM_SUBROUTINE(IO_BUFFER)
C     FILL BUFFER WITH SOME DATA FOR DEMONSTRATION
      DO I=1,20
            IO_BUFFER(I)=I+COUNTER
      ENDDO
C     LOG OUR DATA TO TAPE
      I= SYS$QIOW(,%VAL(MAG_TAPE),%VAL(IO$_WRITEPBLK),,,,%REF(
     1  IO_BUFFER),%VAL(65535),,,,)
            if (.not.i) call exit(i)
c     delay an appropriate period of time
      i= SYS$SCHDWK(,,%ref(time_delay),)
            if (.not.i) call exit(i)
      CALL SYS$HIBER()
C     EXIT LOOP ONLY IF A KEY IS PRESENT
      ENDDO
C     PUT OUR PRIORITY BACK TO AVOID SYS$MGR WRATH
      CALL SYS$SETPRI(,,%VAL(I_OLDPRI),)
      STOP ' PROGRAM TERMINATED VIA REMOTE WINDOW'
      END
```

PROGRAM 2.

```
      PROGRAM WINDOW

C     THIS PROGRAM WILL EXAMINE A BLOCK OF SHARED COMMON MEMMORY


      BYTE IO_BUFFER(65535) ! AREA WE WISH TO EXAMINE
      INTEGER*4       COUNTER,TIME_DELAY(2),sys$schdwk,sys$qio,sys$assign
      BYTE TERMINATOR ! COMPLETE FLAG

C     OUR BLOCK OF DATA
      COMMON /DEBUG/IO_BUFFER,COUNTER,TERMINATOR


C     NEEDED I/O PARAMETERS
      INCLUDE '($IODEF)'
C     OPEN TERMINAL
      I=  SYS$ASSIGN(%DESCR('TT:'),%REF(TERMINAL),,)
            if (.not.i) call exit(i)
```

PROGRAM 2. . . . *continued*

```
C       SET UP A READ/NO WAIT THAT MODIFIES TERMINATOR VALUE
        I= SYS$QIO(,%VAL(TERMINAL),%VAL(IO$_READPBLK),,,,%REF(
     1  TERMINATOR),%VAL(1),,,,)
                if (.not.i) call exit(i)
C       NOTIFY THE USER TO HIT KEYSTROKE WHEN COMPLETE!
        TYPE 02
        TERMINATOR=0
        CALL SYS$SETPRI(,,%VAL(31),%REF(IOLDPRI))



C       set up time delay quad word for 1 second
        time_delay(1)=-10000000
        time_delay(2)=-1


C       GO INTO LOOP UNTIL KEY IS STRUCK!
        DO WHILE (TERMINATOR.EQ.0)

C       EXAMINE ANY VALUE WE WISH sample just first 10 bytes
        TYPE 03,(IO_BUFFER(K),K=1,10),COUNTER

c       delay an appropriate period of time
        i= SYS$SCHDWK(,,%ref(time_delay),)
                if (.not.i) call exit(i)
        CALL SYS$HIBER()
C       EXIT LOOP ONLY IF A KEY IS PRESENT
        ENDDO
        CALL SYS$SETPRI(,,%VAL(IOLDPRI),)
        STOP ' PROGRAM TERMINATED VIA KEYSTRIOKE'

02      FORMAT(' HIT ANY KEY TO STOP')
03      FORMAT(' DATA',10(Z4.2),' LOOP COUNTER',I7)
        END
```

PROGRAM 3.

```
        BLOCK DATA      ! we are going to compile a common memory area

        BYTE IO_BUFFER(64256) ! AREA WE WISH TO EXAMINE
        INTEGER*4       COUNTER
        byte terminator
C       OUR BLOCK OF DATA
        COMMON /DEBUG/IO_BUFFER,COUNTER,TERMINATOR
        end     !  block
```

PROGRAM 4.

```
$ FORTRAN DEBUG_COMMON.for      ! COMPILE AND LINK THE BLOCK OF COMMON DATA
$ LINK /SHARE DEBUG_COMMON.OBJ
$! TELL VMS WHERE TO FIND THE COMMON BLOCK OF DATA
$ ASSIGN /SYSTEM DRCO:[MCCASKEY.PUB]DEBUG_COMMON.EXE DEBUG_COMMON /SYSTEM
$! INSTALL THE GLOBAL SECTION IGNORE ERROR MESSAGE ON THE DELETE
$ MC INSTALL
DEBUG_COMMON /DELETE            ! REMOVE THE OLD VERSION IF ONE IS ACTIVE
DEBUG_COMMON /OPEN/SHARE/WRITE  ! INSTALL THE NEW VERSION OF COMMON DATA
$ FORTRAN REALTIME_PROGRAM      ! BUILD THE REALTIME PROGRAM WITH COMMON
$ LINK REALTIME_PROGRAM,SYS$INPUT/OPTIONS
DEBUG_COMMON/SHARE
$ FORTRAN WINDOW                                ! BUILD THE WINDOW
$ LINK WINDOW,SYS$INPUT/OPTIONS
DEBUG_COMMON/SHARE
$ SET PROC /PRIOR=31/NOSWAP
$ WRITE SYS$OUTPUT " RUN REALTIME_PROGRAM FROM ANOTHER TERMINAL "
$ DEASSIGN SYS$INPUT
$ RUN WINDOW
```

■

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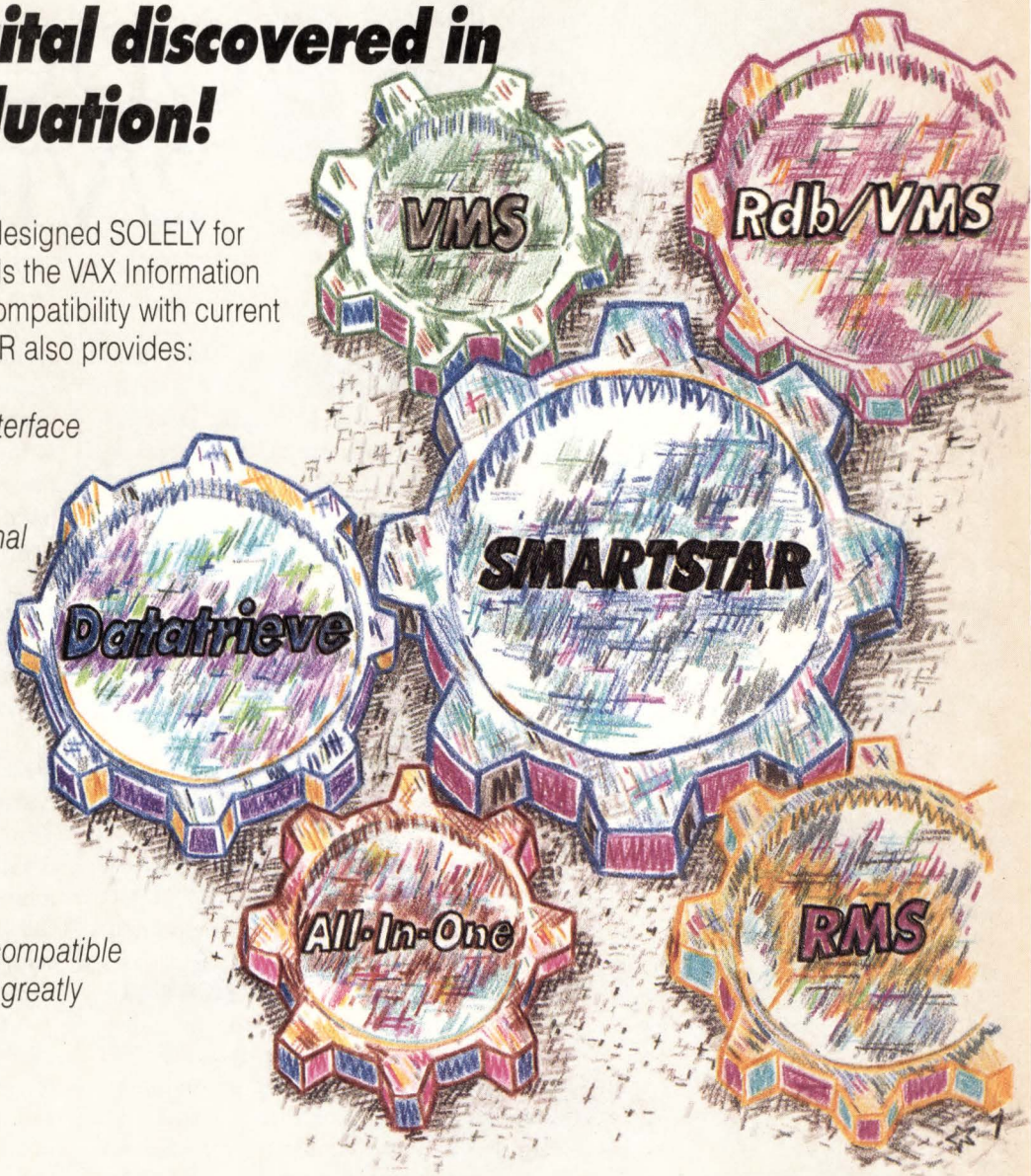

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RT-11

MODULA-2/VRS

By Gunter Dotzel

How To Make The Most Of This Programming Language On PDP-11s Running RT-11.

In 1981, during the DECUS Munchen Symposium in Konstanz, West Germany, I was informed that the programming language MODULA-2 was available for the PDP-11 running under RT-11. Mr. George Maier from ETH-Zurich reported that this compiler directly generates native code, supporting FIS and FPU (floating instruction set and floating point unit) hardware options. He pointed out that even a symbolic debugger was available for MODULA-2. Best of all, the compiler, linker, debugger and utilities were written in MODULA-2 and distributed with its source code by the Institut fur Informatik at ETH-Zurich.

It was at this symposium where the 22-bit addressing capability of LSI-11/23's MMU (memory management unit) was announced.

Introduction To A Perfect Marriage

Programs have a tendency to grow until they won't fit into low memory. You can use overlay techniques, but most programmers dislike this method and it doesn't always help. In late 1983, the Lehrstuhl fur Prozesrechner at Technical University of Munich (TUM) came out with a MODULA-2 implementation that makes use of the MMU. Now MODULA-2 and the MMU have married. Let's call the marriage VRS (virtual run-time system). VRS meets the challenge of developing and running very large programs under the unmapped single-job operating system, RT-11.

WITHIN FOUR YEARS memory prices have dropped by a factor of 16. Before VRS became available, the only way to use the extended memory was by means of a mapped operating system (which most programmers disliked), or with the VM handler, which emulates a fast, but nothing more than a dumb, solid-state memory disk. But there was no transparent way for the programmer to write large application programs without overlays. The memory management supports virtual addressing of up to 4 MB, but virtual means not really. Compare it to virtual money: It simply isn't available when you really need it.

MEMORY IS INEXPENSIVE NOW. A full megabyte is standard on LSI-11/23 and LSI-11/73 systems. The programmer's primary goal is easily defined: Let me write very, very large programs in MODULA-2 on my smart desktop or full-blown rack-mounted PDP-11 micro, but without overlays and without the need for tricky constructs.

But how do we accomplish this on a 16-bit computer? First, we have to tell the RTS (run-time system) something about the MMU and extended memory; let's call it VRS instead of RTS. Then tell the linker to separate code and data. Furthermore, tell the linker, loader and symbolic debugger about programs that should execute resident in virtual memory. TUM did it for the MODULA-2 implementation with VRS. Note that the compiler doesn't know anything about MMU and extended memory. It just wonders about the large heap

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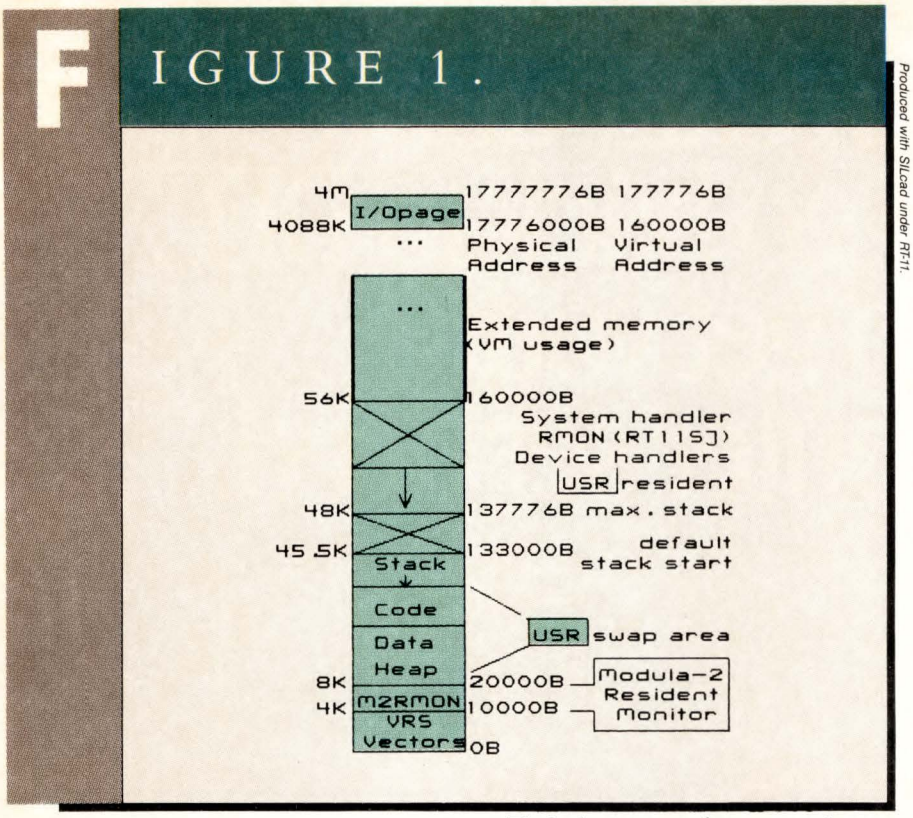

Typical unmapped memory layout.

and stack it now has. This assures compatibility and transparency of MODULA-2 programs. Existing system and application programs only have to be linked by the VRS linker to be executable under VRS.

VRS Real-Memory System

VRS is MODULA-2 with a virtual runtime system implemented on a real-time computer under a real-time operating system, RT-11. Best of all, large programs run really fast under VRS on the PDP-11 without memory constraints. And "really fast" means you will not notice the difference between so-called unmapped programs and programs running under VRS. Note that you still can access the I/O-page directly. Results of the performance test are published in the *Journal of PASCAL, ADA, and MODULA-2*, Vol. 3, No. 4 (West Publishing Company, Orem, Utah, 1984).

Let's illustrate the situation for normal unmapped programs running under RT-11. Operating system, device handlers and user program code, heap, stack, constant and variable data share the low memory up to 56 KB or 160000B (B means octal). An address between 160000B and 177776B is virtual and is translated by the CPU to a physical address between 17760000B and 17777776B, where the I/O-page is located (Figure 1).

In VRS, all MODULA-2 program code is virtual and resides in extended memory starting at 160000B, freeing the low memory and leaving more space for data. For those who have a good knowledge of the PDP-11's architecture, I'll try to explain the memory layout of a MODULA-2/VRS program at load time and during execution. Program code is linked in portions of 8 KB, always to the base address 140000B. Depending on the size of the procedures, there are one or more in the same area, which is called the code segment. The linker output file consists of descriptor packets for constant and variable data which are directly addressed. This data resides in low memory up to the address 140000B at execution time. Furthermore, the linker output file contains virtual code packets (code segments), determined to reside in extended memory during execution. Remember, virtual code means that all addresses are relative to the address 140000B. At load time, the loader fills the extended memory with these code segments. First, the memory area from 160000B is filled, then the area starting at 200000B, and so on. During execution, the PAR6 of the MMU points to one of these areas to make the code of the currently active code segment available.

Translation Of Virtual To Physical Address

Now you know why virtual code packets start at 140000B: If the MMU is enabled, the APF (active page field, determined by the bits 13 through 15 of a virtual address) is used to select a base address via PAR. Since the APF value is 6, this selects PAR6 to construct the physical address. Here two restrictions become visible:

1. Procedures longer than 8 KB can't be handled. But don't worry! The compiler can't produce longer procedures.
2. Direct RMON (resident RT-11 monitor) database access via fixed offset, which is normally located somewhere between 140000B and 160000B, is not accessible since either the virtual code or the operating system is mapped at the same time. Clean programs use the .GVAL request to get fixed offset values. Another method is to use a special procedure, XMEM.GETRT11WORD. Both methods avoid the direct access conflict.

But how can RT-11 operate if its own code (or the code of its device handlers) isn't always mapped? Operating system services always are requested synchronously via trap instructions (EMT) or asynchronously via hardware interrupts. Both are handled by VRS. VRS intercepts all of these requests and loads the appropriate value into PAR6, before passing the request to the operating system.

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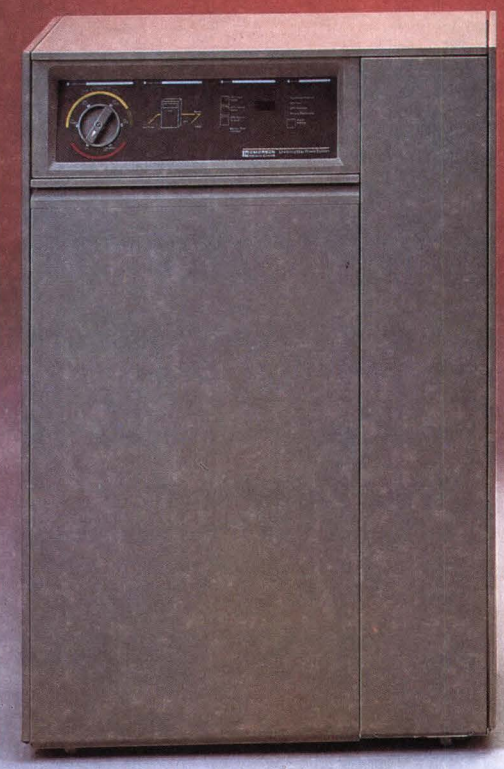

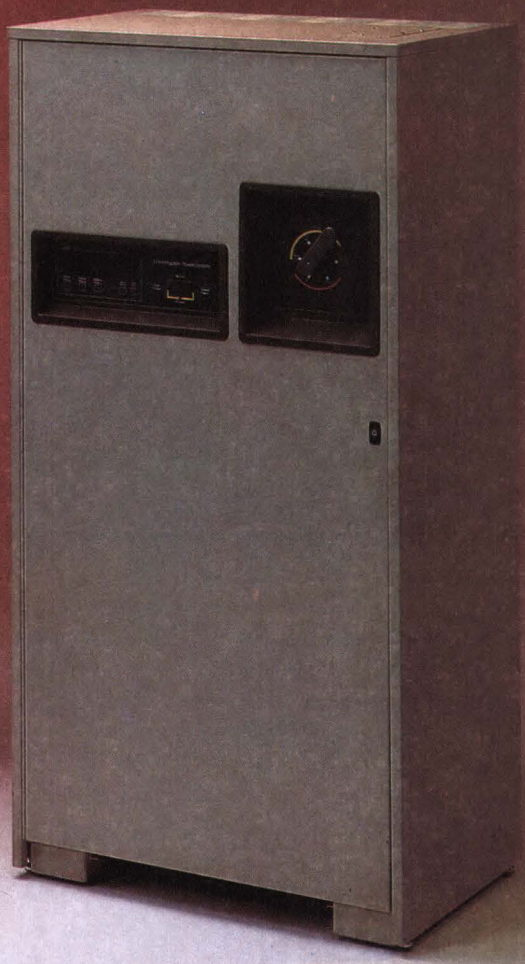

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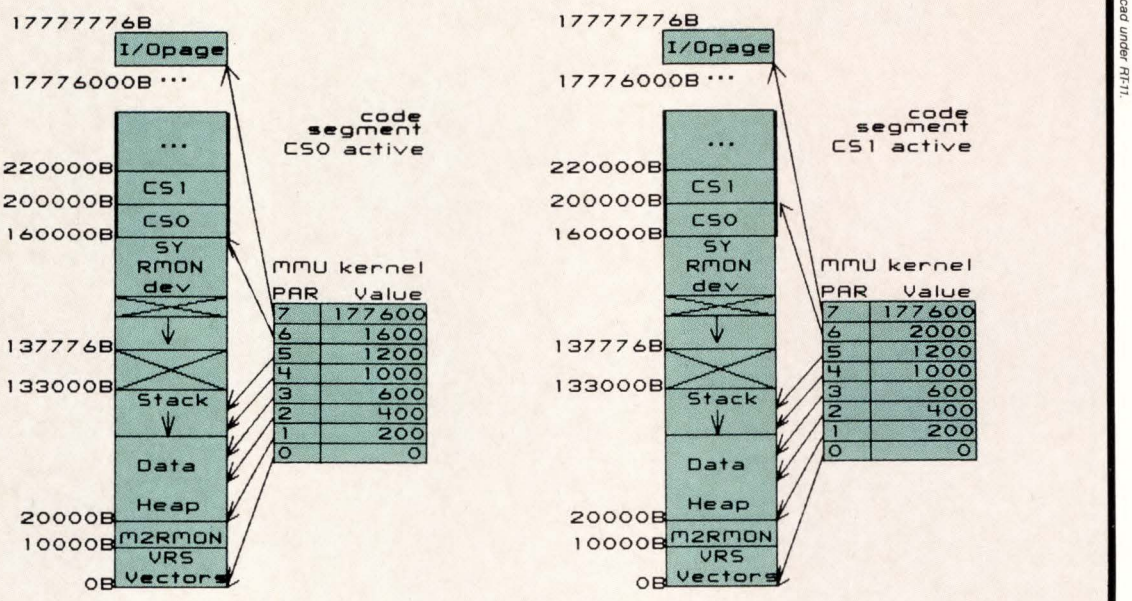

VRS and VM sharing extended memory.

Remember that memory below 140000B, where possibly some handler code or the USR resides, always is mapped directly (Figure 2).

Besides separating code and data, the linker changes all subroutine calls (JSR) generated by the compiler to trap instructions (TRAP). The VRS trap handler interprets these traps at execution time and maps another code segment, if the procedure to be called is not in the currently mapped area. This is accomplished through saving and simply loading PAR6 before the call, and restoring it if the called procedure returns. The new PAR6 value is determined by the so-called code segment table, which is part of VRS. This table is filled at load time. Even calling a procedure that is in a new code segment doesn't produce any remarkable overhead since this mechanism is implemented efficiently.

Until now, we were talking about virtual program code. What about virtual data; i.e., large data structures such as large arrays and records? Assuming that your pure program code is mostly smaller than 72 KB and you have more than 128 KB memory (56 KB low memory + 72 KB), you even can use the memory above 128 KB up to 4 MB to define virtual data and operate on it via a procedural interface. The module that is responsible for this task is called XMEM. XMEM is part of the resident VRS, since it is used by the program loader to place your program code into extended memory (for the loader, your code is data). There are only four procedures to deal with virtual data: DefArray, RemArray, GetElement, and PutElement. If you are using virtual data via the XMEM procedures, your MODULA-2 program is no longer portable. Note that your constants and variables, heap and stack, always are located in low memory up to 140000B. The stack pointer for the main process always is on top of this area (i.e., it must be smaller than 140000B). The stack start address is defined by the RT-11 SYSCOM location 42B and 50B in block 0 of the file VRS.SAV (resident MODULA-2/VRS system). (See Figure 3.)

VRS And The VM Handler

Even if you are using VRS for virtual code and data, there yet may be a large amount of unused memory. What about RT-11's VM handler, the dumb RAM-disk emulator? VM doesn't know anything about VRS! Clearly VM can't be used with VRS. There is a special version called XS.SYS (eXtended Storage) that was written from scratch by Modula-Ware GmbH in 1985 to be compatible with VRS. XS has configurable memory start and stop addresses. The start address is usually at the 18/22-bit boundary at 256 KB or 1000000B. XS can be used as system device (i.e., XS is bootable) and supports 22-bit addressing mode. Furthermore, XS operates on non-standard RT-11/Star-eleven systems

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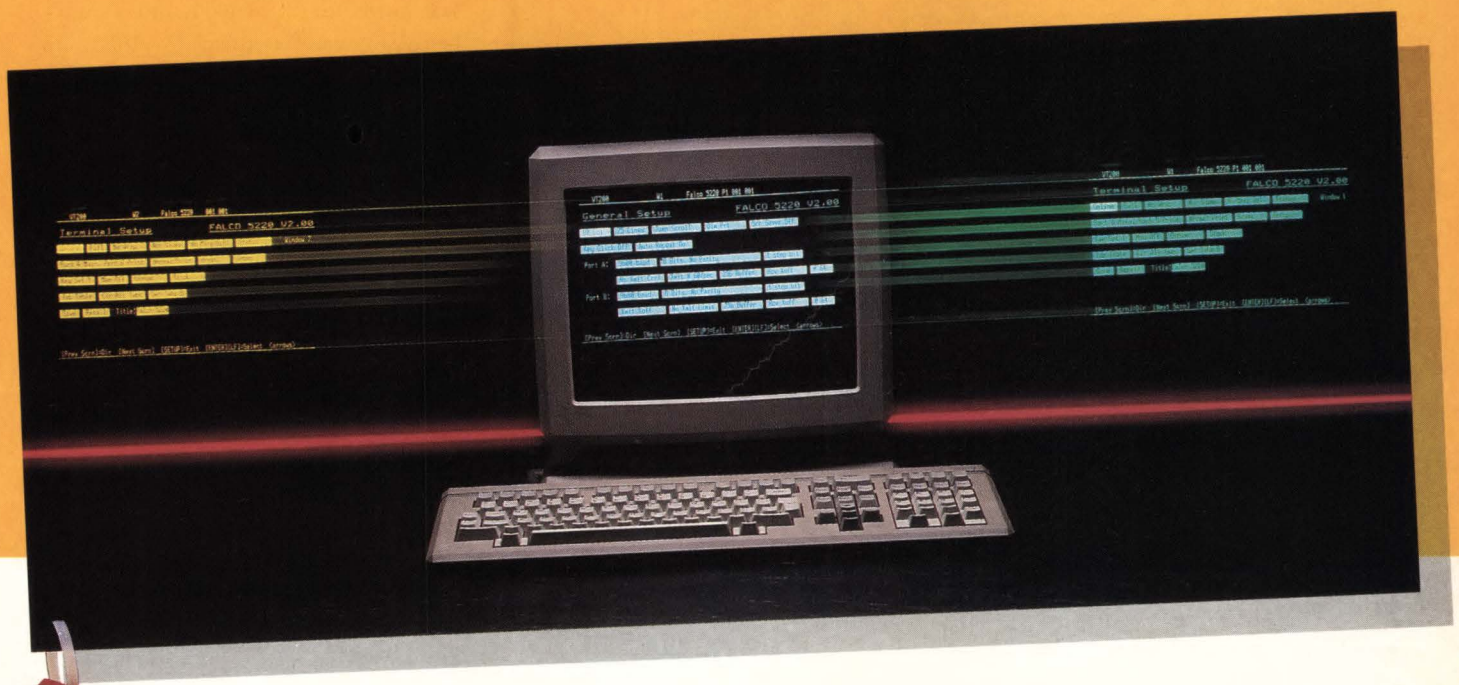

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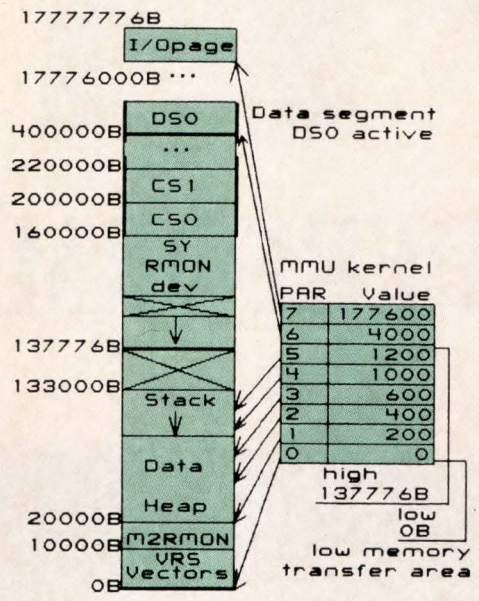
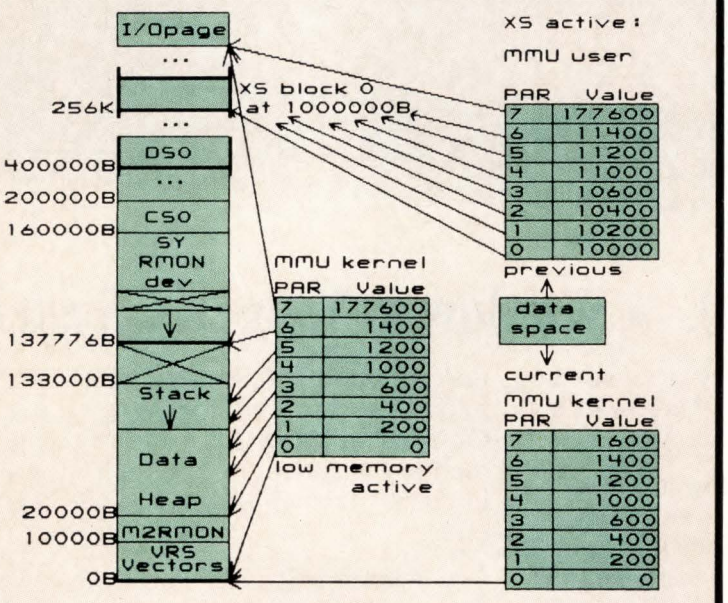


Produced with SILcad under RT-11

Virtual data transfer.

FIGURE 4.



Produced with SILcad under RT-11

Virtual code mapping.

with short (4 KB) I/O-page. Note that VM and VRS need standard 8 KB I/O-page (Figure 4).

Since you don't care about restrictions concerning program size and overlays, MODULA-2/VRS now is the standard programming environment to develop MODULA-2 programs on PDP-11 under RT-11. In 1983, for example, a very large program, RDS-11 (relational database system), which is part of LIDAS (Lilith Database System), successfully was ported to PDP-11/RT-11 using MODULA-2/VRS from ModulaWare GmbH. The illustrations in this article were created with the graphics editor called SILcad running under RT-11 also using MODULA-2/VRS. In 1984, SILcad was ported to the PDP-11, and its functionality was extended by 1985. To operate SILcad you need the NEC7220A-based GDC-11 Q-bus raster-scan graphics display controller. The interactive design of the drawings is controlled by a three-button mouse connected (via a small adapter) to the DRV-11. The size of SILcad's program code is about 50 KB. The stack and heap that resides in low memory is about 30 KB in size. The large heap is used to store information about SILcad's graphical elements. The hardcopy from the display (17-inch monitor, 1024 * 832 pixels resolution, 55-HZ refresh, non-interlaced) was produced with an inexpensive matrix-printer.

LIDAS and SILcad are written in MODULA-2 and originally have been developed and implemented for the Lilith MODULA-2 computer at the Institut fur Informatik, ETH-Zurich, Switzerland.

Acknowledgements

Credit is due to Gerhard Koller from TUM/LPR. He developed VRS under direction of Dr. Ing. Demmelmaier in 1983 using the 1981s M2RT11 distribution kit from MODULA-2 from ETH-Zurich, Institut fur Informatik, where MODULA-2 was designed and implemented.

Gunter Dotzel is manager of software development for ModulaWare GmbH, Erlangen, West Germany.

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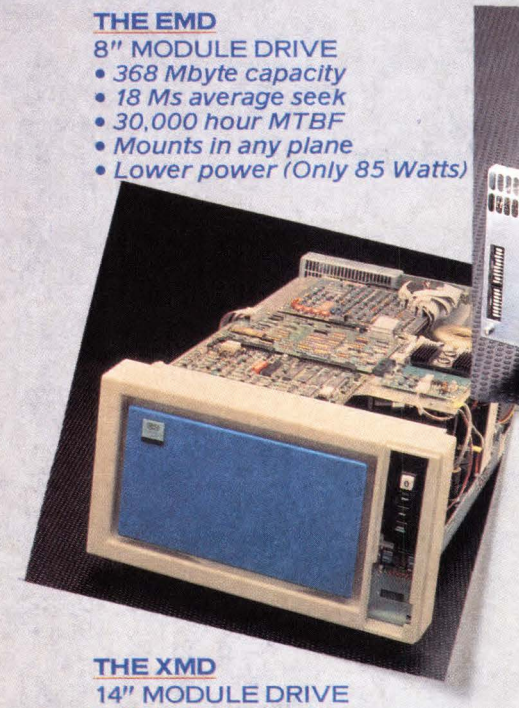

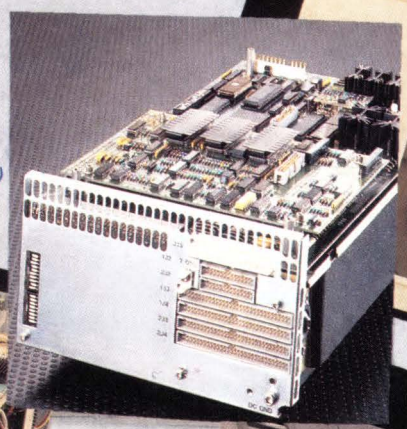

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DBMS

ACCENT R

By Bob Meyer

A Mature DBMS, In Need Of Some *VAXination.*

Accent R is a relational database package from National Information Systems, Inc., Cupertino, California. The software consists of a data definition language, a programming language, a command language, in which complete applications can be developed, a report generator, an interactive data manipulation language, and two editors. Features such as simultaneous update, screen development tools, and a host language interface have been made available recently, to round out the package.

The host language interface allows access to database functions from any language that can call assembly language routines. Existing applications can be upgraded by replacing the current I/O statements with *Accent R* calls. In theory, programs need not be rewritten to gain new capabilities. Simultaneous update permits access to the same dataset by multiple users, and system designers can control dataset level or record level lockout, access privileges, wait time and wait messages for access.

All interaction with *Accent R* is performed from within one large executable image. The built-in editors are used to create and modify schema definitions (record layouts) and process modules (data manipulation routines written in *Accent R*'s own procedural language). The editors also create and modify command modules (complete "applications" that can ask the user questions), call process modules to manipulate data, or call other command modules), and define indexes and domains.

Getting Started

First, we must create a DBL (Data Base Library), the main control area for the database. It contains process modules, command modules, schema definitions, and locations of the actual files containing the data (datasets). To create our own DBL, we invoke *Accent R* and use the CREATE command:

```
$ R [ACCENT_R]ACCENT
```

Accent R identifies itself:

```
ACCENT R, VAX/VMS Version 9.01
```

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```
*
```

The asterisk is *Accent R*'s prompt. To create our DBL, we use:

```
*CREATE DBL BOB
```

This creates the file BOB.DBL in our default directory. If we already had a DBL, we could access it with:

```
*USE DBL BOB
```

Record layouts are created using the DEFINE command. This command has other uses, so we must tell it what we want to define:

```
*DEFINE SD ADMASTER
```

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This command creates a schema definition named ADMASTER and stores it in the DBL file. The DEFINE command then places us in the hands of the editor; more on that later.

The syntax of the schema definition is:

```
—10 UNIT.PRICE,N,8,2
```

where:

—	is the Editor's prompt
10	is a line number
UNIT.PRICE	is the field name
N	is the data type (N being "numeric" or floating)
8	is the field width
2	is the number of decimal places

Line numbers are required, and may range from 1 to 99999. Other data types include C for character, I for integer, and R for real (single precision). N is numeric with double precision, D is a date field (only the last two digits of the date are saved), and F is the full date (all four digits of the year are saved). Other options available include alias names, validation criteria, input/output edits and default formatting.

We enter the schema definition for ADMASTER (part of *DEC PROFESSIONAL*'s advertising master file), which we'll use for testing:

```
*DEFINE SD ADMASTER

—10         SEQ,C,4
—20         COMPANY,C,30
—30         ADDR_1,C,30
—40         ADDR_2,C,30
—50         CITY,C,16
—60         STATE,C,2
—70         ZIP,C,5
—80         PHONE,C,10
—SAVE

*
```

After the data items are entered, the SAVE command is used to return to command level. Detailed syntax and validity checking is performed first, to make certain everything makes sense. If any errors are encountered, the user remains in the editor until the lines in error are corrected or deleted.

To re-enter the edit level from command level, we use:

```
*MODIFY SD ADMASTER
```

and are again given the editor's prompt:

```
—
```

It also should be noted that commands exist that allow the user to define record characteristics (multiple record types and storage modes), and record grouping.

In order to store and retrieve information, we must define a dataset. Each dataset is a separate file in the current directory, which contains the actual data described by some schema definition. The commands to create a new dataset are:

```
*CREATE DS ADMASTER SD ADMASTER
```

The SD clause specifies the name of the schema definition to be associated with the dataset, and is required. Optionally, the user can specify an index at this time, by adding the phrase KEYED ON, and one or more field names, to the end of the command. The index also can be defined with the DEFINE command after the dataset is created, providing the user with more control over the layout of the index:

```
*DEFINE DI ADMASTER
— 10 INDEX TYPE IS RAM
— 20 INDEX TO ADMASTER
— 30 DOMAIN COMPANY ON COMPANY
— 40 DOMAIN STATE ON STATE
— SAVE
```

DI stands for data index, and ADMASTER is the name of the index being created. Line 10 specifies that a RAM (Rapid Access Method) index is being built, and is required. Line 20 specifies the dataset to which this index applies, and also is required. A DOMAIN is an ordering or "view" into the dataset.

Each domain may be keyed using multiple fields, and the user may create as many domains as needed. In lines 30 and 40, the domain name is specified after the keyword DOMAIN, and the field to be used, in the key after ON. Options exist to allow or disallow duplicate keys and key changes.

Entering And Retrieving Data

Commands exist for manually entering data at the terminal. For example, the commands:

```
*USE DBL BOB

*USE DS ADMASTER

*ENTER NEW WITH PROMPTS
```

> Each domain may be keyed using multiple fields, and the user may create as many domains as needed.

tell *Accent R* to clear the contents of the dataset (NEW), and prompt the user for each field (WITH PROMPTS). A typical entry is:

```
*ENTER WITH PROMPTS

SEQ: 1
COMPANY: CMC
ADDR_1: SUITE 300
ADDR_2: 525 ROUTE 73 SOUTH
CITY: MARLTON STATE: NJ ZIP: 08053
PHONE: 6095964360

SEQ: ***
```

The string *** terminates this data entry operation, and returns the user to command mode.

To display the contents of the dataset, the EXTRACT command is used. Used alone, it dumps the entire contents of the current dataset to the terminal, with spaces between fields for readability:

```
*EXTRACT

1 Big Al's Used Computers 525 Route 73 . . .

2 Joe's Greasy Spoon          101 Burger Street . . .
```

Extract operations can be tailored to display only records whose fields meet (or don't meet) certain conditions (IF; UNLESS), and display only specified fields of those records (SHOW). Furthermore, records can be added to other datasets (APPEND TO), indexes can be used to speed up the extract (USE DOMAIN, and WHEN), process modules can be called to execute a stored "program" (VIA), and data being sent to another dataset can be modified before it is moved (SET).

To get bulk data into the system, the LOAD command is used. The SD (schema definition) and DS (dataset) must exist already, and indexes can be added later at the user's discretion (said to be more efficient). A load operation might look like this:

```
*USE DBL BOB

*USE DS ADMASTER

*LOAD FROM DRB1:[AD.DATA]ADMASTER.DAT

*COUNT

637 Record(s) found

*
```

The input data must be in a readable ASCII file (no binary data), and options are available to load data that does not match the schema definitions exactly (FIELD/SKIP). Process modules can be called in to validate or modify the data as desired, with the VIA clause (more on that later); and, data can be appended to the specified dataset instead of clearing it first (the default), with the APPEND clause. The count command counts the total number of records in the current dataset and displays the total. COUNT also takes record selection options such as IF, UNLESS and WHEN.

Relational Operations

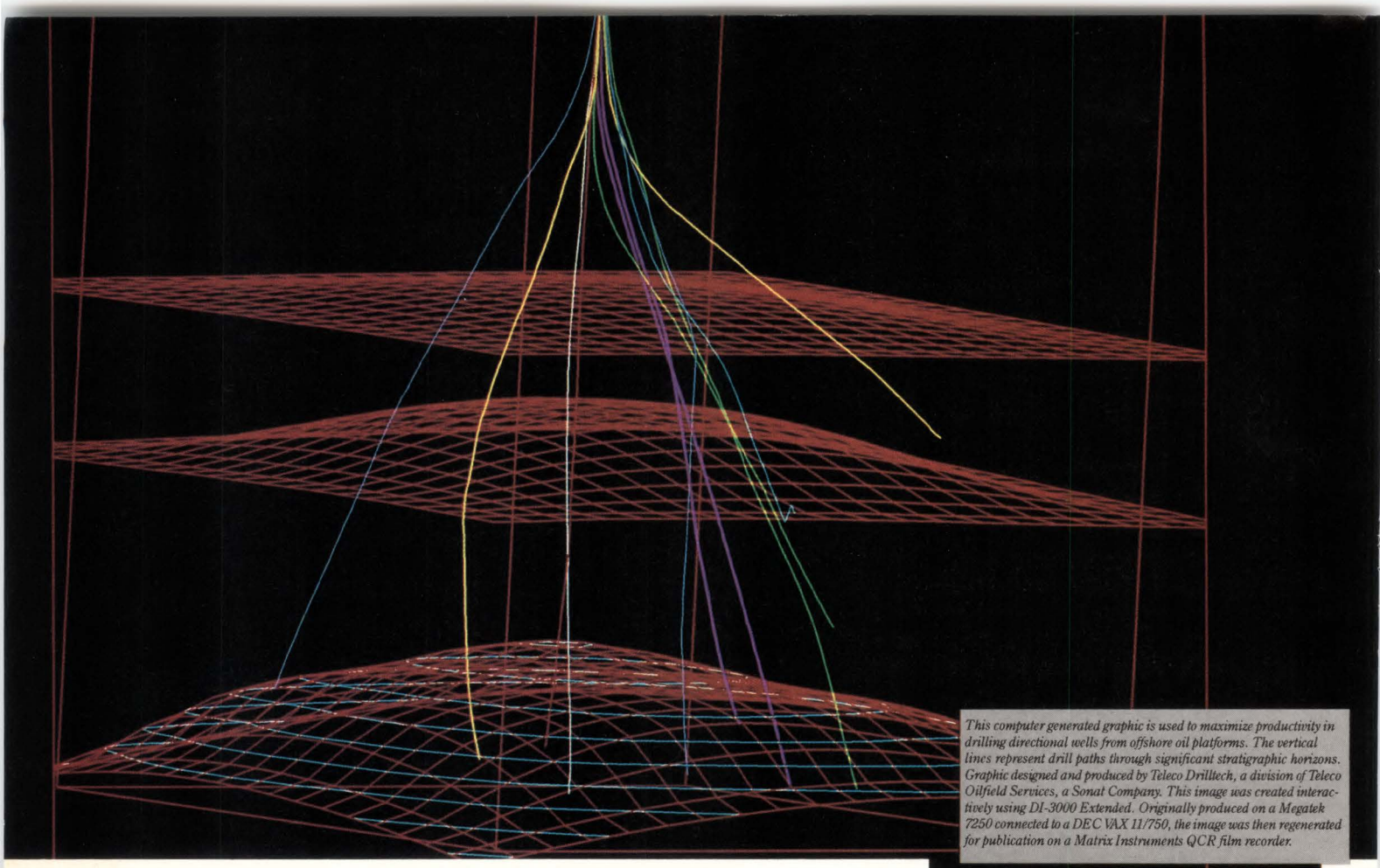
When two datasets (relations) exist, and one common field exists between the two, a relational "join" can be used to extract, move, modify or delete information, based on record selection criteria. Only one dataset can be modified (the master), while the other is used for selection purposes (the transaction dataset).

Consider the following schema definition for the file ADVERT.DAT, which contains a record for every ad placed in any of our magazines by any of our advertisers. (The list of advertisers exists in the dataset ADMASTER, defined earlier.) Information includes advertiser name, size of ad (1/2 page, full, etc.), month the ad was run (1-12), magazine in which the ad was run ("DP" for *DEC PROFESSIONAL*, "VP" for *VAX PROFESSIONAL*, etc.) and other information.

```
*LIST SD ADVERT

10 SEQ,C,4
20 COMPANY,C,
30 30 MAG,C,2
40 MONTH,I,2
50 AD_TYPE,C,10
60 PAGES,I,2
70 TEXT,C,30

*
```



This computer generated graphic is used to maximize productivity in drilling directional wells from offshore oil platforms. The vertical lines represent drill paths through significant stratigraphic horizons. Graphic designed and produced by Teleco Drilltech, a division of Teleco Oilfield Services, a Sonat Company. This image was created interactively using DI-3000 Extended. Originally produced on a Megatek 7250 connected to a DEC VAX 11/750, the image was then regenerated for publication on a Matrix Instruments QCR film recorder.

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DI-3000 is machine independent with streamlined versions for "load and go" installations on DEC VAX, MicroVAX, IBM/VM and IBM/MVS. Run-time shareable libraries and dynamic node support save computer disk space, memory space, and programmer time. Support is also provided for other computing environments from Apollo to Cray, plus an AT&T System V UNIX version. DI-3000 is device independent and provides support for over 100 graphics devices, including some of the most sophisticated workstations. Prices for DI-3000 start at $3,800 on the DEC MicroVAX.

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ENTER 51 ON READER CARD

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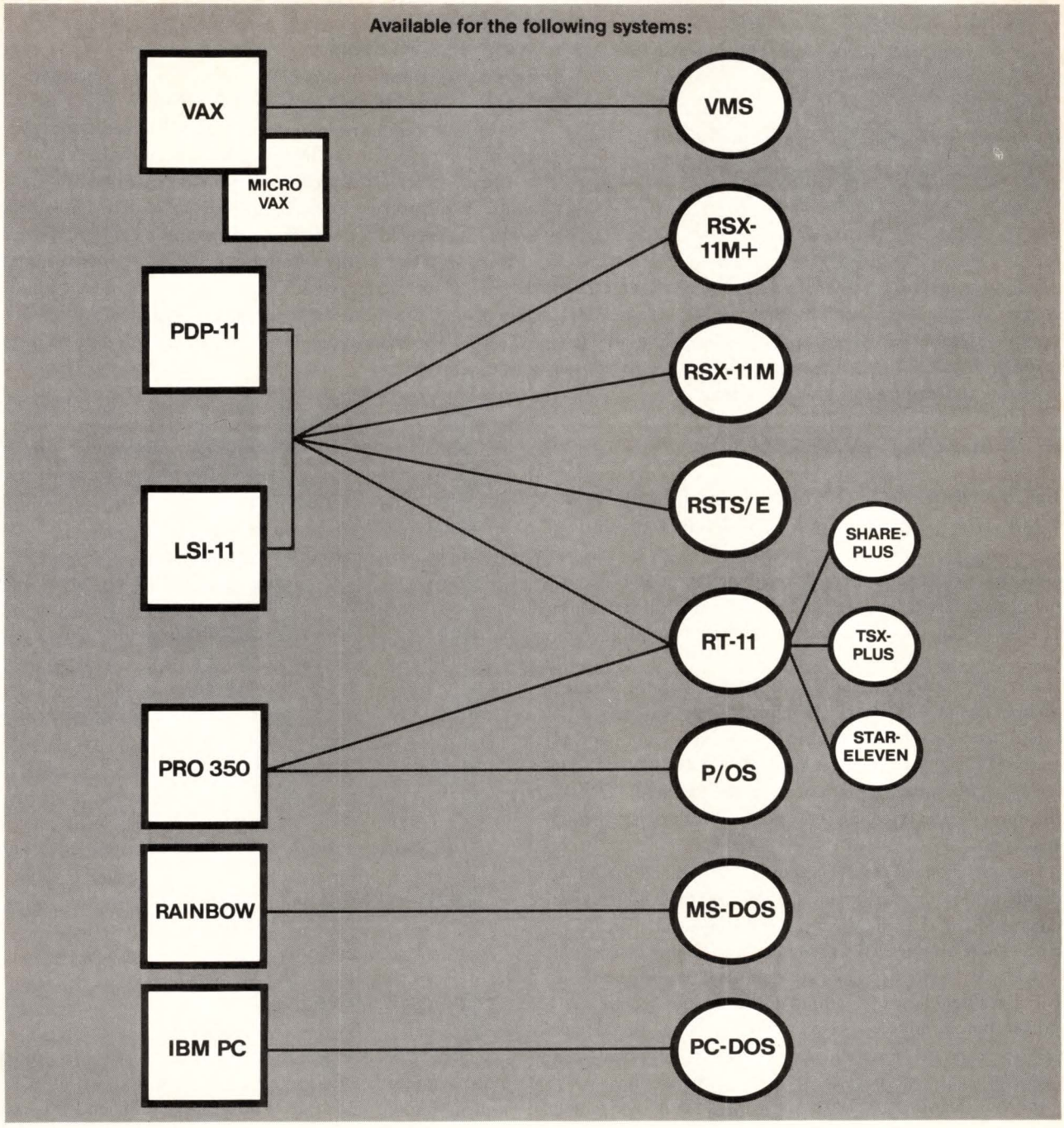

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ENTER 78 ON READER CARD

In order for the two datasets to be joined, the master set must have indexes, or both must have been sorted previously using the SORT command. The index for the ADVERT dataset looks like this:

```
*LIST DI ADVERT

10 INDEX TYPE IS RAM
20 INDEX TO ADVERT
30 DOMAIN COMPANY ON COMPANY
40 DOMAIN MAG ON MAG

*
```

The index for the ADMASTER dataset was shown earlier. A typical query might be, "Show me the name, state and phone number of all companies advertising in *DEC PROFESSIONAL*." The following commands extract that information and display it on the terminal:

```
*USE DS ADVERT DI ADVERT

*SELECT WITH ADMASTER MATCH BY COMPANY &
IF:M MAG = 'DP' SHOW COMPANY,STATE,1B,PHONE
```

First, we select the master dataset with the USE DS command, making sure to activate the index by use of the DI clause in the USE statement. (The ampersand ("&") is used as a line continuation character.)

Next, we specify the transaction dataset with the SELECT command. The MATCH BY clause tells the system which common field between relations should be used for the join operation. A MATCH ON statement is available for datasets without indexes. The IF clause in this syntax, states: "If the field MAG in the master dataset equals DP, then consider this record for matching."

Other variations of the IF clause are IF:T, which tells *Accent R* to test a field in the transaction dataset, and IF:A, which tests conditions AFTER the relational match has occurred. The order of record selection causes IF:M statements to be processed first, followed by IF:T statements. Any records making it past these tests are considered for matching. Records that match are subject to the IF:A conditional, after which passing records are processed. All of the IF statements are of course optional, and only one of each type may exist in a command line.

Another relational exercise might be to show the name, state and phone number of all companies in New Jersey who advertise in *DEC PROFESSIONAL*:

```
*USE DS ADVERT DI ADVERT

*SELECT WITH ADMASTER MATCH BY COMPANY &
IF:M MAG = 'DP' IF:T STATE = 'NJ' SHOW &
COMPANY,STATE,1B,PHONE
```

In the case of different datasets containing fields with the same name, the optional :M or :T can be added to the end of the field name to specify which dataset contains the field.

Process Modules

"Programming" in *Accent R* is done through routines of procedure code called process modules (PM), which consist of a group of numbered statements divided into sections. In the simplest situation, the sections used are INITIAL, DETAILS and FINAL. The INITIAL section always is executed before anything else in the process module, and only once. The DETAILS section is executed for every record passing whatever constraints were specified in the command calling the process module. The FINAL section (you guessed it) is executed at the very end, and can be used to print summary information, etc.

This is an example of using a process module on a single dataset:

```
00010       control section
00020             relate di am as master for input
00030             relate sf bob as report 1
00040       declare section
00050             c,i,4
00060       headings section
00070             print "List of Advertisers as of
                  " + @fdate + " " + @etime
00080       detail section
00090             c + 1 to c
00100             type '.',nocr
00110             print c,1b,company,1b,state 00120
            final section
00130             type "Total: ",c
00140             print "Total advertisers: ",c
```

This process module was created with the command:

```
*DEFINE PM BOB
```

It can be executed by typing:

```
*REPORT VIA BOB
```

The CONTROL section defines the datasets, data indexes, reports, and other files to be used by the PM. The DECLARE section defines fields that will act as variables during execution of the PM. Headings can be placed in the report as shown in the HEADINGS section. Note the built-in functions (@FDATE & @ETIME), which provide the obvious system data and time. There are *many* of these types of functions available, providing information about the database and system, as well

In a nutshell, this package just needs a little *VAXination* . . .

as allowing the programmer control over the user environment.

In the DETAIL section, we simply increment a counter (defined earlier) for each record in the dataset, and print some information about the record to the report file. The PRINT command sends the data to the report file, while the TYPE command prints to the user's terminal. The FINAL section is used to dump the total record count in this dataset.

The following process module uses two datasets in a relational join operation:

```
00010       control section
00020       relate ds ad as master for input
00030       relate ds am as transaction for input
00040       declare section
00050             u,i,4
00060       unmatched:t section
00070             u+1 to u
00080             !type company
00090       final section
00100             type 'Total unmatched:',u
```

And, assuming it's called JOIN, the process module is activated by the commands:

```
*USE DS ADVERT DI ADVERT

*SELECT WITH ADMASTER MATCH BY
 COMPANY VIA JOIN
```

Here, the USE command establishes the dataset, ADVERT as the master, while the SELECT command specifies that ADMASTER will be the transaction dataset. The MATCH BY clause determines which common field between data sets will be used for the join operation. Also, as mentioned earlier, MATCH BY is used for datasets having indexes, while MATCH ON would be used for sequential datasets.

When executed, this PM would count the number of records in the transaction data set that had no matching records in the master set. By removing the comment indicator (!) at line 80, we receive a listing at our terminal of those who don't advertise in our magazines. The nerve.

Other record processing sections for relational operations are BEFORE (always executed before each record), MATCHED (executed for each master record having a matching record in the transaction dataset), UNQUALIFIED (executed for each master record that failed the master selection criteria), and several others.

Background

National Information Systems, Inc. was established in 1972, and introduced *DPL*, a DBMS for the DECsystem 10 and 20. *Accent R* first was offered in 1982. The VAX version was released late in 1985, and the current update, during the second quarter of 1986. It is identical syntactically to the older version.

In summary, the product did what its documentation said it would do (unlike some products I've used in the past year). I was quite pleased with the amount and content of the documentation itself. And, *Accent R* offers the database administrator and programmer many ways of storing, retrieving and selecting information.

On a less enthusiastic note, I'm not at all pleased with the required use of line numbers in the schema definitions, process modules, etc. This method of editing data layout and processing instructions is primitive, and should be replaced with full-screen editing, as most VMS users have come to expect. The built-in line editing features requiring use of the Escape key also are a carry over from the old days, (it took me an hour to find the Escape key the first time I used a VT220), not to mention that various terminal characteristics must properly be set up in order for the system to pass the Escapes to *Accent R*. And let's face it: Who wants to learn *another* editor? (*Editor's Note:* NIS reports that an external editor interface is currently under development.)

Time did not permit our testing of the Screen Paint package, nor the Host Language Interface.

In a nutshell, this package just needs a little *VAXination*, to be a contender with most other relational database packages available today.

Bob Meyer is a senior software engineer at Computer Methods Corporation, Marlton, New Jersey.

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SOFTWARE

SUPERCALC3

Was It Worth The Wait?

By Victor J. Chorney

For many years I did all my electronic spreadsheet work on one product: *SuperCalc*. While working under CP/M, I started with the original version, then got *SuperCalc2*. Unfortunately, when I moved to MS-DOS, *SuperCalc* did not, and I learned to use another product (the one named after a flower and numbers). I was envious when *SuperCalc3* was announced only for PC-DOS. Well, now *SuperCalc3* is available for the Rainbow under MS-DOS and the question I'll try to answer here is: Was it worth the wait?

Comparison

Since one of the reasons for going to a new release is increased functionality, it's useful to look at the product's growth.

SuperCalc2 provided the following features not available in the original *SuperCalc*:

Arithmetic functions: ROUND, MOD
/A(rrange) — primary sort
Calendar functions
Consolidation on load
Double space and auto form feed on Output
Hide values
Percent (%) operator
Quit to another program
Tab on edit line
Textual values
User-defined format

SuperCalc3 adds the following enhancements:

/A(rrange) — secondary sort
/D(ata Management list and records maintenance commands
Data disk drive selection
Double quote (") not required for text
Financial functions: IRR, PMT, FV, PV
Function name abbreviations
Graphing commands
Special functions: TRUE, FALSE, ISNUM, ISTEXT, ISDATE

Installation

Typing INSTALL starts the installation program, which is quite simple to use. As indicated by the menu (Figure 1), your choices are rather limited.

A word of warning: Do NOT try to set the screen width to 132 columns; you'll get a useless display of hash.

Operation

SuperCalc3 comes up rather quickly and (aside from differences in commands) performs the same functions as others of its ilk. Memory management is quite good, providing both rapid computation and quick movement between cells, evidenced by the speed with which the screen is repainted. I created a couple of worksheets to test the system in a rather non-standard way. My wife (who has her own advertising agency) asked me to come up with an easy way for her to compare media rates. Using the information she provided, I created a spreadsheet that listed one radio station in each column, the time periods in each row, and filled in the rates. I printed it out and she decided to add a few more stations and a few more time periods. I had no problem doing

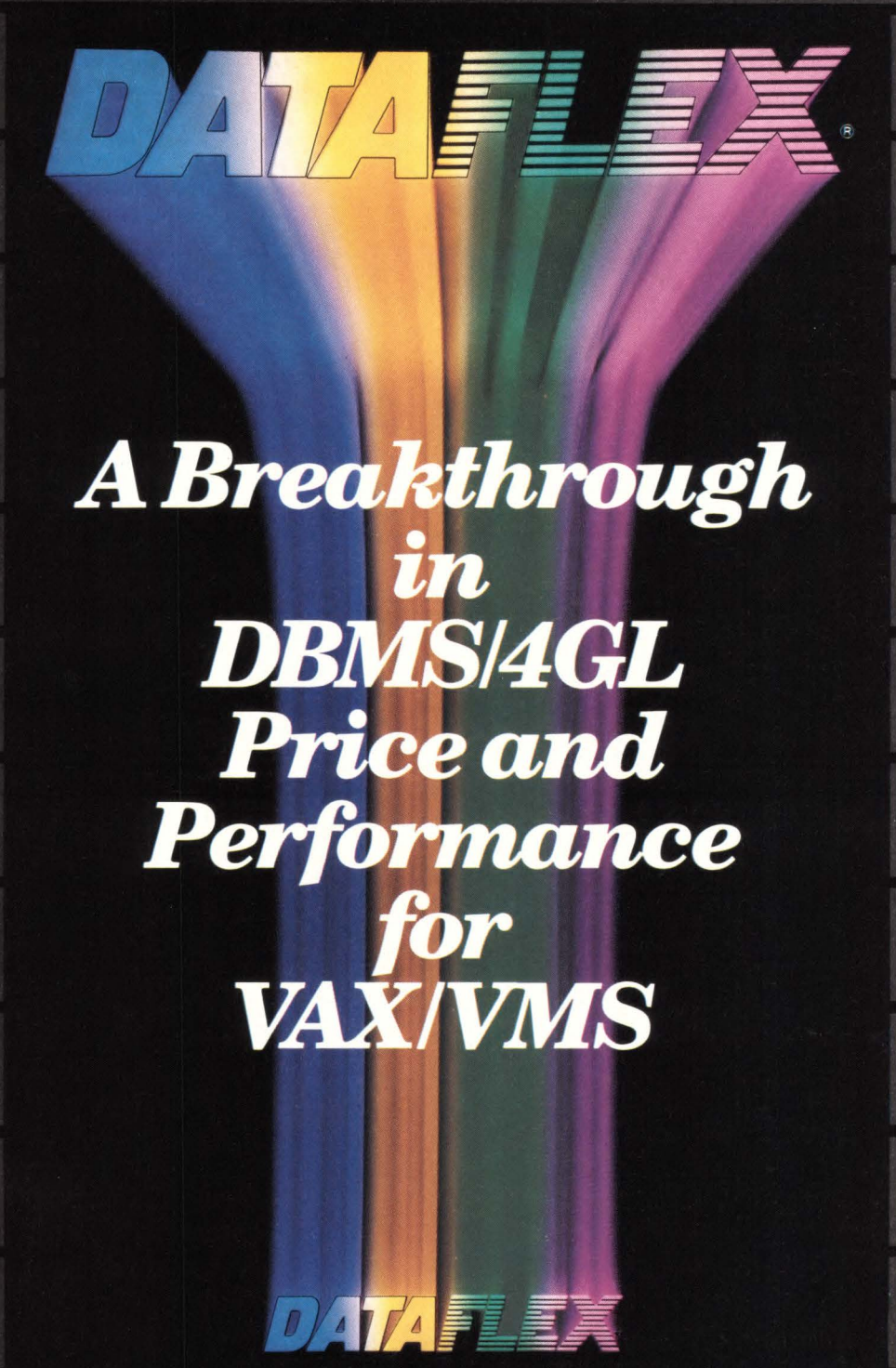

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FIGURE 1.

SuperCalc3 Install Program

MODIFICATIONS

You can change:

A. Screen dimensions
B. Printer page dimensions
C. Printer initialization string
D. Printer status
E. Border character

S. Save changes on *SuperCalc3* disk
X. Exit without changing *SuperCalc3*

Enter A-E; S or X :

FIGURE 2.

!		- Forces recalculation.
&		- Resumes Execute (.XQT) file control.
<Find>	or =	- Specifies a cell to jump to.
<Select>	or ;	- Puts cursor in other window.
<Help>	or ?	- Displays current AnswerScreen.
<F8>	or Ctrl/Z	- Erase Entry Line/Return to spreadsheet.
<PF4>	or Ctrl/Y	- Plots current graph.
<PF1>	or Ctrl/T	- Displays current graph.
/		- Starts a command entry.

A(rrange)	- Sorts cells in ascending or descending order.
B(lank)	- Removes (empties) contents of cells or graphs.
C(opy)	- Duplicates graphs or contents and displays format of cells.
D(elete)	- Erases entire rows or columns.
E(dit)	- Allows editing of cell contents.
F(ormat)	- Sets display format at Entry, Row, Column, or Global levels.
G(lobal)	- Changes global display or calculation options.
I(nsert)	- Adds empty rows or columns.
L(oad)	- Reads spreadsheet (or portion) from disk into the workspace.
M(ove)	- Inserts existing rows or columns at new positions.
O(utput)	- Sends display or cell contents to printer, screen or disk.

that, because all I had to do was use the column and row Move and Insert capabilities of *SuperCalc*. It got a little more complicated when she asked me to print out just a few columns for a proposal to a particular client, but I worked that out, too. By this point, she had become so enthusiastic about the concept that she had me do the same thing with the various newspapers and their rates.

The end result was a proposal that delineated not only the rates, but also, by creating a variation of the spreadsheet that included the frequency with which ads could be placed, a bottom-line dollar amount for her client.

I certainly could have used any of the other spreadsheets available, but I wanted to see how *SuperCalc* would do. All in all, I think it fared quite well.

Function Keys

Considering what could and should have been done, the implementation of function key support is minimal:

Find - generates an equal sign (Go To);
Select - generates a semicolon (put cursor in the other window);
PF4 - generates current graph;
PF1 - displays current graph;
Help - displays help screen (see Help, below).

Help

Help is invoked by pressing either the Help function key (F15) or a question mark. It displays information and commands that are appropriate at that time. For example, if you enter a slash and then call for Help, a list of commands is displayed. By contrast, calling for help after typing /B (blank) gives you information that helps you complete the Blank command (though some or all may be pertinent to other commands).

Keyboard Entry

Information entered from the keyboard falls into categories:

1. Cursor movement (the four arrow

FIGURE 2 . . . continued

P(rotect) - Prevents future alteration of cells.
Q(uit) - Ends the *SuperCalc3* program.
R(eplicate) - Reproduces contents of partial rows or columns.
S(ave) - Stores the current spreadsheet on disk.
T(itle) - Locks upper rows or left-hand columns from scrolling.
U(nprotect) - Allows alteration of protected cells.
V(iew) - Shows data as Pie, Bar, S-Bar, Line, Area, X-Y or Hi-Lo graph.
W(indow) - Splits the screen display.
X(eXecute) - Accepts commands and data from an .XQT file.
Z(ap) - Erases spreadsheet and format settings from workspace.
/ - Additional commands (//D accesses Data Management options).
//D(ata) - Data management command. Allows finding and extracting portions of your spreadsheet that satisfy certain criteria.

Note: Many of the slash commands have subcommands, allowing for a wide range of selectivity for processing.

keys move the spreadsheet cursor).
2. Commands (see Figure 2).
3. Text entry (" Starts entry of text which otherwise would be treated as a formula, and ' starts repeating text entry.

Any other character starts a formula or text entry.

Functions

The ability to perform mathematical functions without having to enter the formula is among the most beneficial features that an electronic spreadsheet provides. *SuperCalc3* has a wide selection of mathematical and other useful functions (see Figure 3).

Data Management

With the //Data command, the spreadsheet can be treated as a database with each record corresponding to a row. A variety of commands permit manipulation of the data:

I(nput) - Defines the limits of the database to be searched.
C(riterion) - Defines the criteria that records must meet in order to be selected.
O(utput) - Defines the output range into which the selected or extracted records will be copied.
F(ind) - Searches the database for records meeting the criteria within the stated boundaries of the database.
E(xtract) - Copies the group of records that have met the selection criteria.
S(elect) - Copies the individual records that have met the selection criteria.
R(emain) - Positions the cursor at the first field of the record found by the search.

In addition, from the regular command list:

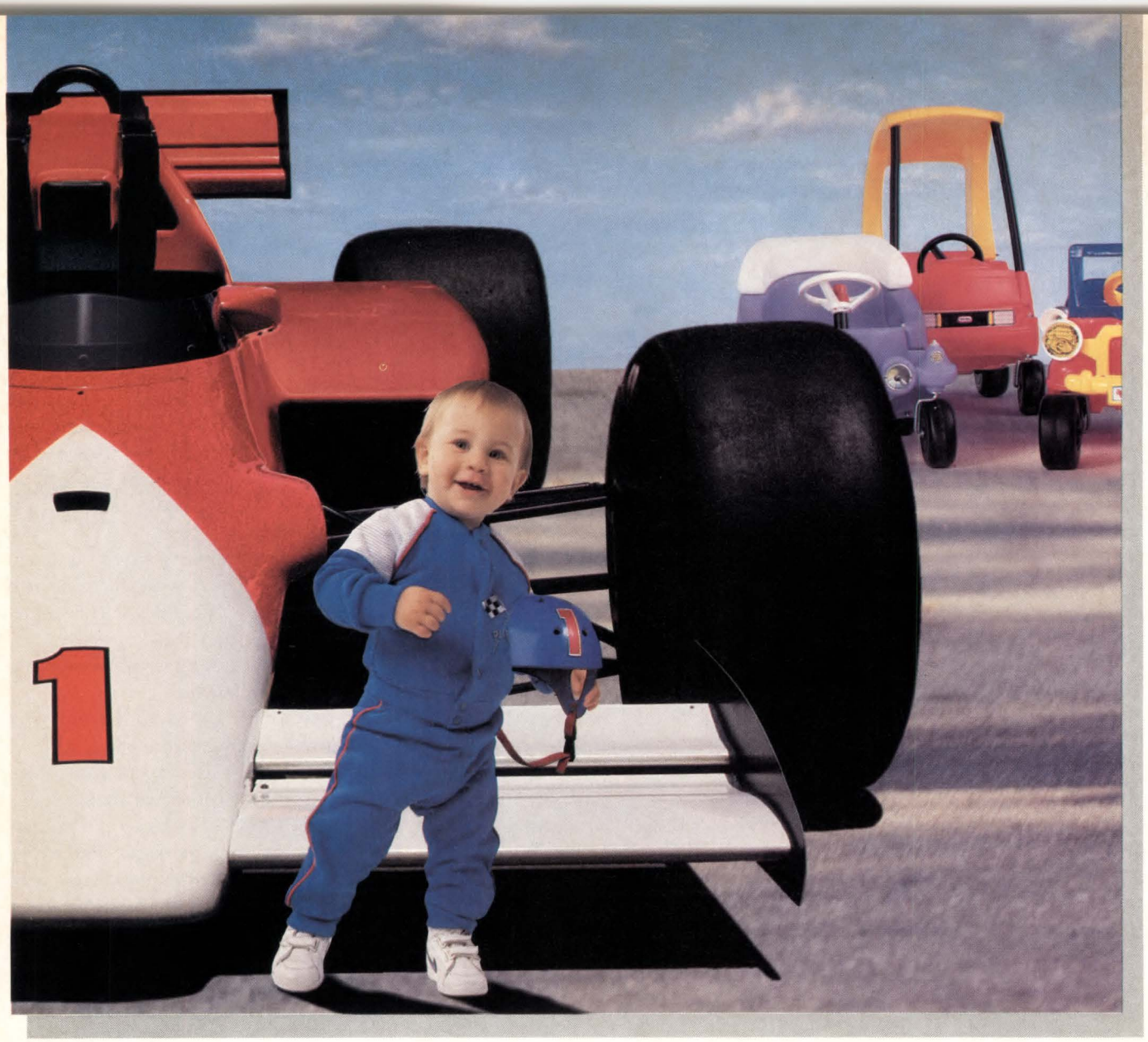
/A - Arrange (sort) the data, by row or column, ascending or descending, with both primary and secondary keys available.

Graphing

SuperCalc3 supports seven different types of graphs that may be generated — complete with titles and notes — from spreadsheet data.
1. Bar Graph - With variables shown as clustered rectangles.
2. Stacked-Bar - As above, but with vertical stacking of the bars.
3. Line Graph - The variables are shown as "markers," connected by lines.
4. Area Graph - Similar to the Stacked-Bar, but with the markers connected by lines and graphed cumulatively, with each line "stacked" above the previous.
5. Hi-Lo Graph - Shows the spread between a "high" variable (the first defined variable) and a "low" variable (the second defined). Each point is shown as a vertical line from low to high, with markers for the appropriate points from any other variables.
6. Pie Graph - A single variable, or parallel point from each variable, graphed as segments of a circle.
7. X-Y Graph - Where variable (usually the first defined) represents the X (horizontal) axis, and any other variables are used as the "Y" value, graphed as separate marker/lines. "Time" is implied by the order in which the points are plotted, making the X-Y or scattergraph a three-dimensional representation.

Documentation

The documentation set for *SuperCalc3* is quite comprehensive, consisting of an



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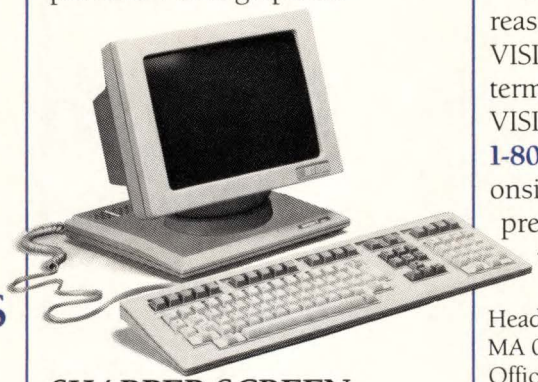

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VISION II

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FIGURE 3.

Mathematical Functions

ABS(Value)	LOG[10](Value)
ACOS(Value)	MAX(List)
ASIN(Value)	MIN(List)
ATAN(Value)	MOD(Value1,Value2)
AV[ERAGE](List)	PI
COS(Value)	ROUND(Value,Places-value)
COUNT(List)	SIN(Value)
EXP(Value)	SQRT(Value)
INT(Value)	SUM(List)
LN(Value)	TAN(Value)

Logic Functions

IF(Value1,Value 2[,Value 3])	NOT(Value)
AND(Value 1,Value 2)	TRUE, FALSE
OR(Value 1,Value 2)	

Date Functions

TODAY	YEAR(Date Value)
DATE(MM,DD,[YY]YY)	WDAY(Date Value)
MONTH(Date Value)	JDATE(Date Value)
DAY(Date Value)	DVAL(Value)

Table Functions

LOOKUP or LU(Value,Col/Row Range)
NA, ERR[OR]
ISNA(Value), ISERR[OR](Value)
ISNUM(Value), ISDATE(Value), ISTEXT(Value)

Financial Functions

NPV(Discount,Row/Col Range)
PV(Payment,Interest rate,Periods)
PMT(Principal,Interest rate,Periods)
FV(Payment,Interest rate,Periods)
IRR([Guess,]Row/Col Range)

"Answer Card" (command summary), a small booklet entitled *10 minutes to SuperCalc3*, another booklet entitled *Super Data Interchange* (covering the methods by which data may be converted to be usable by SuperCalc3), and an extensive users manual. The users manual is well written with a comprehensive Table of Contents and Keyword Index. No knowledge on the part of the user about electronic spreadsheets is assumed. One section is an extensive tutorial, and numerous illustrations are used in the examples. Note: There is minimal reference to IBM hardware, appearing primarily when function keys are mentioned.

Conclusion

If you are already a *SuperCalc* user, you'll be pleased with the features that *SuperCalc3* has to offer. On the other hand, if you are using another electronic spreadsheet, unless you're dissatisfied with it (or are sentimental), there's probably no reason to change. The real problem with *SuperCalc3* is the same problem vexing users of many other software packages: Without Digital's support, vendors and developers of software are reluctant to provide updated/current versions for the Rainbow. *Editor's Note: SuperCalc 4* has been released in PC-DOS version only.

Victor J. Chorney is senior consultant at the accounting firm of Glickman, Berkovitz, Levinson & Weiner in Elkins Park, Pennsylvania.

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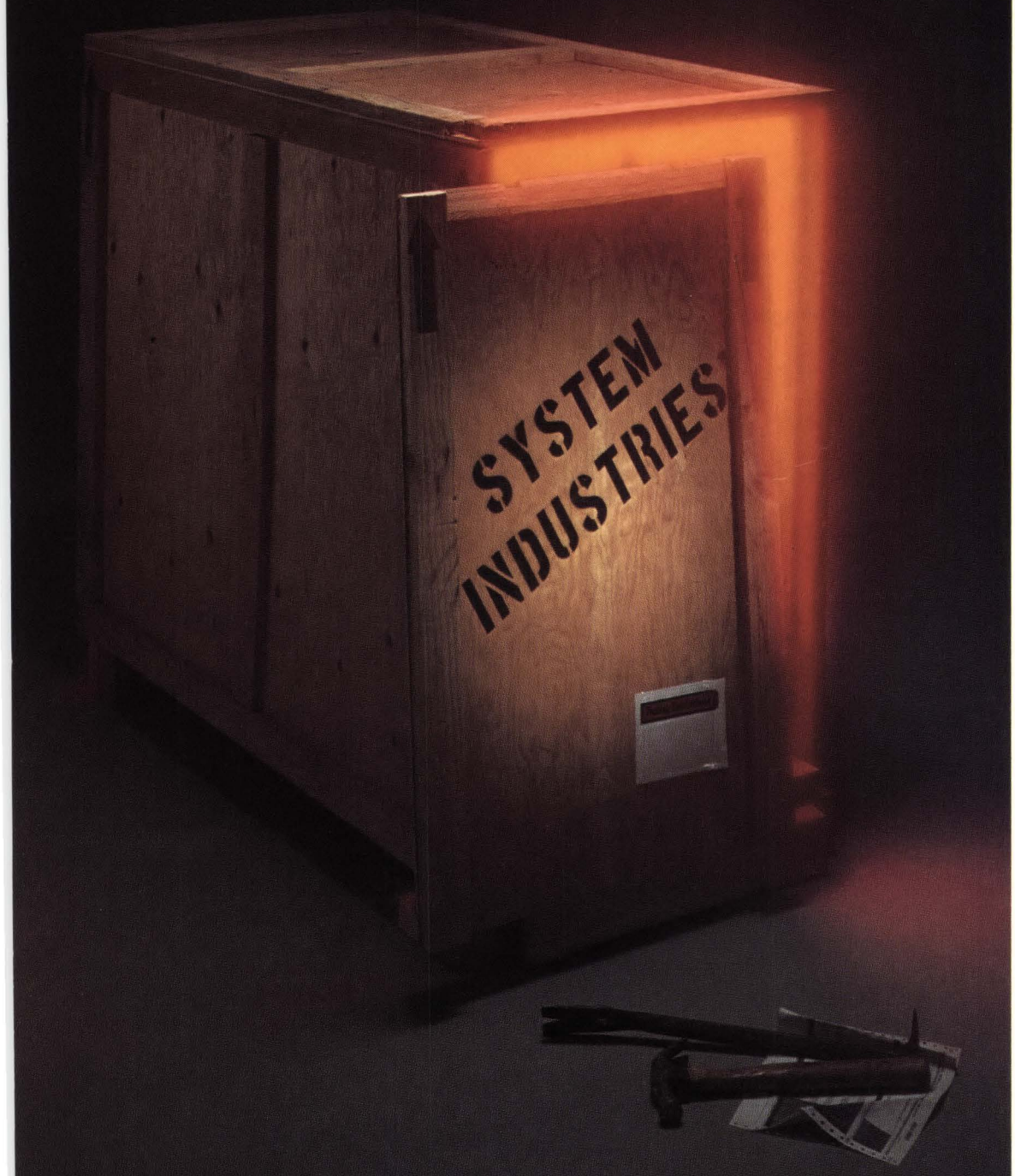

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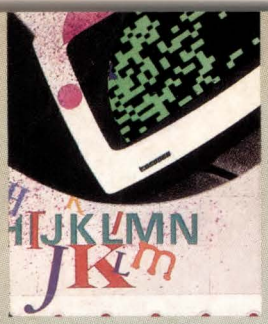


HARDWARE

VT200 SERIES

Gateway To The Computer, Part 4.

By Eliezer May

In Part 3 of this series, we focused on basic control of the terminal functions, and display. This month, we examine character set control, and loading a new character set from the host.

In the VT100 terminal, we had a repertoire of three to five character sets. UK differed from ASCII only in terms of one character: the pound sign instead of the number sign. Semigraphics replaced the lowercase characters with line drawing symbols and a few other characters. An alternate character set and/or alternate graphics were available to those who had the advanced video option, and acquired the PROMs (programmable read-only memory chips). Only two sets could be mapped to each of the stand-by sets. This mapping required the transfer of three characters from the host to the terminal.

The control switching between the two stand-by sets (G0 and G1), required the transfer of only one character (Shift-In or Shift-Out). In effect, the set was mapped to the graphics-left area; i.e., the seven-bit range from 0 to 127 decimal (0-31 is used for C0 control codes). After taking into account control codes, <space>, and <delete>, 94 "visible" characters were left. By using the character-set mapping sequences, characters from any and all sets could be displayed simultaneously.

In the VT220 series, we retain all character features of the VT100 while adding more character sets to our repertoire, double the character sets on stand-by, and also double the number of characters immediately available.

In addition to UK, ASCII, and semigraphics (or, special graphics), we now have a multinational character set, a display controls font, and a down-line load capability. The multinational character set primarily contains characters used in European languages that are not found in ASCII. The "display controls" font is invoked by a parameter in the terminal Set-Up (activated by the terminal operator, and not the host software).

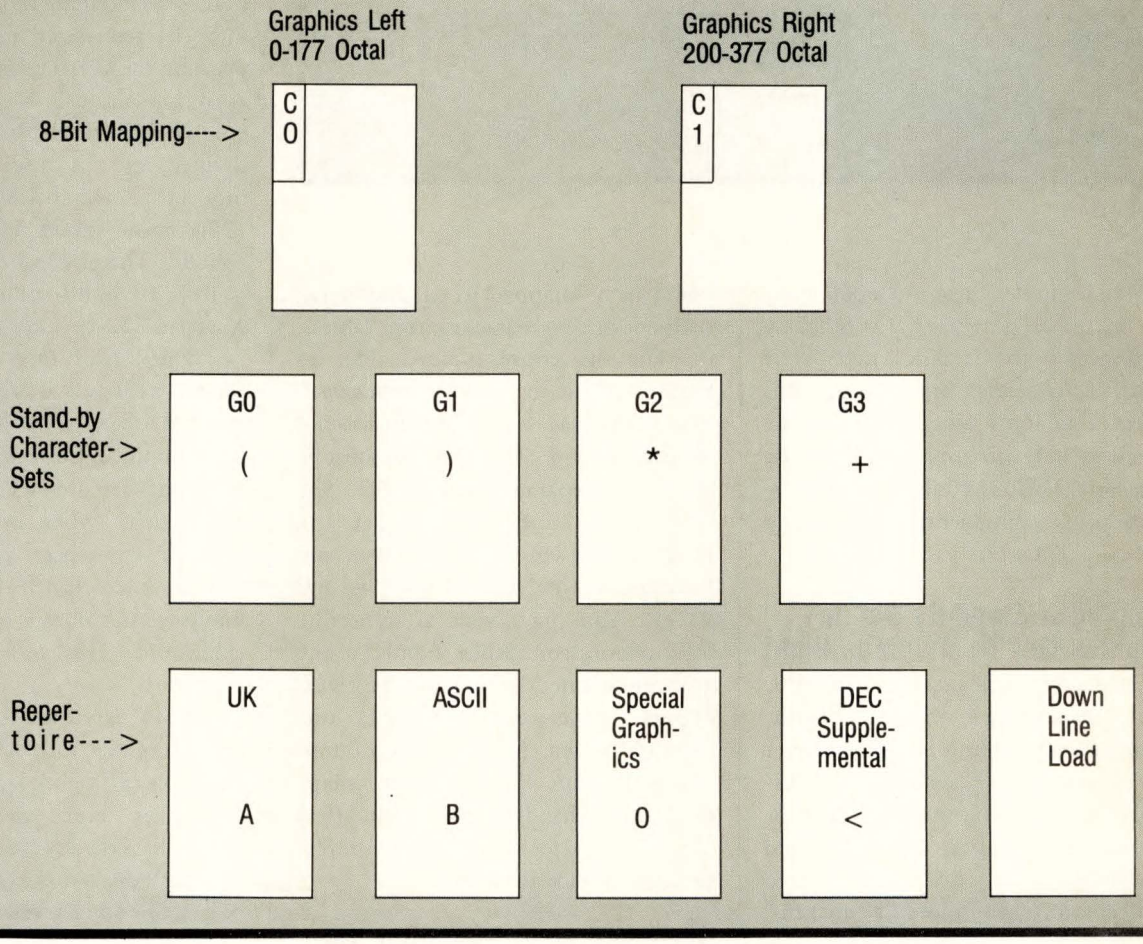
One of the most powerful features of the VT220 series is the down-line load capability. This facility allows the software engineer to design his own character set, up to 94 symbols, in addition to the previously mentioned sets provided by the hardware. You can use this to minimize communications, by defining semigraphic characters, your special characters, and the foreign characters in the 94 characters of this font, and thus avoid set remappings. Examples include a scientific set with Greek and math symbols, and a set of electronic symbols.

You may define character primitives that can be combined (not overlayed) to define numerous new characters, spanning two or more character positions. If you redefine the bit matrix of a character in the down-line load set, all currently displayed copies of the character on the screen will be changed to the character's new bit matrix. Note, that the loading may take several seconds. This is not effective for display dynamics (much longer in the VT240/241 than in the VT220). Down-line load capability is available only in VT200 mode.

Mapping The Character Sets

The easiest way to understand the mapping of character sets is to visualize a two-stage switching system. In the first stage, we con-

FIGURE 1.



nect a character set to a stand-by set (G0, G1, G2, or G3). Next, we can connect a stand-by set either to Graphics Left (GL) (range of 33 — 126 decimal) or to Graphics Right (GR) (161 — 254 decimal). The only exception is that G0 cannot be mapped to Graphics Right.

At any given time, the character received by the terminal is displayed according to the current character mapping in effect. When we first turn on the terminal, G0 is mapped to GL, and the character set is determined by Set-Up parameters. Visualize the effect in Figure 1, where a character is received by the terminal. If the value received is in the range of 41—177 octal, it enters GL. Otherwise, if it is 241—376 octal, it enters GR. The set is connected to a stand-by set, G0-G3, and the character migrates downward to that box.

Finally, the character passes through the character set that is connected to the stand-by set. Then, the bit matrix of the entry associated to our character (in the current attributes) is displayed on the screen.

Mapping A Character Set To A Stand-By Set

Each of the stand-by sets has a symbol associated with it. Similarly, the character sets of the repertoire each are identified uniquely by a symbol (see Table 1).

To connect a stand-by set to the character set, the terminal must receive:

<ESC> <Stand-by Set Identifier>
<Character Set Identifier>

TABLE 1.

Stand-by Set	Identifier	Character Set	Identifier
G0	(	UK	A
G1	)	ASCII	B
G2	*	Special Graphics	0
G3	+	DEC Supplemental	<

For example, <ESC>(0 would connect the special graphics to G0. Since G0 is connected to Graphics Left (your primary characters), try entering this sequence in local mode, or from the computer, and then displaying lowercase characters. Various countries will have additional sets and identifiers according to local adaptations and standards.

Mapping A Stand-By Set To Graphics Left Or Graphics Right

Unfortunately, this mapping cannot be defined in a general way, as could the stand-by set mapping to the character sets. (The mappings are defined individually in Table 2.) Note that some mappings consist of two characters, and some of only one. The two most often used repertoire sets should be mapped through stand-by sets, to G0 and G1. In general, it is desirable to minimize communications overhead so that the two less often used sets can be mapped to the remaining stand-by sets. These two sets then can be mapped to GL and/or GR with one or two characters from Table 2.

For the entire picture, refer to Figure 4-3 in the VT220 *Programmer's Reference Manual*. Unfortunately, it is not included with the terminal, and must be purchased separately from DEC. The DEC codes for the manual are EK-VT220-RM-001 (for the VT220), and EK-VT240-RM-002 (for the VT240 and VT241). You may wish to transcribe information from Tables 1 and 2 to the aforementioned page in the DEC manual. Note that mappings one through seven stay in effect until changed, while the single-shift mappings eight through nine stay in effect for one character only, and then revert to their previous status.

Down-line Load Character Set

The VT200 series terminals allow the user to design and down-line load up to 94 characters from the host computer. This means that software can use previously unavailable symbols, specific to an application area. This may include Greek characters, math symbols, or electronic component symbols, for example. You even can build large symbols by subdividing the larger bit matrix into character-sized bit matrices, and printing the associated characters in the correct positions.

The screen has 240 pixels, vertically divided into 24 rows. In 80-column mode, the screen has 800 pixels, and in 132-column mode, 1188 pixels, horizontally. The physical character cell size is 10 X 10, in 80-column mode, and 9 X 10, in 132-column mode.

The *VT220 Programmer's Reference Manual* defines two types of characters: text and full cell. I haven't succeeded yet in defining a full-cell character. Text characters are defined to be an 8 X 10 pixel matrix, where usually you define the left seven-pixel columns. In the VT220, the eighth column bit is replicated in columns nine and 10 (pixel extension). This *doesn't* occur in the VT240/241.

Pixel extension is necessary for characters that must connect horizontally, like orthogonal graphics symbols for boxes. Since the entire cell is definable vertically (10 pixels), it's up to the user's discretion as to whether symbols will connect vertically or not.

The down-line loading is accomplished by sending a command sequence that identifies:

1. The font to be loaded.
2. The specific character in the font.

TABLE 2.

1. G0 to Graphics Left	<Shift-In>	(17 octal)
2. G1 to Graphics Left	<Shift_Out>	(16 octal)
3. G2 to Graphics Left	<Lock Shift 2>	<ESC> n
4. G3 to Graphics Left	<Lock Shift 3>	<ESC> o
5. G1 to Graphics Right	<ESC> ~	
6. G2 to Graphics Right	<ESC> }	
7. G3 to Graphics Right	<ESC> |	
8. G2 to Graphic Left for 1 Char	<Single Shift 2>	(217 octal) or <ESC>N
9. G3 to Graphic Left for 1 Char	<Single Shift 3>	(216 octal) or <ESC>O

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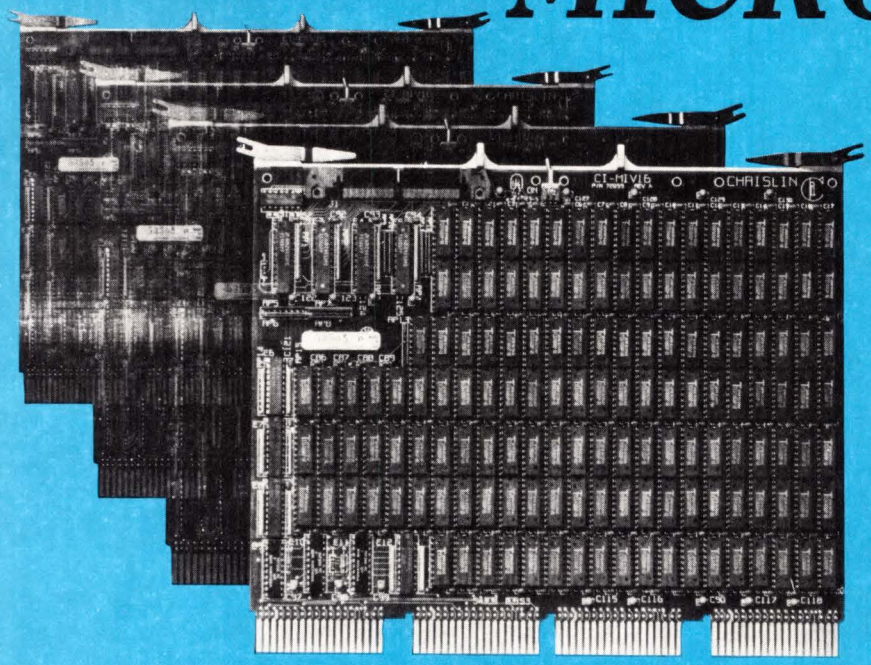

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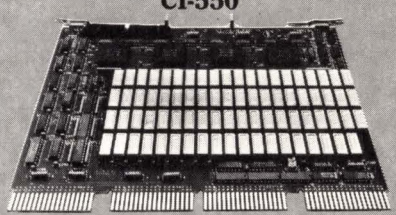

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FIGURE 2.

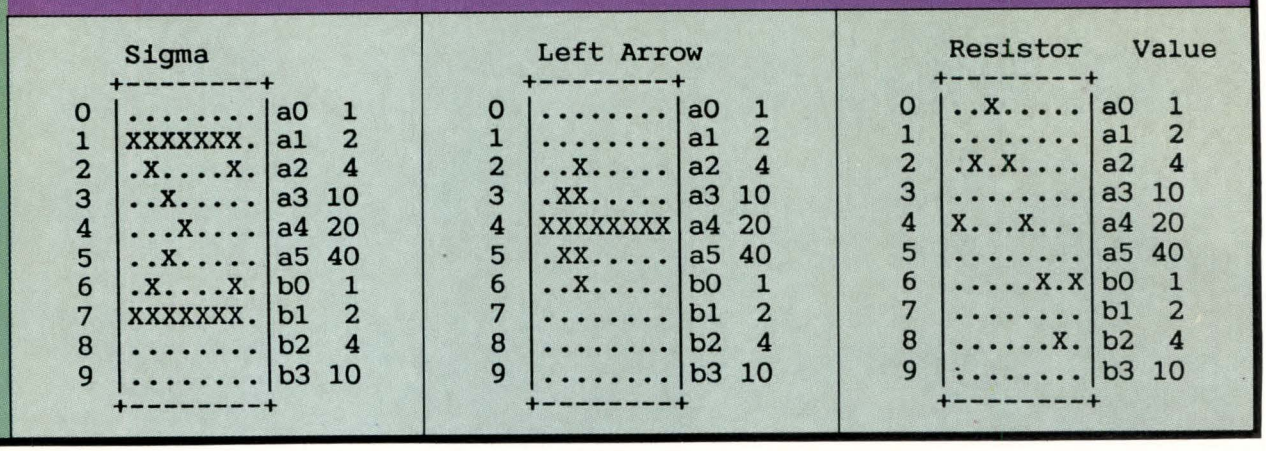


FIGURE 3.

Column totals	2	6	52	22	2	2	6	0
Add 77 octal	77	77	77	77	77	77	77	77
	101	105	151	121	101	101	105	77
Corresponding Characters	A	E	i	Q	A	A	E	?
Now we do the same for the second band.								
Column totals	2	3	2	2	2	2	3	0
Add 77 octal	77	77	77	77	77	77	77	77
	101	102	101	101	101	101	102	77
Corresponding Characters	A	B	A	A	A	A	B	?
For the left arrow we get:								
band 1 values	20	70	74	20	20	20	20	20
characters	0	w	{	0	0	0	0	0
band 2 values	0	0	1	0	0	0	0	0
characters	?	?	@	?	?	?	?	?
For the resistor primitive we get:								
band 1 values	20	4	1	4	20	0	0	0
characters	0	C	@	C	0	?	?	?
band 2 values	0	0	0	0	0	1	4	1
characters	?	?	?	?	?	@	C	@

FIGURE 4.

```
<DCS>1;51;1{MAEiQAAE?/ABAAAAB?<ST>                Sigma (8-bit controls)
<ESC>P1;91;1{MOw{OOOOO/??@????<ESC>\              Left arrow (7-bit'')
<DCS>1;2;1{MOC@CO???/????@C@<ESC>\                Resistor (mixed 7 & 8)
```

3. Whether or not other characters in the font will be erased.
4. Cell size.
5. Whether the character is for 80- or 132-column mode.
6. The full cell (see previous comment on full cell) or text.
7. The pixel-matrix information.
8. The Command-String Terminator.

In general, the cell size, 80/132 column, and text or full-cell parameters, can be omitted. To further simplify, we always can set the font number to one and the erase control also to one (erasing only the character being defined).

Now let's look at the sixel representation of a few example characters. Figure 2 shows three examples: the Greek symbol Sigma, the left arrow, and a resistor primitive.

The top row is labeled zero, and the bottom is nine. (See page 4-43 of the *VT220 Programmer's Reference Manual.*) DEC uses a scheme based on sixels — six pixels (picture elements).

We divide the cell into horizontal bands, six pixels high. In our case of 10-pixel rows, we have two bands: the top six-pixel band, and the bottom one consisting of four pixels of the matrix, plus two blank pixels. In Figure 2, the first band is a0 through a5. The second is b0 through b3 (b4 and b5 are zero). Should our cell size be larger for a future terminal type, we also would divide the cell vertically into bands, and have a character to describe each vertical column in the band. The six bits form a binary number where the top most bit is the least significant, and the bottom most bit is the most significant. The number is in the range of zero through 77 octal (0-63 decimal).

We now must convert this number to a character in the visible range (i.e., exclusive of control codes) of the seven-bit ASCII set. This is done by adding 77 octal (63 decimal). We now produce a character for each column in the range of the question mark (77 octal) through the tilde (~ — 176 octal).

Let's build our characters. In the Sigma character we traverse the top band from left to right. See Figure 3 for the column values in octal.

Now we can proceed to the building of the command. The format is:

```
<DCS><font number>;<character number>;<erase control>
{<Set-identifier>                    <top band>/<bottom band><ST>
```

<DCS> is a C1 control code (220 octal). You also can use the seven-bit equivalent <ESC>P. The font number is zero or one (one is recommended). The <character number> is one or two characters in the numeric character range, which conveys a value of one through 94. The user-defined character is addressed by this value, plus 40 octal. In other words, character one would replace the exclamation mark positionally, and 94 would replace the tilde. You can save communications time by loading an entire set; however, I prefer to work modularly, one character at a time.

In this case, the <erase control> is one for replacing only the specific character. Next is the left brace followed by the <set-identifier>. The <set-identifier> consists of one to three characters, where the final one *must* be in the character range of 0 (zero) through ~ (tilde); 60 through 174 octal. If the final character is preceded by one or two characters, they must be in the character range of <space> (40 octal) through / (77 octal). The <top band> is the eight (or less) character sequence that we computed. We follow with a / (slash) which separates bands, and continue with the <bottom band>. The command sequence now is terminated with an <ST> or the seven-bit equivalent <ESC>\.

Now we can "install" our three characters in a new set, which we'll call M, for mine. The characters will be in positions 51, 91, and two, which replace the S (51 + 32 = 83 decimal), { (left brace 91 + 32 = 123 decimal), and '' (2 + 32 = 34 decimal). We enter VT200 mode (down-line load does not work in VT52 or VT100 modes), and send to the terminal the sequence in Figure 4. (Note that <ESC>P is the seven-bit equivalent of <DCS>, and <ESC>\ is the seven-bit equivalent of <ST>).

We now must map the set into a stand-by set. Let's map to G3. To do so, we send: <ESC>+M. The plus designates G3, and M is the set identifier we chose. Now we map G3 to GL or GR. Let's choose GL. We must send: <SS3> or <ESC>O. We now can access our characters by typing the S, {, or '' respectively. Since we haven't defined the other characters in this set, we'll see a reversed question mark for any other key.

In Part 5 we'll describe user-defined keys and printer control.

Eliezer May is senior software engineer and manager of Tadiran Systems Division Computer Center, Holon, Israel.

HARDWARE

TEXT MEETS GRAPHICS

By Michael Kantrowitz

A New Generation Of Video Display Terminals For DEC Users Comes Of Age.

New microprocessors, denser memories, and advancements in graphics controller-chip technology are now permitting manufacturers to develop terminals with high-resolution integrated text and graphics at lower cost than ever before.

This new generation of text and graphics terminals combines DEC VT220 emulation with the ability to display graphic objects on the screen simultaneously. This is especially important, considering the large amount of DEC equipment used for engineering and technical computing.

Traditional VAX users recognize the advantage of applications that allow data to be presented graphically. An increasing number of users require graphics capability for their desktop terminals. Although this need has existed for some time, only recently has it been possible to produce cost-effective integrated text and graphics terminals for general use. Because of declining prices for memory and microprocessors, and the availability of sophisticated, low-cost graphics controller chips, a terminal that combines text and high-resolution graphics now can be produced for only a small increment above the price of a text-only terminal. These new integrated terminals address some of the unique requirements of the technical DEC user. They're worth a close look by users of office automation and technical data analysis applications.

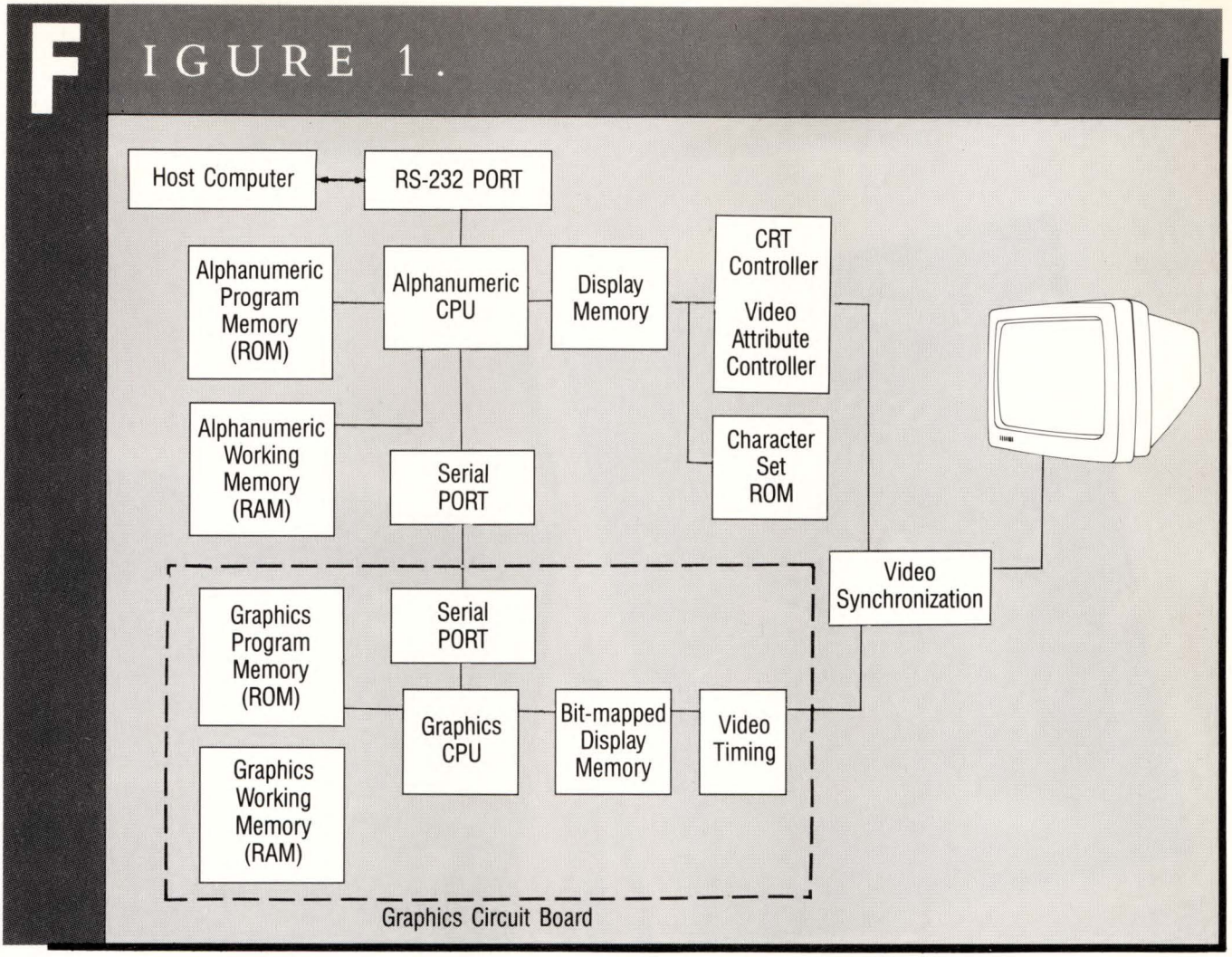
Integrated text and graphics terminals became commercially available in the early 1980s. By 1982, a class of machine existed that combined DEC VT100 compatibility with the graphics features of the Tektronix 4010. Almost all of these early terminals used two separate logic circuit boards — one for text, and the other for graphics.

Actually, this type of device was two terminals in one, since each logic board functioned as an independent unit, and communicated with the other through an internal RS-232 port. This level of integration usually was adequate from the user's perspective, but the number of duplicate parts on the circuit boards made it costly to produce.

Designers realized that combining the two boards into one would result in a lower device count and a direct cost reduction. However, using a single board also meant that the text microprocessor would have to do all the work previously split between the two processors. This would result in unacceptably slow graphics operation. Recently developed graphics controller chips have solved this problem.

New Graphics Controller Chips

A graphics controller chip is a dedicated microprocessor designed to perform graphics functions with built-in software. In the 1982-era graphics terminal, a general-purpose microprocessor with its separate memory, video, and communication logic, did all of the graphics calculation and drawing. Graphics commands were interpreted by software running on the graphics board's microprocessor, and any manufacturer wanting to develop a graphics terminal had to write all of the graphics software himself. The typical graphics



The 1982-era integrated text and graphics terminal required two logic boards and considerable duplication of parts to perform its functions.

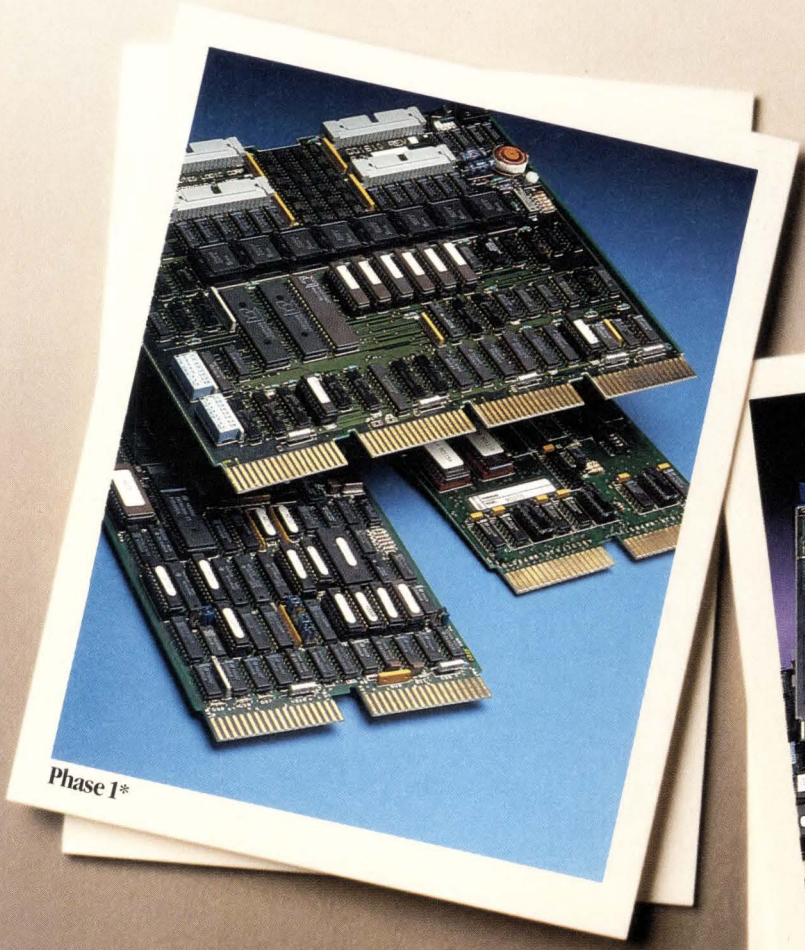
terminal of this era was a fairly simple device, usually with the capability to draw and erase vectors.

Today's more advanced integrated terminals use one of the new generation graphics controller chips to execute graphics functions. These controller chips replace the separate microprocessor required in the 1982-era terminal, with its custom software, video logic and external memory. As a result, new terminals have all of their logic circuitry on a single board. And even though the circuitry is less expensive and takes up nearly 75 percent less space, the new terminals use built-in functions of the graphics controller chip to provide dramatic improvements in performance.

The more sophisticated graphics terminals available today perform many graphics functions that simply were unavailable to graphics terminal users in 1982. Today's terminals can draw or erase vectors using multiple line types, and can draw and fill circles, arcs, rectangles, and polygons, with up to a dozen different fill patterns. Where older terminals typically had one character size only, today's devices have five or more character sizes which can be rotated, slanted and even defined locally in the terminal. This increased capability is due primarily to the availability of these new graphics display controllers.

Powerful Memory Chips

Another important difference between today's graphics terminals and those available in 1982, is the level of screen resolution. Typical monitor resolution for an integrated text and



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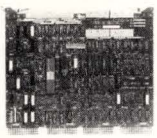

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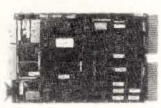
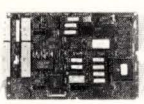


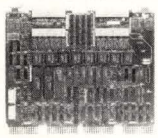
QBUS/MICROVAX 15MHz ESDI Disk Controller

New DQ696 with DU driver emulation • 1:1 interleave • 16K byte buffer • Elevator & overlap seek • Bad block replacement • On-board format diagnostics & multiple device bootstrap • 32-bit ECC • LSI-11, Micro PDP-11 & MicroVAX



QBUS/MICROVAX Multifunction SA450 & ST506 Disk Controller

New MQ606 with DU driver emulation • RX50 media compatible • 1:1 interleave • Elevator & overlap seek • 8K byte buffer • On-board format & diagnostics • 32-bit ECC • LSI-11, Micro PDP-11 & MicroVAX.



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graphics terminal used to be approximately 512 x 250 pixels. This meant that a graphics terminal could display 128,000 pixels on its screen. Although this level of resolution was fairly common then, it is considered quite inadequate today.

The typical integrated text and graphics terminal in 1986 has a physical screen resolution of 1024 x 780 pixels. This results in a total of 798,720 displayable points on the terminal's screen. Compared to 1982 resolution, pixel density has increased more than 600 percent in three and a half years. This is due principally to the commercial availability of denser 256K RAMs that store 256,000 pieces of information in a space that previously stored only 16,000 pieces. These memory changes have had a dramatic effect on the integrated text/graphics terminal market and have resulted in higher resolution displays, smaller logic boards, and significantly lower costs and prices.

A comparison of the 1982 price for a 16K RAM chip to the 1986 price for a 256K RAM chip illustrates the type of price decreases and performance increases that have occurred in the memory chips used in manufacturing graphics terminals. In 1982, a 16K RAM chip cost approximately $4 in OEM quantities, and was in wide use in the typical 1982 graphics terminal. By comparison today, the 256K RAM, which stores 256,000 pieces of information (16 times the storage of a 16K RAM), costs approximately $2 to procure in OEM quantities. This translates into a 97 percent price decrease for memory storage. And price is only one side of the story. Using 16K-RAM chips to store the information contained in one 256K-RAM chip would require 16 times as much board space. Since integrated text and graphics terminals generally are used on a desk, space is at a premium. Terminals larger than the familiar data entry terminal have limited market appeal.

These advances have resulted in more than just increases in screen resolution, higher graphics performance, and lower prices. The trends toward integration of circuit boards, and more powerful processors and controller chips replacing large areas of circuitry, also result in increased reliability and serviceability.

Early graphics terminals had complex logic boards with a large number of devices, many internal connectors between circuit boards, and significant power requirements. The new generation of integrated text and graphics terminals have fewer components, fewer connectors, and smaller, simpler power supplies. As a result, some of the leading graphics terminals available today carry one-year warranties and very low service and maintenance prices. Policies and prices still vary widely from one manufacturer to another. Evaluate carefully when determining the true cost of an integrated text and graphics terminal.

Exact Emulations

Quality of emulation in the newer integrated graphics terminals also has improved substantially. Older terminals,

A Fond Look Back

The first DEC computers supported only one kind of terminal, the model 33 Teletype made by the Teletype Corporation. It was almost completely mechanical and ran at 110 baud, 10 characters per second. For the purests, 110 baud was only 10 characters per second because the Teletype used one start bit, 8 data bits and TWO stop bits. Thus each character had 11 bits and it took 110 baud to deliver 10 CPS.

The model 33, still seen on many TELEX machines around the world, made lots of noise, vibrated with gusto when it was typing, and, when in need of overhaul or lubrication, it had a nasty habit of double typing characters on input . And it loved lubrication — oil was constantly dripping out the bottom and fuzz and lint accumulated in great quantities on the parts inside. Only the great and knowledgeable field service men could field strip, clean and repair a model 33. The less experienced often were driven to drink after only a few hours with the beast.

The model 35 Teletype was an improvement only in design. It was more durable but not any faster and used more oil than an old Chevy. It was marginally quieter, but it was still hard to talk in a room with more than one of them clacking away.

As computers became more popular and terminals were being sold beyond numbers the Teletype people anticipated, it was hard to buy a Teletype without waiting six months for delivery. (In 1968, used model 33s were selling for $900 while new ones could be had for $600 — but you had to wait six months to get one.)

Tektronix introduced its first graphics terminals for the DEC market and found that many people wanted them because they were quiet and could run at higher speeds. We wanted to run the ones attached to our PDP-6 at 2400 baud (240 CPS), but in order to do it, we had to change the wiring in the controller that ran the terminals. The Tektronix terminal used a storage oscilloscope type of screen that "remembered" what was typed (or graphed) on it; the phosphor itself retained the image so that it did not have to be refreshed out of terminal memory. In fact, there was no terminal memory. These were the days when only core memory existed and it was very, very expensive; too expensive for a mere terminal that would have to store 24 lines of 80

with their separate logic boards, had widely varying degrees of compatibility with the terminals they were designed to replace.

Compatibility is a very important issue in the design of combination text/graphics terminals. In most cases, these terminals are used for applications written with an original VT220 or Tektronix 4014, and it's very common for applications to use undocumented features of the original terminal command set. Therefore, accurate emulation is critical for a replacement terminal to work effectively: Even small deviations from the VT220 or Tektronix 4014 command set can cause data to appear incorrectly on a terminal screen.

Deviations from an original terminal's command set are only one form of incompatibility, however. Customers demand that a replacement terminal perform all of the functions of the original, and in exactly the same way.

For example, a VT220 terminal accepts a command that causes characters to blink on the screen. A replacement terminal must accept the same command, and its characters also must blink. Many customers also require that the replacement terminal blink *in exactly the same manner* as the original terminal. A VT220 blinks its characters by alternating between a higher and a lower intensity than normal.

This same technique must be used by a replacement terminal, for a true emulation. Some replacement terminals do not emulate to this extent, however, and blink their characters by alternately placing a reverse video field around the characters, or by turning the characters on and off. Although this is a simple point, errors in emulation at this level often indicate a manufacturer's true commitment to full emulation. And exact emulation is what the market demands.

Full Graphics Emulation

Similarly, the Tektronix mode of operation of an integrated text and graphics terminal has many subtleties that determine whether a terminal is a true emulator, or actually is incompatible with the model being replaced. One example, is the way alternate line types are used.

A Tektronix terminal can draw using several different line types, such as dotted, dashed, or dot-dash patterns. It's essential that a replacement terminal draw the same patterns, and most do. It's easy to evaluate emulation up to this level, by looking at specification sheets. However, it's difficult to ascertain whether the replacement terminal performs exactly the same way as the original in every situation where these line patterns are used.

For example, an alternate line pattern on a Tektronix 4014 allows a user to draw a line that consists of a dot, followed by a space, followed by a dash, followed by a space. When this pattern is repeated, it should look like a dot-dash line. That's the easy part. More difficult, is figuring out exactly what a

Continued . . .

characters, or 1,960 letters or symbols. The terminal could be "erased" in total only and there was no scrolling. After all, if there was no memory, how could you move line 19 to line 18? When the terminal screen filled up at the 24th line it went happily to the top of the screen and started writing over itself. The smart programmer set up his programs so that after 24 lines output would stop, the operator could "clear" the screen and output could continue.

To my knowledge these were the first actual CRTs to be used on DEC computers. Of course we did real-time graphics and other interesting things with their capabilities, but, at that time, they were great because they were quiet and fast.

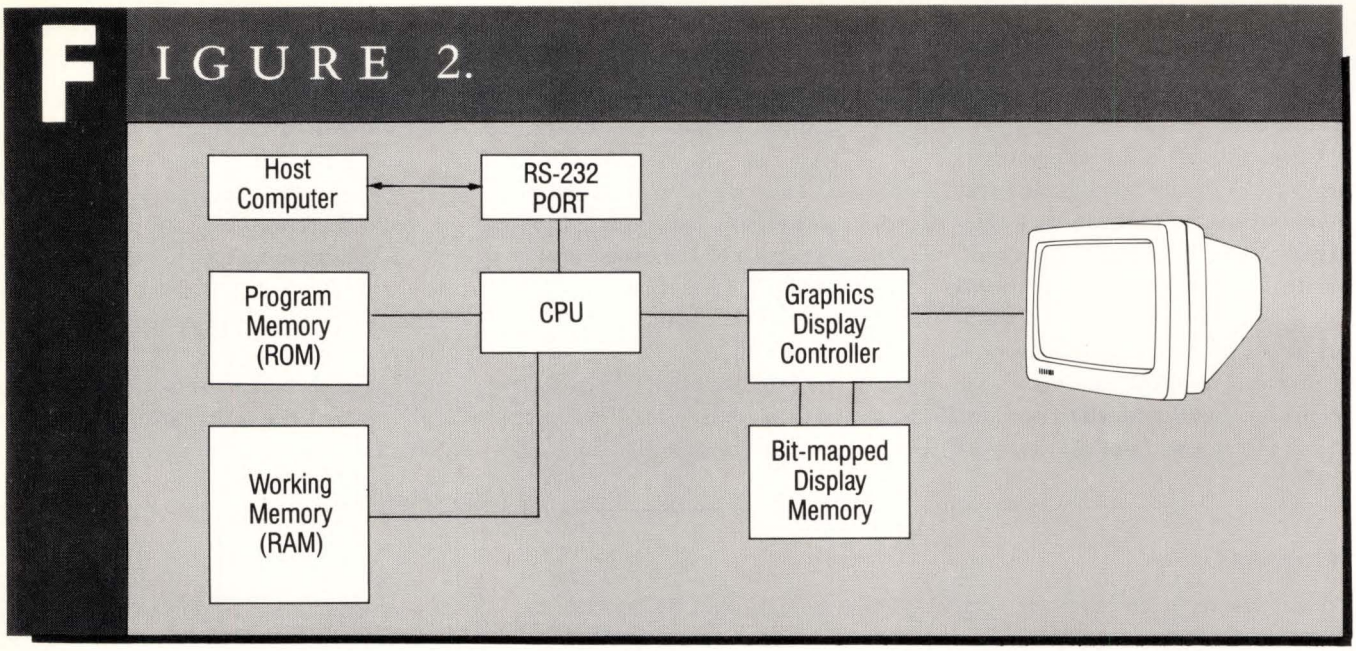
DEC's first attempt at the CRT business was the VT05. It looked like an Italian racing car. The problem was that it was a CRT terminal, not a car. It took about two feet of desk space in depth and could display only uppercase characters. Lowercase could be entered but not displayed. It was an original "glass teletype" and, although it had some rudimentary functions and cursor addressing, its main mission was to replace the noisy teletypes.

DEC doesn't always get it right the first time. The LA30 was a kludge that preceded the late great LA36. The VT52 that followed the VT05 turned out to be DEC's first successful CRT. The VT52 had upper- and lowercase, good programmability and addressability, a large but more docile-looking footprint and was adopted by programmers and package writers. It became a "standard" that brought out the first emulators, foreign terminals that were supposed to act like VT52s.

The VT52 was so good that when the VT100 replaced it as the new standard, people said that not much functionality was added. Of course, 132 columns, scrolling regions, reverse video, printer ports, blinking and highlighting were all nice to have, but did they really change the functionality of the basic device? Many of today's screen-oriented products, like word processors or generic screen painters, retain the ability to work in "VT52 mode."

So, while keyboards change and size and color are argued, I dream about the yellow clunker on which I first used a DEC computer. Even then, you walked up, typed CNTL-C and said: LOGIN.

—Carl Marbach



New generation integrated text and graphics terminal. Today's sophisticated graphics controller chips replace large areas of circuitry required in early integrated terminals. The result is faster operation, lower power requirement, and enhanced reliability.

Tektronix terminal does with this line pattern in every situation and mode of operation.

Suppose a user wants to draw a long dot-dash line made up of hundreds of very small segments only a few pixels long, by using an incremental vector mode command. In order for a replacement terminal to generate a plot that looks the same as on the original terminal, it must treat the line pattern in exactly in same manner. If the Tektronix terminal starts the line pattern over at each starting point of a segment, the replacement terminal must do the same. If the Tektronix terminal continues the pattern, ignoring breaks between segments as it draws the individual lines from dot to dot, the replacement terminal must perform that way also. This may sound like a trivial matter, but a terminal that executes this function incorrectly might show a solid line instead of a dot-dash line, or no line at all.

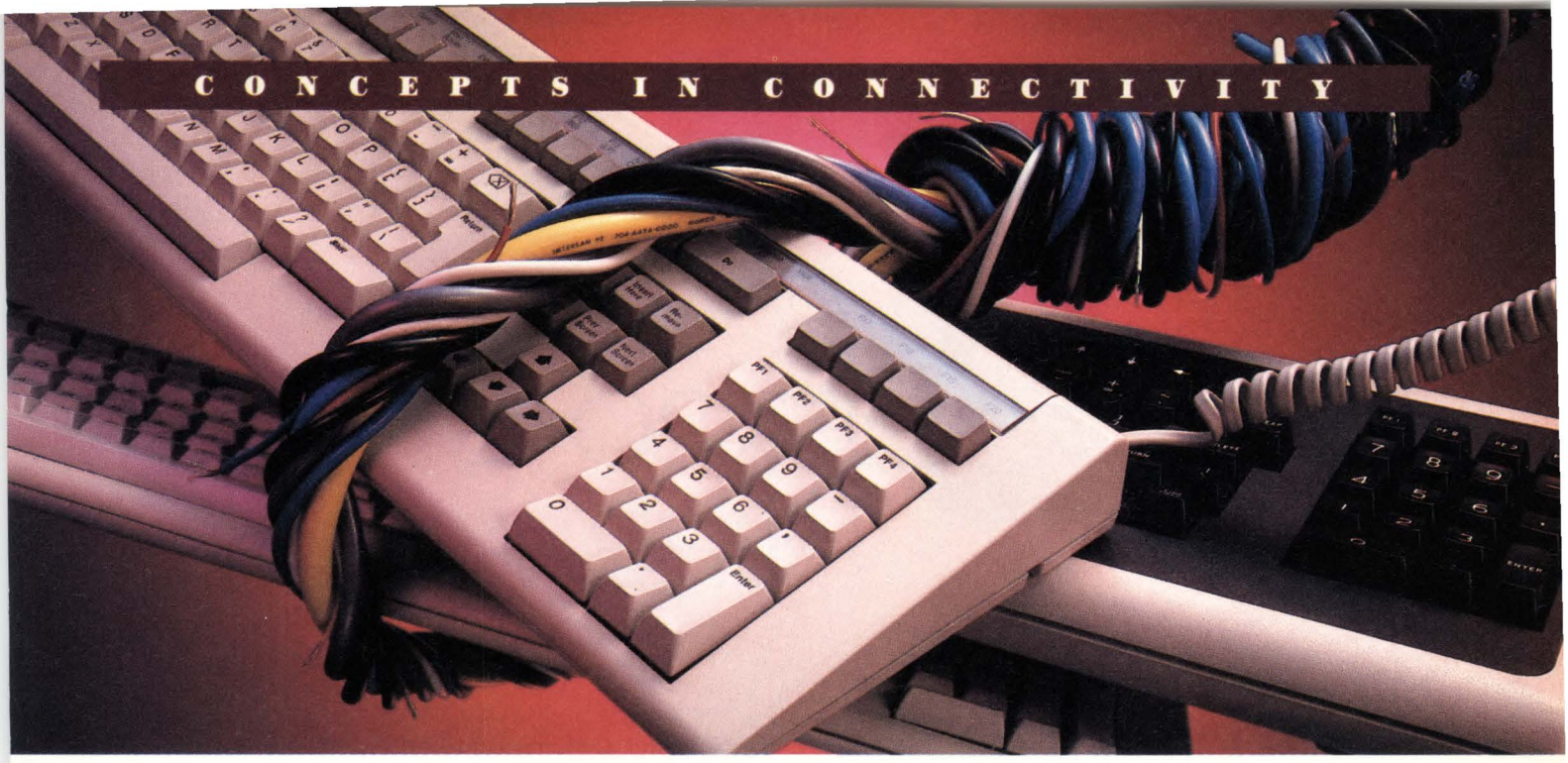
These are only a few examples of possible incompatibilities. Many others exist, and a buyer should test a terminal fully to make sure that it performs acceptably.

Since full, accurate emulation of even the subtle aspects of a VT220 or Tektronix 4014 is critical to ensure compatibility with existing applications, and since customers are wary of claims made by manufacturers, a number of users choose to purchase only original manufacturer terminals. To overcome this uncertainty over compatibility, a few manufacturers offer firmware warranties.

A firmware warranty typically states that the manufacturer guarantees a product will meet its specifications, including compatibility compliance. If any deviations are found, the manufacturer usually agrees to update the firmware at no charge. This is a fairly new type of warranty in the terminal market, and there still are many manufacturers having statements in their general warranties explicitly excluding firmware from the warranty coverage. A typical clause of this type might state that the firmware is provided "as is," without any guarantee of it being error free, or that it will operate without interruption. Because of the subtle aspects of emulation, and the importance of true compatibility to ensure that a text or graphics application runs correctly, a firmware warranty is becoming a much more important element in evaluating graphics terminal performance.

Large new markets and market segments for graphics equipment and applications have opened up as a result of the new technology. In the past, the main obstacle to the implementation of integrated text and graphics applications on DEC systems was the lack of low-cost, reliable, high-performance integrated graphics terminals. Now, the challenge lies in the hands of software developers. From a hardware standpoint, there no longer is any reason why VAX users can't get the same interaction of text and graphics that commonly is available with even a standard Apple Macintosh or IBM PC.

Michael Kantrowitz is director of marketing at Human Designed Systems, Inc., Philadelphia, Pennsylvania.



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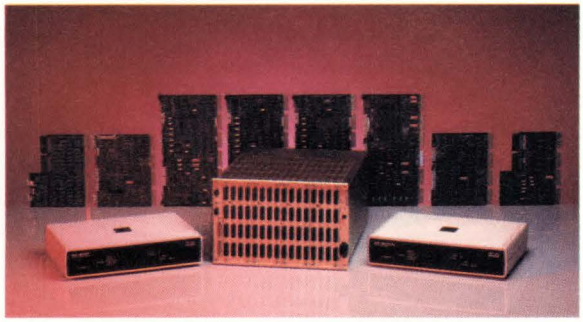

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DEXPO

DEXPO BITES THE APPLE

By Ted Melohis

New York City Plays Host To DEXPO East '86.

To paraphrase from the song "New York, New York": "If you can make it there, you'll make it anywhere." If you believe in that phrase, then Expoconsul International's DEXPO East 86, the DEC-specific trade show, taking place December 17-19 at the Jacob K. Javits Convention Center, has made it to the top of the heap. This marks the first time the show has invaded The Big Apple. New York is the world's top visitor city, boasting more than 900 conventions and 17 million people each year. It's the financial, commercial and cultural capital of the country and one of the great metropolises of the world. The city's five boroughs (Manhattan, Brooklyn, Queens, Staten Island and the Bronx) account for a population of eight million.

It would take a lifetime to explore all that The Big Apple has to offer. You can take advantage of the 25,000 acres of parks, 690 historic landmarks, 150 museums, 400 art galleries, 30 department stores, 40 Broadway theaters, 90 night clubs and entertainment spots and 50 discos.

HISTORY

Giovanni da Verrazano, the Florentine navigator, was the first European to enter New York Harbor in 1524. Henry Hudson, an Englishman in the service of the Dutch, followed in 1609 and brought trading into the region. New York, then New Amsterdam, was established in 1625 on the lower tip of Manhattan Island and became the main town of the new province. The next year Govenor Peter Minuit purchased the rest of Manhattan from the Indians for $24 worth of kettles, axes and cloth. In 1664, the English, under the Duke of York (later James II), took control of the province from the Dutch.

New York was the first capital of the United States and was the New York state capital until Albany succeeded it in 1796. Between 1840 and 1860, the city received its first great wave of immigrants as the population rose from 300,000 to 800,000. In the early 20th century, the arts flourished, construction of skyscrapers took place and Coney Island was beginning to thrive. During World War II, New York moved half of all United States troops and one-third of the war supplies bound for Europe.

WHAT TO WEAR

The holiday season in New York is a beautiful sight, but be prepared for the cold and wet weather that accompanies it. Temperatures in December range from 30 to 40 degrees. The wind chill factor can make it feel extremely cold, so be sure to bundle up. New Yorkers like to dress comfortably, so don't be surprised if you see Reeboks and full-length fur coats.

WHAT TO SEE

Although the 100th birthday and renovation of the Statue of Liberty has stolen the spotlight this year, there are many more sites and attractions to visit. The following attractions are a small sampling of things to do in Manhattan.

For complete information on attractions, theater shows, sightseeing tours and restaurants, contact the New York Convention & Visitors Bureau at 2 Columbus Circle; (212) 397-8222.

Empire State Building

King Kong made it famous in the 1930s, but its Art Deco architecture makes it a sleek and modern 1,472-foot structure as it enters its second half-century. The sky-high observatories on the 86th-floor observation area give an impressive view of the city and the 102nd floor is a space ship environment complete with special lighting effects. It's open daily from 9:30 a.m. to midnight. For more information, call (212) 736-3100.

The New York Experience

Located in the McGraw-Hill Building on the Avenue of the Americas, this multiscreen, multisensory show unfolds the story of New York City. Enjoy it in swivel seats. The show runs daily, on the hour, until early evening. For more information, call (212) 869-0345.

Radio City Music Hall

The world's largest indoor theater is the home of the Rockettes, the Mighty Wurlitzer and the largest contour curtain in the world (weighing nearly three tons). Its annual Christmas Pageant has become known around the world, so be sure to call early for seats. Backstage tours run daily. For reservations, call (212) 541-9436.

Rockefeller Center

While in the vicinity of Radio City Music Hall and the New York Experience you must see Rockefeller Center decorated for the holidays. It boasts the world's largest freshly cut, lit and decorated Christmas tree. Skaters show off their skills on the skating rink below.

The Metropolitan Museum of Art

Aside from its exclusive collection of art, a must see at the museum is the museum's Neapolitan Christmas tree and Creche. The Baroque angels and cherubs that decorate the tree are world famous. For unique gifts make sure to visit the gift shop. The museum is located on Fifth Avenue at 82nd St.; (212) 879-5500.

Backstage on Broadway

Enjoy a behind-the-scenes look at Broadway shows with a Broadway professional escorting you on a tour that visits on-stage, backstage, in the wings and dressing rooms of New York's theaters. Reservations are required. For more information, call (212) 575-8065.

Fifth Avenue

No trip to New York would be complete without a stroll down Fifth Avenue to see how the exquisitely decorated shops transform the Avenue into a holiday wonderland. You can begin at FAO Schwartz, the famous toy store. Heading south you will pass Saks, Fortunoff, Cartier and Tiffany's. Also, you won't want to miss the animated window displays at B. Altman & Co. and Lord and Taylor.

No trip to New York would be complete without a stroll down Fifth Avenue . . .

South Street Seaport

On the East River, at Fulton and Water Streets is the city's 19th century port district with all pedestrian streets. It is a recently restored landmark with waterfront piers and historic ships that are open to the public. It is loaded with shops, restaurants, pubs, an international food court and street performers.

Other Points of Interest

Obviously, there are too many places to mention here. Some other sites to see are Lincoln Center (home of the Metropolitan Opera, the New York City Ballet and the New York Philharmonic), the World Trade Center, the United Nations, Central Park, the Museum of Natural History and the Hayden Planetarium, SoHo, Wall Street and much more.

RESTAURANTS

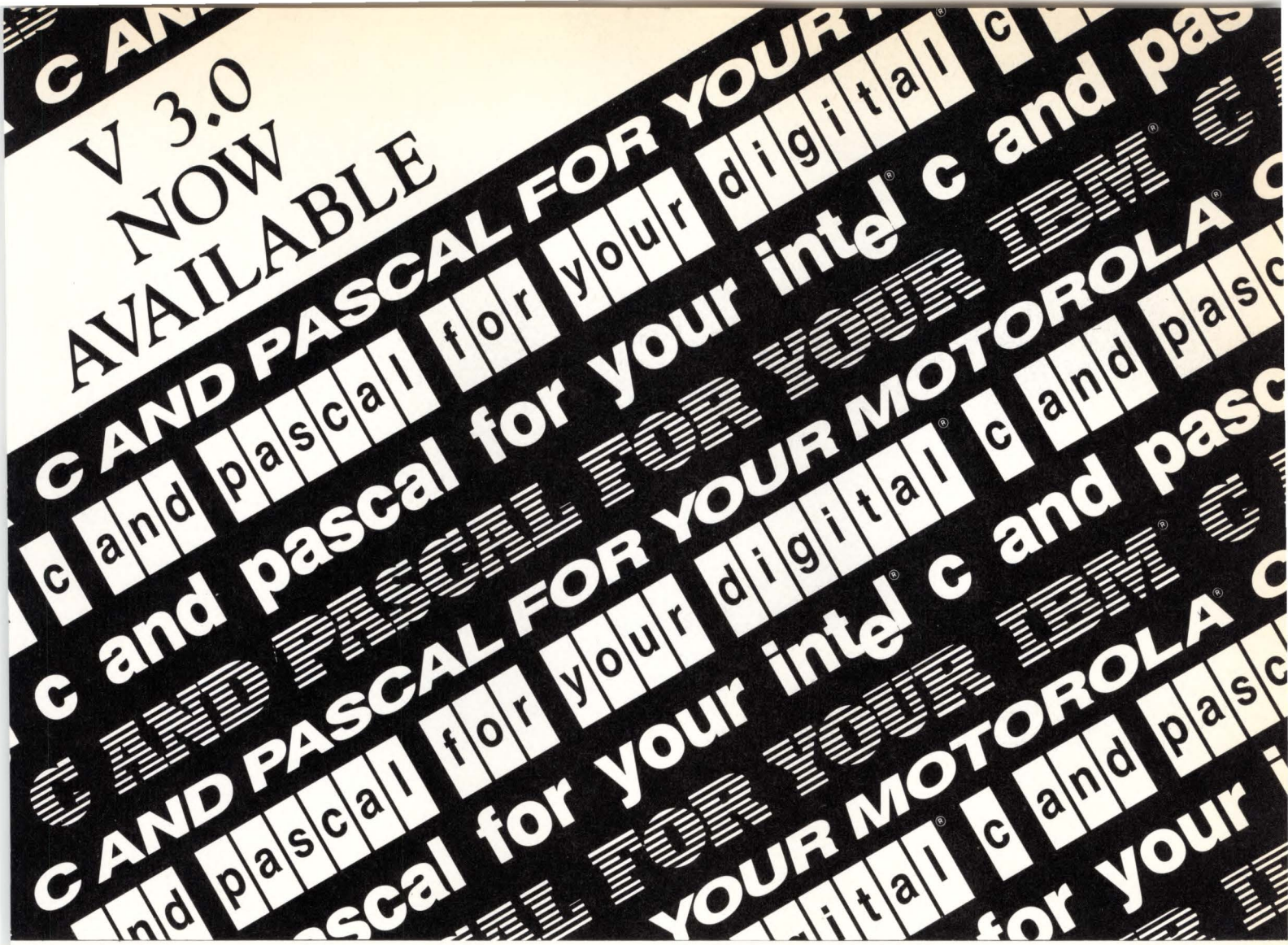
By all means, bring your appetite to The Big Apple. The city unleashes 25,000 restaurants on visitors, representing every fare and price range. From sushi to pastrami, haute cuisine to hot dogs, nouvelle to nosherai, New York can satisfy all palates and budgets.

TRANSPORTATION

There are several ways for you to get from one place to another in the city.

The city-owned subway system is the largest rapid transit systems in the world. It features 461 stops and 25 free transfer points where subway lines intersect. The New York City Transit Authority runs 4,000 buses that operate 200 routes covering about 1,000 route miles. The city's cab fleet consists of nearly 11,800 licensed yellow taxis.

Ted Melohis is a Riverside, New Jersey-based free-lance writer.



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Emulation	3161	3162	3163	3164
ADDS Viewpoint	X	X		
DEC VT220/100/52		X		
DEC VT100/52			X	
DEC VT220 w/Hot Key/ 3708		X		
Hazeltine 1500	X	X		
Lear Siegler ADM-3A	X	X		
Lear Siegler ADM-5	X	X		
TeleVideo 910, 910+, 912, 920, 925, 925E	X	X		
TeleVideo 950			X	
WYSE 50/50+		X		
IBM 3101	X	X	X	X
Enhanced IBM 3708 Attachment	X			

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But our three year warranty isn't the only significant development in IBM ASCII terminals.

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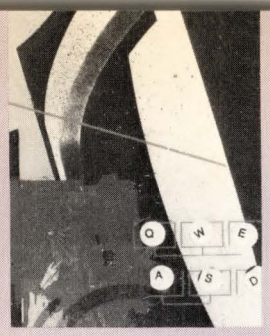
*Keyboard, display and base. **9 x 15 character cell in 25-line mode only.



RSTS

DUPLICATE YOUR TAPES

By Michael Mayfield

With TOPCAP You Can Change The Density Of Any Magtape.

This article describes a program to change the density of magtapes. It has proved to be a valuable general-purpose tool for working with tapes.

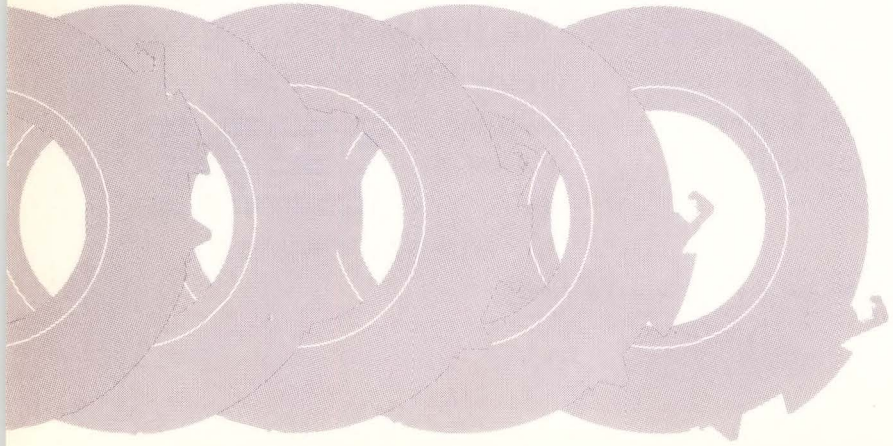
THE TAPCOP PROGRAM will duplicate any magtape, regardless of label type, record format, record length (up to 20 KB per record) or character set (e.g., ASCII or EBCDIC). The tapes may be for any operating system or computer type. Multiple copies may be made from one source. If you simply are changing the density of a tape, the copy may be put onto the original tape (if it will fit in its new density).

To use TAPCOP you mount the tape to be duplicated (i.e., the tape to read) and answer the dialog. The tape will be read and copied to disk along with information about record length, end-of-file marks, and end-of-tape. If an in-place copy is being performed, the tape then will be rewound and rewritten from the disk in the new density. If the copy is going onto a different tape, dismount the old tape and mount the new one when prompted.

TAPCOP has a recover mode in case of abortive errors. This especially is useful when an error occurs while writing data back onto the same tape at a different density. If you enter "RECOVER" at the prompt to mount the source tape, the tape will not be read. Instead, the disk files created when the tape originally was read will be used to create the output tape. Once a tape is created successfully, the disk files will be deleted.

The following example shows the use of TAPCOP to copy an 800 BPI tape to 1600-BPI:

```
$ RUN TAPCOP TAPCOP V1.1 = =
 Tape Copy Utility

Mount the tape to copy FROM and press
 RETURN?
<CR>
Input tape density <1600>? 800
Is the copy going to be stored on the same tape
 <YES>?
NO
Output tape density <1600>? <CR>
Number of copies <1>? <CR>
[Copying source tape to disk]
Mount the tape to copy TO and press
```



```
RETURN? <CR>
[Creating output tape]
Finished

$
```

TAPCOP reads each record on the tape and creates two disk files. One file (TAPDAT.TMP) is used to hold the data read from the tape. Each record of information is stored in disk in variable length records that are a multiple of 512 bytes in length.

The other file (TAPREC.TMP) is used to record record length information about each record. The length of the record, in bytes, is written for each record of data read from tape. A -1 is written to indicate end-of-file. A -2 is written to indicate end-of-tape.

After the entire tape has been read and transferred to disk, the new tape is mounted and the data is transferred from the disk data file to the tape using the record length and end-of-file information stored in the record length file. When an end-of-tape flag is read from the record length file, three end-of-file marks are written to signify end-of-tape and the tape is rewound and dismounted.

Michael Mayfield is an authority on RSTS/E and author of RSTS/E Monitor Internals.

PROGRAM 1.

```
1     EXTEND
2       ! TAPCOP == Copy from one magtape to another                    &
        !                                                               &
        ! This program copies the entire contents of one tape to one or &
        ! more other tapes or inplace to the same tape.  Density may be &
        ! specified as 800 or 1600 BPI.                                 &
        !                                                               &
        ! If "RECOVER" is entered in response to the first prompt, the  &
        ! input tape will not be read, but the output tape(s) will be   &
        ! written using the data previously read from the input tape.   &
        !                                                               &
        ! This program is provided as a service to the RSTS community.  &
        ! It is provided "AS IS" with no warranties, expressed or implied.&
        !                                                               &
        ! Author:                                                       &
        !  Michael Mayfield                                             &
        !                                                               &
        ! Edit History:                                                 &
        !  00 24-May-85 MEM     Original version                        &
        !  01 12-May-86 MEM     Update for new RSTS versions            &
        !                                                               &
        ! RSTS Version:                                                 &
        !  V8.0-H, V9.0, V9.1                                           &
        !                                                               &
        ! Variable Usage:                                               &
        !  BELL$                Constant value of a bell                &
        !  COPIES%              Number of copies of input tape          &
        !  COPY.LOOP%           Loop counter for making multiple tape copies &
        !  DATCHN%              Channel number for tape data storage I/O &
        !  DENSITY%             Output tape density                     &
        !  DEVICE$              Device and account to open tape data files in &
        !  LENCHN%              Channel number for record length data I/O &
        !  RECLEN%              Length of current tape record           &
        !  TAPCHN%              Channel number for tape I/O             &
        !  Z%                   Temporary variable                      &
        !  Z$                   Temporary variable                      &

10      DEVICE$="SY:"           !Temp file storage device  &
\       TAPCHN%=1%   &
\       LENCHN%=2%   &
\       DATCHN%=3%   &
\       BELL$=CHR$(7%)  &
\       ON ERROR GOTO 32000   &
        ! Define channel numbers for tape I/O, record length file, and   &
        ! tape data file.  Enable error trapping.  &

100     PRINT "TAPCOP V1.1 == Tape Copy Utility"  &
\       PRINT  &
\       INPUT "Mount the tape to copy FROM and press RETURN"; Z$  &
\       OPEN "MTO:" FOR INPUT AS FILE TAPCHN%, RECORDSIZE 40%*512%   &
\       Z%=INSTR(1%,Z$,":")  &
\       IF Z% THEN  &
          DEVICE$=LEFT(Z$,Z%)  &
\         Z$=RIGHT(Z$,Z%+1%)
105     IF CVT$$(Z$,-1%)="RECOVER" THEN  &
          PRINT "[Using previous tape data]"  &
\         RECOVER%=-1%  &
\         GOTO 125
110     !ELSE  &
          INPUT "Input tape density <1600>"; Z%  &
```

PROGRAM 1. . . . *continued*

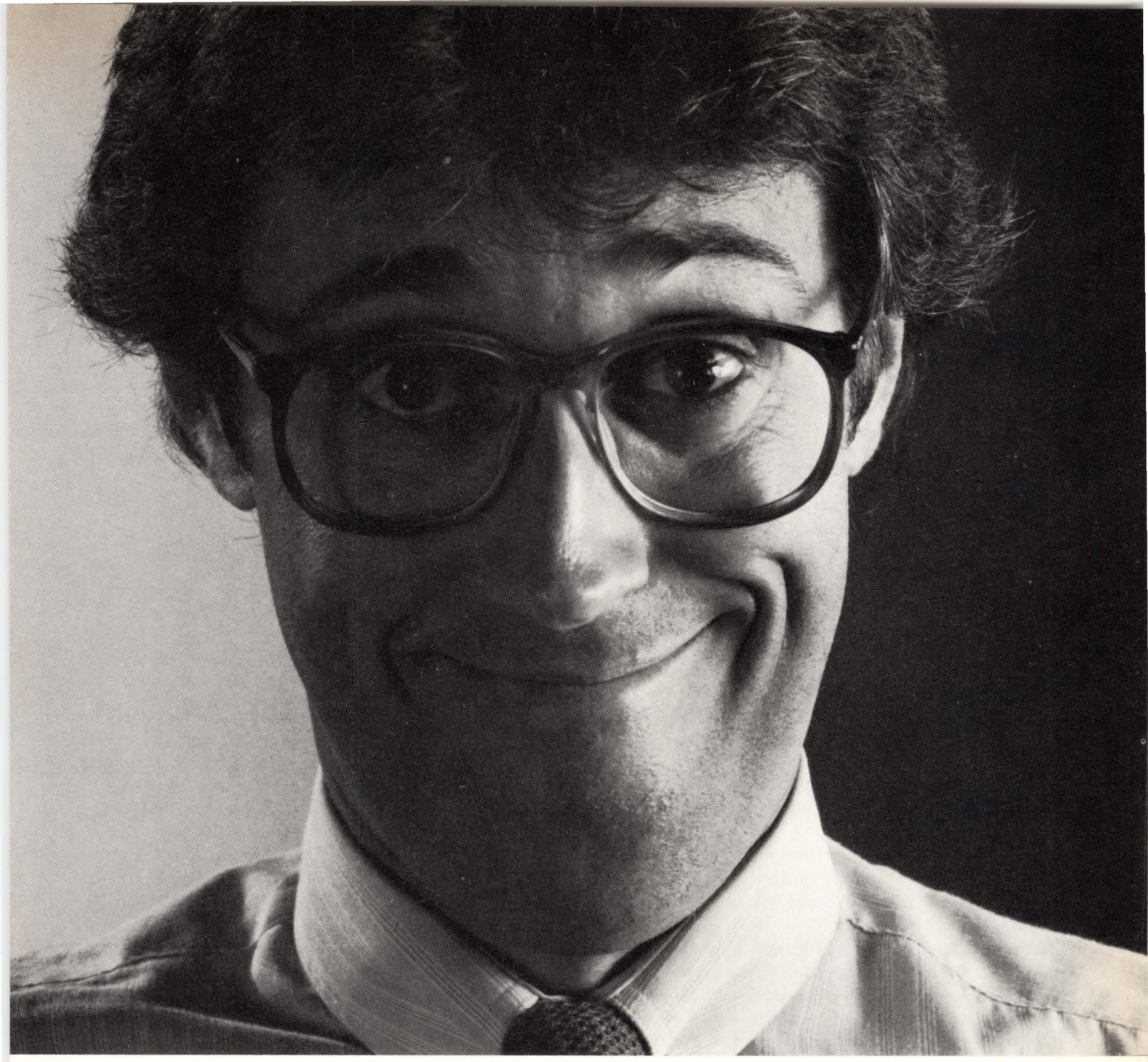
```
\         Z%=FNC.DENSITY%(Z%,1600%)  &
\         GOTO 110  IF Z%=0%  &
\         Z%=MAGTAPE(6%,Z%,TAPCHN%)  &
\         Z%=MAGTAPE(3%,0%,TAPCHN%)  &
\         OPEN DEVICE$+"TAPREC.TMP" AS FILE LENCHN%,   &
                CLUSTERSIZE 32%,  &
                FILESIZE 32%  &
\         OPEN DEVICE$+"TAPDAT.TMP" AS FILE DATCHN%,   &
                RECORDSIZE 2% OR NOT(32767%),  &
                CLUSTERSIZE 256%,  &
                FILESIZE 256%*7%   &
        ! Announce ourselves.  Ask for the input tape to be mounted.  &
        ! If "RECOVER" was entered in response to the prompt for the input  &
        ! tape, use the data file created by the last use of the TAPCOP.  &
        ! Open the tape for input.  Get input tape density from user.  &
        ! Create our work files.  &

120     COPIES%=1%  &
\       INPUT "Is the copy going to be stored on the same tape <YES>"; Z$  &
\       Z$=CVT$$(Z$,-1%)  &
\       Z$="Y"  IF Z$=""  &
\       IF LEFT(Z$,1%)="Y" THEN  &
          SAME.TAPE%=-1%  &
        ELSE  &
          IF LEFT(Z$,1%)="N" THEN  &
            SAME.TAPE%=0%  &
          ELSE  &
            PRINT "?Please enter YES or NO"  &
\           GOTO 120
125     INPUT "Output tape density <1600>"; Z%  &
\       DENSITY%=FNC.DENSITY%(Z%,1600%)  &
\       GOTO 125  IF DENSITY%=0%  &
\       INPUT "Number of copies <1>"; COPIES%  IF NOT SAME.TAPE%  &
\       GOTO 200  IF RECOVER%  &
\       PRINT "[Copying source tape to disk]"  &
        ! See if we are using more than one reel of tape.  See what density  &
        ! to use for the output.  If using more than one reel of tape, see  &
        ! how many copies we need.  Skip reading the input tape on a recovery. &

130     GET #TAPCHN%  &
\       RECLEN%=RECOUNT
140     PRINT #LENCHN%, RECLEN%  &
\       PUT #DATCHN%+SWAP%(TAPCHN%), COUNT INT((RECLEN%+511%)/512%)*512%  &
\       EOF%=0%  &
\       GOTO 130  &
        ! Get the next record from the tape (EOF goes to 32000).        &
        ! Record the length.  Store the data in the temp file using     &
        ! block I/O.  Reset the "just read an EOF" flag.  Repeat until  &
        ! two EOFs read in a row (EOT).  &

200     COPIES%=1%  IF COPIES%<=0%  &
\       FOR COPY.LOOP%=1% TO COPIES%  &
\         IF NOT SAME.TAPE% THEN  &
            PRINT BELL$;  IF COPY.LOOP%>1%  &
```

PROGRAM 1. . . . *continued*

```
\           PRINT "Mount the ";  &
\           PRINT "next ";  IF COPY.LOOP%>1%  &
\           PRINT "tape to copy TO and press RETURN";  &
\           INPUT LINE Z$
210       PRINT "[Creating output tape]"  &
\         CLOSE LENCHN%, DATCHN%   &
\         OPEN DEVICE$+"TAPREC.TMP/RO" FOR INPUT AS FILE LENCHN%   &
\         OPEN DEVICE$+"TAPDAT.TMP/RO" FOR INPUT AS FILE DATCHN%,   &
              RECORDSIZE 2% OR NOT(32767%)  &
\         Z%=MAGTAPE(6%,DENSITY%,TAPCHN%)
220         INPUT #LENCHN%, RECLEN%   &
\           GOTO 240  IF RECLEN%=-2% &
\           IF RECLEN%=-1% THEN   &
              Z%=MAGTAPE(2%,0%,TAPCHN%)   &
            ELSE   &
              GET #DATCHN%+SWAP%(TAPCHN%),  &
                COUNT INT((RECLEN%+511%)/512%)*512%   &
\           PUT #TAPCHN%, COUNT RECLEN%
230       GOTO 220
240       Z%=MAGTAPE(2%,0%,TAPCHN%)   &
\         Z%=MAGTAPE(1%,0%,TAPCHN%)   &
\       NEXT COPY.LOOP%  &
\       KILL DEVICE$+"TAPREC.TMP"  &
\       KILL DEVICE$+"TAPDAT.TMP"  &
\       CLOSE #TAPCHN%, LENCHN%, DATCHN%  &
\       PRINT BELL$; "Finished"   &
\       PRINT  &
\       GOTO 32767  &
        ! All errors are fatal now.  For each record originally read    &
        ! from tape... Get the record length.  If EOT flag (-2), then   &
        ! finish this tape and do the next one, if any.  If EOF flag    &
        ! (-1) then write an EOF, else get the stored data and write     &
        ! it.  After writing all records, write third EOF and            &
        ! rewind/offline the tape.  Repeat for any additional copies of &
        ! the tape.  Kill our temp files and we're done.          &
10000   ! FNC.DENSITY% == Parse magtape density value                    &
        !                                                               &
        ! Returns the value to use to set the required density in the   &
        ! MAGTAPE() function.                                           &
        !                                                               &
        ! Input:                                                        &
        !  VALUE%              Value to parse (800, 1600, default, or error) &
        !  DEFAULT%            Default density if VALUE%=0              &
        !                                                               &
        ! Output:                                                       &
        !  FNC.DENSITY%        MAGTAPE() function parameter value.  Returned &
        !                      as 0 if no valid passed in VALUE%.       &
        &
        DEF* FNC.DENSITY%(VALUE%,DEFAULT%)  &
\        VALUE%=DEFAULT%  IF VALUE%=0%  &
\        IF VALUE%=800% THEN  &
```

PROGRAM 1. . . . *continued*

```
           FNC.DENSITY%=12%  &
         ELSE  &
           IF VALUE%=1600% THEN  &
             FNC.DENSITY%=256%  &
           ELSE  &
             PRINT "?Invalid density.  Please enter 800 or 1600." &
             FNC.DENSITY%=0%
\       10010   FNEND  &
        ! Use default value if no density specified.  Use a value of 12 for  &
        ! 800 BPI and 256 for 1600 BPI.  Return 0 for invalid density.  &
        32000   ! ERROR TRAPPING &

        32010   IF (ERR=11% AND ERL=100%) THEN  &
                  CLOSE TAPCHN%, LENCHN%, DATCHN%   &
\                 RESUME 32767  &
                ! If ^Z or ^C, close our temp files and exit.                  &

        32020   IF ERR=11% AND EOF%=0% THEN   &
                  EOF%=-1%   &
\                 PRINT #LENCHN%, -1%   &
\                 RESUME 130   &
                ! EOF while reading magtape:  &
                ! If the last record also was not an EOF, write an "EOF read"  &
                ! flag to the record length file and count it as a record.     &

        32030   IF ERR=11% AND EOF%<>0% THEN  &
                  PRINT #LENCHN%, -2%  &
\                 Z%=MAGTAPE(3%,0%,TAPCHN%)  IF SAME.TAPE%  &
\                 Z%=MAGTAPE(1%,0%,TAPCHN%)  IF NOT SAME.TAPE%  &
\                 CLOSE LENCHN%, DATCHN%   &
\                 RESUME 200   &
                ! End of tape (EOT) detected by at least two tape marks.       &
                ! Record the EOT point in the record length file.  Rewind or   &
                ! Rewind/offline the tape.  Change tape density.  Continue     &
                ! with second half of copy operation.                          &

        32040   IF ERR=13% THEN  &
                  RECLEN%=RECOUNT  &
\                 PRINT "%"; BELL$; BELL$; BELL$;  &
                        "Data error reading tape.  Continuing..." &
\                 RESUME 140  &
                ! DATA ERROR ON DEVICE:                                       &
                ! Print a warning message but continue on as if nothing       &
                ! happened.                                                   &

        32099   CLOSE #LENCHN%, DATCHN%  &
\               ON ERROR GOTO 0  &
                ! Any other error is fatal.                                   &

        32767   END                                                          ■
```



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Graphics Standards: A Mid-80s Assessment

OPINION

James R. Warner
Dr. Rolf Doerr

At Precision Visuals, Inc., we have been embracing and wrestling with graphics standards for 10 years. We have participated in standardization committees and have talked with literally thousands of managers, application developers, government spec writers, and others caught in the allure of standardization as the answer to their graphics problems. Precision Visuals Inc., has marketed successful commercial implementations of the de facto CORE standard and the recently sanctioned GKS standard. We have seen standards being considered for a full spectrum of applications ranging from CAD/CAM to cartography to process control to business graphics to image processing, running in every conceivable operating environment from PCs to supercomputers.

Here we share our perspectives on the market needs for graphics software and how standards fit these needs. We examine the impact of technology on the standardization process, highlighting the problems of legislating standards for an adolescent technology. We puncture some of the conventional wisdom cloaking graphics standards. And we conclude with suggestions for the buyers and evaluators of graphics standards, including when to consider standards-based software and when to consider non-standard or device-dependent software.

Market Needs

In developing and marketing graphics software tools over the last several years, we have found the following four groups to be most interested in graphics standardization:

1. The DP manager or information center manager in a large organization. This person typically is responsible for supplying productivity tools to application developers. Such tools include compilers, editors, code management systems, database systems, user interface management systems, and graphics.
2. The project manager developing a specific internal-use application. Graphics may be either a small or large part of the application.
3. The system integrator. This person is building an application with graphics embedded, that will have wide distribution, typically on multiple CPUs and graphics devices. The distribution may be either internal through the organization or offered for sale to third parties.
4. Anyone who is facing a graphics application rewrite. Such applications originally were targeted to specific graphics hardware such as storage tubes or pen plotters, and need to be rewritten to take advantage of new graphics technology like color raster displays or hardcopy units.

All of these groups are looking for insurance. They want the chosen software to run on all their computers and support all their graphics devices. Those doing software rewrites wish to protect their new software investment and to avoid being locked into a single vendor or display technology.

The computing center manager is looking for a single platform for all application development, both today and in the future — either a standard or a vendor committed to supporting the target computing environment and offering staying power as a company to support future technology.

> ***". . . the technological evolution is more than a moving target; it is a blur."***

These constituencies have varying priorities for the following needs:

1. Product robustness. A preference or a usable, working product over state-of-the-art, but less reliable, technology.
2. Optimal use of the target graphics hardware. A need to squeeze functionality and performance from the target graphics peripheral or workstation.
3. Modest use of CPU cycles and memory. Willingness to do lower level programming on a lean set of tools, possibly targeted to specific hardware as an alternative to higher level programming on a rich set of standards-based tools that consume more computer resource and run slower.
4. A corporate-wide or project-wide standard set of tools used by all applica-

tion developers for consistency and productivity.

5. Product support. A supplier commitment to aid useability by providing extensive professional documentation, training, and telephone or on-site assistance.

In meeting these needs, the major appeal of standards is consistency of style in application development, and the improved productivity of application programmers.

The Impact Of Technology

The standardization process requires a reference model, usually a body of knowledge about practical current use of technology in industry. As technologies mature and conventional wisdoms stabilize, a consensus reference model develops and standardization makes sense. Good examples include programming languages and the relational model for database management systems.

In graphics, however, the technological evolution is more than a moving target; it is a blur. The peripheral and workstation vendors play technological leapfrog with one another every six to nine months. As a result, anyone purchasing graphics hardware experiences buyer's remorse soon after purchase when a new vendor offers expanded functionality, better performance, and smaller packaging at a lower price. Therefore, the essential reference model either doesn't really exist or is an academic construct without a practical industry foundation.

An important timing problem also exists. Selecting a reference model for a graphics standard requires taking a snapshot of technology at a moment in time. The standard then is built around this reference model. With the standardization process being a three to five year cycle, such standards are approaching technological obsolescence as soon as they are sanctioned. A good example is GKS. GKS is an adequate model for the technology of the late '70s and early '80s, but is an inadequate platform for 3-D applications, hierarchical modeling, local rendering of solids, and local raster operations on bitmap workstations.

Hardware vendors thrive by offering bells and whistles which differentiate themselves from one another. Reference model-based standards can address only a subset of the functionality available on the emerging graphics

devices and workstations.

The problems that have plagued standards in the '80s are likely to persist, caused by the lack of reference models with solid practical footing and rapid technology evolution causing premature standards obsolescence.

The conventional wisdom surrounding graphics standards often masks many of the realities of their implementation and use:

Conventional wisdom: Standards are at the forefront of technology.
Reality: Standards always are playing catch-up.

Because standards take three to five years to become approved, they offer only a partial gateway to the functionality of today's higher functionality graphics engines.

Conventional wisdom: Writing applications on standards-based software will provide the best insurance that my application will run on all CPUs and devices.
Reality: Yes, but only if you write to the lowest level of the standard.

Graphics standards, like GKS, are defined in several levels. Suppliers can choose the level to which they wish to support the standard. For example, if you write an application based on level 2b of GKS, it won't run on another vendor's level 1b implementation.

Programming in pure GKS is like programming in pure FORTRAN — nobody does it. All developers take advantage of vendor-defined extensions or escape functions, which provide either higher level functionality to the developer, for example, utility routines to produce a graph; or provide access to special device functionality not available in the standard, for example, nested structures. Using the higher level functionality still may let you use multiple CPUs and devices, but your application becomes bound to a specific device. Neither of these is particularly bad, but standards users must realize that programming extensions beyond the standard severely hampers program portability.

Conventional wisdom: New standards should be built on old standards.
Reality: Old standards are an inadequate platform for new technology.

The concept of a single graphics programming standard is as much a myth as the universal programming language or database model. Both the functionality of the graphics hardware and the needs of application developers are too diverse to be covered under the umbrella of a single standard.

Look at the proposed blending of PHIGS into the GKS model. GKS is already groaning under the baggage of more than 200 subroutines providing access to relatively low-level graphics functionality. PHIGS is proposed as an object modeling standard which, if kept sufficiently lean, could be built on top of any graphics engine. Forcing the merger of GKS and PHIGS will yield bloated user interface that will be difficult to implement and equally cumbersome to use in building practical applications.

> ***"Old standards are an inadequate platform for new technology."***

Conventional wisdom: The performance of standards-based applications will improve as the standards move into firmware.

Reality: Other than possibly the proposed CGI standard, there will be no practical implementations of graphics standards in firmware for at least five years.

As we mentioned above, the hardware technology is moving so rapidly that a GKS chip or GKS engine is functionally obsolete compared to the hot new graphics and workstation technologies. Hardware vendors may offer GKS

or PHIGS subsets as part of their graphics command set, but only as a bait-and-switch tactic. Developers will be encouraged to write their applications in native mode, and thereby become locked into the vendor's technology.

Hardware and workstation vendors prosper by offering more functionality and performance at a lower price than their competitors. Legislating a graphics standard based on three-year-old technology to these vendors is like trying to contain a herd of wild stallions with a two-foot-high corral. Extending standards to keep pace with new technology makes sense only if the underlying platform is sound. However, graphics today is too adolescent a technology to have a stable platform.

Conventional wisdom: Standards are the same decision for all my applications.
Reality: Standards are the safe decision for many of your applications.

GKS currently is the only sanctioned standard. PHIGS is at least two years away from any sanctioning, and the current user interface is likely to change considerably before then. PHIGS may be delayed even longer if the GKS compatibility battles aren't resolved soon. That leaves GKS as the only sanctioned standard with commercially-accepted, device-independent packages like PLOT-10, GDDM, and DI-3000 as de facto standards.

For any application, the developer must measure the importance of fidelity to the standard versus robust functionality, versus access to special device features, versus portability of the application, versus performance. GKS is a platform where portability is very important, the level of graphics functionality and performance required is relatively low, and special device functionality isn't required. GKS is an inadequate platform for high-performance 3-D, or CAD applications.

In those applications where GKS is appropriate because of the need for portability, the long-term key success factor will not be the GKS functionality, but rather the availability of device drivers from the GKS supplier. For example, we have found that over 70 percent of our GKS support goes into building and tuning new device drivers.

Suggestions For Buyers

Pure standards typically are good for prototyping, simple data display, and simple interaction applications, where portability and the assurance of machine and device independence are more im-

portant than expanded functionality and performance. For example, we have found that large scientific and research computing facilities can use vanilla GKS for their simple 2-D graphing applications and interactive programs with simple graphics input. These environments primarily are using low-end graphics displays (e.g., DEC VT240, IBM 3179, Tektronix 4105, Tektronix emulators) and hardcopy devices.

PHIGS-like packages (i.e., object modeling systems) are good for modeling 2-D or 3-D phenomena, where world coordinate object modeling and manipulation is more important than performance. In our view, PHIGS is a database standard and it is a mistake to believe it will be a successful platform for high-performance graphics until the graphics hardware matches the PHIGS model almost exactly. Since PHIGS is still a moving target within ANSI, and the hardware vendors are more concerned with differentiating themselves from each other and providing upward compatibility to their old products, such hardware support for PHIGS is unlikely in the near future.

> ***". . . useability and performance will be of higher priority to application developers . . ."***

We believe that, at least for the next few years, useability and performance will be of higher priority to application developers than strict adherence to a standard. While device independence remains quite important, application developers at least want the *option* to access special device features from within their device-independent program. Prado's rule applies — if 80 percent of the program is device-independent and 20 percent is device-specific, performance can be increased by 80 percent or more by accessing the device-specific features. The standards purists may not like it, but anyone buying a higher performance graphics display or workstation for $8,000-$40,000 doesn't want to run it like a dumb terminal.

It's entirely typical for an organization to feel pressured into buying standards-sanctioned software. It's important to play safe with these decisions and no one can be severely criticized for

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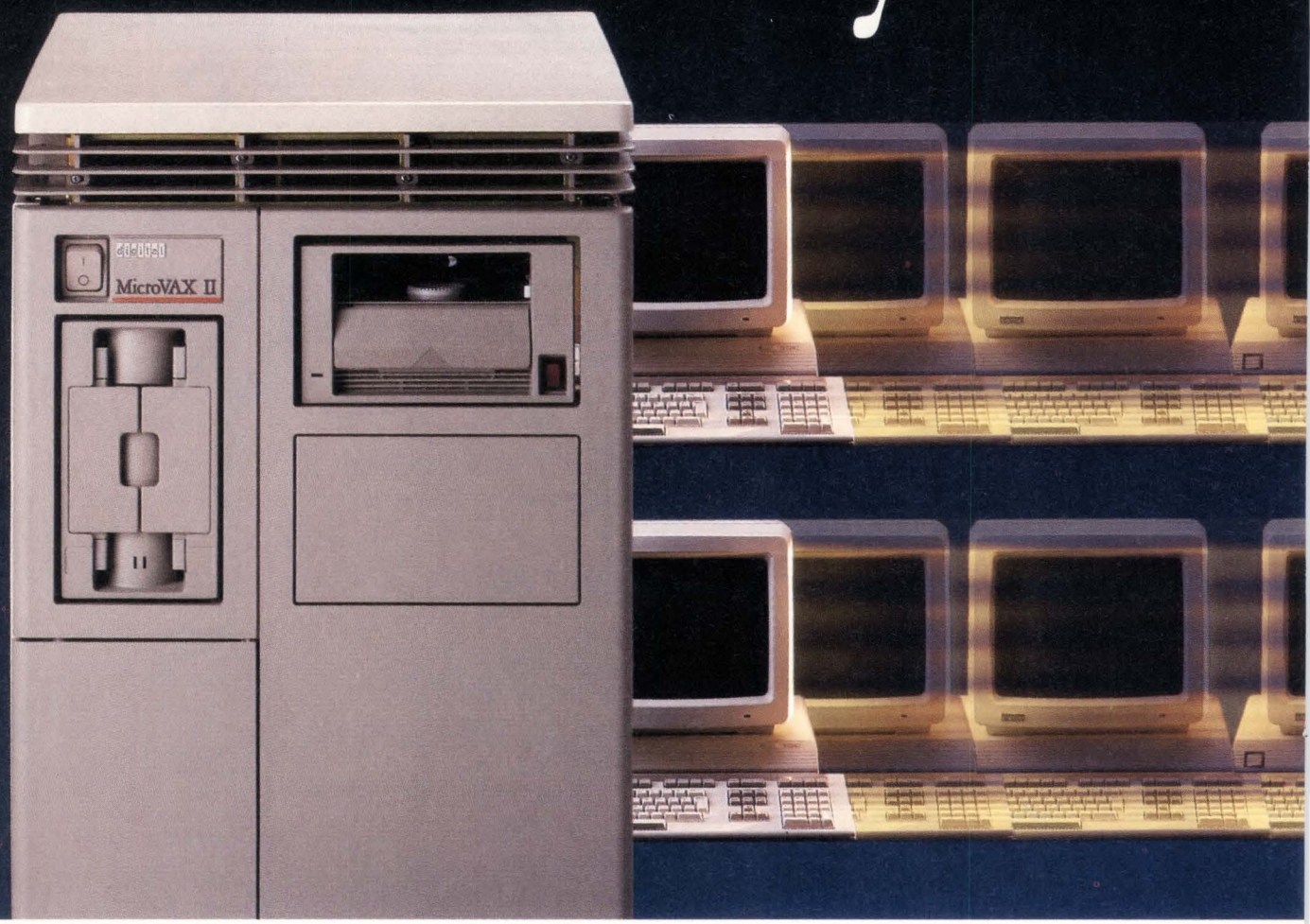

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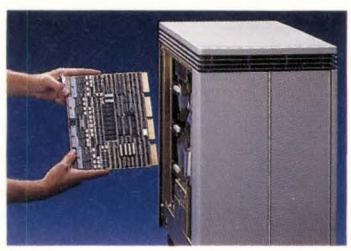

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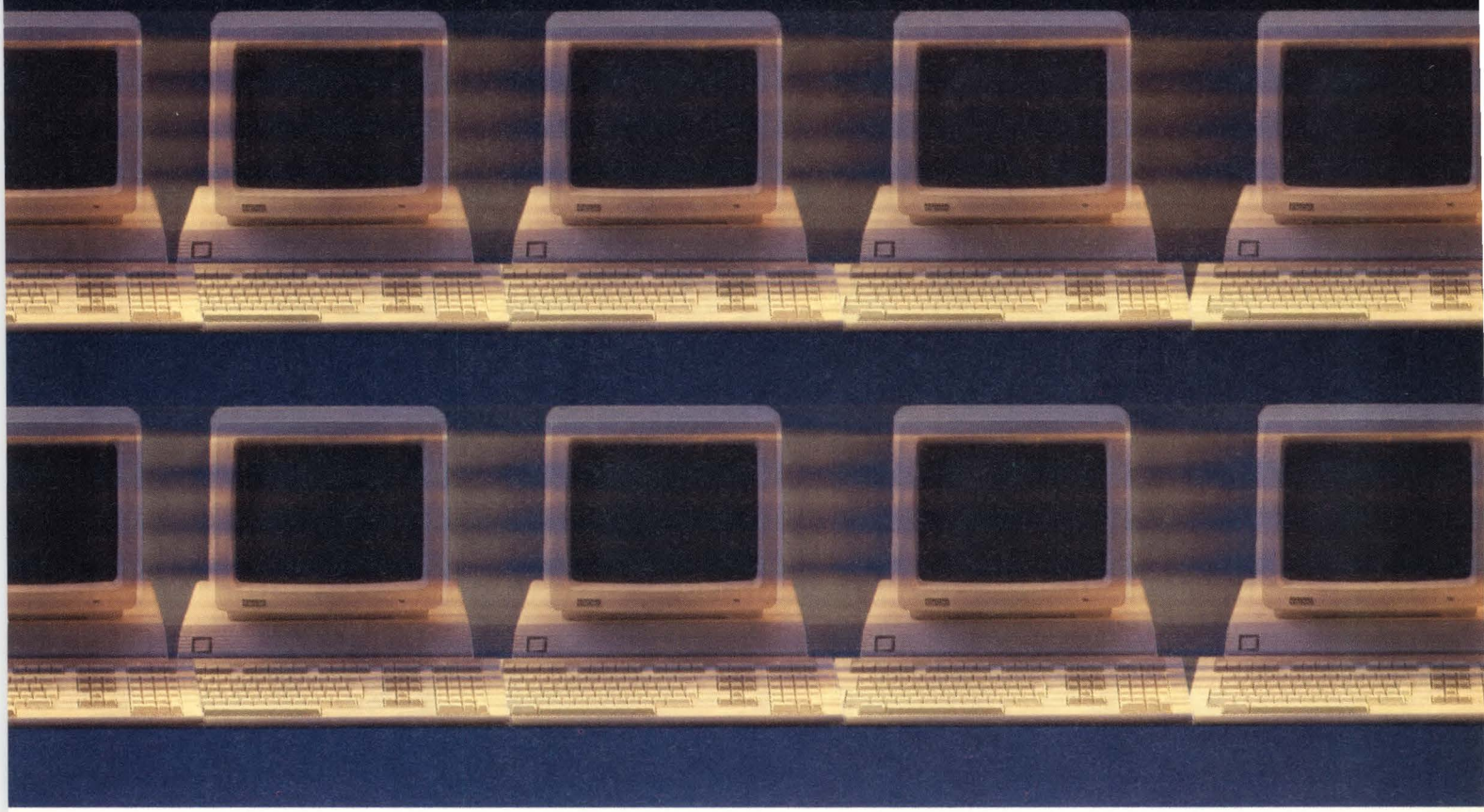

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> ***". . . every organization faces the trade-off of standards insurance vs. standards shortcomings."***

James R. Warner is chairman/CEO at Precision Visuals, Inc., Boulder, Colorado. Dr. Rolf Doerr is managing director of PVI Precision Visuals International GmbH, Frankfurt, West Germany.

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COMPUTER BOOKSHELF

R.B. Trelease

Rainbow Freeware

Dedicated Rainbow owners will find a kindred spirit expressed in the pages of this compendium of DEC PC software. The feeling perhaps is articulated best in the author's introductory thanks to the developers of Rainbow-specific public-domain programs: "As DEC took flight from the consumer market and fewer and fewer commercial software manufacturers provided Rainbow versions of their programs, these people wrote programs that have kept the Rainbow a viable machine. Every program described here, and the many others not described here, was developed in answer to the question: How might this be done better, or how might this be done at all? These authors gave their work to the rest of us freely or have requested at most a minimal contribution for only the programs we find useful. In a commercial environment in which manufacturers of expensive programs won't even guarantee that their programs work, this is truly a spectacular gift."

The appearance of the text makes another statement about DEC's apparently neglected personal computer. Seemingly typeset with justified columns, multiple fonts, and in-text bolding, *Rainbow Freeware* was produced on a Rainbow 100B, using *WordPerfect* 4.1 and a Hewlett-Packard LaserJet+. At a time in which desktop publishing has become the rage and province of more expensive machines with more powerful CPUs, Rainbow users easily can produce text attractive enough for formal publication. While the Rainbow may not have all the bells and whistles of a $10,000 system, *Rainbow Freeware* clearly demonstrates what you can do when stripped of the blinders imposed by commercial marketing concerns.

Divided into three major sections with program and author indexes, *Rainbow Freeware* provides summaries of major public domain programs, as well as notes on bulletin board systems (BBS) with technical information about the FIDO BBS and MS-DOS.

In the Introduction, the author provides an overview of the book, with statements on its philosophy and on practical aspects of obtaining the reviewed software. He also justifies the coverage exclusively of MS-DOS systems. For readers without BBS access, *Rainbow Freeware* supplies the address of a source for a disk set containing all the programs reviewed. The Introduction also provides notes about how the software was tested (with warnings about some Trojan Horse disk-eaters) as well as a guide to the format used for each software review entry. The Introduction closes with thoughtful statements on public domain software, the law, a disclaimer about the reliability of downloaded software, and the aforementioned thanks to contributors, supporters, and DEC.

The author then offers extensive reviews covering more than 160 of the most useful freeware, shareware, and public domain programs. Entries are grouped into nine categories, encompassing communications, general utilities, computer, disk, and file managers, file "shrinkers and bundlers," printer controllers, text editors, graphics and games. Most entries provide a brief description of function, notes on program components, an in-depth description of program usage, status notes (public domain, free- or shareware), and substantial comments on program characteristics. Usage and comment notes are particularly useful: In the Communications subsection, for example, they provide comparative information on VT-100 emulation, program functionality, XMODEM and *Kermit* protocol implementation, and known bugs.

> **". . . Rainbow Freeware *clearly demonstrates what you can do when stripped of the blinders imposed by commercial marketing concerns.*"**

Readers who have been following articles on Public Domain software (see "What's New in the Public Domain" and "FIDO's Choice," *DEC PROFESSIONAL — PLUS EDITION*, Vol. 5, No. 6, June 1986) surely will recognize the names of some of the most popular programs reviewed in *Rainbow*

Freeware. Other entries may be new, unusual, or just plain odd-ball. As the author notes, this is not an exhaustive guide to public domain and shareware programs, but most of the "heavy hitters" are covered. While there are some trivial rough spots in the analysis of program function (e.g., the author states he hasn't figured out the castle move in CHESS—White E1- G1) the extensive notes on program versions, bugs and menus far outweigh any minor oversights.

I found the reviews for a number of previously unacknowledged programs of special interest. TALLY and the WORDS and WC utilities of the *Boston 6Pack* provide word listing, counting, and word-frequency counting functions for text files, of use especially to commercial writers and researchers. F provides "filtering" functions, including one for converting *WordStar* and *WordPerfect* files to "plain" ASCII text without most imbedded control characters. SELKEY gives access to the Rainbow's various foreign character sets, allowing rapid keyboard remapping for users dealing with multilingual text editing. MEMBRAIN permits the creation of custom-sized RAM disks, in size increments smaller or larger than the 64 KB dictated by DEC's MS-DOS *MDRIVE*. FEDIT/FPRINT and TYPSTYL allow special type fonts to be created and printed on LA-50 and LA-100 printers. PRNTSCR4 enables use of the Rainbow's previously unimplemented PRINTSCREEN key for "dumping" screen text to the printer.

The final section of *Rainbow Freeware* provides technical notes for users unfamiliar with FIDO communications and MS-DOS directory paths, batches, and file-handling. The FIDO subsection includes a guide to the menu system, tips on communications connections and potential problems, and a sample communications session with file down-loading. The MS-DOS subsection begins by providing practical instruction, with examples, on making use of paths and the directory tree structure. Going beyond the information supplied in the *MS-DOS User's Guide*, useful guidance is given for setting up batch files, managing filenames, and taking advantage of programs allowing access to MS-DOS shells. Another cautionary subsection warns about the fortunately rare public domain equivalent of "assassin programs" (disk-eating worms, Trojan Horses, and viruses). The final subsections provide notes on printing .DOC files, using archival programs, and accessing sources of free software. Prior to the final program listing and author indices, there is a list of DEC-related bulletin boards with phone numbers, locations, and SYSOP notes, as compiled by Rob Elliott and Caroline Mack.

All things considered, *Rainbow Freeware* provides a very useful guide to building a low-cost, highly-functional library of utility programs for the DEC Rainbow. Now that the VAXmate has been introduced, and there's every excuse for DEC, software developers, and the print media to forget about the Rainbow, publications like *Rainbow Freeware* may provide hope for the many thousands of DEC PC users not ready to abandon their productively functional machines.

Rainbow Freeware
By Bruce Jackson
New South Moulton Press, 1986
96 Rumsey Road
Buffalo, New York 14209
170 pages, softbound.
$20 by mail order only

DCL DIALOGUE

The 'Secrets' Of DCL Programming

Kevin G. Barkes

In keeping with the spirit of the holidays, this month, as a present of sorts, I'm going to reveal the three "secrets" of successful DCL programming.

Are your highlighter marking pens ready? Good. The three steps required to become a crack DCL programmer are:

1. Read the documentation;
2. Read the documentation; and, of course,
3. Read the documentation.

This attempt at humor is only half facetious. The reason most persons never achieve advanced DCL skills is an ongoing lack of familiarity with the elements of the command language.

DEC FREQUENTLY IS CRITICIZED for not offering courses on DCL programming. The Utilities and Commands, and System Management classes, many complain, do not provide the training necessary to write DCL command procedures.

In fact, these courses, coupled with DEC's generally superb documentation, supply a firm foundation on which to build DCL abilities.

After all, DCL never really was intended to replace the traditional, compiled high-level languages. One has to wonder if the continuing absence of the ELSE and FOR . . . NEXT statements in DCL is due to some arcane idiosyncracy of the interpreter's design or is just DEC's way nudging you into buying VAX-11 BASIC. Anyway, it takes less than a half-day of reading to master the rudimentary components of controlling DCL program flow; IF . . . THEN, ON, GOTO, GOSUB, etc., are not that hard to learn.

But I'm digressing. If you want to write good DCL, you have to be familiar with the DCL commands. The problem is most users learn enough to enable them to perform most of their normal daily functions, assign them to symbols in their login files, then forget the original commands. Atrophy starts to set in, and soon users actually have regressed to the point where they know less DCL than they did six months ago.

For example, take a look at the user-written command procedures on your system, DECUS tapes, bulletin board systems, and even in magazines like this one. Look for procedures that use the DIRECTORY command to generate data files, which the procedure then reads to perform some type of function.

You'll notice lines that check for the text "Directory of" or "Total of" and perform various contortions to make certain the files are located in the default directory of the process currently executing the procedure. In some cases, ASSIGN or DEFINE commands will be used to redirect the output of the command from SYS$OUTPUT to a disk file.

It's obvious the authors of the procedures never really have read the current *DCL Dictionary*. The DIRECTORY command has an impressive array of 34 qualifiers, including /OUTPUT to specifically redirect the output from the command, and /NOHEADING and /NOTRAILING to produce a listing in single column format with the full file specification of every file.

***It's obvious the authors of the procedures never really have read the current* DCL Dictionary.**

Similarly, users will expend significant amounts of system resources writing information to temporary disk files and reading the data back into the procedure. In many cases, a simple call to a DCL lexical function will return the information required in one line of code. (*DEC PROFESSIONAL*'s sister publication, *VAX PROFESSIONAL*, currently is running a continuing series [written by me] on using DCL lexical functions.)

BACK IN THE DARK AGES when VAX system management was thrust on me, I devised a painless method of learning DCL. Modeled after those calendars that list a new word each day to increase one's vocabulary, I made it a point to learn a new command qualifier every day. I maintained a looseleaf notebook and organized the commands for quick review, developing a cross-reference for certain qualifiers. For example, if I ran

across a qualifier that I thought was particularly useful, such as one that performed a function based on owner UIC, I'd start a /BY_OWNER page and list commands that supported the qualifier.

I'd also make a point of checking the DCL Dictionary (formerly called CLUG, for Command Language User's Guide) if it took more than one line of code to perform a particular task. It was in this manner that I discovered the /SELECT=SIZE qualifier of the DIRECTORY command. I wanted a procedure to search through the user disk on the system and create a listing of files greater than 1,000 blocks for potential obliteration when space became tight.

First I created a procedure that performed a simple DIRECTORY/NOHEAD/NOTRAIL and used the F$FILE_ATTRIBUTES lexical to return the size and compare it to my designated maximums. Too much coding. Adding the /SIZE qualifier to the DIRECTORY command was not much better, since it still was necessary to use lexicals to extract the size field from the output and compare it to the desired value.

Being inherently lazy, I grabbed the document, read the command description, and changed my complex procedure to a single DCL command.

ANOTHER EXCELLENT METHOD of learning DCL programming is studying procedures written by others. Paradoxically, the .COM files, which are written by DEC to perform various system management functions, are perhaps the worst to review. They contain few comment lines, do not use indentation to set off subprocedures, abbreviate commands to the point of illegibility and pretty much violate all the rules generally associated with writing readable procedures. Of course, mucking with these files can have an unpleasant effect on your system's operation, so the intentional obscurity probably is justified.

But other user-written command files can provide a wealth of information. Try to follow the algorithms used to perform the procedure's tasks. As an exercise, write a procedure that does the same thing, only using different commands and/or qualifiers.

DCL programming can be compared to running. When you stop practicing, you get out of shape. Keep your DCL muscles in top form by exercising them regularly.

Definitely Dialogue

It's encouraging to see that *DEC PRO* readers are taking the name of this col-

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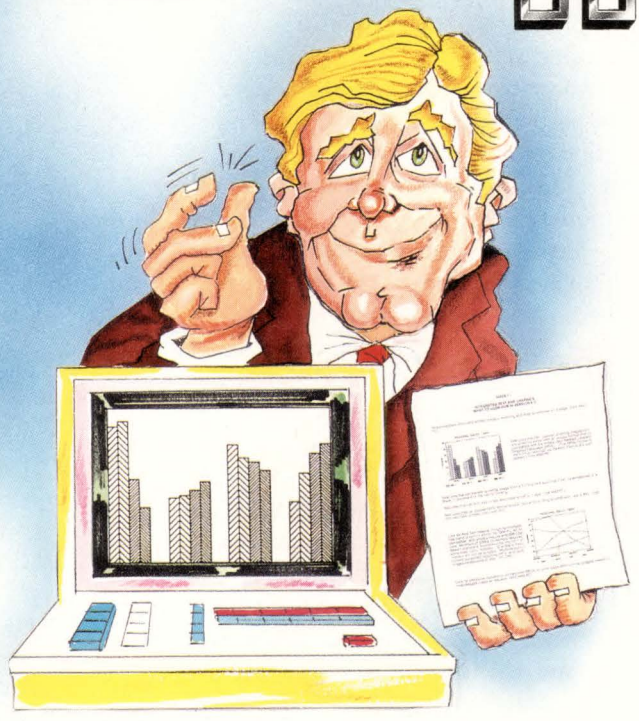

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umn literally and are writing to the editor and calling into my BBS (412-854-0511) to discuss DCL-related issues.

Eric M. Ross of New York City, in a superbly researched and lucid letter, noted an area of possible confusion in the September column on DCL debugging.

Under VMS 4.x, the F$USER() lexical function returns the UIC of the calling process in named ([GROUP,MEMBER]) rather than integer ([000,000]) format, as was the case in

> ***". . . the easiest way to circumvent the "bug" in the procedure is to use named UICs."***

earlier versions of the operating system, prior to the introduction of named UICs. Therefore, in the example used in the sample procedure, F$USER() would return [1,4] only if no other named UIC had been defined for the account.

The [1,4] UIC was used simply because most of the systems on which I work have maintained [1,4] as the system manager's UIC.

Mr. Ross submitted procedures using the F$IDENTIFIER() and F$FAO() lexical functions to convert an identifier in named format to integer format, similar to the example given in the explanation of F$IDENTIFIER() in the DCL Dictionary.

Of course, the easiest way to circumvent the "bug" in the procedure is to use named UICs:

```
IF F$USER().EQS."[GROUP,MEMBER]"
```

Another method that can be used to obtain the numeric UIC of the calling process is by using the F$GETJPI() lexical function. F$GETJPI("","GRP") will return the integer of the calling process' UIC group while F$GETJPI("","MEM") will return the member number of the uic as an integer. Bear in mind the integers returned are in decimal form and have to be converted to octal.

Pointing out that symbols are "cleaner for the programmer and less expensive for VMS" than logical name translation, Mr. Ross implemented the DEBUG_SWITCH test with a symbol,

deassigning it with DELETE/SYMBOL/GLOBAL DEBUG_SWITCH.

Either method works equally well. Although not mentioned in the column, the logical name method can offer some additional protection from unauthorized users entering "debug mode".

Change the example given in the procedure from:

```
F$TRNLNM("DEBUG_SWITCH") to
F$TRNLNM("DEBUG_SWITCH",
"LNM$SYSTEM_TABLE")
```

Unless the logical DEBUG_SWITCH was DEFINEd or ASSIGNed using the /SYSTEM qualifier, which requires the SYSNAM privilege, the test will fail. Since most users do not possess SYSNAM, it is an effective control method. Of course, it must be implemented carefully so that procedures running in batch mode, other users logged in under the same account, or detached processes don't unexpectedly enter the "debug" state.

"Also," Mr. Ross noted, "for the sake of clarity I wish we all agreed to adhere to commonly recognized terminology. In this respect, the DCL command procedures 'promoted' by the author to the rank of programs in my opinion was an objectionable confusion of terms."

Hmmm. A DP dictionary of mine refers to a program as, "A set of instructions or steps that tells the computer exactly how to handle a complete problem." It would appear to me the procedures that appear in this column meet these tests.

What about it? I'd be interested in the opinion of *DEC PROFESSIONAL* readers on this subject. Are we being pretentious in referring to command procedures as programs? Or is DCL, the Rodney Dangerfield of the VAX environment, just a victim of lack of respect?

Stay tuned.

Kevin G. Barkes is a specialist in VAX systems software, management, tuning and training, in Library, Pennsylvania.

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RESOURCE EXECUTIVE

Reporting Errors

Ralph Stamerjohn

One standard function of operating systems that RSX performs poorly is processing errors from system directives or I/O requests. Errors are reported by RSX by returning a negative error code in either the Directive Status Word ($DSW) or the I/O Status Block. There is no further mechanism to let the application turn the error value into some constructive message to the user or invoke exception handlers for various conditions.

In contrast, VMS provides an excellent mechanism for handling system errors. The default processing for the LIB$SIGNAL system call outputs the appropriate error message to the user. Depending on the severity of the error, either the image exits, or control is returned to after the LIB$SIGNAL call. A program may establish exception handlers to perform any needed special processing. Finally, applications can define their own unique error codes and matching messages using the MESSAGE utility.

Implementing the VMS signal mechanism certainly is made easier by a 32-bit virtual address space. But it is possible to put together an RSX error package that provides error messages at low overhead.

The RSX distribution kit includes a file named [1,2]QIOSYM.MSG. This file is made up of 64-character fixed-length records, one for each I/O and directive error code. Records one through 128 match up to I/O error codes -1 through -128. The remaining records in the file match directive errors. These records are indexed by adding 128 to the absolute value of the directive error.

QIOSYM.MSG has the messages we want to output for errors. Now all we need is a mechanism to read the appropriate record from QIOSYM and output to the user terminal. Buried in PIP is a set of routines that do just this. However, the routines are not general purpose enough for our requirements.

The error package must be unobtrusive. You want to be able to use the package with existing applications without thinking about it. The packet must be small and require no special task build options. Several problems must be solved to meet these goals.

One problem is what logical unit numbers should be used to read QIOSYM.MSG and output the error message. If specific logical unit numbers are used, it is almost certain that there will be conflicts with other uses. Floating numbers could be used but then you have to be sure which numbers are free, add an error package initialization routine and adjust the task build command files for the new units.

Fortunately, TKB provides us a clean mechanism to allocate logical units for special uses. The definition of certain reserved global symbols in the root segment of a task causes TKB to allocate additional logical unit numbers and store the numbers in the words referenced by the symbols. This mechanism is used to allocate the logical units used by the overlay run-time system and ODT as shown below:

```
.NOVLY::.WORD 0   ;  Overlay LUN
.ODTL1::.WORD 0   ;  ODT TI:
.ODTL2::.WORD 0   ;  ODT CL:
```

The error package uses the same technique to allocate its two logical units. The package uses the special symbols reserved for user software: .USLU1 and .USLU2. These symbols are declared in the module **ERLUN** (Program 1). For more information on reserved symbols, see Appendix E of the *Task Builder Manual.*

Another problem is how to read QIOSYM.MSG without the overhead of FCS or RMS. The solution is to issue the QIOs directly to the file system. The module **ERTXT** (Program 2) shows how this is done. After assigning one of our special logical units to the system disk (LB:), the routine finds the directory [1,2] in the master file directory by using the filename 001002.DIR. The results of this lookup are used to find the file QIOSYM.MSG, which then is opened for read access. The record number is divided by eight to find which block number to read. Finally, the QIOSYM.MSG file is deaccessed.

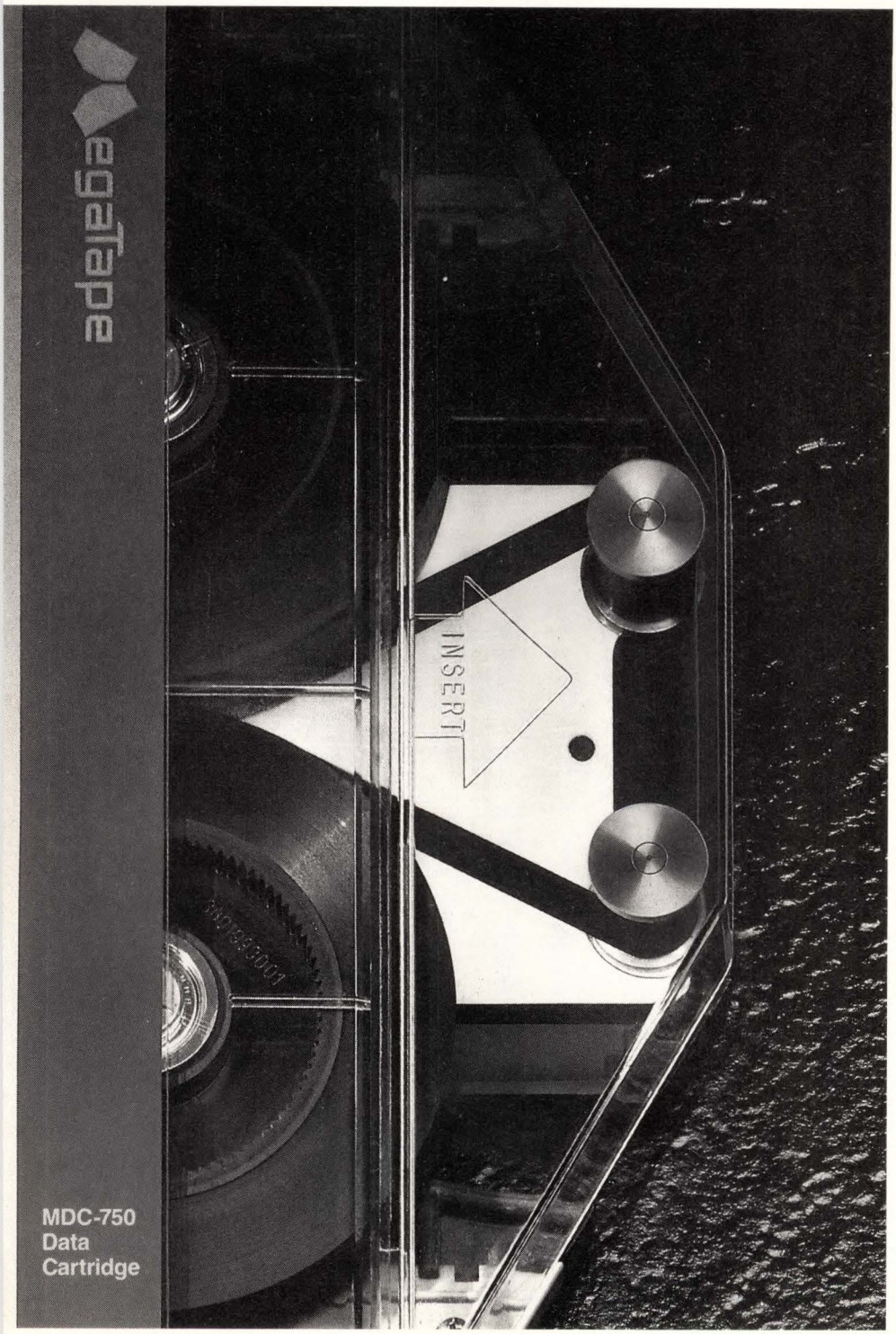
The above steps are exactly the same sequence of QIOs that would be issued by FCS or RMS to read a record from QIOSYM.MSG. All file protection mechanism still are in effect so no system security is compromised.

ERMSG (Program 3) is the common error routine. It outputs a FORTRAN style error message. A typical fatal error message for a QIO error would look like:

```
KATIE — Exiting due to QIO error -71
Too many outstanding messages
Lun: 2 Device: QC0:
At PC 003456
```

The error package handles four classes of errors: directive, QIO, FCS, and user-declared or program errors. The first line gives the task name, error class, and error number. The next line is the corresponding text from either QIOSYM.MSG

Any disk backup system can save your data. This one can save your life.



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AND TWO IS TOO MANY.

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PROGRAM 1.

```
        .TITLE  ERLUN - Define Luns
        .IDENT  /V01.00/
;
; Declare  special lun definitions. This module must be loaded
; in the task root.
;
        .PSECT  ERR$LU,RO,D,GBL

.USLU1::                        ;Declare user special lun #1
ERLUN1::.WORD   0               ;Use for message output
.USLU2::                        ;Declare user special lun #2
ERLUN2::.WORD   0               ;Use for QIOSYM file I/O

        .END
```

PROGRAM 2.

```
        .TITLE  ERTXT - Get Error Message From QIOSYM
        .IDENT  /V01.00/
        .ENABL  LC
;+
; This routine gets a message from QIOSYM and returns a pointer to it
; to the caller. The routine uses Files-11 QIOs to avoid FCS/RMS over-
; head. QIOSYM.MSG is a file with 64. character fixed length records. the
; caller supplies the record number he desires (starting with 1).
;
; Call with:    JSR PC,ERTEXT
;               R2 = Message number in QIOSYM.
;
; Exit with:    R2 = Message address or 0 if not found.
;-
        .MCALL  NMBLK$,ALUN$S,QIOW$,DIR$

        .PSECT  ERR$RW,RW,D

QIONMB: NMBLK$  QIOSYM,MSG,,LB,0        ;File name block
DIRNMB: NMBLK$  001002,DIR,,LB,0        ;Directory name block
.       = DIRNMB+N.DID
        .WORD   -1,-1                   ;Set directory access
.       = DIRNMB+S.FNB

GETDIR: QIOW$   IO.FNA,,24.,,IOSTAT,,<0,0,0,0,0,DIRNMB>
GETFIL: QIOW$   IO.FNA,,24.,,IOSTAT,,<0,0,0,0,0,QIONMB>
ACCESS: QIOW$   IO.ACR,,24.,,IOSTAT,,<QIONMB,0,0,0,100000,0>
READBK: QIOW$   IO.RVB,,24.,,IOSTAT,,<BUFFER,512.,0,0,0,0>
DEAESS: QIOW$   IO.DAC,,24.,,IOSTAT,,<QIONMB,0,0,0,0,0>

BUFFER: .BLKB   512.                    ;Disk block input buffer
IOSTAT: .BLKW   2                       ;I/O status buffer

        .PSECT  ERR$CD,RO,I

ERTXT:: MOV     R2,-(SP)        ;Save the record number
        TST     QIONMB+N.FID    ;Have we been here before?
        BNE     2000$           ; if NE - yes, skip setup

        MOV     ERLUN2,RO       ;Get lun to use
        ALUN$S  RO,#"LB,#0      ;Assign to LBO:
        BCS     9998$           ; if CS - assignment error

        MOV     #GETDIR,R1      ;Get the first QIO
        MOV     #5,R2           ;We know there are 5 QIOs
1000$:  MOV     RO,Q.IOLU(R1)   ;Store lun number
        ADD     #Q.IOPL+12.,R1  ;Advance to the next QIO
        DEC     R2              ;Count till we are done
        BNE     1000$           ; if NE - not done

        CALL    QIOW            ;Lookup directory file
        .WORD   GETDIR          ;
        BCS     9998$           ; if CS - error
        MOV     #DIRNMB,R1      ;Get address of directory nameblock
        MOV     #QIONMB+N.DID,RO;Get address of file name block directory id
        MOV     (R1)+,(RO)+     ;Move directory id
        MOV     (R1)+,(RO)+     ;
        MOV     (R1)+,(RO)+     ;
        CALL    QIOW            ;Lookup file
        .WORD   GETFIL          ;
        BCS     9998$           ; if CS - error

2000$:  CALL    QIOW            ;Access file
        .WORD   ACCESS          ;
        BCS     9998$           ; if CS - error
        DEC     (SP)            ;Correct record number to 0 base
        MOV     (SP),R2         ;Save record number
        ASR     R2              ;Get block number to read
        ASR     R2              ;
        ASR     R2              ;
        INC     R2              ;Vbn start at 1
        MOV     R2,READBK+Q.IOPL+8. ;Store in dpb
        CALL    QIOW            ;Read block
        .WORD   READBK          ;
        ROR     RO              ;Save carry for later check
        CALL    QIOW            ;Deaccess file
        .WORD   DEAESS          ;
        BCS     9998$           ; if CS - error
        RDL     RO              ;Unsave carry from read
        BCS     9998$           ; if CS - error

        MOV     (SP),R2         ;Get the record number again
        BIC     #177770,R2      ;Get record inside block
        SWAB    R2              ;This way there are less shifts
        ASR     R2              ;
        ASR     R2              ;
        ADD     #BUFFER,R2      ;Make into real pointer
        TSTB    (R2)            ;If first byte is null, no message
        BNE     9999$           ; if NE - good message
```

PROGRAM 2. . . . *continued*

```
9998$:  CLR     R2              ;Set to no message
9999$:  TST     (SP)+           ;Clean stack
        RETURN                  ;Return to caller

;+
; This routine issues QIOs for ERTXT and checks for errors on return.
;-

QIOW:   MOV     @(SP),RO        ;Get DPB address
        ADD     #2,(SP)         ;Return to caller+2
        DIR$    RO              ;Issue QIO
        BCS     9999$           ; if CS - exit
        TSTB    IOSTAT          ;Where we a success?
        BGT     9999$           ; if GT - yes
        SEC                     ;Set error flag
9999$:  RETURN                  ;Return to caller

        .END
```

PROGRAM 3.

```
        .TITLE  ERMSG - Error Processing
        .IDENT  /V01.00/
        .ENABL  LC
;+
; This routine formats and outputs error messages.
;
; Call with:    JSR PC,ERMSG
;
;               RO = Error number  (0 if none).
;               R1 = Error type    (0 if none).
;               R2 = Error message (0 if none).
;               R3 = Error PC      (0 if none)(odd if exiting).
;               R4 = Parameter to supply to optional line routine.
;               R5 = Address of optional line routine (0 if none).
;
;               R1 and R2 are pointer to ASCII strings.
;
; Exit with:    Message output, task exits if PC is odd.
;-
        .MCALL  EXST$S,EXIT$S,GTSK$S,ALUN$S,QIOW$,DIR$

CR      = 15                    ;CARRIAGE RETURN.
LF      = 12                    ;LINE FEED.

        .PSECT  ERR$TX,RO,D

DSHMSG: .ASCII  / -- /
XITMSG: .ASCII  /Exiting due to /
ERRMSG: .ASCII  /error /
APCMSG: .ASCII  /at PC /

        .PSECT  ERR$RW,RW,D

BUFFER: .BLKB   <64.*4>+4               ;Output message buffer
ERRTMP::.BLKW   18.                     ;Temporary buffer

MSGDPB: QIOW$   IO.WVB,,24.,,,,<BUFFER,,0>

        .PSECT  ERR$CD,RO,I

ERMSG:: MOV     R2,-(SP)        ;Save the error message
        MOV     RO,-(SP)        ;Save the error number
        MOV     R1,-(SP)        ;Save the error type
;
; Format the first line.
;       (taskname) -- [Exiting due to] [(error type)] ERROR [(error number)]
;
        MOV     #BUFFER,RO      ;Get start of buffer
        MOVB    #CR,(RO)+       ;Insert blank line
        MOVB    #LF,(RO)+       ; ..
        MOVB    #LF,(RO)+       ;Insert blank line
        GTSK$S  #ERRTMP         ;Get the taskname
        MOV     ERRTMP+0,R1     ;Get the first part of the taskname
        CALL    $C5TA           ;Convert to ASCII
        MOV     ERRTMP+2,R1     ;Get the last  part of the taskname
        CALL    $C5TA           ;Convert to ASCII
        MOV     #DSHMSG,R1      ;Get dashes
        CALL    ERMOV           ;Move to buffer
        BIT     #1,R3           ;Is this message an exit?
        BEQ     1000$           ; if EQ - I think not
        MOV     #XITMSG,R1      ;Say we are exiting
        CALL    ERMOV           ;Move to buffer
1000$:  MOV     (SP)+,R1        ;Get the error type
        BEQ     1100$           ; if EQ - there is none
        CALL    ERMOV           ;Move to buffer
        MOVB    #' ,(RO)+       ;Place a space into buffer
1100$:  MOV     #ERRMSG,R1      ;Get the word error
        CALL    ERMOV           ;Move to buffer
        MOV     (SP)+,R1        ;Get the error number
        BEQ     1200$           ; if EQ - no error number to output
        CLR     R2              ;No leading zeros
        CALL    $CBDSG          ;Convert to signed decimal ASCII
1200$:  MOVB    #CR,(RO)+       ;Done with first line
        MOVB    #LF,(RO)+       ; ...
;
; Format the second line.
;       [(error message)]
;
        MOV     (SP)+,R1        ;Get message address
        BEQ     1300$           ; if EQ - none
        CALL    ERMOV           ;Move to buffer
        MOVB    #CR,(RO)+       ;Done with second line
        MOVB    #LF,(RO)+       ; ..
;
; Format the third line.
;       [(optional error line)]
;
1300$:  TST     R5              ;Is there a routine
```

PROGRAM 3. . . . *continued*

```
        BEQ     1400$           ; if EQ - none
        CALL    (R5)            ;Call said routine
        MOVB    #CR,(R0)+       ;Done with third line
        MOVB    #LF,(R0)+       ; ...
;
; Format the fourth line.
;       [at PC (pc)]
;
1400$:  BIT     #177776,R3      ;Is there a PC?
        BEQ     1500$           ; if EQ - no
        MOV     #APCMSG,R1      ;Get at PC message
        CALL    ERMOV           ;Move to buffer
        MOV     R3,R1           ;Get PC
        BIC     #1,R1           ;Make sure even
        MOV     #1,R2           ;Set for leading zeros
        CALL    $CBOMG          ;Convert to octal magnitude
        MOVB    #CR,(R0)+       ;Done with fourth line
        MOVB    #LF,(R0)+       ; ...
;
; Output the resulting message.
;
1500$:  MOVB    #LF,(R0)+               ;Skip line
        SUB     #BUFFER,R0              ;Get number of characters in message
        MOV     R0,MSGDPB+Q.IOPL+2      ;Store in QIO DPB
        MOV     ERLUN1,R0               ;Get the logical unit
        ALUN$S  R0,#"TI,#0              ;Assign to user terminal
        MOV     R0,MSGDPB+Q.IOLU        ;Store lun number
        DIR$    #MSGDPB                 ;Issue QIO

        BIT     #1,R3                   ;Should we exit
        BEQ     9999$                   ; if EQ - no, return to caller
        EXST$S  #EX$SEV                 ;Exit with severe error
        EXIT$S                          ;Exit if exit status fails

9999$:  SEC                             ;Set error return
        RETURN                          ;Return to caller

;+
; Move ASCII string to buffer and update buffer pointer.
;-
ERMOV:: MOVB    (R1)+,(R0)+     ;Move character
        BNE     ERMOV           ; if NE - continue moving
        DEC     R0              ;Back up buffer pointer
        RETURN                  ;Return to caller

        .END
```

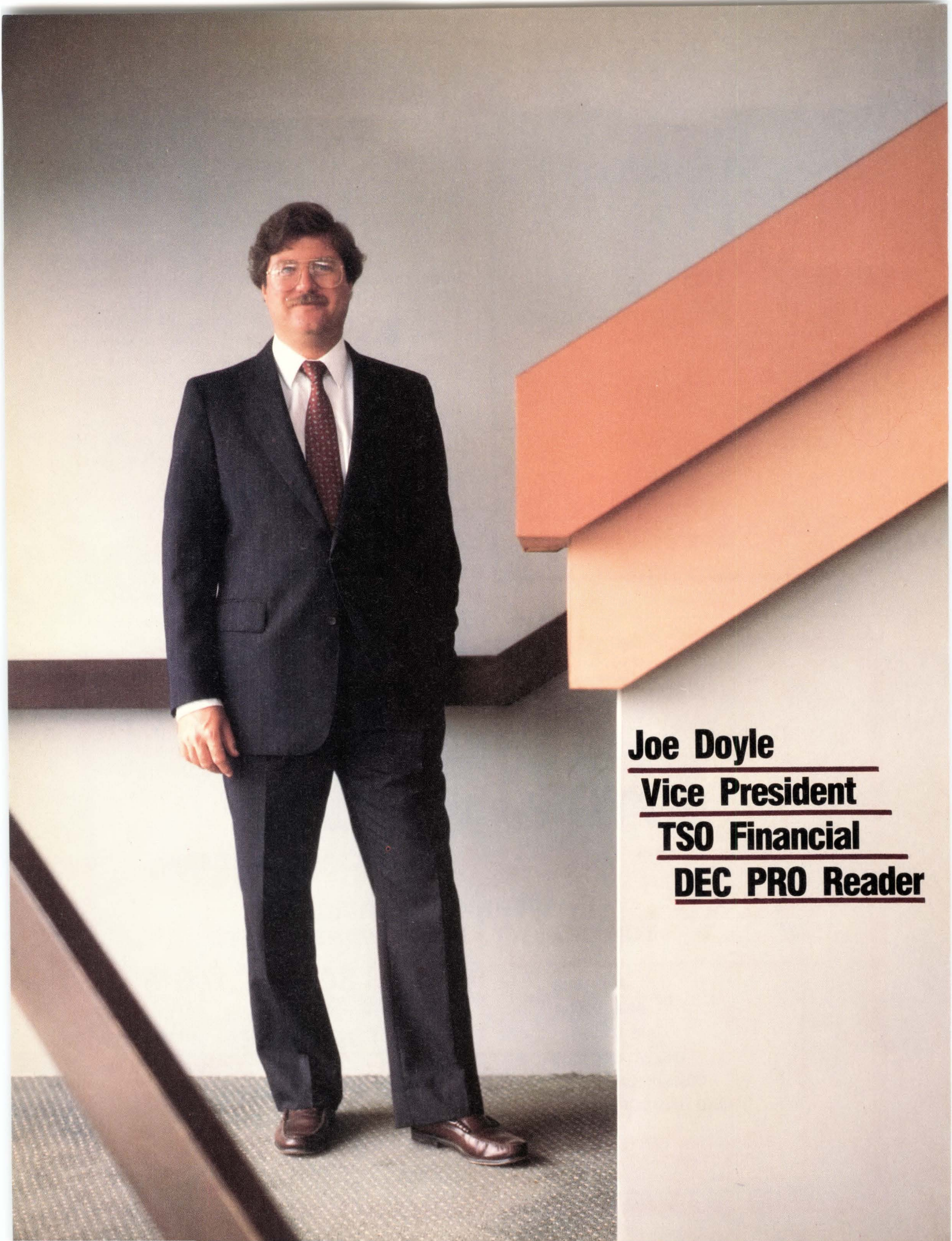
or the caller. The third line depends on the type of error. For QIO errors, the line specifies the logical and devices assigned to the unit. FCS errors also display the current filename. The final line types the program counter at the point where the error was detected.

ERQIO (Program 4) shows how ERTXT and ERMSG are called to process QIO errors. There are similar modules for the other three classes of errors. There is no RMS support because I have not found any text file similar to QIOSYM.MSG for RMS errors.

The last step is to add calls to the error package from the application code. A set of macros is provided to make the package easy to use in assembly language programs. The definition of **QIOWRN** and **QIOERR** (Program 5) illustrates the features of the macro definitions. The macros begin by checking the I/O status and skipping error processing if the I/O completed with success. Notice how MACRO-11 automatically will generate a label if the **?defadr** argument is blank.

The directive and FCS error macros check for errors by branch to defadr if the carry bit is clear. Both directives and FCS use the carry bit set to signal an error.

Not all errors are illegal. For instance, you might expect to get an end-of-file error (IE.EOF) when reading from a terminal. The QIOWRN and QIOERR macros will check the error



Joe Doyle
Vice President
TSO Financial
DEC PRO Reader

WHO ARE THE DEC PROS?

They're people like Joe Doyle, VP of TSO Financial, Horsham, PA. Joe moved from high school math teacher to computer science teacher, to programmer, to analyst, to DP manager, to VP for MIS in just a few short years.

To Joe, the most important and difficult thing for an MIS professional is to separate the future from reality. You have to get the job done now, and at the same time, dodge obsolescence. That's why Joe went with DEC in the first place:

"By going with DEC three or four years ago we made the right choice. Later we were able to cluster, and clustering enabled us to grow."

"As DEC grew, we grew."

And grow they did. Joe now runs an operation encompassing a crew of 40 specialists, including programmers, analysts, microfilm operators, and mail and telemarketing pros. The hardware at TSO Financial, a direct marketer of financial services to individuals, consists of a room full of VAXs, including a new VAX 8500 — the 12th such installation in the country.

"I want articles that deal with performance issues."

Joe's management philosophy is to encourage professional growth by clearing the way for people to work on things that excite them, using equipment that allows that to happen. "MIS people like to work with state of the art hardware and software. Here, they get a chance to do that." And, despite enormous boardroom responsibilities, Joe, too, is still seen at his terminal writing programs at each opportunity.

In a computing magazine, Joe wants articles that present the facts and treat the reader with respect. "I'll form my own conclusions," he says. "I want articles written by users, not glossy overviews."

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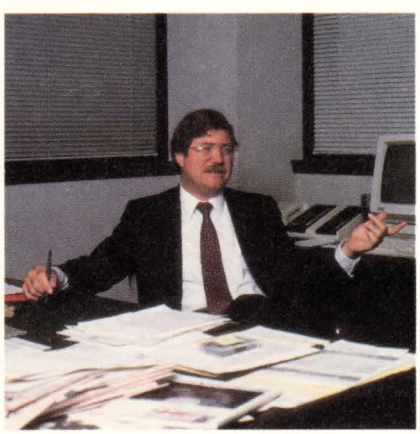

PROGRAM 4.

```
        .TITLE  ERQIO - QIO Errors
        .IDENT  /V01.00/
        .ENABL  LC
;+
; This module processes QIO errors by outputing the QIO status code value,
; the matching message from LB:[1,2]QIOSYM.MSG,  and an optional line with
; the logical unit number and device name.
;
;       (taskname) -- [Exiting due to] QIO error (I/O error number)
;       (I/O error message from QIOSYM)
;       Lun: (lun number) Device: (device name lun assigned to)
;       at PC (pc)
;
; Call with:    MOV     ERR,-(SP)
;               MOV     LUN,-(SP)
;               JSR     PC,ERQIOX (or ERQIOR)
;
;               ERR = I/O error code.
;               LUN = Logical unit number.
;
; Exit with:    ERQIOR -> Message output and return to caller (PSW/CS).
;               ERQIOX -> Message output and task exit (with error status).
;-
        .MCALL  GLUN$S

        .PSECT  ERR$TX,RO,D

QIOERR: .ASCIZ  /QIO/
QIOLUN: .ASCIZ  /Lun: /
QIODEV: .ASCIZ  / Device: /

        .PSECT  ERR$CD,RO,I

ERQIOX::INC     (SP)            ;Set to exit
ERQIO:: MOV     #9999$,-(SP)    ;Set return address
        JSR     PC,$SAVAL       ;Save all registers
        MOVB    22(SP),R2       ;Get error number
        NEG     R2              ;
        CALL    ERTXT           ;Get the error message from QIOSYM
        MOVB    22(SP),R0       ;Get error number
        MOV     #QIOERR,R1      ;Get the error type message
        MOV     20(SP),R3       ;Get the PC
        MOV     24(SP),R4       ;Get the lun number
        MOV     #QIOLIN,R5      ;Set the QIO optional line processor
        CALLR   ERMSG           ;Go processor the error and return
;
; Clean up on return.
;
9999$:  MOV     (SP),4(SP)      ;Set return address
        ADD     #4,SP           ;Clean stack
        SEC                     ;Set error
        RETURN                  ;Return to caller

;+
; This routine formats the optional line in a QIO error message. It
; outputs the logical unit and device name.
;-

QIOLIN: MOV     #QIOLUN,R1      ;Get lun message
        CALL    ERMOV           ;Place in buffer
        MOV     R4,R1           ;Get lun number
        CLR     R2              ;Set for no leading zeros
        CALL    $CBDMG          ;Convert to ASCII decimal
        MOV     #QIODEV,R1      ;Get device message
        CALL    ERMOV           ;Place in buffer
        MOV     #ERRTMP,R2      ;Get a buffer
        GLUN$S  R4,R2           ;Get the device information
        BCS     9999$           ; if CS - skip on error
        MOVB    (R2)+,(R0)+     ;Store device name
        MOVB    (R2)+,(R0)+     ;
        MOVB    (R2),R1         ;Get the unit number
        BIC     #177400,R1      ;Only want low byte
        CLR     R2              ;Set for no leading zeros
        CALL    $CBOMG          ;Convert to ASCII octal
        MOVB    #':,(R0)+       ;Store closing colon
9999$:  RETURN                  ;

        .END
```

against an optional condition list which consists of error code, branch address pairs. For example, the following sequence issues a read to a terminal and checks for several non-fatal errors. This sequence also shows how the DIRERR and QIOERR macros are used together to check for QIO completion.

```
QIOW$S #IO.RVB,#1,#1,,#IOS,,<#BUF,#80.>
DIRERR
QIOERR IOS,#1,<<IE.EOF,1000$>,<IE.VER,2000$>>
```

The directive and FCS error macros also use condition lists to handle non-fatal conditions. Directive errors are checked against $DSW, and FCS errors are compared to F.ERR(R0).

Each error class has two macros. The ERR form declares fatal errors and will exit the task. The WRN form will return control, optionally jumping to the **contin** address if it is specified. If you wish to turn off different error classes once a program is debugged, you can define symbols D$$MSG (directives), F$$MSG (FCS), or Q$$MSG (QIO). The ERR macros now simply will halt if an error is detected.

PROGRAM 5.

```
        .MACRO  QIOWRN  ios,lun,cndlst,contin,?defadr

        CMPB    #IS.SUC,ios     ;Was I/O successful?
        BEQ     defadr          ; if EQ - yes

        .IF NB  <cndlst>        ;
        .MCALL  CMPBYT          ;
        .IRP    code,<cndlst>   ;
        CMPBYT  ios,code        ;Compare codes
        .ENDR                   ;
        .ENDC                   ;

        .IF NDF Q$$MSG          ;
        .IF NB  <lun>           ;
        MOV     lun,-(SP)       ;Save lun number
        .IFF                    ;
        CLR     -(SP)           ;Set no lun
        .ENDC                   ;
        MOV     ios,-(SP)       ;Save I/O code
        JSR     PC,ERQIO        ;Issue error and return
        .ENDC                   ;

        .IF NB  <contin>        ;
        JMP     contin          ;Goto specified address
        .ENDC                   ;

defadr:                         ;
        .ENDM   QIOWRN          ;

        .MACRO  QIOERR  ios,lun,cndlst,?defadr

        CMPB    #IS.SUC,ios     ;Was I/O successful?
        BEQ     defadr          ; if EQ - yes

        .IF NB  <cndlst>        ;
        .MCALL  CMPBYT          ;
        .IRP    code,<cndlst>   ;
        CMPBYT  ios,code        ;Compare codes
        .ENDR                   ;
        .ENDC                   ;

        .IF NDF Q$$MSG          ;
        .IF NB  <lun>           ;
        MOV     lun,-(SP)       ;Save lun number
        .IFF                    ;
        CLR     -(SP)           ;Set no lun
        .ENDC                   ;
        MOV     ios,-(SP)       ;Save I/O code
        JSR     PC,ERQIOX       ;Issue error and exit
        .IFF                    ;
        HALT                    ;Halt the program
        .ENDC                   ;

defadr:                         ;
        .ENDM   QIOERR          ;
```

The package is available from ARIS. For your convenience, all source modules have been concatenated to the file ERROR.MAC. You will need to split the modules apart when you copy ERROR.MAC to your system. The macro definitions are in the file ERDEF.MDF.

The error package also has been submitted to the DECUS Fall 1986 RSX SIG tape in account [346,100] (along with other odds and ends from my system). This tape should be available around February 1987 from your Local User Group or the National DECUS library.

Ralph Stamerjohn is principal engineer at Meridian Technology Corporation, St. Louis, Missouri.

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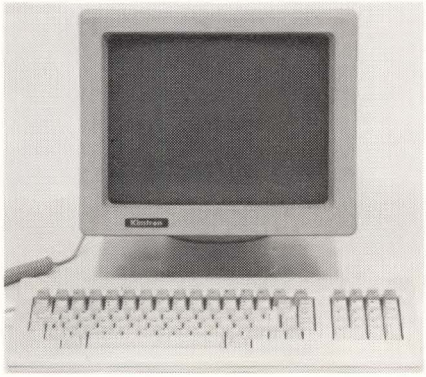

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FROM THE LAB

Hints And Kinks

Dave Mallery

If your installation has a history, it probably has a closet full of antiques just like ours.

Everything Old Is New Again

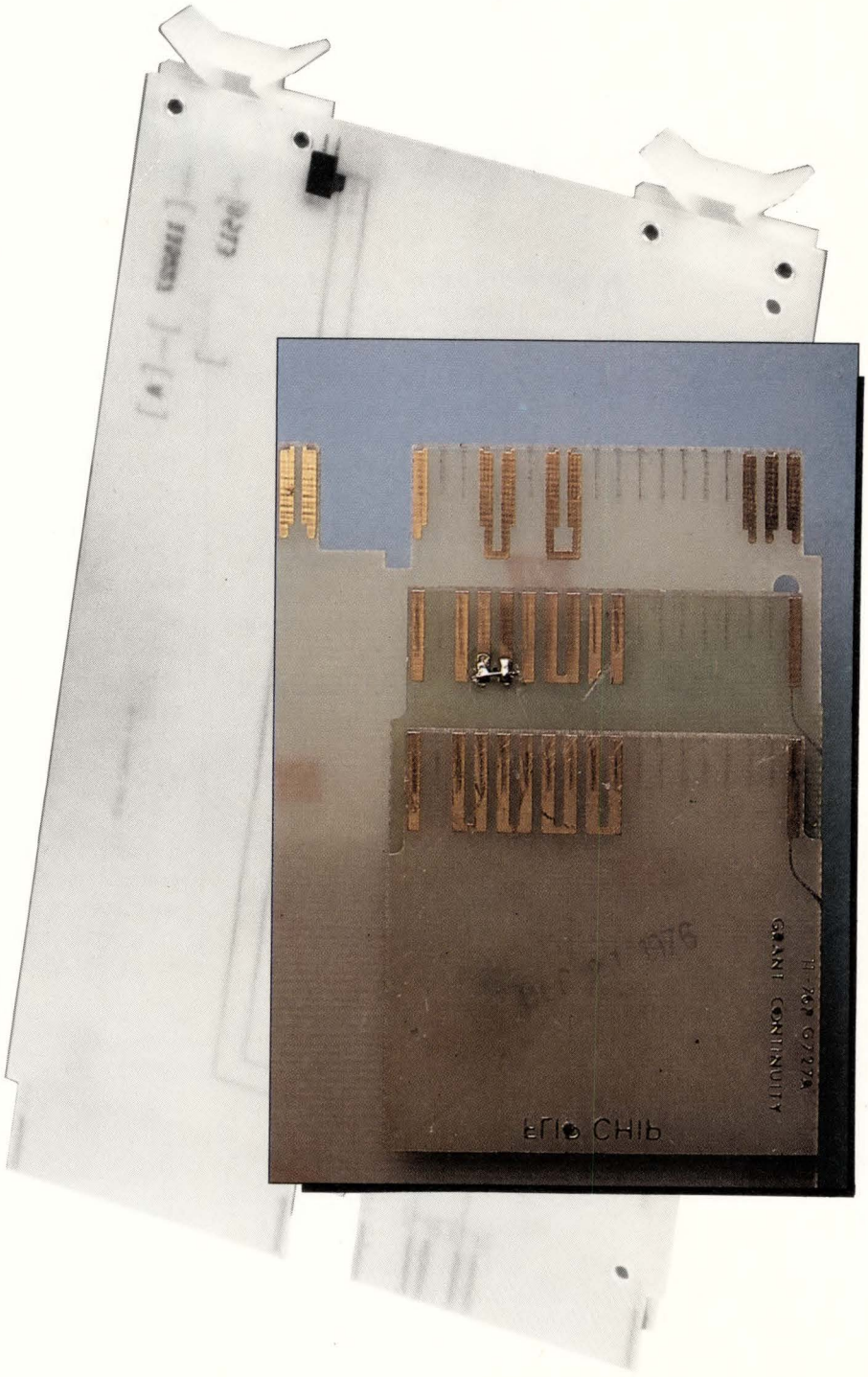
Our first machines were all UNIBUS based and, over the years, piles of the old single-high and even many of the newer dual-high grand cards have accumulated.

Here's how to convert the old into new Q-bus grants! First, line up these basic items:

1. Soldering iron
2. Fine wire
3. Razor blade
4. Pencil eraser
5. Ohm meter

The dual-high UNIBUS cards do not lend themselves to conversion. The old UNIBUS grants are forced into the "D" series of socket pins. However, the really old single variety (Photo 1) are perfect since they are not "forced" to go anywhere. Just use an existing M9047 to direct you when inserting the single card.

1. Line up the old card with an existing Q-bus grant card (M9047).
2. From right to left, cut one, skip one, cut two.
3. Clean the tops of the pins with an eraser and solder the pair indicated in the photo. Note that you are making a pair of the freshly separated members of two old pairs.
4. Now, check your work with an ohm



meter, making sure that only the two pairs are in contact and that the pairs you severed with the razor really are electrically disconnected.

5. Pat yourself on the back. Mark the newly converted board with an indelible marker (a big "Q" will do). Remember that correct orientation of a single-high chip is a 50-50 proposition. Use one of the DEC-supplied dual grants as a guide.

You can use these legions of grants to space out the boards in your MICROVAX or MICRO-11. The extra space will allow more cooling air to flow and will extend the life of the machines. You also need to have a few on hand when some third-party device breaks and you need to remove it.

While we are on the subject of grant cards, I recently saw a nifty idea on a card from Dyna Five Corporation of Santa Ana, California. The card is a dual-high Q-bus grant, but the two grant signals also are routed up to the top of the card and brought to a two-pin connector (Photo 2). You can connect a cable to one of these cards, skip over several slots and re-introduce grant continuity further down the bus without having to populate all the intervening slots with grants.

What To Do With That Old PRO-350

Like many other installations, we have a PRO-350 sitting on the shelf. Its hard disk died and the necessary repairs were not cost effective.

Ours, however, has found at least part-time employment in the Lab as a box for an outboard TK50 connected to our MICROVAX (Photo 3). Since the VAX already has an RX50 using up the slot, I just scrounged up an old SMD "B" cable, stuck it into the TK50, and then the TK into the PRO chassis.

Note: You must leave the main board connected to the power supply. There must be some jumper that tells the power supply to go away if the main board is disconnected. ■

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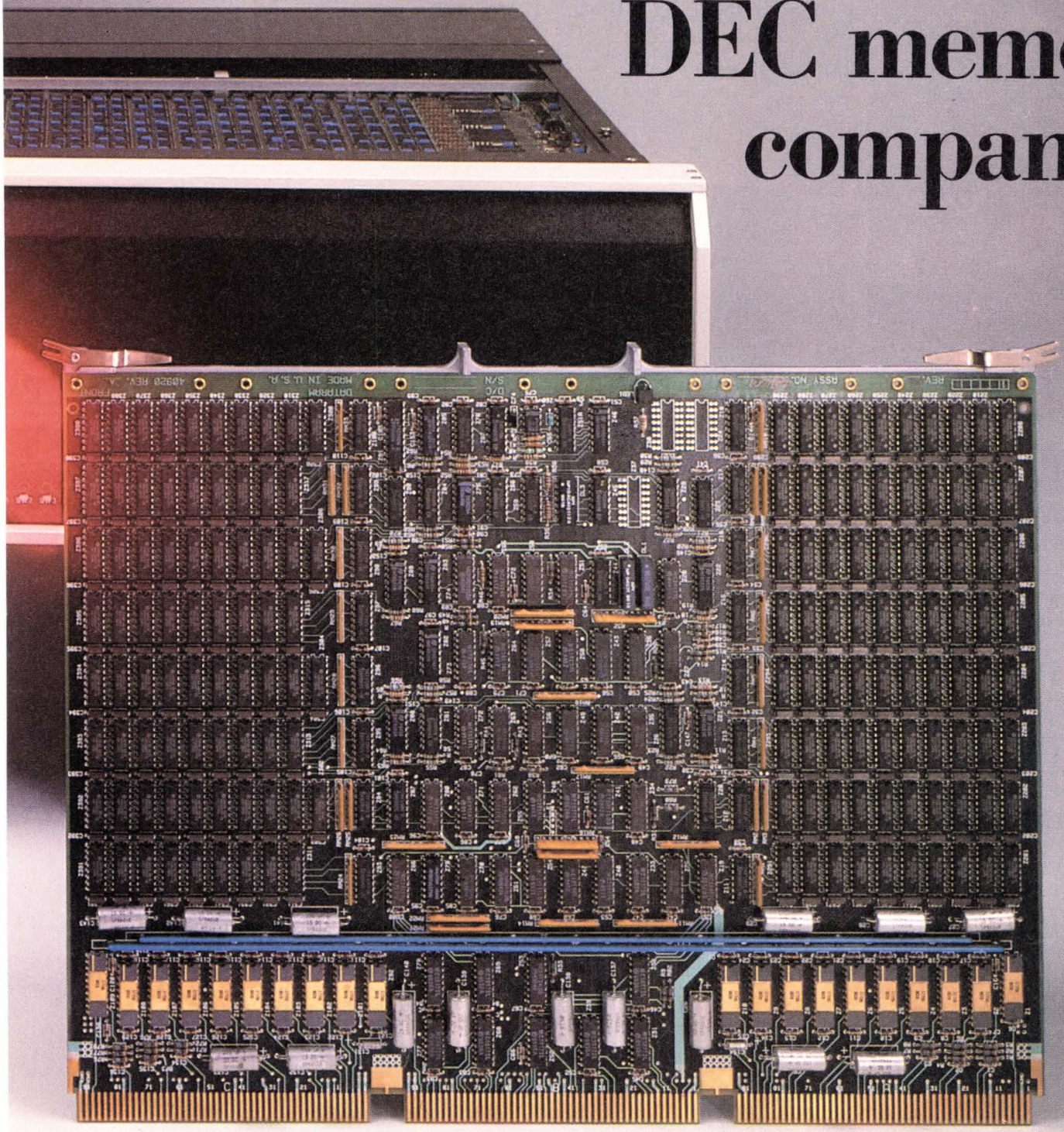

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A Better Mouse Trap

David W. Bynon

Last month I talked about "Controlling Your System," and promised to continue with "Staying In Charge," a discussion on user management, system security, etc. However, current events and announcements have prompted me to digress here and report on the EMS/380 from Emulex Corporation.

As delivered by DEC, the MICROVAX II is a machine whose great potential is masked behind its poor performance, low capacity disk system. Fact!

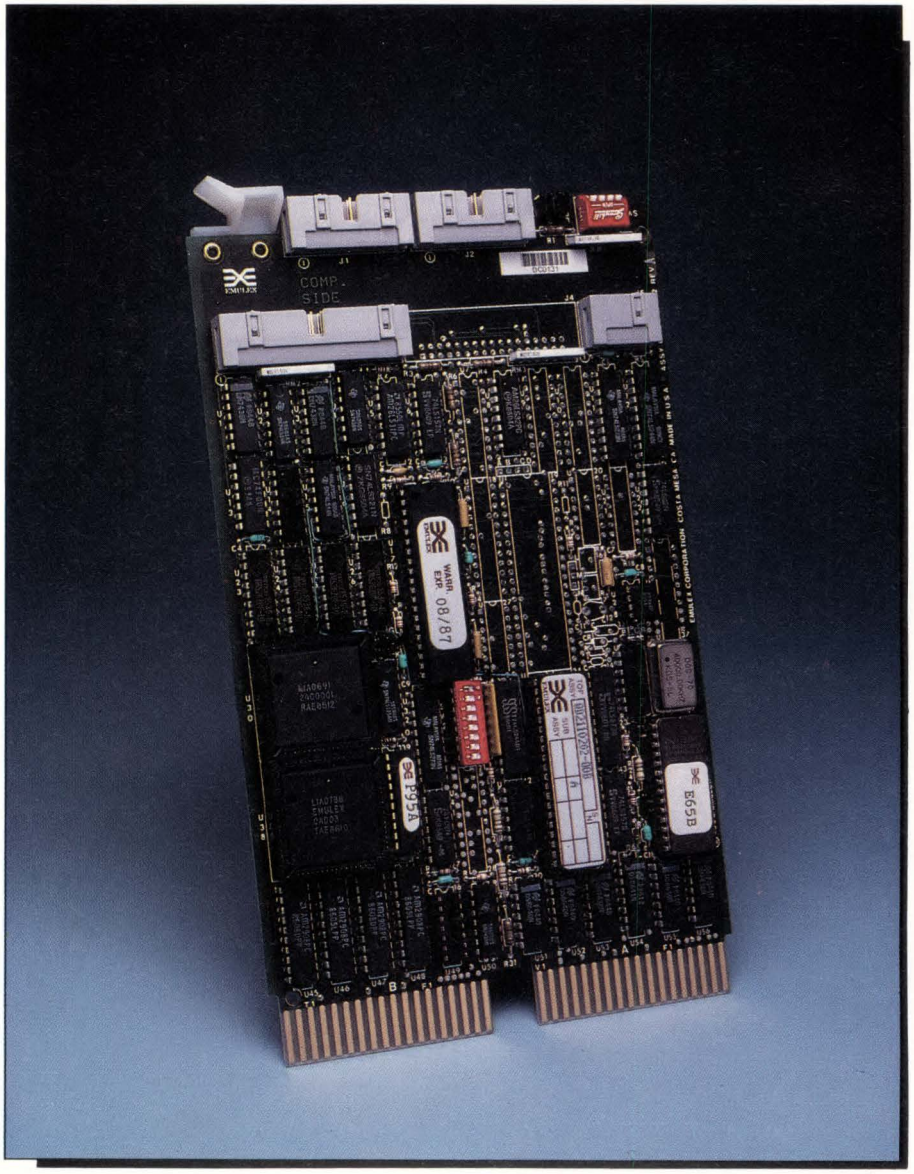
The RD series drives (RD51, RD52, RD53, etc.), standard in Digital's MICROVAX II systems, use the Segate Technology (ST) 506 standard disk interface. The ST506 interface is characterized by a 625 KB maximum transfer rate, and a maximum track density of 10,416 bytes. The ST506 interface was designed to support the typical floppy-based single-user microcomputer system.

If this performance tidbit isn't enough to disappoint you, let me also inform you that DEC is trying to monopolize its customers and the add-on disk market, by producing disk controllers that will not support a disk geometry other than those selected by DEC. And it's working. DEC's customers stand in line to buy RD53 drives, even at twice the cost per megabyte that the competition can offer.

Consider this: I purchased a 30-MB ST506 drive for my IBM-AT for $795, but had to pay DEC $3,100 for an RD52, a 31-MB (40-MB unformatted) ST506 drive. The little mounting slide plate must be costing DEC a fortune to make!

An Alternative

Many third-party vendors have recognized the MICROVAX II drive performance and price dilemma, and offer a variety of controller and drive solutions. Some simply build a better mouse trap, choosing to emulate DEC's RQDX controllers, with support for a wide range of ST506 drives. Others, however, offer true performance, capacity and cost solutions.



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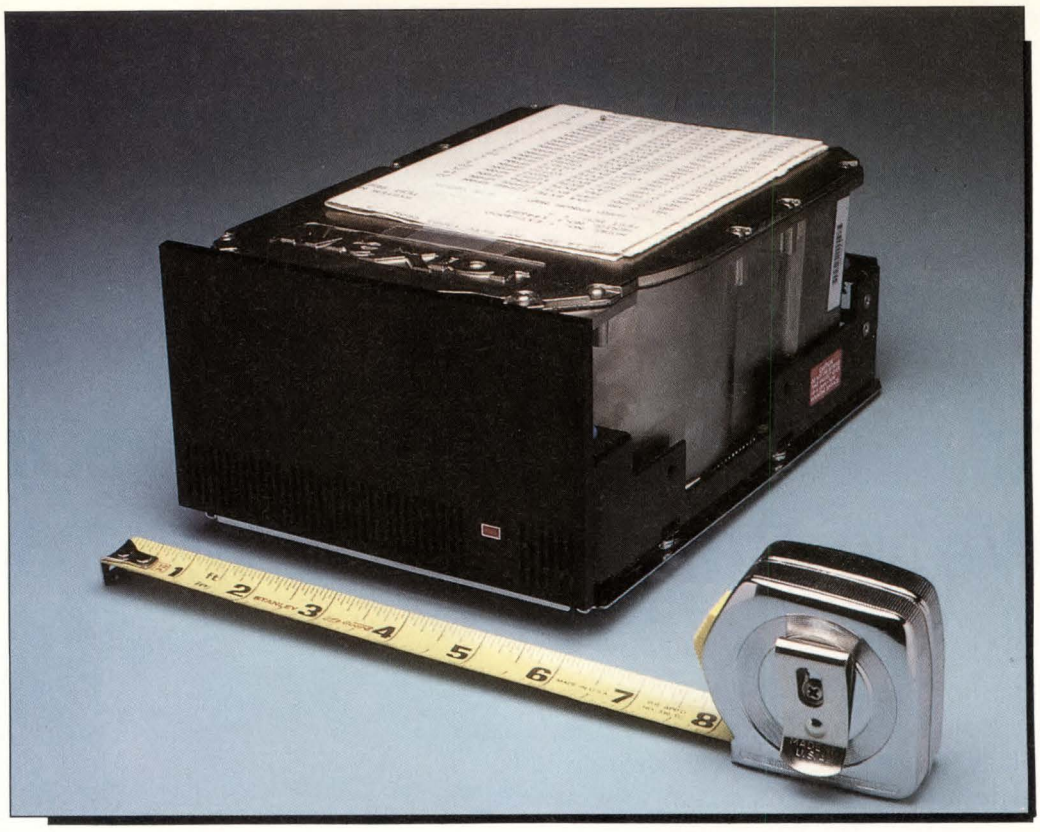

Emulex Corporation of Costa Mesa, California, offers one of my favorite RQDX/RD alternatives with its QD21 controller and large capacity 5-¼ ESDI Winchester disk drives. The QD21 implements the Mass Storage Control Protocol (MSCP) on the host side, and the Enhanced Small Disk Interface (ESDI) for the storage device.

The ESDI disk drive interface, for all practical purposes, is a high-performance version of the ST506. The ESDI, however, improves on the ST506 standard in two ways. First, the ESDI supports a serial command mode that allows the controller to send high-level commands to the disk drive as 17-bit (16-bits plus one parity bit) serial words. In this way, the controller is able to address directly any cylinder on the disk. Second, the ESDI increases the maximum disk transfer rate from 625 KB per second to 10 Mbits (1.2 MB) per second. This increase is made possible by implementing data separation on the drive itself. This allows data separation to be tuned to the drive. Finally, the ESDI controllers are simpler in design and less expensive to implement.

For my MICROVAX II, I selected the Emulex EMS/380 subsystem, which offers the QD21 controller, a Maxtor 4380 drive (319 MB formatted), cables, drive activity panel, and mounting hardware. Other drives, from such manufactures as CDC, Micropolis, and Fujitsu, also are available and drive capacities approaching one gigabyte soon will be on the market.

Installation

Installing the Emulex disk subsystem was a snap. Within 45 minutes, I had the controller and drive configured, installed, formatted, and working. It was that easy, and that compatible.

The particular cabling configuration I received was for a BA123 chassis (World Box). I opted to install it in one of my BA23 chassis to find out how it would work as a direct replacement for the RQDX3 controller and RD53 disk drive. Emulex manufacturers external drive cabling kits if you wish to keep your original equipment.

The transformation was perfect. The drive slid right into place, using the Emulex-built slide bracket, the cables fit neatly under the card cage, and the BA23 box had plenty of power to operate the drive and controller. In fact, my only complaint with the whole subsystem is that the cable connectors on the QD21 controller are a very tight fit.

The BA23 installation takes slightly longer than that of the BA123 because the cables must be routed under the card cage and through a trap door in the drive/card cage bulkhead. To do this, the chassis must be pulled out of its cabinet, the side access panels must be removed, all printed circuit cards must be removed and the plane must be loosened. With a BA123 chassis you simply slide the drive onto an empty shelf, route the cables back to the card cage, mount the activity panel and plug in the controller. Only one side panel needs to be removed to accomplish this.

WARNING: All printed circuit cards in the MICROVAX are static-sensitive. You always should use an electrostatic kit while working inside a MICROVAX.

Operation

To bring the Emulex disk subsystem into operation I had to configure the QD21 controller for the Maxtor drive, then format the drive. One of the special features of the Emulex controller is the implementation of Non-volatile Random Access Memory (NOVRAM) for storing disk geometry tables. Two physical drive configurations may be specified. With this method, drives available now as well as in the future may be used with the QD21 controller.

Unlike Digital, Emulex provides utility programs to configure the QD21 disk controller and format supported drives. For the privilege of formatting an RDxx drive on a MICROVAX II, you will pay Digital $2,500 for a set of Field Service diagnostics. The Emulex diagnostics and utility programs, provided with the disk subsystem, are easy to use, and are well documented. All of the information I needed to configure the controller for the Maxtor 4380, and many other drives, was in the documentation.

After formatting the drive, I restored an image backup of my original RD53 from a TK50 tape drive, using standalone BACKUP. With a flick of the reset button the MICROVAX was booting, and, faster than I had ever imagined, it was ready for user logins.

Anxious to see how MICROVMS viewed the drive, I logged in, and, before I could take a sip of my coffee, the DCL prompt was in sight; this disk subsystem is incredibly fast. The $ SHOW DEVICE/FULL DUB1: command revealed why the Emulex subsystem works so well—it emulates DEC's own RA81. Screens 1 and 2 respectively, show the Emulex version versus DEC's own RA81.

I have had the drive in heavy operation, day and night, for over 45 days. In no instance has the Emulex disk sub-

Disk VAXIN$DUB1:, device type RA81, is online, mounted, file-oriented device, shareable, available to cluster, error logging is enabled.

Error count	0	Operations completed	20660
Owner process	" "	Owner UIC	[1,1]
Owner process ID	00000000	Dev Prot	S:RWED,O:RWED,G:RWED,W:RWED
Reference count	57	Default buffer size	512
Total blocks	602745	Sectors per track	33
Total cylinders	1218	Tracks per cylinder	15
Volume label	"MICROVMS"	Relative volume number	0
Cluster size	1	Transaction count	85
Free blocks	496213	Maximum files allowed	150686
Extend quantity	5	Mount count	1
Mount status	System	Cache name	"_VAXIN$DUB1:XQPCACHE"
Extent cache size	64	Maximum blocks in extent cache	49621
File ID cache size	64	Blocks currently in extent cache	3588
Quota cache size	0	Maximum buffers in FCP cache	89

Volume status: subject to mount verification, write-through caching enabled.

Screen 1. The Emulex Subsystem.

Disk DUA2:, device type RA81, is online, mounted, file-oriented device, shareable, available to cluster, error logging is enabled.

Error count	2	Operations completed	41383
Owner process	" "	Owner UIC	[1,1]
Owner process ID	00000000	Dev Prot	S:RWED,O:RWED,G:RWED,W:RWED
Reference count	74	Default buffer size	512
Total blocks	891072	Sectors per track	51
Total cylinders	1248	Tracks per cylinder	14
Volume label	"VAXVMSRL4"	Relative volume number	0
Cluster size	1	Transaction count	57
Free blocks	487965	Maximum files allowed	222768
Extend quantity	5	Mount count	1
Mount status	System	Cache name	"_DUA2:XQPCACHE"
Extent cache size	64	Maximum blocks in extent cache	48796
File ID cache size	64	Blocks currently in extent cache	48646
Quota cache size	0	Maximum buffers in FCP cache	334

Volume status: subject to mount verification, write-through caching enabled.

Screen 2. DEC's RA81.

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FIGURE 1.

Disk Subsystem Specification Comparison

Device	Emulex QD21 Maxtor 4380	DEC RQDX3 DEC RD53
DRIVE		
Formatted capacity	318MB	71MB
Maximum transfer rate	1.2MB/sec.	625KB/sec.
Average Seek time	30 milliseconds	35 milliseconds
Price as tested	$7,955	$4,050
CONTROLLER		
Interface	ESDI	ST506
Max units	2	4
Board size	Dual-height	Dual-height
Power requirements	2.5 amps @ +5VDC	2.48 amps @ +5VDC
Price as tested	$1,495	$1,850
SUBSYSTEM		
Drive mounting	Internal or external	Internal or external
Throughput rate as tested	257KB/second	150KB/second
Subsystem cost per MB	$30	$83

system not operated with superior performance, and as expected.

Cost Effectiveness

It isn't difficult to see the present cost effectiveness of the Emulex disk subsystem; the DEC RQDX3/RD53 prices out at $83 per megabyte compared to the Emulex EMS/380 at $30 per megabyte. But what about future cost effectiveness?

At the recent DEXPO show in San Francisco, DEC announced the long awaited RD54 (155-MB ST506), and along with it a $7,900 price tag. The RD54 is compatible with the RQDX3 disk controller; however, future DEC MICROVAX drives (RD55 and RD56) will not be. This is because the drive capacities will have exceeded what an ST506 controller can manage. DEC will have to produce an ESDI controller with, no doubt, a healthy price tag.

The Emulex QD21 disk controller supports the medium capacity ESDI drives being produced now, and will support the high capacity ESDI drives soon to be announced. When you need an additional 380 MB to 1 GB of disk storage, you won't have to buy a new Emulex controller, only another drive.

The Emulex EMS/380 is a true performance, storage capacity, and cost solution for your MICROVAX. Fact!

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Emulex Corporation
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Style And Maintenance, Part 3

LET'S C NOW

Rex Jaeschke

Editor's note: This month Mr. Jaeschke gives us more useful tips on writing and managing C code. As well as making suggestions, he follows through with a detailed discussion on their rationale.

The convention used in K&R to make macro names all uppercase is useful for two reasons: First, a large number of programmers learned C from that book, or refer to it regularly. Second, it allows for obvious distinction with other identifiers. If you can't immediately tell that an identifier is a macro, you don't know if any hidden side effects exist. For example, in:

```
...
i = process(27);
...
```

it is not obvious whether **process** is a macro or a function if the case distinction rule is ignored. Another example that can take some time to fathom is:

```
update(arg-list) = expression;
```

At first glance, this statement looks like something is being assigned to a function, which is, of course, an error. If the macro name **update** had been written in uppercase, the confusion would have been avoided as follows:

```
UPDATE(arg-list) = expression;
```

Even if you use the rule that macro names are written in uppercase only, there is one reasonable exception. The routines declared in **ctype.h**, while normally implemented as macros, actually may be functions. For this reason, you always use **islower**, **tolower**, **isalpha**, etc., regardless of the implementation method. It would be clumsy to change the spelling in all source files if you wanted to use a function version instead of a macro or vice versa. The exception, then, is to use lowercase macro names ONLY when that macro replaces an existing function and has exactly the same calling sequence and functionality. (What are rules without exceptions?)

Tags And Typedef

According to my earlier rules, structure, union and **enum** tags also should be written in lowercase. While you may argue with this, I find that this approach keeps the rule simple and hence easier to remember and follow. Whatever approach you choose for naming tags, be consistent.

The **typedef** keyword is used to assign a synonym to a data or function declaration. Since these declarations must be in lowercase when written in their basic form, it seems reasonable to do likewise with their **typedef**ed versions. My rule here is that, since the type keywords must be in lowercase, so must all names of derived types. No exceptions. Consider the following example:

```
typedef char * STRING;
typedef char * string;

f()
{
        STRING name1;
        string name2;
        ...
}
```

You may argue that, by using uppercase letters in the first declaration, it is obvious **STRING** is a derived type. One reply could be that, since **string** obviously isn't a native type of C, it must be a derived type. In any case, recognizing that either of them actually is a declaration is more difficult than deciding which of them is better. Once you become used to **typedef**s, either approach works fine, although I still prefer the lowercase approach.

Documenting Code

Some time ago I was interviewing Jim Brodie, the founder and chairman of the ANSI C Standard's Committee. We were discussing C programming styles and the (controversial) idea of self-documenting code. His belief was that perhaps the most significant thing you could do when writing C (and other language) code, was to choose meaningful identifier names. If you do this, you have gone a long way toward making the code reasonably easy to read and follow.

It can be argued that a program never can have too many comments. However, brief yet applicable comments placed strategically are all that is needed, at least within the source file itself. More detailed discussion may be necessary in a design document.

While a comment can occur anywhere white space can occur, the code will be much clearer if comments are restricted to either the ends of source lines or on lines by themselves.

```
i = min /* comment here */ + sqrt(value) - /* here we
      calculate the square root */ max(i, j, k);
```

As shown above, embedding comments between operands in an expression helps no one. A far better version would be:

```
/* comment */
        i = min + sqrt(value) - max(i, j, k);
```

or

```
i = min + sqrt(value) - max(i, j, k);   /* comment */
```

> ***. . . you can waste more time making sure the comment beginnings line up vertically than you spend on generating a useful comment.***

Since indenting commonly is used with C programs, it becomes increasingly difficult with each nested level to have sufficient room at the end of each line, for a meaningful comment. Also, you can waste more time making sure the comment beginnings line up vertically than you spend on generating a useful comment. My approach here is to put a comment block before the start of a related section of code. Then, if I really need to highlight something within the code section, I add brief comments at the end of the appropriate lines as follows:

```
/* ..........................................
   ..........................................
   .......................................... */

    if (i == 'A')
        ...                    /* ... */
    else if (i == 'D')
            if (j == 1)
                ...                    /* ... */
```

If possible, I try to separate a trailing comment from the code by at least one tab. The value of using comment blocks is that they can use the whole line length and, with blank lines preceding and following them, they can start in column one and not upset the visual appearance of any indenting currently being used.

A common, reasonable approach to blocks of comments

is to place the /* and */ on lines by themselves as follows:

```
/*
This program ....
...
...
*/
```

This allows lines to be inserted and deleted without requiring the start- and end-comment characters to be moved.

Indenting

I always use tabs for indenting. Tabs are obvious; even if your editor lets you set the display width to other than eight spaces, tabs are much easier to locate and count than spaces. A tab takes up less space on disk than the equivalent number of spaces, it requires less typing, it is easier to distinguish and, if you need to add an extra or remove an existing level of indenting, you needn't mess with space counting. You just insert an extra tab on all subordinate lines.

I have wasted countless hours working with other people's sources in which they insisted on indenting four or less spaces. When you use an 80 x 24 character screen steadily for some hours, your eyes and the curvature of the screen reduce your ability to discern which source lines are at the same level. I say use tabs and stop wasting your time and that of others. Not only do you have to key in all those extra spaces, you have to count as you go.

The justification I get for space indenting is that if you use tabs, you soon run off the right side of the screen with heavily nested blocking. While that is true, I suggest you look at the appropriateness of the levels of nesting before you solve the indenting problem.

Those of us who have embraced structured programming can answer that one easily. Except in rare circumstances, you have no business writing a routine that is bigger than a page; anything bigger is too complicated and can't be absorbed all at once. Assuming that the width of the paper is the same as that of the screen, you should not march off the side. If you really need that many levels of nesting, you probably should be calling a function so the details of the algorithm are not all in the same place. This does not mean you never must have source code lines longer than one screen line. C is free-format, and a statement can span an indefinite number of source lines. This often is needed in verbose argument lists as follows:

```
if (cond)
        if (cond)
                if (cond)
                        process(arg_1, arg_2, arg_3, arg_4,
                                arg_5, arg_6, arg_7, arg_8);
```

This idea can be taken even further to restricting a source version of an algorithm to just one screen since that's all you can see and manage properly at any time in most editors.

One particularly thorny problem occurs with long literals, as follows:

```
        if (cond)
                if (cond)
                        if (cond)
                                fprintf(outfile,"The table values are: \
i = %d, j = %d, k = %d\n", i, j, k);
                        else
                                ...
```

The standard approach to continuing long literal strings requires a backslash as shown, and for the continuing text to begin in column one of the following line so that intervening white space (if any) is preserved.

The method for continuing such literals in newer compilers and the ANSI C Standard is to allow adjacent string literals to be concatenated. For example:

```
"string1""string2"
"string1"       "string2"
"string1"<tab><tab><tab>"string2"

are all identical to the string

"string1string2"
```

This allows the **fprintf** call above to be implemented as:

```
if (cond)
        if (cond)
                if (cond)
                        fprintf(outfile,"The table values are:"
                        " i = %d, j = %d, k = %d\n",
                        i, j, k);
        else
                ...
```

Important Note

Several astute readers found bugs in my coverage on the comma operator (September 1986, page 120). The examples do not match their explanation. To correct this, the examples should be as follows:

```
i = 5, ++j;
```

As previously written, **j** was used BEFORE it was incremented, not after, as stated.

```
i = ((j = 6),(int) sqrt((double) j));
```

Without the extra parentheses, both **i** and **j** were set to 6 and the cast sqrt value was discarded.

```
i = (e(), f(), g(), h());
```

Without the extra parentheses, **i** is set to the value returned by function **e**, NOT **h**, as stated.

The readers also noted that the different examples of the **for** construct are not necessarily equivalent, particularly if the **continue** statement is used.

This approach is much more aesthetically pleasing. Well, isn't it?

More Reader Mail

Dear Mr. Jaeschke,

I do not know when to use the memory allocation functions ***calloc*** *and* ***malloc****.*

As part of my learning C, I am writing a program that collects personnel data entered at the keyboard. When all data for an individual has been entered correctly (and stored in temporary char strings), it is transferred to a buffer. The data records are buffered such that the buffer only is written to disk when it fills.

Each user data record looks something like:

```
char first_name[20];
char initial;
char last_name[30];
char street[30];
char city[15];
char state[2];
```

Is this a case in which should I use ***malloc*** *(or* ***calloc****) to allocate, for example, 1000 bytes at the start of the program for use as the intermediate buffer? Each data record then is packed into the buffer and eventually is written to disk.*

What if I just allocate a 1000-byte ***char*** *buffer as an automatic variable instead? What is the difference between these two approaches, if any?*

You have touched on a number of points, each of which is worth discussion. Before I get into the algorithm itself, I'd like to discuss the various methods for allocating space.

There are four possible ways to allocate the 1000-byte buffer. They are:

1. external (global) **char** array
2. internal **static char** array
3. internal **auto char** array
4. from dynamic storage (the heap) via a memory allocation routine such as **malloc**

Let's look at each approach individually.

1. Space for an external variable permanently is allocated throughout the life of a program. This space is reserved (and conceptually initialized) at compiletime. This storage class will be adequate for your needs; however, it may not be appropriate since external variables are accessible from anywhere in the whole program. If you don't need access to this buffer from other functions, or you specifically want to forbid such access, then don't use a global buffer; its scope is too broad.

If you need to access the buffer from a set of functions that are all defined in the same source code file, you could use a **static** "external" buffer. This is one that is defined outside any function and has the class **static** prepended. While this

variable will exist permanently, it will be accessible only by the functions defined in the same source file.

2. Space for an internal **static** variable is allocated permánently throughout the life of a program. This space is reserved (and conceptually initialized) at compiletime. This storage class also may be adequate for your needs. The scope of an internal **static** is the block in which it is defined and all subordinate blocks. Such variables also retain their contents across function calls, as do external variables.

3. Space for an **auto** variable is allocated temporarily each time its parent function is called and is released when that function terminates. The space is reserved at runtime. This storage class also may be adequate for your needs. The scope of an **auto** is the block in which it is defined and all subordinate blocks. Automatic variables DO NOT retain their contents across invocations of their parent function.

4. Using **malloc** or **calloc** (or a similar function) one time at the program's start also may be sufficient, provided, of course, that you make the pointer to the allocated area available to any function that needs to access that area. You also will need some externals, or internal variables and pointers to them, to describe the current context of the buffer, as necessary. The space will remain allocated until the program terminates or the space explicitly is released by a call to **free**.

All four methods will work, but some may be better than others, once you take scope into account. For this particular application, you don't need to initialize this area. Since you copy complete data records into it and they occupy contiguous locations, any original contents are overwritten and unimportant, provided you know where the "current" contents end. However, in other applications, initialization may be important.

External and internal statics are initialized (typically) at compiletime and, if no explicit initializer list is provided, the variable (or each element of the variable in the case of an aggregate like an array or structure) is initialized to zero cast to the type of the variable. For **char** arrays, each **char** would be set to the nul character '\0'.

Automatic variables can be initialized explicitly. If they are not, their initial values are undefined. However, most compilers won't allow you to put an initializer list on an auto aggregate definition. That is, you can not have a definition of **auto char[] = "abcd";**. To provide a list, the class must

be changed to **static**. The only way to initialize each element in an auto aggregate is to use assignment statements at run-time, or some kind of block-move using **strcpy**, etc.

The **calloc** function initializes the allocated space to all-bits-zero, which on most (all?) DEC machines, is equivalent to zero cast to the data type to be stored there. The **malloc** function does not initialize the storage it allocates, nor does **realloc** when it enlarges an allocated area.

Regardless of how you allocate the space, you will (or can) finish up with a pointer to that area, so data records easily can be moved into, or out of, that area as necessary.

As each data record input consists of a number of related fields, the record is an aggregate and naturally fits into C's notion of a structure as follows:

```
struct datarec {
        char first_name[20];
        char initial;
        char last_name[30];
        char street[30];
        char city[15];
        char state[2];
};

#define RECORD_SIZE sizeof(datarec)
```

Since the buffer will contain some number of these data records, the buffer is organized best as an array of structures as follows:

```
#define MAXREC 10 /* 10 records per buffer write */

struct datarec record[MAXREC];
```

For **static** and automatic buffers, the class specifiers **static** and **auto**, respectively, should be prepended to the declaration. Regardless of the storage class you use, **record[i]** always accesses the *ith* element in the buffer. When using **calloc** or **malloc**, do something like:

```
extern char *calloc();

f()
{
        struct datarec *record;

        record = calloc(MAXREC, RECORD_SIZE);
}

extern char *malloc();

f()
{
        struct datarec *record;
        record = malloc(MAXREC * RECORD_SIZE);
}
```

In these two cases, **record** is a pointer to the allocated

space where the array of records is to be stored (provided, of course, the null data pointer is not returned). Using the + + and -- operators, or pointer arithmetic, any element of the array can be accessed either randomly, or in forward or backward sequence. Also, since pointers can be subscripted, the expression record[i] yields the *ith* data record in the array. You may use either the pointer or the array approach, or both in the same program.

Now, to the question of buffering. Any operating system worth its salt buffers I/O to disk files, and most modern disks have sector sizes that are a power of two; 128- and 256-byte sectors are very common formats. A device also may perform I/O in clusters where a cluster is some integral number of sectors. In any case, the file system helps a lot in this area. Therefore, there is less (or perhaps no) need for the application programmer to get involved in optimizing performance. Doing so does require extra code to be written and larger data space, and, if it isn't done properly, may result in worse efficiency. (Note that **MAXREC** could be defined as the disk sector size divided by **sizeof(datarec)** rather than hardcoded as 10.)

In any event, the end result is that there now will be two lots of buffering: that done by your program and that done by the file system. Your program now may run even slower.

One final comment: If you choose to deal with the input fields as strings, that is, as **char** arrays with '\0' terminators, you must provide storage space for them. In this example, **char state[2]** obviously does not, since each state code abbreviation is two characters. You must be careful when copying to such non-terminated strings, or else you will overwrite the next character with the trailing '\0'. It is OK to use non-terminated strings provided you also keep their length somewhere.

Next issue I'll look at white space, positioning braces and the format of declarations and function definitions. Readers are encouraged to submit any C-related comments and suggestions to Rex Jaeschke, 2051 Swans Neck Way, Reston, Virginia 22091.

Rex Jaeschke is editor of "The C Journal" and the author of numerous articles on the C language. He is a member of the ANSI X3J11 standards committee for C.

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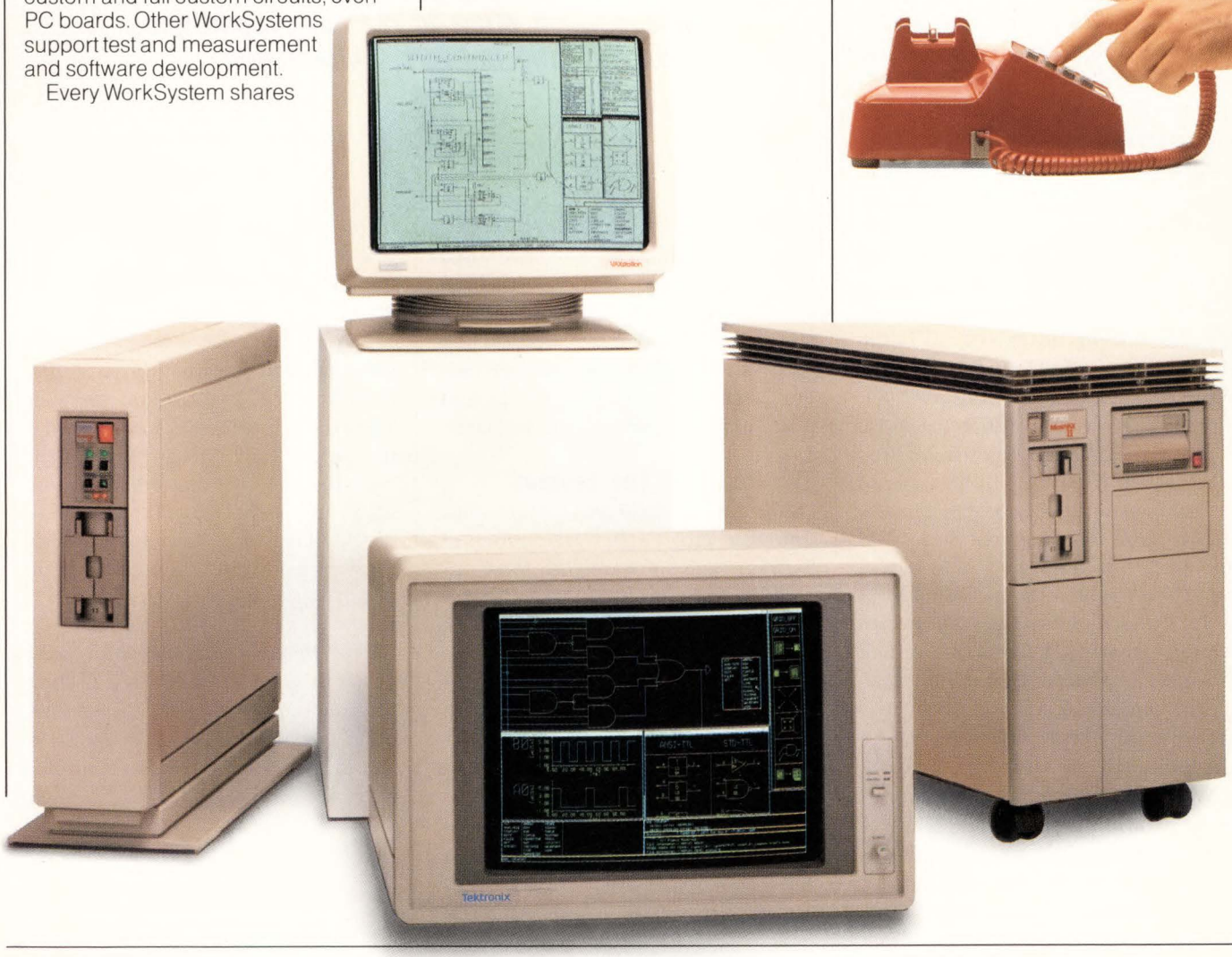

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NETWORKING

Bill Hancock

Network MAPping

For some time, there's been a great deal of harping about the OSI architecture and how every network vendor will be getting into the act through its own implementation. DEC is not different. First, were Layers One and Two with standard offerings such as Ethernet. Next, it was the VAX OSI Transport Service (VOTS). Still, a complete seven-layer OSI implementation hasn't been available from any vendor (or from the ISO for that matter), and there hasn't been a big rush to implement one. The protocols, especially at Layers Six and Seven have not yet been completed. Nonetheless, there's still a great interest in getting OSI up and running, especially in Europe where some countries consider such services mandatory.

In the U.S., however, General Motors (GM) formed a task group in 1982 to work on a method for hooking together manufacturing systems in the shop floor environment in a common, cohesive network architecture. In 1984, a prototype was demonstrated at NCC — the Manufacturing Automation Protocol (MAP). While the initial number of vendors was small, they were impressive in size (two of the seven were IBM and DEC). The popularity of MAP was on its way. Soon, other potential users of MAP joined in the fray, such as Ford Motor Company, DuPont, Lockheed, Boeing and Kodak. As a result, MAP has become the focus of a major network development effort to reduce expenditures on differing network technologies and cable plants in the manufacturing environment.

In addition to being an initial vendor, DEC participated throughout the development of the system. When IEEE 802.4 (the token bus hardware standard used by MAP) was being developed, DEC was involved. And, DEC also may be one of the first major computer vendors to market a commercially-viable MAP implementation incorporating most of the proposed seven-layer OSI architecture. The VAX-based product set, called DEC/MAP, has been tested for some time, and soon will have a profound effect on the selection of a corporate manufacturing hardware vendor, further entrenching DEC's lead position in the network marketplace.

> ***". . . the focus of a major network development effort to reduce expenditures on differing network technologies . . ."***

The Heart Of The System

DEC/MAP is a hardware/software solution that incorporates DEC-provided hardware and software with the Concord Data Systems (CDS) Token/Net Interface Module (TIM 220 HSA). The VAX hardware interface is comprised of a KMS1P UNIBUS controller and driver which connect to the TIM 220 through the RS422 connector on the TIM 220. Through the use of the KMS1P, the TIM box, and the driver, Layers One and Two of the OSI architecture are provided for in a manner prescribed by IEEE 802.2 and 802.4, and the MAP V2.1 broadband HDLC LAP-B w/credit recommendation. DEC calls the external box, MAPserver/Plus TIM.

It basically contains three cards:

1. An RF modem for MAP broadband access (IEEE 802.4.14 & .15).
2. An Access Unit (AU) which implements the token passing mechanism.
3. A Control Unit (CU) which implements the IEEE 802.2 logical link control, HDLC, network diagnostic exerciser, and other necessary software.

A connectivity arrangement like this seems fairly temporary, since DEC most likely will work toward providing a BI-oriented IEEE 802.4 controller in the future, and since DEC doesn't necessarily enjoy using other vendors' hardware in the network arena. The development of DECnet for Ethernet, further supports this assumption. In the original development cycle, the port to Ethernet was demonstrated using an Interlan Ethernet controller and a special device driver, XXDRIVER.EXE, to show the connectivity potential. Since then, other DEC controllers have appeared, and support for the Interlan controller never was mentioned publicly, although

references were made in the microfiche source listings for NETACP and other network processes.

Software For DEC/MAP

Software support for DEC/MAP is provided in a layered method using, where reasonable, the proposed ISO specifications for each layer of the OSI architecture. The network layer (Layer Three) provides for routing of message traffic, as well as other necessary operations, such as conversion of global address information into routing information. The transport layer (Layer Four) provides NBS Class-IV transport services called MAP OSI Transport Service (MOTS — in line with ISO 8072/8073, and similar in nature to the VOTS product set). The session layer (Layer Five) still is not totally specified by ISO, so DEC implemented a basic session support mechanism to allow initiation and termination of communications between nodes. A presentation layer (Layer Six) doesn't seem to be implemented, probably due to a lack of ISO specification, and also a lack of need: The necessary access functionality for MAP has been provided by DEC at Layer Seven, the applications layer.

The applications layer provides a series of MAP functionality products:

1. MAP File Transfer, Access and Management (FTAM) services.
2. Manufacturing Message Format Standard (MMFS).
3. MAP Common Application Service Elements (CASE).

FTAM is based on the ISO 8571 phase-one draft that provides for file transfer between dissimilar machines with dissimilar file structures. Within the FTAM section, there are three different functional components that provide the service — the MCOPY DCL command, FTAM high-level access routines, and FTAM low-level access routines. MCOPY is very similar to the VMS COPY feature when used with DECnet; for instance, to copy a file from one MAP node to another, the command is:

$ MCOPY BILL.DAT WELDER::OUT.DAT

where BILL.DAT is on the host node, and OUT.DAT is created on node WELDER. There also are options that allow for the deletion of the input file and other items, after the copy is complete. All in all, however, it's a very similar situation to VMS COPY in the DECnet environment.

At the program level, files may be transferred under program control, us-

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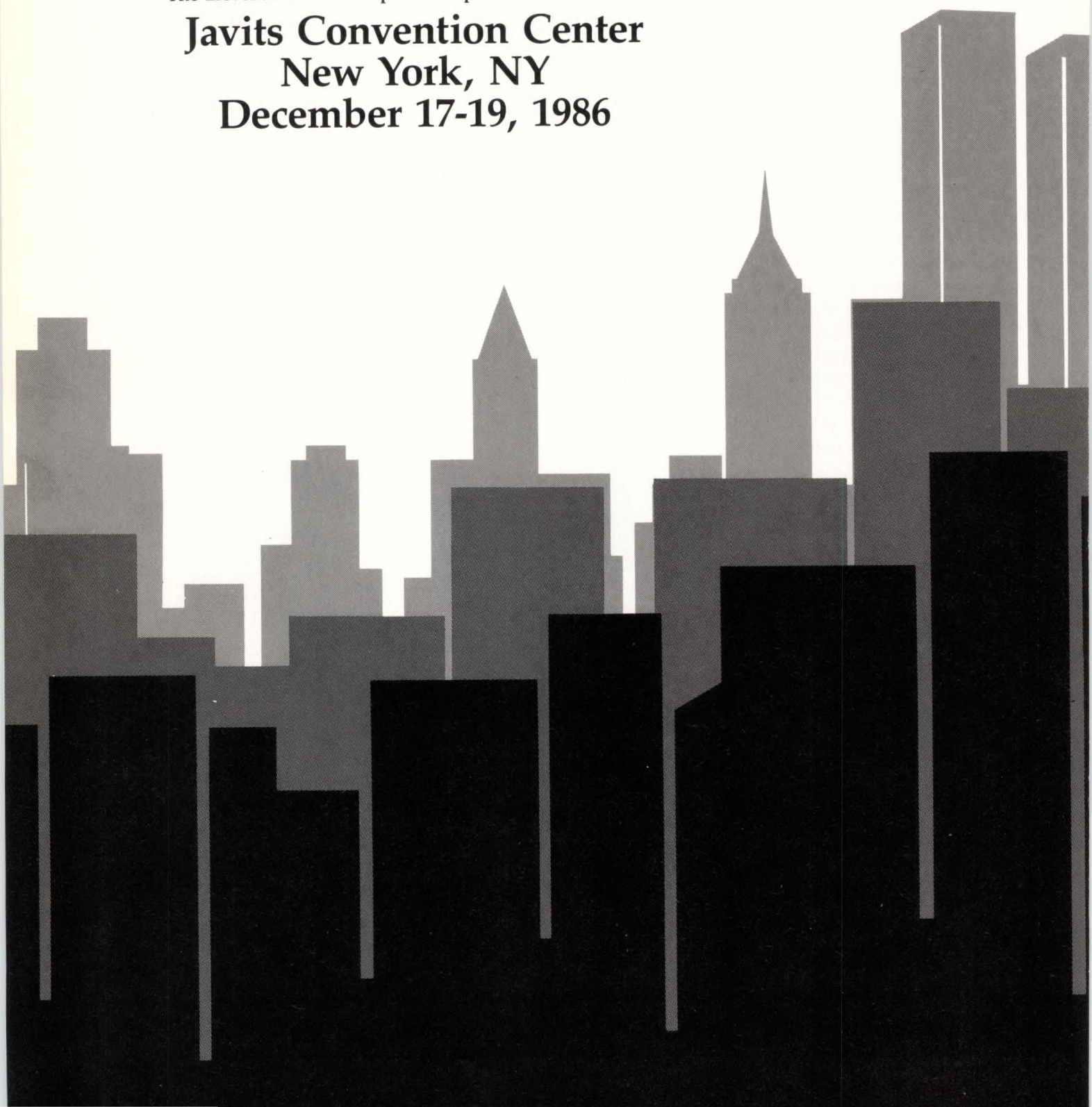

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ing the high-level FTAM$COPY routine (invoked similarly to a system service, except a MAP-required definition file must be included in the code). For the enterprising few, however, explicit network access, file open, and file access routines are available for specific programming requirements.

The applications layer also includes support for Manufacturing Message Format Standard (MMFS), a vocabulary and syntax used to control robots, numerical controllers, and programmable controllers. MMFS frequently is used in "definition" tools and languages that compile an MMFS-compliant series of routines to be used in a manufacturing environment. Similar to a sophisticated script of "what to do," MMFS will become increasingly important to companies that wish to use the same controlling equipment for a variety of differing functions.

Another feature of the applications layer is a service called Common Application Service Elements (CASE). Basically, CASE is used to provide connectivity to non-DEC MAP nodes that may be under the control of, say, a VAX in a control room or in a machine hierarchy.

As with any network, the need to control, configure, monitor, and manage is a critical component of the network product set. DEC/MAP includes a network management program called MAPCP that provides similar functionality to DECnet's NCP (Network Control Program). Statistics can be collected and viewed, events logged, loopbacks performed, network parameters adjusted, and counters monitored.

A final, and essential, component is the MAP OSI Transport Service (Layer Four). Since MOTS is set up as a separate entity, it's capable of being accessed by programmers who wish to have very direct interaction between the network and a given program. This is a fairly complex interface and should be used with caution, since the wrong bit in the wrong place can cause a variety of damage.

A Forecast

In the networking arena, there's an increased amount of pressure for adherence to ISO and ANSI standards when developing network products, to allow cross-vendor communications and reduce the amount of software and hardware required for inter-vendor networking. Since MAP draws heavily on the various ISO standards as well as currently evolving draft standards, it's quite possible that many MAP implemented features, such as FTAM, one day may find themselves on your DECnet node. Also, with adherence to the IEEE 802 specification at the hardware level, it's a matter of time before the fiber distributed data interface (FDDI) media access control (MAC) becomes economically viable and available. When that happens, MAP networks will be able to converse with Ethernet (as well as IBM token ring) networks, and then the fur really will start to fly!

DEC recently announced X.400 electronic mail for VOTS, and such capabilities may end up in the sister product of MAP, Technical and Office Protocol (TOP), DECnet, or some other standard such as ISDN. Therefore, it seems that the networking area is becoming blurred with the introduction of standards into the network space: In the near future, it may be difficult to tell MAP from TOP, from whatever else appears.

DEC/MAP is an innovative product that will help secure DEC's networking goals. Preliminary testing shows it to work fairly well, in spite of some bugs, but all new technologies have their problems. Overall, however, MAP will prove an important addition to the DEC product space, and help further entrench DEC-style networking.

I won't say I told you so, but . . .

Bill Hancock is an independent systems and network consultant based in Arlington, Texas.

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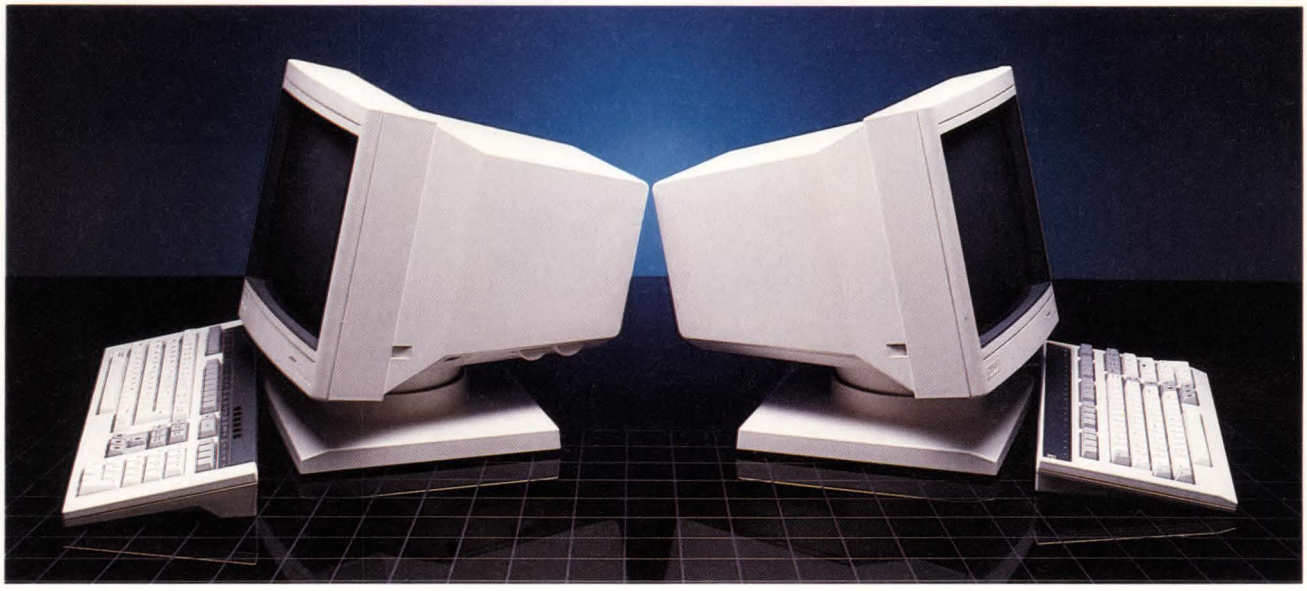

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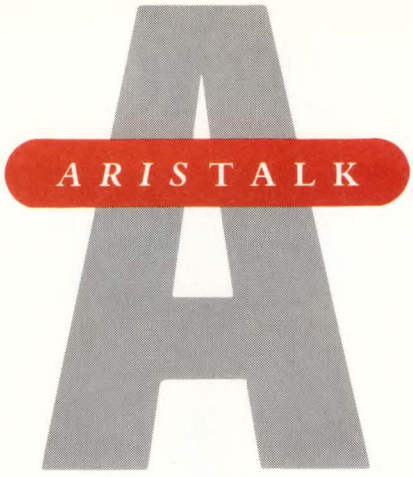

Forum on DEC's Licensing Policies

QUERY:

Tom O'Toole: Does anybody understand the VMS licensing policy for the BI processors? In the new add-ons and upgrades catalog I just received, there seem to be new categories for licensing; i.e, "paid-up," and "one-year and fee." The difference is astounding: In the case of the VAX 8500, it is $40,000! It also seems that ULTRIX is quite a bit less expensive (at least for the 8200). There absolutely is *no* explanation about any of this, despite the curiosity of the 8600 line being priced in a completely different way.

Is DEC trying to scuttle its own operating system? You don't get anything with VMS anyway, compared to the tools you get with ULTRIX. (For just a few examples: MAKE, SCCS, F77, C, LISP, TCP/IP networking, etc., all are *bundled* with UNIX systems.) The price of the equivalent software for a VMS system is tens of thousands of dollars! The trend is getting worse: Now, you have to pay for compatibility-mode software. (Note that it costs more for a machine like the 750 which has the hardware, than for the MICROVAX!) They say they won't include the microfiche any more (unless you fork over $$$). Is EDT going to become a *layered product*?

The money is not the only problem: The administrative headache of keeping contracts for every piece of software you have is ridiculous. I would hate to have to switch to UNIX, etc., but Digital is making it very difficult to justify VMS any more. They just aren't competing. Any comments?
Tom

REPLIES:

Doug Schneyman: I agree with you, Tom, that VMS is becoming a major problem in regard to DEC hardware costs. I have a VAX 11/750 which is aging rapidly. The replacement cost is about $250,000 or more for a VAX 8500(!), if I'm really to improve things for my company.

I have to start considering other hardware vendors who can supply UNIX and also support Relational Technology, Inc.'s *INGRES* DBMS (see the product review in the August 1986 *DEC PROFESSIONAL*, Vol. 5, No. 8). The choices are growing including AT&T, Pyramid Technology, and CCI. So, by 1990 I predict that I will "shell out" to the competition!
Regards.
Doug S.

Pat Scopelliti: Seems you're comparing apples and oranges, Doug. Last I looked, an 11/750 was equivalent to 0.6 of an 11/780.

Doug Schneyman: Pat, If you're referring to the MIPS rating of the VAX11/750 as 0.6, compared to the MIPS rating of the 8500 as 3.1, granted the numbers are very different, but the MIPS ratings do *not* tell the full story of a computer's success or failure in a high-volume corporate computing environment.

The VAX 11/750 contains a "design flaw" in the construction of the UNIBUS, I would contend. The UDA50 controller must be put in slot number six on the UNIBUS backplane, resulting in a severe time delay for I/Os to and from the RA81 disk drives. If the UDA50

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is placed in slot one for example, the DZ11 boards all will time-out for lack of attention by the UNIBUS. From what I understand, the Q-bus contains a similar flaw. Only a class action law suit against DEC would force them to correct this flaw.

I have spent tens of thousands of company dollars developing the SMD MASSBUS side of the VAX11/750, with an Emulex SC70000 and SMD drives. I plan to upgrade to the SC70003 and the CDC9772 825 MB disk drive at 3600 RPM, to overcome the severe performance flaw of the 750. The 8500, of course, contains a VAXBI for correcting the flaws!!!

Regards.

Doug S.

Tom O'Toole: My problem is the cost of software, not hardware, Doug. The new VAX machines seem reasonably priced (we have a large educational discount so maybe I'm in a dream world), but VMS is expensive, even with the discount, and the trend is to give you less and make you pay for everything.

Tom

Bill Mayhew: The new software licensing you've stumbled across is representative of Digital's new alternative to traditional, one-time fee (now called "paid-up") licensing. The alternative is a form of software rental: You pay a lower periodic fee (monthly or quarterly, I suppose, though I don't know the details), although eventually it costs more. Seems to me like a page out of IBM's book.

Richard B. Gilbert: Tom, I think that in comparing DEC's pricing for VMS with the pricing for UNIX, you are neglecting some quality considerations. Yes, you get FORTRAN free with UNIX but, how does it compare with VMS FORTRAN? The last reports I heard (two years ago) were that VMS FORTRAN (V3.5) made UNIX FORTRAN look sick. The speed of the generated code has been increased in VMS (Version 4) FORTRAN.

How about diagnostics? My CE tells me that hardware errors that merely cause an entry in the VMS error log, will bring a UNIX system to its knees. Yes, DEC's prices are somewhere between high and outrageous, but what you get for free is sometimes worth just what it costs.

Joel Gallun: What can anyone say? I agree with everything you [Tom] said. One approach is to go to DECUS and try to rally the users to fight this idiocy. What Digital is trying to do is clear: be as much like IBM as they can. If they succeed, the little guys will kill them.

Victor Dura: I agree with you [Tom] 100 percent. DEC really is getting to be a pain in the butt. So much so, that I'm going to a seminar on technical computing using a SUN supermicro multiuser/multitasking system. I don't know much about it yet, but the price/performance looks good on paper. It's a UNIX system that runs at about 2 MIPS. Looks about half the price of a MICROVAX, with more capacity and performance. The BIG questions, of course, are support and software availability, etc. You might consider looking into it.

Phil Anthony: Personally, I begin to wonder if maybe DEC is trying to shift the makeup of their user base. Traditionally, the DEC market has been one of knowledgeable people (OEMs, VARs, or end users) who took DEC machines and bundled utility software, and went on to create their own wild and wonderful applications. More and more, however, the DEC offerings seem to be geared toward end users who essentially want a turnkey package consisting of all-DEC hardware and software components (ALL-IN-1, Datatrieve, and so on, would've been unthinkable five years ago).

DEC still supplies the necessary compilers and system services for in-house development, but this isn't what they're emphasizing. And by now, everybody has heard about the closed architecture of the VAXBI bus, and limited availability of the J-11 chip.

Unbundling the development tools would be a logical step in that progression, and it already was apparent with the introduction of VMS. Under RSTS, you not only got the MACRO-11 assembler, but BASIC-PLUS as well. You don't see DEC giving VAX BASIC away, do you (or, BLISS-32, which DEC uses extensively in its own system and utilities development and may be a closer analogy to BASIC-PLUS under RSTS)?

DEC's apparent goal, then, is a

market base of relatively naive end users — the kind who call Software Support to ask how to copy a file. And if some of us old-timers (read "dinosaurs?") drop by the wayside in the process, I'm not sure DEC will be completely unhappy.

Let's face it, from DEC's point of view, we may be a valuable resource but we're also trouble-makers. Does this make sense to the rest of you?

Geoff Brunkhorst: I'll second the motion [Phil]. I agree! Second, if DEC would stop taking my boss to lunch to try to sell him another $400,000 VAX/HSC70 combo, and instead listen to us and find out the "installed" base is clamoring for more good tools and the ability to use DEC's hammer with SI's nails, we *could*, and *would*, build better stuff than if we used all DEC "solutions."

Cooperation: DEC cooperated with users, and with VARs and OEMs, and it was good. Now we see DEC looking to compete with IBM, using IBM's rules of competition; i.e., "Go for the big sales, the total packages, the 'DEC only' solutions, . . . the *profit margin*!"

We watched RSTS suffer through DEC's marketing decisions. "VMS upgrade" was their answer to just about all questions concerning RSTS/E. Many of us upgraded. Now they say, "Sorry, the BI technology is only for those who swear allegiance to DEC, its peripherals, its maintenance, and its software."

I think I hear DEC saying "Let them eat cake!" The question is, do we eat, or do we revolt? Do we march to the drums of DEC's marketing staff, or does DEC march to ours? I suggest bloody revolution!

Phil Anthony: Geoff, I'm reasonably sure there's *already* a revolution under way within DEC, though as a consultant to end users I personally hope it isn't too bloody — bad for business, y'know. What I'm most concerned about is that before the revolution is over, DEC may have faded from "No. 2 and trying harder," to No. 22 and in serious trouble. They already lost one VAX client of mine, in part, because of the closed-architecture and DEC-knows-best

attitude. The client just wasn't going to treat the current peripherals as paper plates, and sit around wondering whether the new peripherals would be disposable too, in three or four years.

It's interesting you should mention RSTS. I have regular work from two RSTS sites, currently. These PDP-11 systems are very supportable, and you don't have to love dollar signs to use them — especially on RSTS V8 with *Patch Kit G*. So despite DEC's seemingly official marketing direction, RSTS is alive and well and living in some new, well-made, open-architecture systems. Assuming Cluster-11 makes it to market, I'm looking forward to upgrading a couple of RSTS systems to VAX-8200 or -8500 size; DEC already has thrown up its collective hands on conversion of the applications to VMS.

And as for dinosaurs like thee and me, well, we'll always have work. I also have PC network clients and some UNIX/XENIX jobs. Amazing how a RSTS background helps bridge clients from single-user to multiuser systems!

Vic Dura: Bravo! Well said, Geoff!

Phil Anthony: "Most other products that connect PCs to VAXs require a degree of familiarity with operating systems to implement." — Vern Poulter, DEC marketing manager for office automation, justifying the high price of PC All-IN-1 ("PC All-IN-1 Cost Jars Users," *Digital Review*, September 15, 1986, page 6).

Does this sound like an offering from a company trying actively to reach and serve a customer base of knowledgeable end users? I just wonder who they think is going to manage the 30-user (maybe) PC All-IN-1 system on the MICROVAX II they sell it with, if their justification is that you don't have to know how to SET TERM and create a handful of user accounts and/or directories.

Speaking of PCs, how far is the expensive VAXmate going to get in the

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face of the list price of the IBM PC/XT-286? The two machines are apparently comparable, right down to the s-l-o-w disk drives, and systems like the Sperry PC/IT, with 40 MB of reasonably speedy hard disk, can be had for the same price or less. Well, maybe VAXmates will sell to people who lack "a degree of familiarity with operating systems." Or, maybe DEC will renege and refuse to sell the Ethernet hardware and software without a VAXmate.

Gus Altobello: I hear a lot of outrage and anger at DEC for its present marketing practices, but I feel some sympathy is in order. DEC is no longer the techie-oriented computer company we all knew and loved, but this was not necessarily planned by them. Like it or not, they *are* in competition with Big Blue. IBM has never been known as a friendly sparring partner. DEC seems to be going for a "leaner and meaner" approach toward pushing its products. What it seems not to realize is that I don't use IBM, by choice — I've been a DECie for some years now and do *not* want it to get too patriarchal.

I wonder, considering where DEC is located, if it hasn't been overrun by MBAs toting huge printouts of detailed statistical analyses of IBM's past marketing strategies.

In any event, my company is a "corporate account" and our new DEC salesperson is a WONDERFUL improvement over past experiences. We get new product information in a timely manner, the information generally is directed at the proper technical level, and ordering and contractual screw-ups are handled as never before! I like what I see DEC doing in the technical realm, and hope for bigger and better things in the future.

If only they see the level of antagonism their causing in time to ease it, they indeed may surprise everyone. If DEC stopped chasing BI third parties, eased up a bit on all this "unbundling" and that sort of thing, I think all the flak would disappear in a week. (Well, *some* of it — we have to have *something* to do at DECUS.) ■

Editor's Note: Be sure to see a demonstration of ARIS at DEXPO East in New York City, December 17 to 19, 1986, at the Javits Convention Center, Booth 811. For further information, see "Marketplace," page 168.

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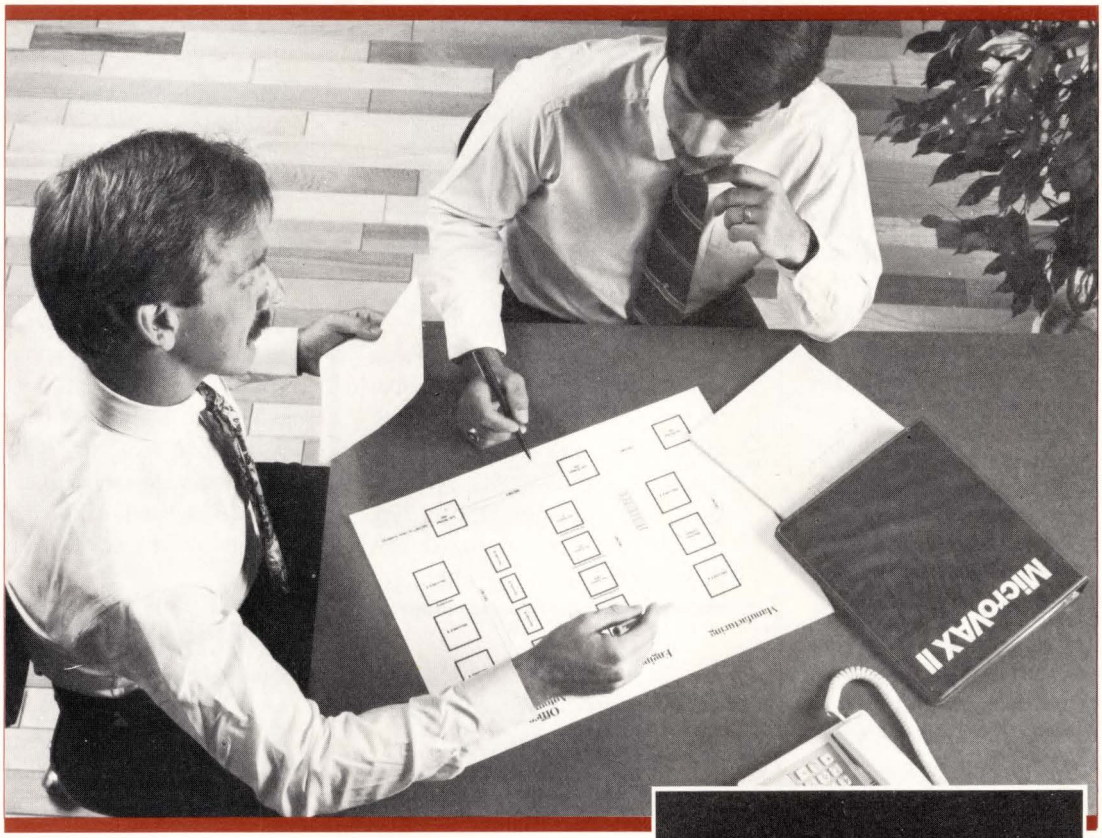

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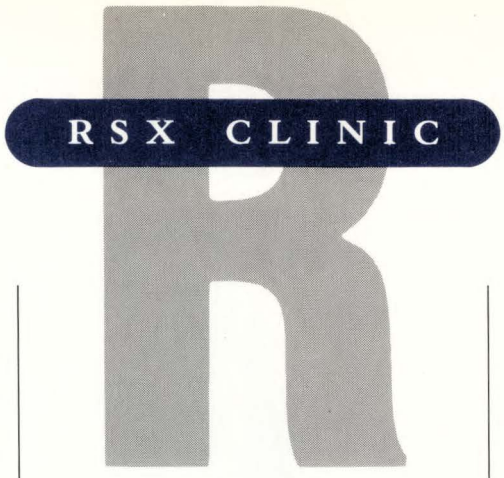

USING ODTs

Question: How do I use ODT with overlaid tasks? We are having trouble getting ODT to set breakpoints in an overlay. We set a breakpoint and either it doesn't happen or the breakpoint happens in the wrong place. Any ideas?

Reply: When using ODT with overlaid tasks, you have to make sure that the overlay in which you want to set the breakpoint is both in memory and mapped by the memory management hardware. This principle holds for both disk-resident and memory-resident overlays, and for both ODT and the DEC Debugger. When using ODT, you have a choice of two techniques. The first is simply to insert BPT (Breakpoint Trap) instructions into the code path you wish to debug. In MACRO-11, this can be done by editing BPT instructions into your code and then re-assembling the code. You might want to control the inclusion of BPTs by using conditional assembly, such as:

```
D$$BUG = 0
        ; enable debugging breakpoints
        ; (comment out to remove)

.IF DF D$$BUG
BPT
.ENDC
        ; Is debugging enabled?
        ; if this assembles, yes.
```

If you're debugging a high-level language using ODT, you can place the BPT instruction in a MACRO subroutine called from the high-level language. The address of the calling routine will then be placed on the top of the stack for you by the JSR PC,xxx instruction.

If you're one of those people who is opposed, either in principle or by fiat, to including debugging code, then you can use the following procedure. You'll need a full Task Builder Map in order to do this, so recreate the map using the /MA switch on the Map File. Assuming that your task is built as a set of subroutines configured as Autoloaded Overlays, do the following:

1. Set a breakpoint on the entry point of the routine you wish to debug. Make sure you look up the exact value of the entry point. You'll find it in the root segment of your task. (Why is it in the root? TKB has done a little hand-waving here, and has created an alias entry point for your subroutine. The alias invokes the overlay loading run-time routines before branching to your code. This same run-time routines will determine if the segment being called is resident and will initiate an overlay load if it is not. With memory-resident overlays, these routines invoke the memory management [(PLAS)] directives to remap the hardware to map the invoked subroutine into the task's virtual address space.)
2. Place breakpoints on both $ALBP1 and $ALBP2 in your task, and then issue the Proceed ('P' command) in ODT. These are entry points in the overlay loading routines. One will be called if your subroutine must be loaded; the other will be called if not. When you hit the breakpoint at either $ALBP1 or $ALBP2 you know that your subroutine is now mapped.
3. Place breakpoints as necessary in the subroutine you wish to debug. It is now in memory and mapped, and the breakpoints will be correctly inserted.

By James McGlinchey

I respond to those questions that are both interesting and applicable to the general RSX user. Please mail your questions to: RSX Clinic, DEC PROFESSIONAL, P.O. Box 503, Spring House, PA 19477-0503. Questions also can be submitted through ARIS.

IO.RPR FUNCTION PROBLEM

Question: We are using the M-PLUS version 3.0 Pregenerated Distribution Kit and are having problems with the IO.RPR function. I tried issuing an IO.RPR (Read-after-Prompt) QIO to the console terminal, which had been set up to have a scrolling region containing the current line. This worked until the operator made a mistake when entering a number, and hit the DELETE key. Whenever the operator depressed the DELETE key, the terminal driver would not interpret the key. I then tried a Read Logical Block QIO with the same result. I finally had to handle each individual, etc. . . . .

Is the pregenned terminal driver limited in handling standard terminal function keys? I know that a fully genned system has options that can be selected to supply this.

Reply: I'd really need to know the characteristics of the terminal you're

having trouble with. Since it's the console and you're using the pregenerated kit, make sure that TT0: is set up to be a CRT, using the

$SET TERM CRT TT0:

or

$SET TERM VT2XX TT0:

commands. I also assume that the DELETE key on your console otherwise operates correctly, i.e., that there are no parities or other discrepancies between the terminal line characteristics (what RSX expects you to send) and the actual device (what you really send). The RSX-11M-PLUS Pregenerated Distribution Kit has exactly the same Terminal Driver as M-PLUS, namely the Full-Duplex TTDRV. It has all the options installed.

A couple of other things in your letter bother me, however. M-PLUS has had at least three sets of patches distributed for it. You should be getting a new pregenerated kit every time a patch distribution is made. Some problems have been reported with the TTDRV, and you may be using some exotic combination of terminal characteristics that would cause this malfunction. You also report that you are using the IO.RLB function when reading from terminals. All terminal I/O functions should be done with IO.RVB (Read Virtual Block) and IO.WVB (Write Virtual Block) where possible. An IO.WLB from a privileged task inadvertently sent to a LUN directed at a disk instead of a terminal could badly corrupt your disk.

PDP-11/74

Question: I've been looking at the source code for the M-PLUS executive and have discovered a lot of code conditionalized on M$$PRO, the conditional for multiprocessor support. Does DEC have a multiprocessor version of the PDP-11?

Reply: I guess we have a new generation of RSX users out there who have not heard about the PDP-11/74, a symmetric multiprocessor implementation of the PDP-11/70. DEC built a couple of them in the late '70s, and still is using at least one of them. It's being used as the development host for all RSX development, and that's why the multiprocessor code still is in the the Exec and still is being maintained actively. The PDP-11/74 never was introduced as an official DEC product, but DEC has posed many pointed questions on this very subject during the DECUS Symposia, and rumors persist about a multiprocessor Q-bus prototype with J-11-based processors, existing somewhere up in New Hampshire.

ANNUAL INDEX

This index, which is arranged both by title and author, begins with Volume 4, Number 12 (December 1985) and ends with Volume 5, Number 11 (November 1986).

To locate articles in Volume 1, Number 1, through Volume 4, Number 11, please refer to the Cumulative Index, *DEC PROFESSIONAL*, Volume 5, Number 1 (January 1986), page 150.

In addition, a cumulative index is available in full on ARIS. For information on dialing in, see page 150.

AUTHOR V.N.P.

■

MARKETPLACE

Inventory System Helps Research Facilities

DEC PROFESSIONAL erroneously listed the address for Integrated Systems in its October issue.

Integrated Systems' Requisition Fulfillment and Inventory Control System is designed to generate requisitions and manage intra-company inventory. It is suited for research and development facilities in government, industry, and universities where material and supply inventories are maintained and must be available on short notice to technicians and researchers.

The system allows for generation of both stocking and non-stocking requisitions. Requisitions can be entered by the initiating department or cost center using a simple entry module.

The system runs on the VAX computer family using the VMS operating system. Integrated System's correct address is P.O. Box D, 170 Algonquin Parkway, Whippany, NJ 07981; (201) 884-0892.

Enter 901 on reader card

AMC Introduces V-X MASTER

American Management Company, Inc.'s (AMC) new V-X MASTER is the first complete line of system management products for VAX and MicroVAX computers running under the VMS operating system. V-X MASTER is a single software system offered in three implementations — V-X MASTER I, V-X MASTER II and V-X MASTER-VAR.

V-X MASTER I is designed for VAX or MicroVAX computers in professional settings, such as an office or engineering environment, where the system is not managed by a full-time data processing person. V-X MASTER I provides a menu-driven user interface to the VMS operating system that helps a less sophisticated user manage a VAX system.

V-X MASTER II is a sophisticated software tool for data processing professionals managing VAX/VMS systems. V-X MASTER II allows a manager to implement Structured System Management, a standardized approach to managing multiple VAX systems in a data center environment and remote sites.

AMC allows software developers to customize V-X MASTER I or II and include it as part of their software products. V-X MASTER-VAR allows software developers to provide a complete system management solution with their products.

V-X MASTER I and II and V-X MASTER-VAR Version 1.0 will be available December 1, 1986. Version 2.0 will be available in the spring of 1987. A commercial license for a MicroVAX, including first year support, is $3,000 for V-X MASTER I and $3,500 for V-X MASTER II. Site licenses are available.

Find out more by contacting American Management Company, Inc., 420 Bedford St., Lexington, MA 02173; (617) 861-6262.

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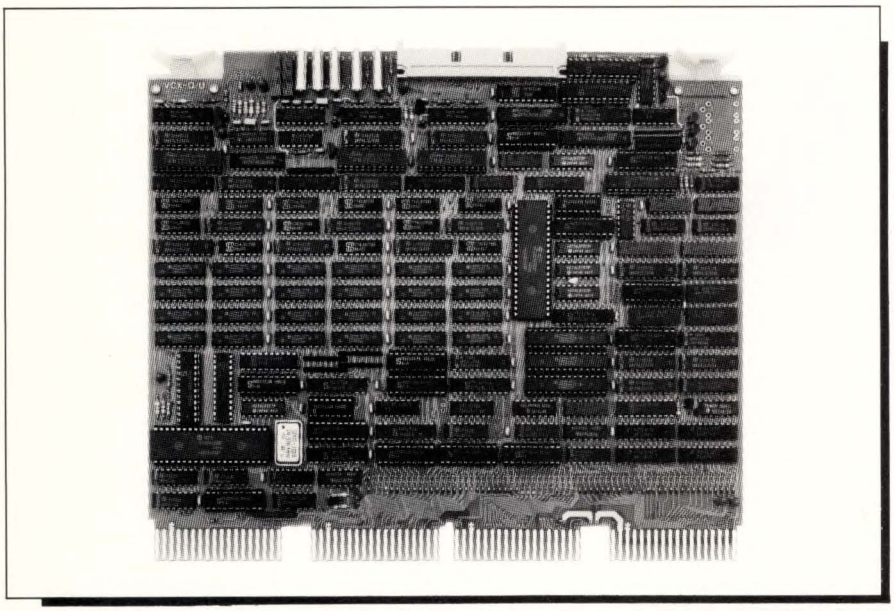


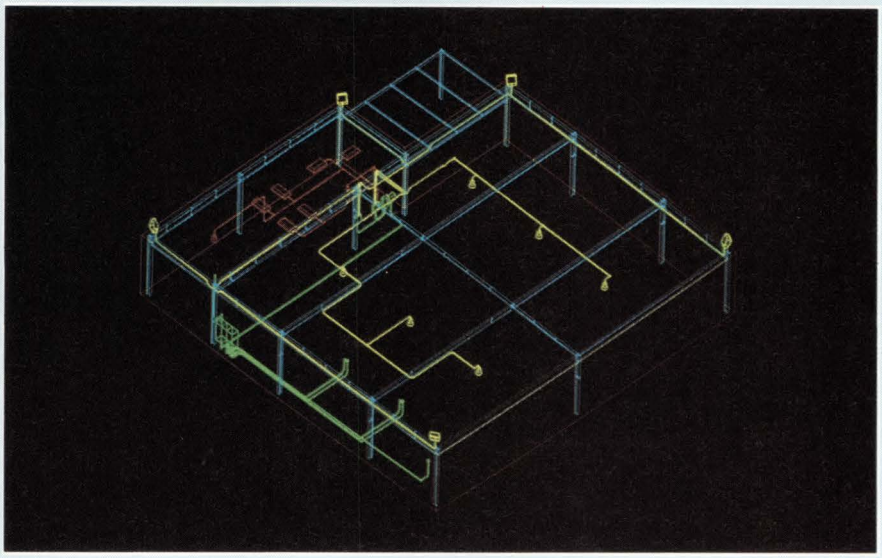
Peritek's new color graphics board, the VCX-Q/U, is the first single board able to create images 24 planes deep with an alphanumeric overlay.

Peritek Releases Color Graphics Board

Peritek's new color graphics board for DEC computers is the first single board able to create images 24 planes deep with an independent alphanumeric overlay. The VCX-Q/U board displays any of 224 or 16 million different colors at any moment, giving the user immediate access to all hues discernible to the human eye. The board is a quad-height size configurable for either Q-bus or UNIBUS computers.

Principal applications are sophisticated imaging, process control, simulation, and presentation graphics. The graphics display consists of 512 x 512 pixels. The color of each pixel is determined by 8 bits each for red, green, and blue. Each 8-bit set is generated by an independent frame buffer and look-up table, permitting maximum flexibility in color selection.

The independent memory-mapped



3-D Raceway Modeling Added To Dimension III

The new Electrical Raceway Layout and Design System from GE Calma is suited for modeling cable trays, conduits, channels and cable vaults in 3-D. The system is fully compatible with Calma's DIMENSION III interference checking capabilities and with all other DIMENSION III application packages. It runs on the VAX, and the MicroVAX II.

Here, 3-D electrical raceway elements are shown in yellow and green. For more information, contact Calma Company at 501 Sycamore Drive, Milpitas, CA 95035-7489; (408) 434-4000.

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alphanumeric overlay consists of 50 lines x 80 characters. The user has a choice of 64 character colors and 64 background colors, all independent of graphics colors. The character set is stored in RAM and is user-programmable.

Software available includes test routines, initialization routines, and a micro-level subroutine library for C and FORTRAN. Delivery is 45 days ARO. The price is $5,895. Additional information may be obtained from Peritek Corporation, 5550 Redwood Rd., Oakland, CA 94619; (415) 531-6500.

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New Operation Develops FASTPATH System

Intel Corporation's new business unit, the Systems Interconnect Operation (SIO), develops, manufactures and markets high-performance connectivity products. SIO is part of Intel Development Operation (IDO). IDO is responsible for Intel's new business opportunities and its activities include Intel Scientific Computer and the Personal Computer Enhancement Operation.

SIO's first product, FASTPATH, is a hardware and software system. It acts as a high-speed interface between IBM and plug-compatible manufacturers' mainframe computers, and Intel MULTIBUS-based original equipment manufacturer (OEM) applications.

OEMs can choose from more than 1,350 MULTIBUS modules for customizing FASTPATH applications. These applications include local area networks for personal computers, engineering workstations and graphics terminals; special peripherals, such as optical disks or satellite communications controllers; and other host computers, such as another IBM mainframe or DEC minicomputers.

The FASTPATH connection supports the data streaming option to allow a 3-MBps data transfer rate for IBM mainframe channels. In addition, FAST PATH supports slower non-data streaming data transfer rates. An optional two-channel switch connects either two channels to one processor, one channel on each of two processors.

Delivery of FASTPATH is 90 days ARO. The list price is $32,000. The cost for the optional two-channel switch is $4,000. For more information, contact Intel Systems Interconnect Operation, 2402 West Beardsley Rd., Phoenix, AZ 85027, or contact Sue Kenny at (602) 869-4806.

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Advanced Technology Develops Phoenix-PMS

Advanced Technology, Inc. developed a microcomputer-based family of program management software packages designed to support government and industrial project managers in complete project management, analysis, and control.

The PHOENIX-PMS Project Management System allows users interactive access to specific project data using graphics, query techniques, high-quality plotted color graphics output, and document-quality reports. The PHOENIX-PMS was designed to run on the VAX, MicroVAX, and Professional series, and has passed DEC's Digital Classified Software (DCS) program.

Four software packages currently are available. The "Network Analysis" package performs critical path analyses, project planning, and what-if analyses. The "Milestone Tracking" package was designed for situations calling for up-to-date printed reports of project status, including planned versus actual start and finish, and percent completion.

The "Milestone Plotting" package augments traditional methods of schedule planning and reporting by allowing for specific activity and milestone schedules with the amount of detail required to adequately monitor projects. At the end of a project, a completion status plot indicates the precise number of days a specific activity took, which gives the necessary data to begin networking the next task.

The "Financial Analysis" package enables users to quantify budgets, schedules, and work done compared to dollars spent and was developed in accordance with government cost reporting requirements. This package allows for a common language that can be used by all levels of management to evaluate cost and scheduling problems. Further information is available by contacting Advanced Technology, Inc., Two Shaw's Cove, Suite 205, New London, CT 06320; (203) 444-2211.

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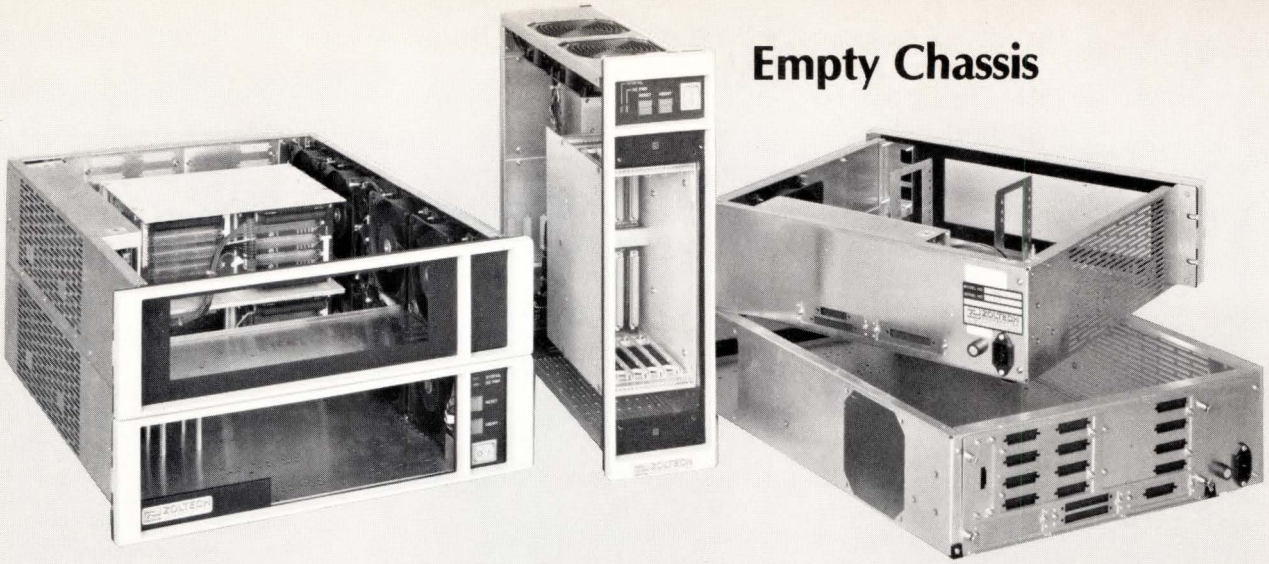

Empty Chassis

Q-BUS AND VME SYSTEM PACKAGES

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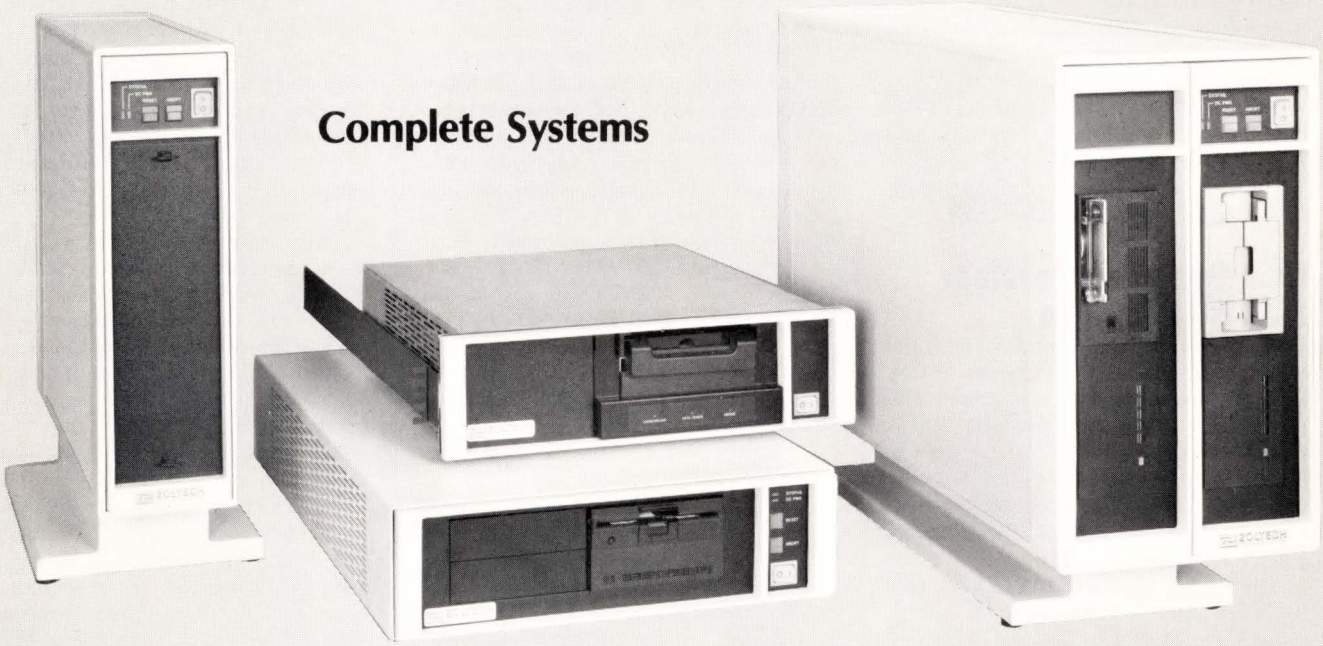

Complete Systems

Zoltech's modular design allows literally thousands of configurations to be built with its V-series family of system chassis. Zoltech will deliver anything from empty metal shells to completely tested turnkey systems: You decide what you want to do and Zoltech will do the rest. Q-Bus and VME systems are our specialty, but we also do custom designs.

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Representative and dealer inquiries are invited.

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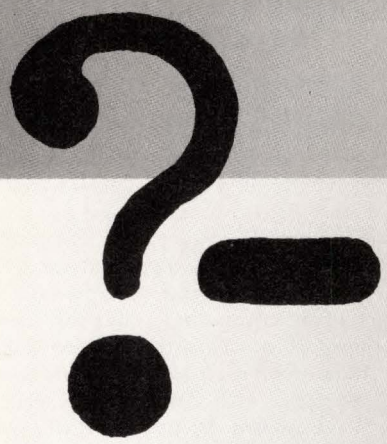
IF/Prolog



Prolog may be a powerful programming language– but it's much too slow for AI-applications, isn't it?

The IF/Prolog Compiler speeds your application up to 175 KLIPS*. And the effectivity of it's user environment can't be measured, only experienced!

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InterFace Computer GmbH

DEXPO East '86 Exhibitors and their Products

***DEC PROFESSIONAL* previews some of the products you'll see displayed at DEXPO East at the Jacob K. Javits Convention Center in New York, December 17-19.**

TAB Unveils Systems-Plus

The new Systems-Plus from TAB Products Company is designed to work on DEC VT100 and VT220 terminals and their clones. It's a microcomputer designed to run IBM PC/XT programs. The terminal becomes the keyboard and the monitor of the microcomputer as well as the terminal on the existing network.

The Systems-Plus won't affect communications between the host computer and the terminal. It allows you to unload the host of some jobs, such as word processing and research work using spreadsheets. Prices start at $1,195 for single units.

For more information contact TAB Products Co., 1400 Page Mill Rd., Palo Alto, CA 94304; (415) 852-2400, or stop by Booth No. 1150.

Enter 907 on reader card

IMSL Has PROTRAN For MicroVAX

IMSL released PROTRAN for MicroVAX I and II computers running the VAX FORTRAN compiler, under MicroVMS.

PROTRAN is a comprehensive problem-solving environment with modules for mathematics, statistics, partial differential equations and linear programming. These modules are available individually or in any combination, according to the user's requirements.

The PROTRAN environment modules include MATH/PROTRAN for general mathematics, STAT/PROTRAN designed for statistical analysis and data management, PDE/PROTRAN for partial differential equations, and LP/PROTRAN for linear programming.

An annual license ranges from $1,700 to $2,000. A paid-up license ranges from $8,100 to $10,000. IMSL offers reduced prices to educational institutions and substantial discounts on orders of two or more of the same product.

Find out more by contacting IMSL Sales Division, 2500 ParkWest Tower One, 2500 CityWest Blvd., Houston, TX 77042-3020; (713) 782-6060. TELEX 791-923 IMSL INC HOU. Outside Texas, call (800) 222-IMSL. Visit Booth No. 1243.

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RTFILE Driven By Command Procedures

Contel Business Networks' RTFILE, its proprietary interactive relational database management system, now can be driven by command procedures and batch processes on the VAX and MicroVAX under VMS. Using the VAX system editor, command procedures can be created that allow users to either interactively communicate with RTFILE at a predefined point; or submit an RTFILE command procedure for execution by the VMS batch processor while the user continues with other interactive or additional batch tasks.

In addition to the VAX and MicroVAX VMS versions, RTFILE is available on the PDP-11s under RT-11, TSX-Plus, RSX-11M/M+, MicroRSX, RSTS; the PRO 350 under P/OS; the Rainbow under MS-DOS; and on the IBM PC and compatibles under PC-DOS. For additional information, contact Judith Mangels, Contel Business Networks, 4330 East West Highway, Suite 200, Bethesda, MD 20814; (301) 654-9120; or stop by Booth No. 851.

Enter 910 on reader card

Artel Unveils FiberWay LAN

Artel Communications Corporation's newest development, FiberWay, is the first fiber optic, digital, broadband local area network. This high-speed (up to 200 MBps) network includes network interfaces and network management software that supports a multivendor environment. FiberWay uses ring topology and digital time division multiplexing to combine industry standard compatible services such as Ethernet on a single fiber.

Complete details are available by contacting Artel Communications Corporation, P.O. Box 100, West Side Station, Worcester, MA 01602; (617) 752-5690; or stop by Booth No. 646.

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DEC PRO To Demonstrate ARIS Bulletin Board

Professional Press, Inc., publishers of *DEC PROFESSIONAL* and *VAX PROFESSIONAL* magazines, will exhibit its Automated Reader Information Service (ARIS) bulletin board at DEXPO East.

Several terminals donated by terminal manufacturers and suppliers will be connected to a MicroVAX II running ARIS. DEXPO attendees will have the opportunity to access the bulletin board, which provides readers of *DEC PROFESSIONAL* and *VAX PROFESSIONAL* with editorial, advertising, and used equipment sales information.

To learn more, stop by Booth No. 811, or contact Professional Press, Inc., P.O. Box 503, Spring House, PA 19477; (215) 542-7008.

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East Coast To View Training Product

ERI Training presents the East Coast debut of its newest video training product called *VAX/VMS FOR PROGRAMMERS.*

VAX/VMS FOR PROGRAMMERS is a series of eight videotapes and a comprehensive workbook designed to teach the programmer or computer-literate user to perform intermediate and advanced tasks under VMS. The series is language independent and covers a wide variety of topics essential to the VMS programmer.

ERI Training offers a free two-week

preview. Customers can contact ERI and receive any full-length tape module of their choice, along with the corresponding workbook chapter, to review before they purchase.

The complete *VAX/VMS PROGRAMMER* series is available in three formats: ¾-inch U = matic, VHS, and Beta. The cost of the series, including five copies of the workbook, is $4,950. Discounts are available for multiple purchases and educational institutions.

For further information, contact ERI Training, 462 Broadway, New York, NY 10013; (212) 334-1240; or stop by Booth No. 843.

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SPSS To Show At DEXPO East

SPSS, Inc. will feature SPSS-X Track and SPSS-X capture for DATATRIEVE at DEXPO East.

SPSS-X Track, an option to SPSS-X, is designed to make the management of VAX/VMS systems easier and more efficient. SPSS-X Capture is an interface to DEC's DATATRIEVE. The interface joins two frequently installed software systems at VAX sites and means that the powerful data analysis and reporting capabilities of SPSS-X may be applied to data stored and managed by DATATRIEVE.

For more information on SPSS products for VAX environments, contact SPSS, Inc., Marketing Department, 444 North Michigan Ave., Chicago, IL 60611; (312) 329-3500; or stop by Booth No. 942.

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DIGITAL VILLAGE Open For DEC Users

Global Villages, Inc. opened DIGITAL VILLAGE, the first worldwide information network for users and providers of DEC and DEC-compatible products.

Accessible with any modem-equipped computer by phone call from thousands of cities worldwide, DIGITAL VILLAGE brings together hundreds of services in one place, 24 hours a day, 365 days a year. It offers interactive catalog purchasing of software and equipment, online special interest groups for VMS, RSX, RSTS, TOPS, and 10 other areas of specific interest, downloadable software, and many other features designed for particular applications and operating environments.

For more information, contact Global Villages, Inc., One Kendall Square, Cambridge, MA 02139; (617) 494-0189; or stop by Booth No. 1210.

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TEC Offers 15-day Evaluation

TEC Inc. currently is offering a free 15-day evaluation of the company's DATA-PAD portable LCD visual display terminal, the Model DP84.

The fully functional DP84, which operates like a large CRT desktop terminal, provides top performance in a small, notebook-sized case.

The DP84 has a footprint of 11.8 inches by 8.8 inches, is 1.4 inches thick and weighs only 3.25 pounds. The portable terminal features a full-sized typewriter-style full-travel keyboard, including 10 programmable function keys, and is compatible with the VT100 terminal.

In single unit quantity, the DP84 is priced at $995 with immediate shipments. Quantity discounts are available.

To order and sign up for the free evaluation

period, contact the Peripheral Sales Group, TEC, Inc., 2727 N. Fairview Ave., P.O. Box 5646, Tucson, AZ 85703; (602) 792-2230; or stop by Booth No. 648.

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Emerson Completes UPS Strategy

Emerson Electric Company completed its plan to provide UPS for all computers, from micro to mainframe. With the recent addition of the AP300 series, AP100 series and AP1000 series, Emerson now can provide power protection from 275VA (200 Watts) up to 400kVA.

Emerson's AP1000 series is designed for the needs of the business and professional microcomputer user. This system constantly monitors incoming power suppressing high-voltage spikes and surges, filtering power line noise, as well as tracking power line voltage. When the voltage drops, commonly called a brownout, the system immediately transfers to its backup battery power source to maintain the output voltage. As incoming power voltage returns, the system monitors the level and after it stabilizes, returns the computer to filtered utility power. This same action also is performed during complete power outages (blackouts).

For more information, contact Emerson Electric Co., Industrial Controls Division, 3300 S. Standard St., P.O. Box 1679, Santa Ana, CA 92702-1679; (714) 545-5581, Telex: 67-8460. Stop by Booth No. 542.

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Mercury Adds To ZIP Line

Mercury Computer Systems added a 20 MFLOP array processor to its ZIP 3200 series product line. The ZIP 3232-20 will be available in early 1987.

The ZIP is a board-level system for Q-bus, Multibus, and VMEbus. It incorporates the functionality, software utilities, libraries and performance of chassis-based systems offered by Floating Point Systems.

The system is available for all popular micros including the MicroVAX. Pricing for the 18 MFLOP version is $18,000 with quantity discounts available to 35 percent. Additional information is available from Mercury Computer Systems, Inc., Wannalancit Technology Center, 600 Suffolk Street, Lowell, MA 01854; (617) 458-3100; TELEX 311-515 MERCOMP LOWE. Stop by Booth No. 704.

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Graphic Outlook Links To LOTUS

Stone Mountain Computing's Graphic Outlook, its VAX/VMS spreadsheet/slidemaker program, now reads and writes LOTUS 1-2-3 spreadsheets, allowing users the flexibility to move their spreadsheet work back and forth between PCs and VAXs. Release 4 of Graphic Outlook includes a Lotus Mode of operation that presents a user interface nearly identical to that of LOTUS 1-2-3.

The company also announced that Graphic Outlook now links to user-written programs to perform complex calculations. User programs can request inputs from the operator, values from the spreadsheet as well as store data back into the spreadsheet.

Demonstration tapes are available from Stone Mountain Computing Corporation, 1096 Cambridge Drive, Santa Barbara, CA 93111; (805) 964-9101.

A program demonstration can be seen at DEXPO East '86 in Booth No. 411.

Enter 918 on reader card

Access Tech Expands 20/20 Spreadsheet

Access Technology, Inc. will demonstrate the newest release of 20/20 at DEXPO East.

Enhancements to 20/20 include optional letter/number cell notation, advanced macro capabilities, cell naming, and interfaces to industry-standard database programs.

20/20 runs on the VAX, MicroVAX, Rainbow and Professional series. 20/20 offers an advanced spreadsheet with up to 1000 x 1000 cell matrix that integrates with graphics, database management and project modeling facilities.

To find out more, call Access Technology, Inc. at (617) 655-9191, or visit Booth No. 428. Access Technology is located at Six Pleasant Street, South Natick, MA 01760.

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Compu-Share Introduces Purchase Order Package

Compu-Share, Inc.'s newest accounting package, Purchase Order, integrates with accounts payable, job cost and inventory control.

Future cash commitments are posted to AP, GL and JC as purchase orders are written to control future liabilities. The software offers tailoring codes to customize characteristics without modifying the DIBOL source code. The financial statements incorporate an interface to a spreadsheet system for financial modeling and forecasting.

Software is offered on VMS, MicroVMS, RSTS/E, RSX-11M+ (A-to-Z), and MicroRSX (A-to-Z).

Find out more by contacting Compu-Share, Inc., 5214 68th Street, Suite 200, Lubbock, TX 79424; (806) 794-1400; or stop by Booth No. 818.

Enter 920 on reader card

Primavera Ships Primavision Version

Primavera Systems, Inc. completed shipping Version 1.7 of its Primavision plotter graphics software package to registered users. Primavision generates presentation quality, time-scaled bar charts and network logic diagrams. The plotter graphics uses project schedules developed in Primavera's project management software, Primavera Project Planner.

Primavision is priced at $1,500 and Primavera Project Planner is priced at $2,500. Both software products require 512K, a hard drive and MS-DOS/PC-DOS 2.0 or greater. Versions of both are available for the VAX series under VMS operating system 4.1 or greater.

For more information, contact Diane Dempster, Primavera Systems, Inc., Suite 925, Two Bala Plaza, Bala Cynwyd, PA 19004; (215) 667-8600; or stop by Booth No. 1159.

Enter 921 on reader card

Cluster To Show Power-11

Cluster Technology Corporation will exhibit the Power-11, which is designed to enhance the performance of PDP-11 series minicomputers, at DEXPO East.

The Power-11 enhances PDP-11 performance by expanding its uniprocessor architecture to include J-11-based application coprocessors — DEC's PDP-11/70-on-a-chip in a tightly coupled multiprocessor arrangement. I/O processors and a high-speed disk cache augment system throughput in a Power-11 configuration.

The add-on is available for existing PDP-11 minis using UNIBUS or a Q-bus architecture. The Power-11 environment is controlled by sophisticated firmware system software to provide an invisible interface between it and RSTS/E. Current applications run unmodified with the Power-11 providing a performance boost for increased throughput.

Additional information is available by contacting Cluster Technology Corporation, P.O. Box 455, Berlin, NJ 08009; or stop by Booth No. 514.

Enter 922 on reader card

MOD-TAP Compatible With DECconnect

MOD-TAP System announced compatibility of its Communications Wiring system with DEC's DECconnect system.

DECconnect is DEC's solution to building communications wiring. Among its new twisted pair features are a Modified Modular Jack (MMJ) for data that is a slight modification of the standard voice modular jack and provides two compatible but not intermateable polarizations for user-proof segregation of voice and data, and a wiring standard that now handles RS-232 and will handle RS-423 in the future. The full MOD-TAP System product line, including patching, harmonicas, adapters, wall plates, and test gear is DECconnect compatible.

Complete details are available from MOD-TAP System; Harvard, MA 01451; (617) 456-3500, Telex 951-369, FAX +1-617-772-2011. Visit Booth No. 20.

Enter 934 on reader card

ACCENT R 4GL Supports VAX RMS Files

National Information Systems, Inc.'s (NIS) ACCENT R fourth-generation language and DBMS now is compatible with the native VAX RMS file structure. This compatibility means that VAX users can integrate 4GL applications written in ACCENT R with existing VAX applications without reloading or restructuring any data files.

Most VAX users have applications that are written in native VAX products such as FORTRAN, COBOL, BASIC, and DATATRIEVE. All these products use VAX RMS files. Most database and 4GL products for the VAX, including ACCENT R, use proprietary non-RMS files, which means they are not compatible with existing applications without a major rewrite. This new feature of ACCENT R allows ACCENT R to directly read and write RMS files, with full compatibility and functionality.

For more information on ACCENT R, contact National Information Systems, Inc., 20370 Town Center Lane, Suite 130, Cupertino, CA 95014; (408) 257-7700; or stop by Booth No. 14.

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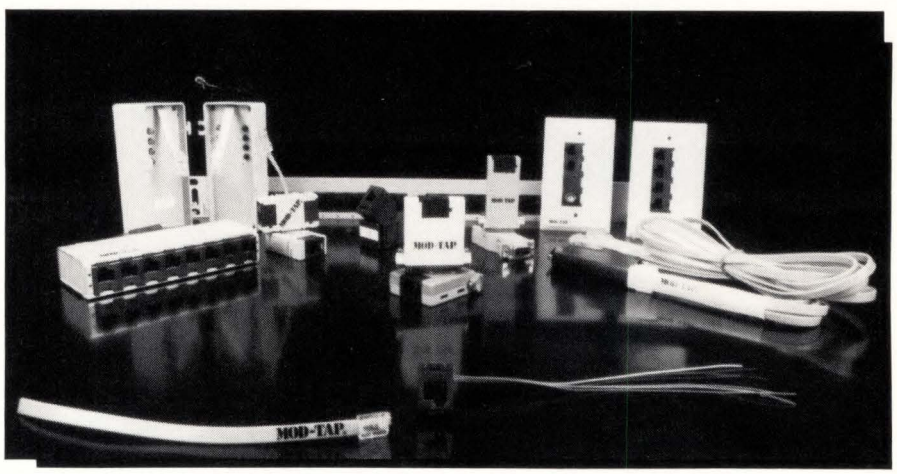

The full MOD-TAP System product line is compatible with the DECconnect System.

DEC Directory To Be Displayed

Computer Management Research will display its directory of DEC installations at DEXPO East. Over 5,000 computer users in 14 states can use the comprehensive data on hardware, software and use, indexed by 137 cross-references. It includes DP users by name, title, company and industry.

The 14 states are Connecticut, Washington D.C., Delaware, Maryland, Massachusetts, Maine, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Virginia, Vermont and West Virgina. For additional information, contact Fay Greenfield, Computer Management Research, Inc., (212) 683-0606. Computer Management Research is located at 20 Waterside Plaza, New York, NY 10010-2643. Visit Booth No. 844.

Enter 923 on reader card

Digital Data Expands VAX Memory Line

Digital Data Systems, Inc. will showcase its full product line of VAX compatible memory boards at DEXPO East.

On display will be its newly introduced 4-MB and 16-MB memory boards, which are fully compatible with the VAX 8600 and 8650. In addition, Digital Data Systems will show its 4-MB and 8-MB boards for the MicroVAX II, 1-MB and 4-MB boards for the VAX 11/780 and 11/785, and 1-MB boards for the VAX 11/730 and 11/750.

Complete details are available from Digital Data Systems, Inc., 1551 N.W. 65 Ave., Plantation, FL 33313; (305) 792-3290; or stop by Booth No. 1146.

Enter 925 on reader card

GSI Transcomm To Show TELESTREAM

GSI Transcomm will demonstrate its telemarketing software system, TELESTREAM, during DEXPO East. Developed in conjunction with Carnegie Group Inc., TELESTREAM is designed to counsel and assist telemarketing employees during sales encounters.

TELESTREAM is comprised of mini-expert systems or knowledge sources, representing managers from various company departments such as sales, inventory, purchasing and promotions, all interacting simultaneously via a special process known as blackboarding. Each of these various experts has the ability to post information on a central blackboard pertaining to their specific business domain.

TELESTREAM is available for the VAX series of minicomputers and can interface with GSI Transcomm's TOLAS Order Entry software module.

Obtain additional information from GSI Transcomm Data Systems, Inc., 1380 Old Freeport Rd., Pittsburgh, PA 15238; (412) 963-6770; or visit Booth No. 425.

Enter 927 on reader card

ISKRA To Demonstrate New FORMATIX Version

ISKRA Software International's FORMATIX 3.0 is a new version of its fourth-generation product, an easy-to-use application generator for end users running on VAX/VMS systems. In addition, ISI released three FORMATIX-based applications packages: the PROSPECT INFORMATION CONTROL SYSTEM (PICS), the REPAIR AUTHORIZATION SYSTEM (RAS), and the CREDIT COLLECTION SYSTEM (CCS). The applications serve as models for user-designed applications. These packages are available at no extra charge to FORMATIX 3.0 licensees.

FORMATIX allows users to implement applications that collect, manage, and retrieve information in a menu- and query-driven environment. FORMATIX is completely interactive. There are no languages or commands to learn, nor is there any need for a

compiler, linker or editor. FORMATIX generates executable code and is RMS compatible.

For more information, contact ISKRA Software International, 222 Sherwood Ave., Farmingdale, NY 11735; (516) 753-0400; Telex: 221-527 ISKNY UR; or stop by Booth No. 1226.

Enter 931 on reader card

FRIL Incorporates SQL Statements

FRIL, an application development environment for the ORACLE DBMS from FORTEX Systems Corporation is designed to incorporate SQL statements into a powerful 4GL to develop production applications. Written in C, FRIL provides optimal execution time by producing C code.

Within the application development environment, specific utilities include graphics, word processing/document management and report writer. These can be used individually or combined within FRIL.

For more information, contact FORTEX Systems Corp., 1935 New York Ave., Huntington Station, NY 11746; (516) 549-4713; or stop by Booth No. 1251.

Enter 926 on reader card

Nemonix Expands Product Line

Nemonix, Inc. announces the introduction of a complete line of VAX compatible memory boards.

The company is manufacturing and marketing a 4-MB and 8-MB board for the MicroVAX II; a 1-MB board for the 730 and 750; a 1-, 2-, 4- and 8-MB board for the 780 and 785; and a 16-MB board for the 8600 and 8650. In addition, Nemonix is handling special orders, including 1-MB and 2-MB boards for the MicroVAX II.

For more information, contact Nemonix, Inc., 106 South Street, Hopkinton, MA 01748; (617) 435-9087; or stop by Booth No. 1101.

Enter 928 on reader card

Corvus To Feature Workstation At DEXPO

Corvus Systems will demonstrate its new Series 386 high-performance workstation, as well as its complete line of DEC-compatible products, at DEXPO East.

The AT-compatible workstation was the first to be shipped using Intel Corporation's 80386 microprocessor. The power advantages of the Corvus Series 386 become significant when attached directly to a VAX database through a Corvus Omninet local area network.

For a demonstration of the Corvus Series 386 workstation and information about the complete line of Corvus networking products, visit Corvus at Booth No. 13; or contact the company at 2100 Corvus Drive, San Jose, CA 95124; (408) 559-7000; Telex: 278-976.

Enter 929 on reader card

A/V Course Offered At Special Price

Mini & Micro Educational Services' new audio/visual training course for VMS is being offered at a special DEXPO show price of $1,300. *VMS for the Timeshare Programmer* audio/visual training course is designed for a programmer who currently is programming on another machine and will be moving to DEC's VAX/VMS operating system.

For more information, contact Mini & Micro Educational Services, 1030 Congress St., Portland, ME 04102; (207) 773-0316; or stop by Booth No. 457.

Enter 933 on reader card

TAPESYS Manages VAX/VMS Libraries

Software Partners/32, Inc. will exhibit TAPESYS V4.2 at DEXPO. TAPESYS V4.2 manages large tape libraries in VAX/VMS

environments, including VAX cluster and remote DECnet configurations. Magtape database management, security, archiving and easy user backup/restore are characteristics of the system. EBCDIC and ASCII capabilities have been added in this newest version, as has an interface for office users of Digital's All-in-1.

TAPESYS V4.2 is available from $3,000 to $7,600, depending on processor size. The license price includes a one-year warranty. Cluster, site, corporate and academic discounts are available.

For additional information, contact Software Partners/32, 447 Old Boston Rd., Topsfield, MA 01983; (617) 887-6409; or stop by Booth No. 1025.

Enter 932 on reader card

Softool To Demonstrate New CCC Version

Softool Corporation will demonstrate the newest version of its Change and Configuration Control (CCC) environment at DEXPO East.

Version 3.0 provides support for multiple levels of modules, the ability to automatically apply changes from one configuration to another, database and journal integrity checkers, an enhanced Build Facility, a programmable interface to CCC, and the ability to communicate between CCC and the database across the network.

CCC is available for the VAX/VMS, MicroVAX, ULTRIX, and UNIX operating systems. Prices for CCC range from $10,000 to $30,000.

For more information, contact Softool Corp., 340 South Kellogg Ave., Goleta, CA 93117; (805) 964-0560; Telex: 658-334. Visit Booth No. 442.

Enter 935 on reader card

U.S. Design To Show New Products

U.S. Design Corporation announced two new products that make optical-disk storage accessible to users of DEC systems with Q-bus or UNIBUS backplanes. The 1108-03 and the 1158-03 host adapters emulate DEC's Mass Storage Control Protocol (MSCP), and provide compatibility with all current versions of RSX and VMS software.

The 1108-03 supports the MicroVAX, MicroPDP and LSI-11 Q-bus systems and the 1158-03 supports the VAX and PDP-11 UNIBUS systems.

U.S. Design 1108-03 and 1158-03 products are offered with a utility package that permits backup and restore images to be transferred between optical and magnetic storage devices attached to the same host CPU and operating within the MSCP environment.

Additional information may be obtained from U.S. Design Corporation, 5100 Philadelphia Way, Lanham, MD 20706; (301) 577-2880. Stop by Booth No. 401.

Enter 936 on reader card

RetroGraphics Upgrades Graphics System

RetroGraphics, Inc.'s new version of the VT640 Monochrome Graphics system, the RETROGRAPH ONE, enables IBM

PC/XT/AT or compatible computer systems users to upgrade their system into a powerful graphics workstation. The system costs $2,995, including graphic board, monitor and software.

The RETROGRAPH ONE, with the introduction of a new 1280 x 960 pixel, high-resolution 19-inch monitor, offers users a larger, brighter screen with a non-interlaced display for sharper, clearer images. Operating at one million pixels per second, the RETROGRAPH ONE can plot a drawing, including circles and complex curves over 10 times faster than the original VT640.

Compatible host systems include VT100, DOS, Tek 4010/4014, Plot 10 and Hercules Monochrome Graphics.

For more information, contact Robert Loonin, (203) 327-5000 or write RetroGraphics, Inc., 65 Commerce Road, Stamford, CT 06902. Visit Booth No. 747.

Enter 937 on reader card

JEB Systems Enhances MMS Software

A total solution for sales and marketing applications is available with the new release of JEB Systems' Marketing Management System (MMS) for the full line of VAX/VMS, SMB Server, PC All-in-1, VAXmate (and other DOS PCs).

Complete information is available from JEB Systems, Inc., 34 Daniel Webster Highway, Suite 24, Box 16, Merrimack, NH 03054; (603) 883-4662; or stop by Booth No. 1139.

Enter 938 on reader card

DECUS To Participate In DEXPO East

DECUS (Digital Equipment Computer Users Society) will participate in DEXPO East '86. The DECUS services include the national symposia, Local Users Groups, newsletters and software exchange.

The booth at DEXPO will be staffed by volunteer leaders of the Society. It is free to join DECUS.

DECUS is a trademark of Digital Equipment Corporation.

For more information, contact DECUS, U.S. Chapter, 219 Boston Post Road, (BP02), Marlboro, MA 01752; or stop by Booth No. 753.

Enter 940 on reader card

MTI Introduces Dual-Wide Controller

Micro Technology, Inc.'s (MTI) MQD12 Winchester disk drive controller supports up to four 5.25-inch ST506 Winchester disk drives on Q-bus-based computers.

Diagnostic functions including loop back, buffer and a variety of read and seek tests are stored on the controller in non-volatile RAM. Error correction and detection capabilities are inherent in the controller. The controller is designed to compensate for any errors detected on the disk, providing the computer with error-free random access memory.

List priced at $1,495, the MQD12 can be upgraded to support the ESDI interface. The MQD12 is available 60 days ARO.

Find out more by contacting Micro Technology, Inc., 1620 Miraloma Ave., Placentia, CA 92670; (714) 632-7580; or stop by Booth No. 1229.

Enter 939 on reader card

EMC To Exhibit VAX 8650 Memory

EMC Corporation will exhibit its 16-MB memory array compatible with DEC's VAX 8600 and 8650 computer systems at DEXPO East.

EMC has been shipping the board since February of this year and was the first board in the industry to use the 1-MB chip. EMC's product enables the VAX 8600 and 8650 computer systems to address up to 128 MB.

For more information, visit Booth No. 710; or contact EMC Corporation, Natick Industrial Centre, 12 Mercer Road, Natick,

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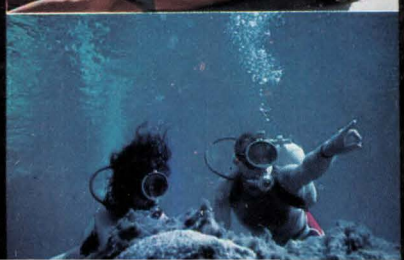

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CDSA To Show In Big Apple

C.D. Smith & Associates, Inc. (CDSA) will attend the DEXPO East '86 convention. CDSA specializes in the VAX product line and buys, sells and rents new and used VAX systems, options and CPUs.

CDSA maintains an extensive inventory of VAX-related items. It will offer specially priced VAX systems and options to qualified buyers during the convention.

To find out more, contact C.D. Smith & Associates, Inc.; 12605 East Freeway, Suite 318, Houston, TX 77015; (713) 451-3112; or stop by Booth No. 452.

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C.Itoh To Show OPCA-11 Subsystem

C.Itoh will exhibit OPCA-11 Laser-Optics disk drive subsystem for VAX, MicroVAX, PDP and LSI computers at DEXPO East.

OPCA-11 is a complete plug-in package that includes UNIBUS or Q-bus controller and software providing the user with 2.6 gigabytes of write-once-read-many-times data storage on each disk. Included is a utility software program that provides the capability to transfer Files-11 data to and from the disk without any modification to the user's current program. Other files are created by FORTRAN callable libraries.

Further information is available by contacting C.Itoh & Co. (America) Inc., 335 Madison Ave., New York, NY 10017; (212) 818-8117; or stop by Booth No. 955.

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Mobius To Debut At DEXPO East

Mobius Micro to Host Integration system for the Apple IIe will be presented by FEL Computing at DEXPO East. The new product allows Apple IIe users to access the same Host Mobius system now available to the IBM-PC/XT/AT and Rainbow.

Apple IIe Mobius includes a hot key VT100 emulator, 26-host resident drives, file transfer, and support for three remote printers. With Mobius, system managers can securely structure non-technical user's access to the host computer from a central file. Drives can be defined for the user, and files can be designated at Read Only.

For more information, contact FEL Computing, 10 Main Street, P.O. Box 72, Williamsville, VT 05362; (802) 348-7171; or stop by Booth No. 846.

Enter 945 on reader card

DP/MIS Managers To See Quantum RS Package

CIS will demonstrate Quantum RS to MIS and DP managers at DEXPO East. This powerful menu-driven VAX resource management package performs resource accounting, department and project-level accounting, budgeting and chargeback, performance analysis, capacity planning, and session accounting.

Quantum RS is priced starting from $2,500 for a single MicroVAX II to $12,000 for a VAX 8800.

For more information, contact Computer Information Systems, 165 Bay State Drive, Braintree, MA 02184; (617) 848-7515, Telex: 499-6932; or stop by Booth No. 801.

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ADAC's PICOBASYS Performs In Real-Time

ADAC's PICOBASYS, a compact real-time Measurement and Control System from ADAC Corporation, operates standalone or as a remote unit linked to an IBM PC or compatible, DEC MicroVAX, DEC 11 series or other host system.

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computer with power to handle real-time data acquisition, sample linearization, scaling, and complex control loop algorithms. Programs are downloaded into battery-backed-up memory for execution under ADAC's real-time language, I/OBASIC.

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PICOBASYS is priced from $2,300 for OEMs and integrators at quantities of 10 or more. Delivery is 4-6 weeks ARO for small quantities.

For additional information, contact ADAC Corporation, 70 Tower Office Park, Woburn, MA 01801; (617) 935-6668; Telex: 951-802. Visit Booth No. 9.

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Northwest Digital Introduces GP-220

A new, high-resolution graphics terminal featuring enhanced emulation of the Tektronix 4014 and DEC VT220 has been introduced by Northwest Digital Systems.

Called the GP-220, the product features two separate 200K byte display banks, each of which allows high-resolution gray-scale graphics or 75 pages of off-screen text memory. The terminal features a completely programmable VT220-style keyboard.

The GP-220 is designed for applications flexibility. Full screen setup menus allow extensive terminal configuration via quick and easy commands. The GP-220 can store four different terminal configurations in non-volatile memory making them available for instant recall. Other features include an 8 x 15 character cell, built-in print buffer, built-in mouse and digitizer support, local find and editing functions, transparent mode with history buffer, smooth scroll, and multiple serial ports.

The GP-220 terminal has a list price of $2,195.

Find out more by contacting Northwest Digital Systems, P.O. Box 15288, Seattle, WA 98115; (206) 524-0014; or stop by Booth No. 1051.

Enter 947 on reader card

Dataram Introduces DRD-207/32

Dataram Corporation's newest addition to its DATARAM-Disk high-performance solid-state disk product line, the DRF-207/32, will be unveiled at DEXPO East. The DRF-207/32 features 32 MB of storage (four times that of its predecessor) in a space-saving seven-inch chassis. The system can be expanded to 128 MB by migrating to a larger chassis.

The DRF-207/32 is designed to extend the useful life of DEC's PDP-11 and VAX systems. Dataram's newest DATARAM-Disk is suited for I/O intensive applications such as transaction processing, database management, CAD/CAM, process control, or simulation.

For further information, contact Dataram Corporation, P.O. Box 7528, Princeton, NJ 08543-7528; (609) 799-0071; or stop by Booth No. 1002.

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DDA To Attend DEXPO Show

Digital Dealers Association (DDA) will attend DEXPO East. Primary objectives of the DDA are to promote an orderly secondary market for Digital products and maintain high ethical and professional standards by its members.

Meetings are held twice each year, a newsletter, "DDA NEWS" is published quarterly, and other association benefits are offered. Materials describing the association and applications for membership will be

available at the booth.

To learn more, contact DDA, 107 S. Main St., Suite 202, Chelsea, MI 48118; (313) 475-8333. Stop by Booth No. 745.

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Human Designed Systems To Unveil New Terminals

Human Designed Systems, Inc. will exhibit a new family of DEC and Tektronix compatible terminals at DEXPO East. The new HDS2000 series provides a full range of compatible terminals — ANSI standard, APL, medium- and high-resolution graphics — to meet the application needs of engineering, scientific, and business organizations.

The HDS2000 terminals range in price from $795 to $1,895 and delivery of the terminals is 45 days ARO.

Further information is available from Human Designed Systems, Inc., 3440 Market St., Philadelphia, PA 19104; (215) 382-5000; or stop by Booth No. 405.

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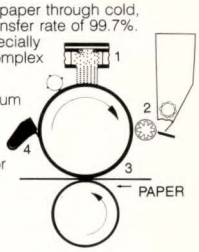

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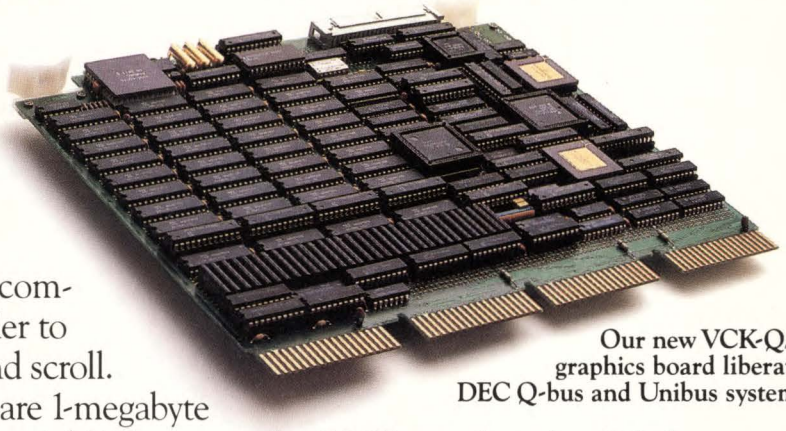

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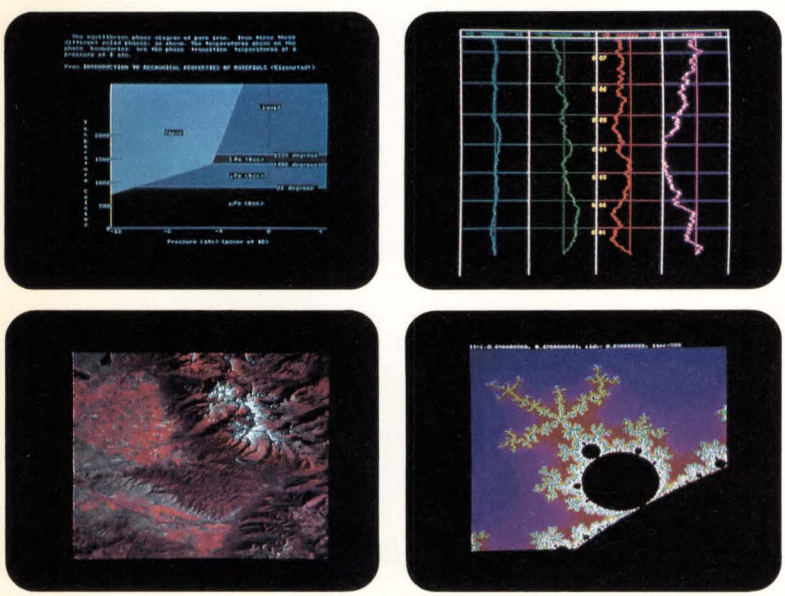

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BACK END

John C. Dvorak

The World's Greatest Light Bulb Joke

Over the past few years I've been attempting to collect computer jokes; however, it seems that they're few and far between. A gold mine of jokes exists on various national networks; for example, USEnet has its NET.joke section.

A system on the West Coast called the WELL (available through Telenet) has a joke conference that has continued for over a year. If you'd like to be the guy in the office who always has the latest sick joke about some recent tragedy, this conference is for you.

Among the endless jokes that you hear are light bulb jokes. These always ask the question, "How many (your career here) does it take to screw in a light bulb?" When light bulb jokes first appeared about six years ago, they weren't about computer users. The questions typically were, "How many Republicans (or Democrats) does it take to screw in a light bulb?" Finally came the computer tie-in, with the classic, "How many programmers does it take to screw in a light bulb?" Answer: "None — it's a hardware problem."

In time, on the various joke networks, a slew of redundant jokes made any listing of light bulb jokes a joke in itself. That was until Kurt Guntheroth of John Fluke Manufacturing in Everette, Washington, documented all of the light bulb jokes and produced his famous *Canonical Collection of Light Bulb Jokes.*

This contained jokes like:

Q: How many Macintosh designers does it take to change a light bulb?

A: One. He holds the bulb while the world revolves around him.

Soon came the *complex* light bulb joke. No longer was an easy laugh from a one-liner enough. There had to be more to the answer:

Q: How many IBM types does it take to change a light bulb?

A: A hundred. Ten to do it, and 90 to write document number GC7500439-0001 Multitasking Incandescent Source System Facility, of which 10 percent of the pages state, "This page intentionally left blank," and 20 percent of the definitions are in the form, "A whoopeedoo consists of sequences of non-blank characters separated by blanks."

Finally, Guntheroth dug up the most outrageous and funny light bulb joke I've yet encountered and guess what company it's about? DEC, of course. Like much urban folklore, we can assume that this joke has "evolved" into this version and probably will continue to grow. We still are searching for the author of the root joke; but, in the meantime, post this one on the bulletin board:

The World's Greatest Light Bulb Joke

Q: How many DEC employees does it take to change a light bulb?

A: 2 People — Preliminary discussion on concept of change.

1 Person — Devise and write formal bulb architecture.

2 People — Feasibility study and timetable of events.

2 People — Produce four utilities to reduce screw-in time (in addition to the electric utility).

1 Person — Maintain ISO and DEC standards (sockets, voltage, AC/DC).

4 People — Commonality task force on bulb change.

15 People — Change bulb.

5 People — Perform bulb functional test.

2 People — Perform bulb load test.

3 People — Perform bulb regression test.

1 Person — Perform bulb performance analysis.

1 Person — Perform bulb bottleneck analysis.

1 Person — Follow-up study (bulb merge feasibility).

1 Person — Interface with Utilities Commission.

1 Person — Interface with users. (Did they want incandescent when we only supply non-tunable fluorescent point product?) BAX (Bulbs Are eXpensive)!

5 People — Perform BOSE (Build Other Socket Enhancements) compatibility/architecture study.

3 People — Ensure form (round/square, clear/frosted) follows function (wattage, 120/240 volts, visible/ultraviolet, flashing, flood/spot).

3 People — Implement temporary alternative bulb socket for already(!?) existing, successful, and profitable socket (bulb-in-one).

5 People — Determine how to market/package/distribute temporary alternative bulb socket.

10 People — Determine how to perform bulb change product split (control: switches, dimmers; versus implementation: screw-in torque, recovery strategies).

1 Person — Interface with utilities commission QA group.

1 Person — Submit to BDC (Bulb Distribution Center).

1 Person — Set up BPR (Bulb Problem Reports) system.

10 People — Answer customer BPRs.

11 People — Football team to challenge bulb changers.

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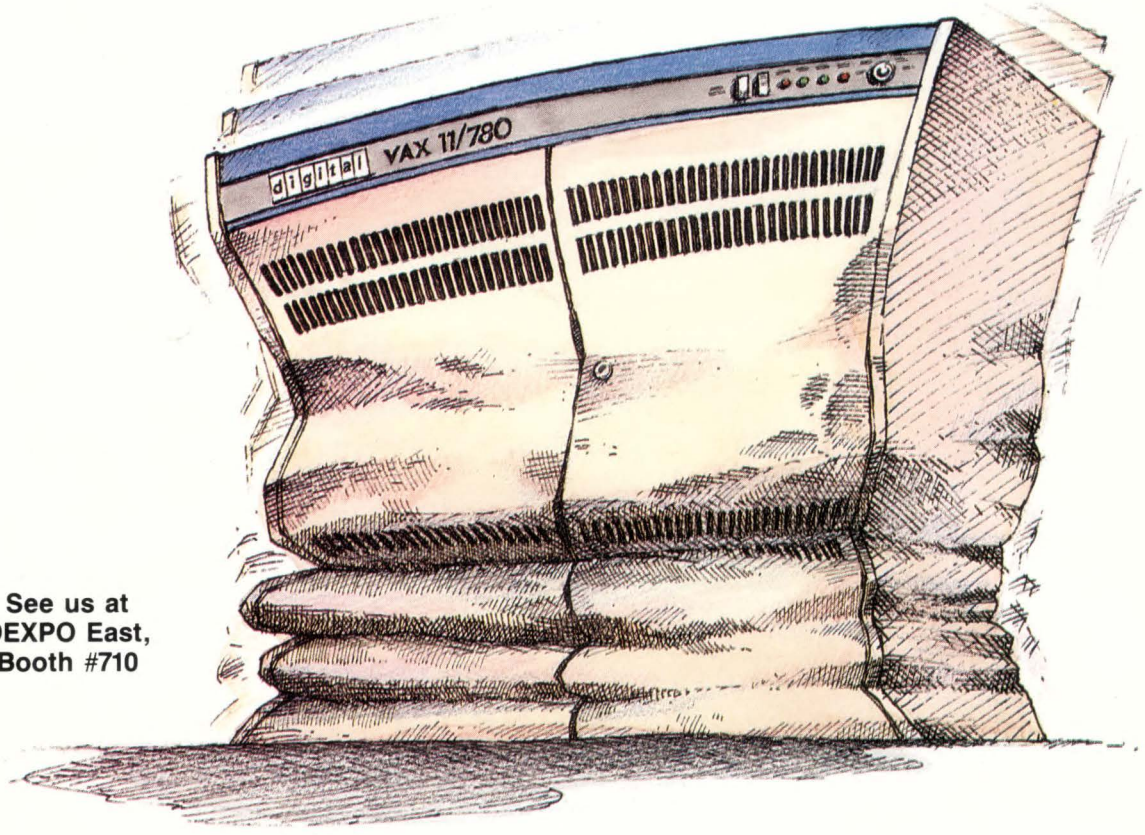

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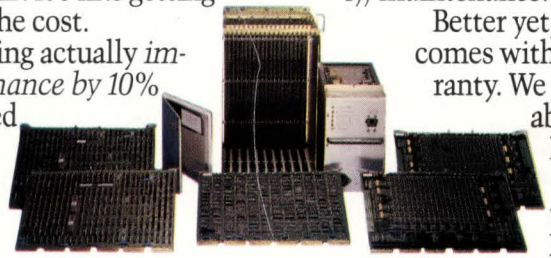

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