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JUNE ■ 1987 VOL. 6, NO. 6 ■ $4.00

DEC PROFESSIONAL

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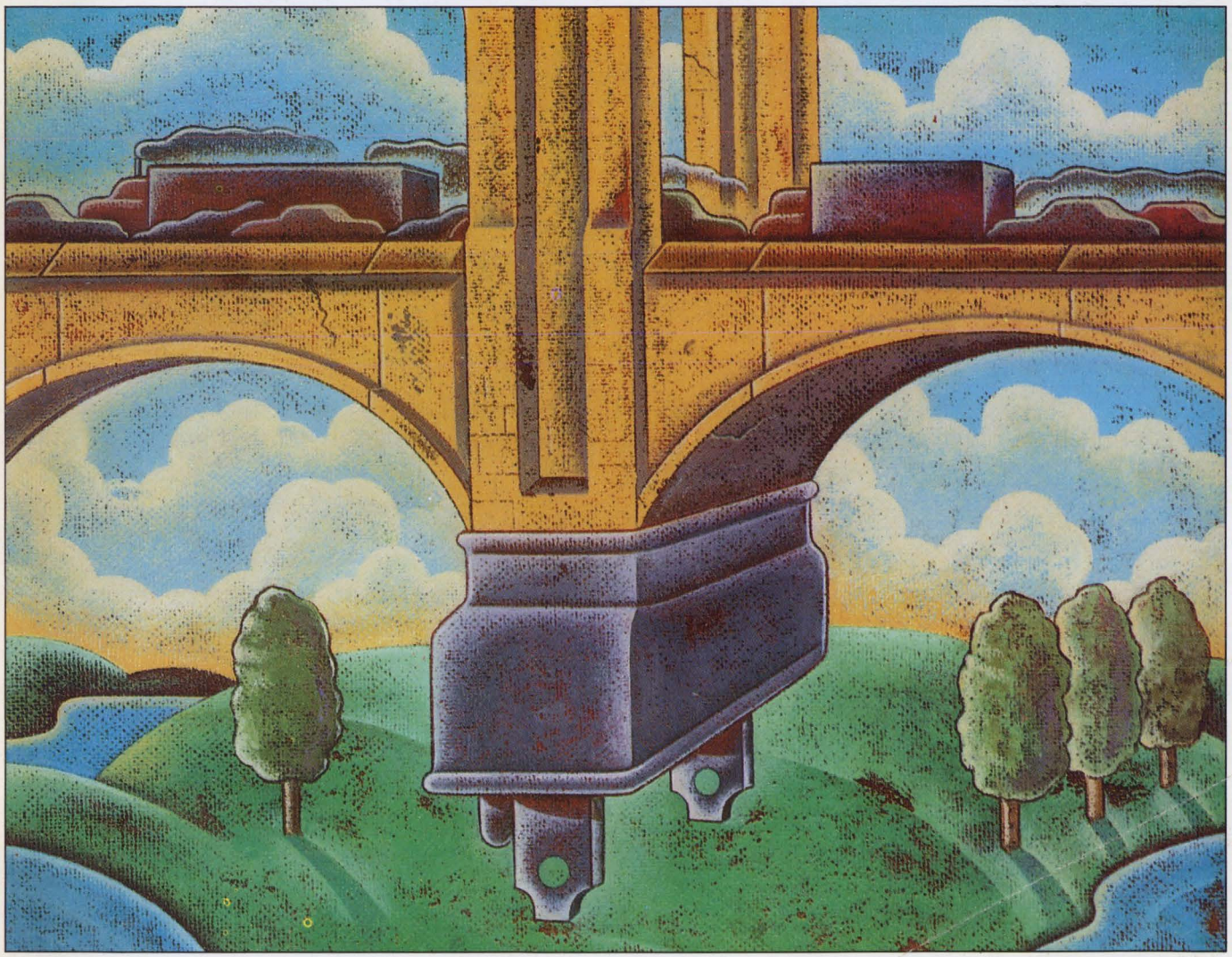

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Users all know that VMS, executing a program directly from memory, is much faster than paging. By selecting EMULEX's 4 MB or 8 MB memory boards a user can reduce paging and obtain increased performance.

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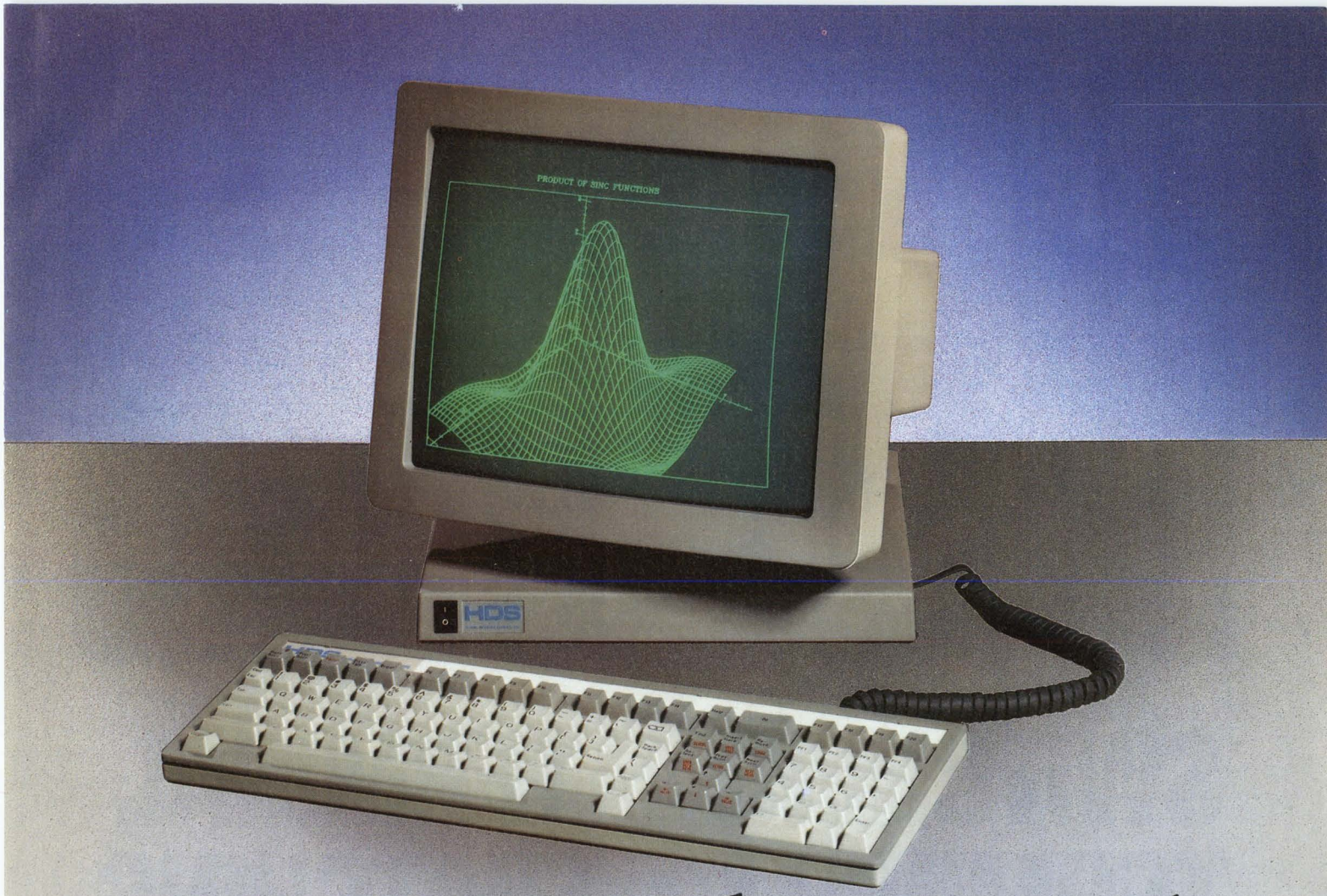

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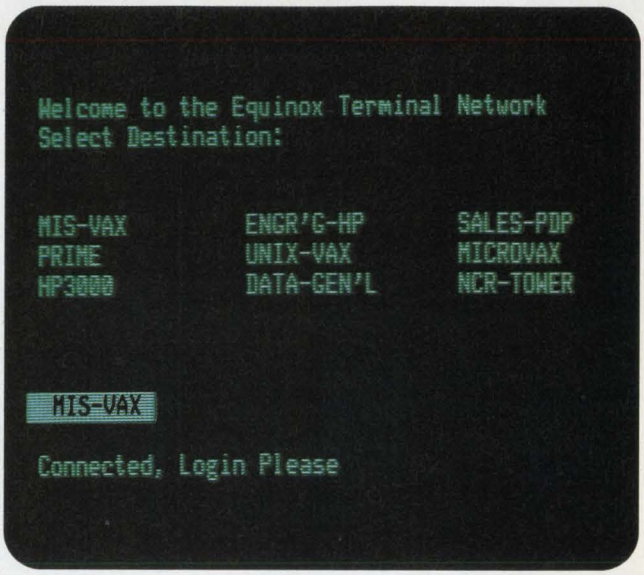

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JUNE 1987 VOL. 6, NO. 6

PERIPHERALS

ARTICLES

Continued on page 6.

LABORATORY DECPRO TESTING CENTER

The lab seal indicates that the product reviewed has been tested by one of our experts in our Laboratory and Testing Center.

ON THE COVER:
This month's cover is the work of Pennsylvania-based artist Michael Schroeder.

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DEPARTMENTS & COLUMNS

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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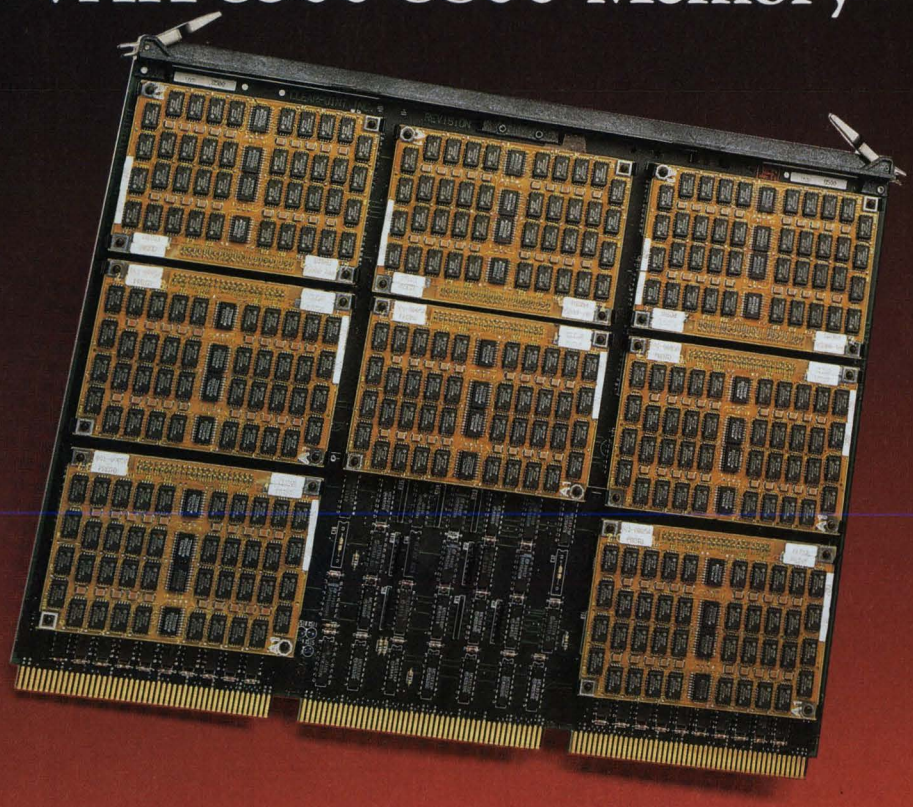
The New Standard for VAX 8500-8800 Memory



64 MB—Four Times the Density of the DEC MS88

Clearpoint engineering once again introduces a VAX-compatible memory upgrade with significant advantages over the original. You benefit from greater density and a wider choice of models to meet your needs. And Clearpoint's VXR8800 technology delivers far greater reliability at substantial savings.

100% Compatible with the VAX 85XX, 87XX, and 88XX

The VRX8800 is compatible with the private array bus used to connect the memory controller with the arrays on the high-end VAX 8000 Series. The board supports single bit error correction and double bit error detection provided by the memory controller.

Available in 16, 32 and 64 MB Capacities

The VXR8800 comes in three capacities, all utilizing one double-wide slot. The 16 MB card uses 256K DRAMs, while the 32 and 64 MB versions utilize megabit DRAM technology.

Features Surface Mount Megabit DRAMs

The unprecedented density of the VXR8800 is made possible by surface mount megabit DRAMs, the most advanced technology for both density and reliability. Fully automated assembly and superior soldering capability assure superior quality.

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- 72-hour dynamic thermal burn-in using the most advanced test systems in the industry

Clearpoint—The Leader in DEC-Compatible Memory

The only supplier of compatible memory for the complete line of VAX 8000 Series computers, Clearpoint offers a 64 MB upgrade system for the VAXBI-compatible 82XX and 83XX models, as well as 16 MB cards for the 8600 and 8650. Clearpoint leads in service as well as technology:

- A Federal Express spares depot in Memphis provides next-day delivery
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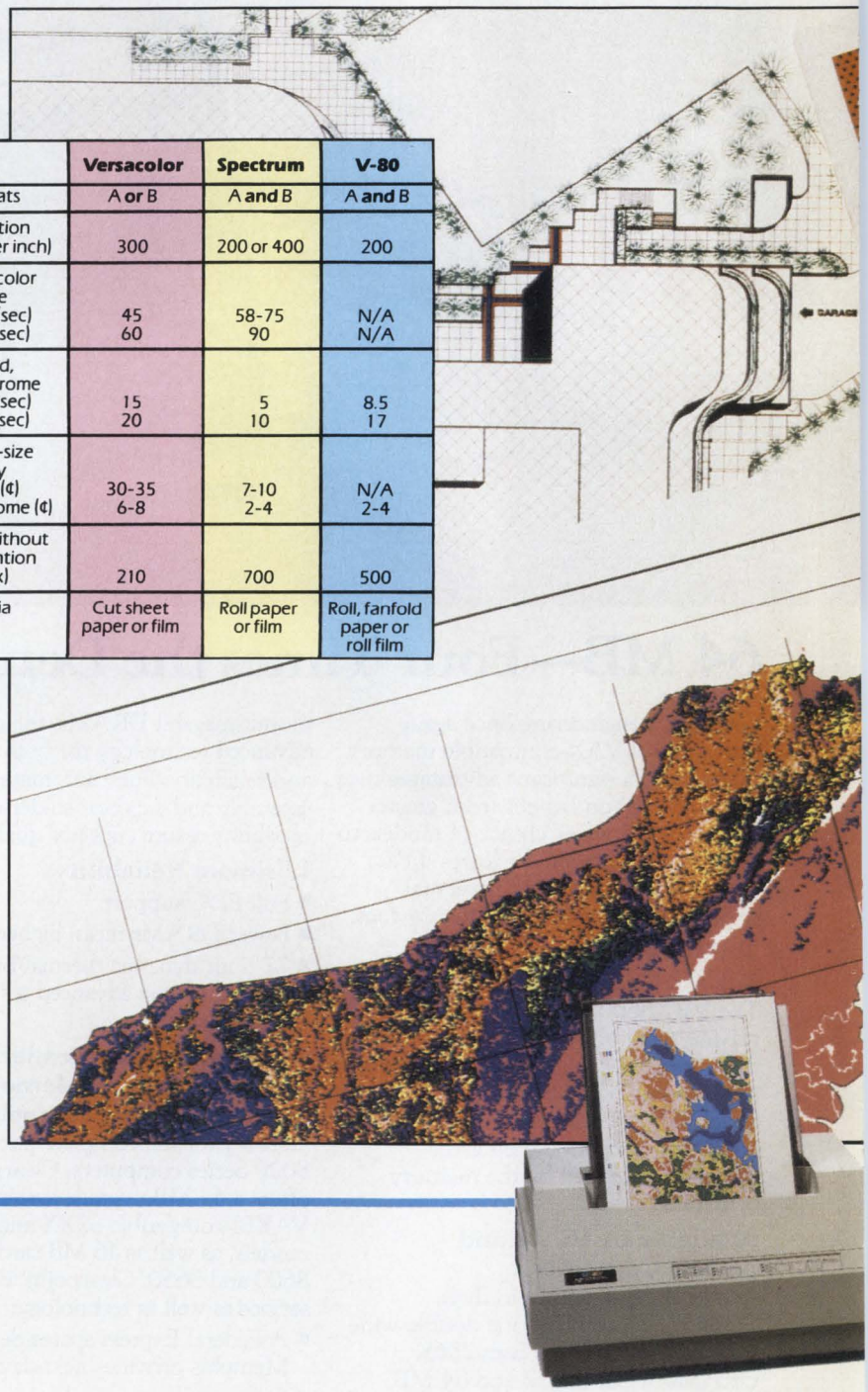
Choose easy connectivity. Versatec offers more interfaces to more computers, a larger library of integrated plotting software packages, and a bigger family of modular standalone and embedded rasterizers than other electrostatic and thermal plotter suppliers.

We'll make your choice easier with information about all three Versatec A/B-size plotters. Simply circle the readers' service number or call toll-free 800/538-6477.*

	Versacolor	**Spectrum**	**V-80**
Formats	A **or** B	A **and** B	A **and** B
Resolution (points per inch)	300	200 or 400	200
Speed, color page A-size (sec) B-size (sec)	 45 60	 58-75 90	 N/A N/A
Speed, monochrome A-size (sec) B-size (sec)	 15 20	 5 10	 8.5 17
Cost, A-size copy Color (¢) Monochrome (¢)	 30-35 6-8	 7-10 2-4	 N/A 2-4
Copies without intervention (Max)	210	700	500
Media	Cut sheet paper or film	Roll paper or film	Roll, fanfold paper or roll film



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PUBLISHER

Carl Marbach

The Bus Stops Here

I took delivery on my first PDP-11/70 in 1975. Ten years later, DEC delivered a MICROVAX II with more power in a box one-tenth the size.

The CPU in my original 11/70 took an entire nine-slot backplane and the boards to fill it. On separate boards were the CPU, floating-point processor (four boards itself) and memory cache. Memory for the vintage 11/70 was housed in its own cabinet and another cabinet held the rest of the computer.

The cabinet held four BA11 boxes that could hold up to 1 MB each, giving the 11/70 a maximum of 4 MB. Memory for this machine cost approximately $30,000 per megabyte.

The disk controller for the 11/70 was an RH-11 MASSBUS device that required four boards in dedicated slots in the computer. Next to that was the four-board tape controller with room for a second disk controller. All of these took up 12 hex-high slots. A 16-port DH-11 terminal controller for the 11/70 required its own nine-slot dedicated backplane and used all of the slots.

Today's MICROVAX II has 1 MB on the CPU board, and an extra 16 MB can be added on another board for about $500 per MB. It requires just one board for disk and tape controllers and it's quad-high to fit the Q-bus backplane. In 10 years we've reduced the size considerably while increasing the power and decreasing the capital cost and operating expense.

What will the next 10 years bring?

The MICROVAX 8800 for 1995: As technology squeezes more and more logic into LSI chips, DEC will begin to incorporate more into the computer's main chip. The entire CPU is there already, and in the MICROVAX 2000, the disk controller migrated to the CPU board as well.

By 1995, DEC will have moved all standard computer functions either to a single chip or to a family of chips residing on a single board. This board will contain:

1. The CPU (with the power of today's VAX 8800)
2. A 64-MB memory (by 1997 this will be increased to 256 MB with the advent of the 256-MB chip)
3. A floating-point processor
4. A CPU cache of 1 MB
5. The disk controller with 256 KB of disk cache on board
6. A backup device controller (tape?)
7. A console terminal port
8. A diagnostic/field maintenance port
9. A SuperEthernet connection running at better than 100 MB per second.

The computer chips and the board will be mass produced and cost approximately what a MICROVAX does today.

Where is the BI bus on this computer? The Q-bus? Any bus at all?

There will be no external computer bus because all of the bus-connected functionality of today will have shrunk onto the main CPU board by 1995. The only external "bus" on the system will be the SuperEthernet connection that every DEC computer will have. Printers, terminals, A/D converters, modems, communication devices and other computers will connect to this Ethernet quasi-bus.

The BI problem has disappeared! There will be no interconnections to the bus because everything will have migrated either to a single chip or a single board, and a bus would add complexity, size and cost.

Disks (small 3.5-inch drives in the 1,000-MB range) will attach to connectors on the main board and be daisy chained in multiple disk installations. Tape (heaven forbid!) or the optical backup device will attach in a similar manner. No controller, no bus — just physical connections to the main board for these devices.

Logic and extra features will move into the disk drive or extra cache, or special personality modules in the drive itself may offer a feature/performance benefit over what DEC will offer. Moving the extra "smarts" to the device is analogous to moving the controller to the CPU board.

The optical devices for backup will have extra features inside as well. Maybe they'll contain resident software for backing up the disk without involving the CPU, or the power to do online journaling, or even to "mirror" the active disk without any outside resources from the rest of the computer.

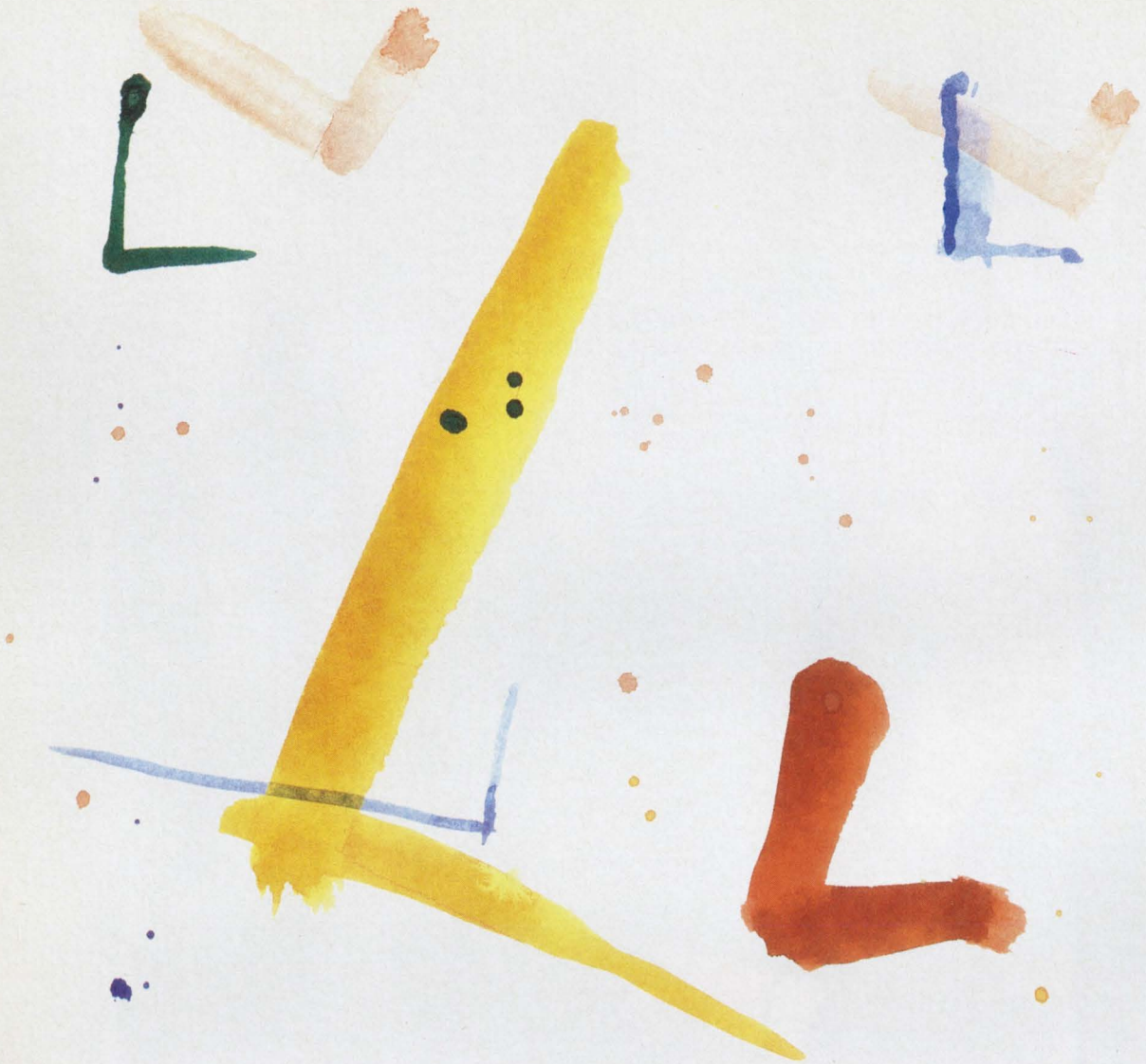
Where are the communications controllers? Attached to the optical Ethernet!

DEC already has the DECservers. Several third parties have developed LAT protocols on PCs allowing the PCs to use the Ethernet to attach to the computer, and more is promised for the future. Opportunities abound. The high-speed optical Ethernet offers a robust environment for all kinds of connections to the computer.

There are opportunities to add value to your DEC computers; it takes innovation and intelligence to do it better than the next guy, and get your share of this large market. While the game is different, it's still there.

Carl B Marbach

Airs Common Lisp



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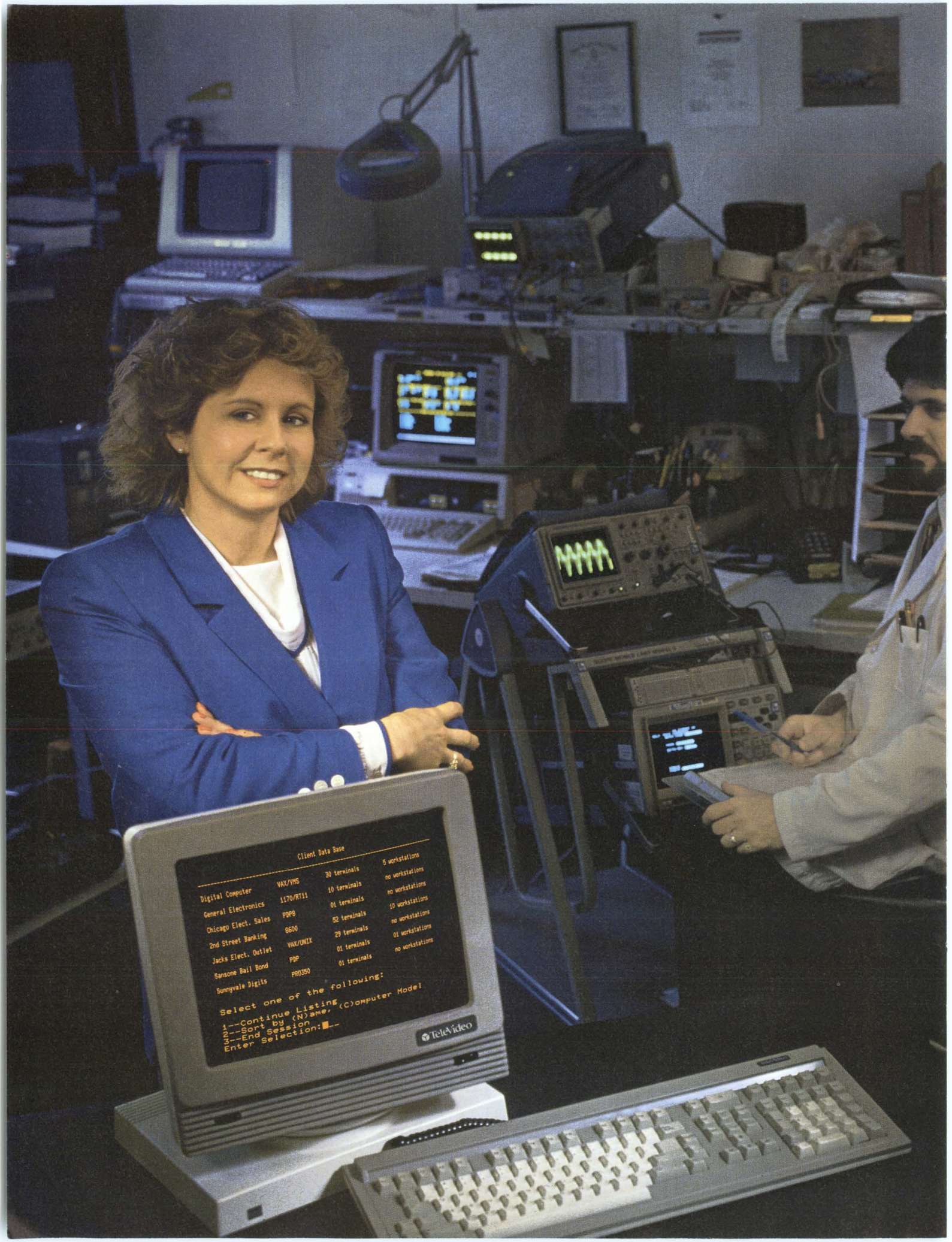
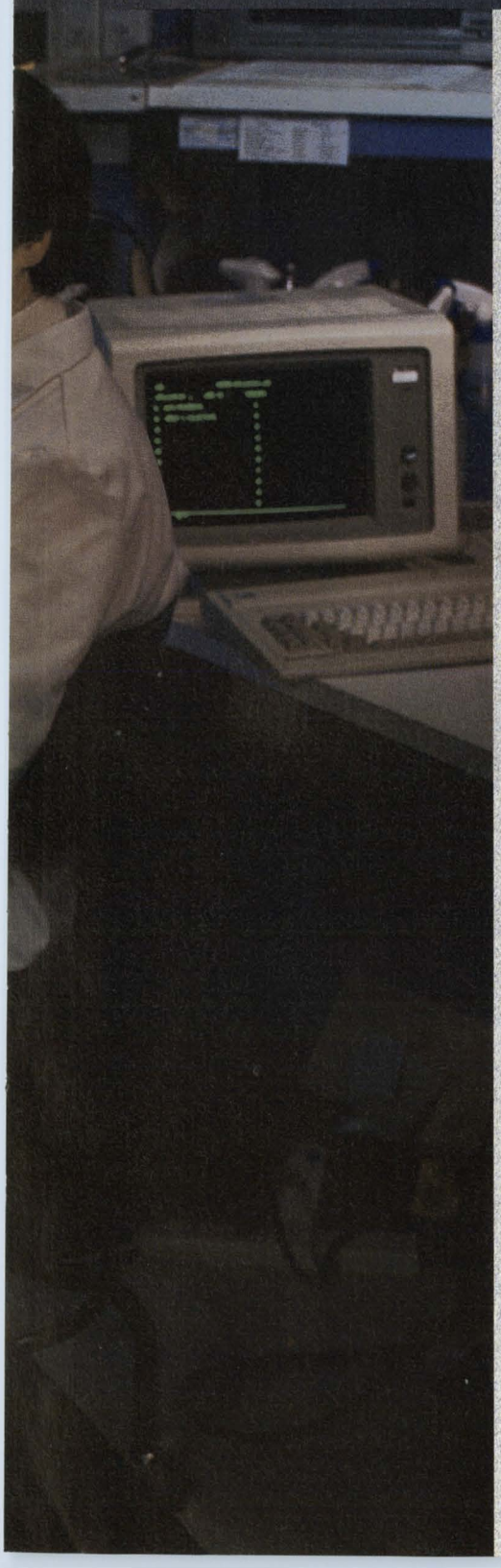

Client Data Base
Digital Computer VAX/VMS 30 terminals 5 workstations
General Electronics 1170/RT11 10 terminals no workstations
Chicago Elect. Sales PDP8 01 terminals no workstations
2nd Street Banking 8600 52 terminals 10 workstations
Jacks Elect. Outlet VAX/UNIX 29 terminals no workstations
Sansone Bail Bond PDP 01 terminals 01 workstations
Sunnyvale Digits PRO350 01 terminals no workstations
Select one of the following:
1--Continue Listing
2--Sort by (N)ame, (C)omputer Model
3--End Session
Enter Selection:
TeleVideo

Introducing the most reliable DEC™-compatible terminal ever built. The TeleVideo 9220.



"Why do we own thousands of TeleVideo® terminals? Because we can't afford thousands of problems."

Susan Kennedy is a product analyst at Leasametric, a company that rents, sells, and services DP equipment all over the country. Including thousands of terminals. And if reliability is important to the average user, it's critical to Leasametric. Because everything they offer not only has to stand up to the rigors of shipping, but the extra wear and tear that rental equipment always takes. And if a Leasametric machine breaks down, so does the cash flow it generates.

So before Leasametric approves one unit, they tear it apart piece by piece. And give it an evaluation that makes an MIT exam seem easy by comparison. We talked to Susan recently, and these are just a few of the things she said:

"Too many terminals just don't measure up... I've seen machines with questionable ergonomics... keyboards that flex in the middle when you type... even cheap little diodes that could drop off... all these factors combine to make a product you either want or don't want in your product line...

9220 KEY FEATURES			
Super dark 14" amber screen (green optional)	✓	30 non-volatile programmable function keys	✓
Full VT 220 compatibility	✓	VT100 compatible keyboard	✓
DB25 connector for printer port	✓	Compose key disable control	✓
Tilt and swivel base	✓	Graphics model available	✓

"But with TeleVideo, the whole product is well designed. They start with solid engineering, and follow through with every detail, down to the steel brace in the keyboard. Overall, they've built the same quality into the 9220 that's made all their other terminals last so long. Obviously, we want to make sure that, two years from now, our equipment will still be working for us. That's why we feel so good about TeleVideo."

Of course, Susan is talking about quality and reliability. When you check the features you get for the money, we look just as good. As you can see from the chart above, the 9220 gives you full VT 220 compatibility. A 14" amber screen. And the best thought-out ergonomics around. All for only $619.

The TeleVideo 9220. If you'd like more information, or the name of your nearest distributor, call 800-835-3228, Dept. 131. In the meantime, we'd like to leave you with a quote from Susan Kennedy, "Keeping customers happy is what my job is all about. And TeleVideo definitely makes my job a lot easier."

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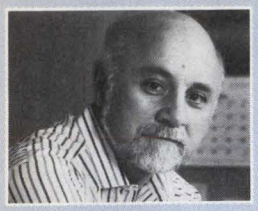

EDITORIAL

Dave Mallery

Spring Thaw?

Attitude shifts come hard and take a long time. We saw a major shift when Digital reversed its stand on licensing transfer recently. That one took guts.

At this writing, Digital just announced a settlement of the several suits by and against System Industries. Some of these suits date back to 11/70 times and are all about MASSBUS interconnect. One of them is quite new, and was filed by SI against Digital, charging antitrust violations in bus licensing policy.

The settlement establishes a licensing procedure for everything from the old 11/70s to the SBI interfaces on the 78xs. It doesn't license the BI, but the parties promise to confer in the future.

There are lots of details missing in the preliminary announcements, especially in the area of the antitrust action against Digital that specifically addresses the BI bus. The parties to the suit are reluctant to disclose the details of the agreement.

Of the four points disclosed, I think the most important is the agreement to talk with each other about future disputes. I have long held that the correct solution to the BI licensing problem is simply that: BI licensing.

Digital should license its products to any firm with the financial ability to engineer and manufacture products for the BI. Digital should re coup its share of the engineering via the licensing and the chip sales, and everyone should get on with business. Our industry has better things to do than to feed generations of lawyers.

In any event, time will tell. Every legal settlement is a study in compromise. Substantive issues were settled in this one and I only hope that the users were well served in the agreement.

FREE WEEKENDS FOR VAX MANAGERS!

Not long ago, a major client called our offices for advice on improving his VAX/VMS disk performance.

"Right now, I spend my weekends backing up and restoring disks," he said. "If I don't, my users complain about the system's poor performance and slow response times."

Unfortunately, his situation is inherent with VMS. It's called *fragmentation.*

DISK FRAGMENTATION

That's when files (and free space) are scattered in pieces around the disk.

Needless to say, accessing, extending and creating files takes longer than it should. Over time, a lot longer.

And cleaning up this mess in the traditional manner can take from 4 to 6 hours—per disk!

A SHIFT FROM TRADITION

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LETTERS

ACCURATE INFORMATION

DEC PROFESSIONAL has given me an accurate, real-life report on operating systems, CPUs, software, hardware and peripherals with unbiased product information. The magazine supplies me with great references when shopping for any of these and their related products.

Paul Moscicki
Programmer
Parrot Software
Buffalo, New York

PLEASE HELP

I read with interest Carl Marbach's article "VAX As Foster Parent" (January 1987), which was about connecting a PC to a VAX. Mr. Marbach refers to an Ethernet cable connection that requires an Ethernet option board that plugs into the PC add-in slot.

I am involved in a distributed control system project that proposes to connect a MICROVAX II host to PCs via DECnet/Ethernet. The plan is to install DECnet/DOS software on each PC, allowing the MICROVAX to treat the PCs as ordinary DEC nodes.

I have two concerns: Are DECnet and DECnet/DOS necessary? My second concern is that the PC needs some way to execute its control program simultaneously, communicate with other PCs over a PC network, communicate with the MICROVAX and modify its own control program as a result of directions received from the MICROVAX.

Charles Pekarek
Software Supervisor
Ann Arbor Computer
Ann Arbor, Michigan

David Bynon: DECnet/DOS V1.1, for the IBM PC XT/AT, is a software networking package that implements a limited version of DECnet on a PC. PCs, using DECnet/DOS, may act as "passive" end-nodes in a DECnet network (including Ethernet). The PCs are passive in that they can use resources of the network, but they do not provide an additional resource to the network. For example, a VAX user cannot copy a file to the PC's printer. It's possible, however, to have a DECnet/DOS PC listen for an incoming connect request, which then will start an application program. The PC must be dedicated to this function; i.e., a user can't be using it.

Connecting your PCs to an Ethernet requires the purchase of an Ethernet adapter. MICOM and 3COM make controller boards compatible with DECnet/DOS. These boards are in the $500—$600 range.

DECnet/DOS has many benefits. Through your MICROVAX II, or other VAX systems, your PCs can share disk, print and compute resources. This is done easily by setting up "Virtual Disks" (MS-DOS disk file on a VAX) and by assigning network print destinations for the PCs. VAX and PC files can be copied freely from the PC using DECnet/DOS utilities.

Digital also has announced a Network Integration Package to support IBM PC XT/AT systems in their Personal Computing Systems Architecture (PCSA). In basic terms, this new hardware/software package will afford an IBM PC system the same integration level as Digital's own VAXmate system. For approximately $1,200 this integration package provides:

DEPCA (Ethernet/Mouse adapter)
ThinWire Ethernet assembly kit
DEC Corporate Mouse
LK250 Keyboard with Gold keys and IBM Blue keys
PCSA/PC Client Software
DECNET/DOS
MICROSOFT *Windows*
MSNET/DECNET
PCSA Configuration Aid
VT220 Terminal Emulator
Online User Information System Documentation.

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.

INVALUABLE PUB

An invaluable publication! The only way to keep on top of the DEC VAX world is to read *DEC PROFESSIONAL*.

Louis Ventola
Wentworth Institute
Hyde Park, Massachusetts

EXTREMELY INFORMATIVE

Beginning with the October, 1986 issue, *DEC PROFESSIONAL* has offered the column "Managing Your MICROVAX" by David W. Bynon. Since the first article, I look forward to receiving the magazine each month to see what new information Mr. Bynon has to offer.

As the only computer operator at Commonwealth Electric, many of my functions are system management duties. I have attended the VAX/VMS system management course offered by DEC, which was an excellent course, but

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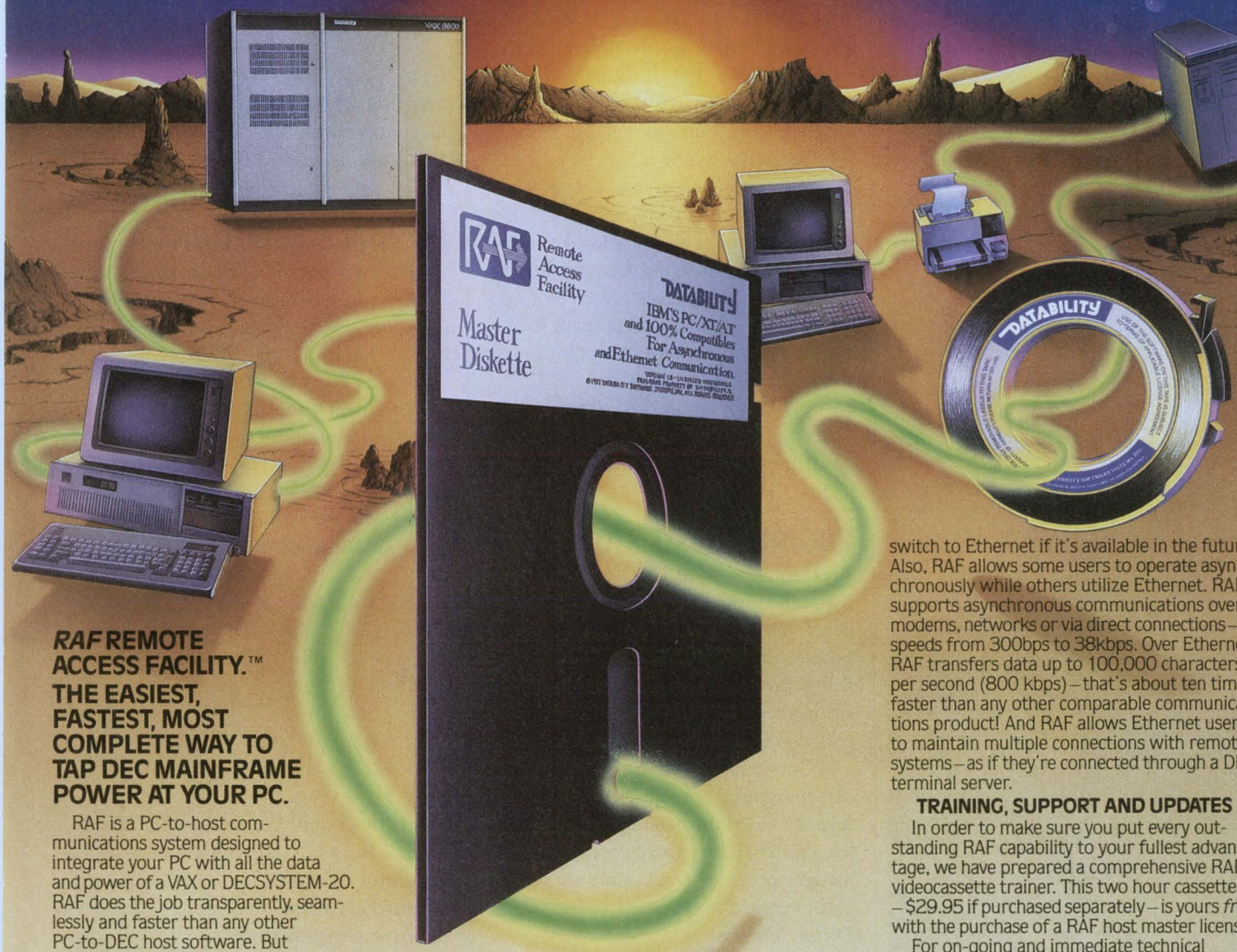

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You can use RAF to communicate asynchronously or over Ethernet. A single copy supports both, so you can install RAF asynchronously now and switch to Ethernet if it's available in the future. Also, RAF allows some users to operate asynchronously while others utilize Ethernet. RAF supports asynchronous communications over modems, networks or via direct connections—at speeds from 300bps to 38kbps. Over Ethernet, RAF transfers data up to 100,000 characters per second (800 kbps)—that's about ten times faster than any other comparable communications product! And RAF allows Ethernet users to maintain multiple connections with remote systems—as if they're connected through a DEC terminal server.

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some of the information didn't always apply to MICROVAXS. Therefore, I have found Mr. Bynon's articles extremely informative and useful.

Jane E. Cardoza
Commonwealth Electric Company
Wareham, Massachusetts

NOT OFF THE WALL

Perhaps John C. Dvorak, in his article "Bizarre Time Capsule Befuddles Experts" (March 1987), thought that he was being totally off the wall with his magnetic pole cause for computer catastrophe. Actually, the magnetic pole has been flipping from pole to pole at fairly regular intervals, composed of millenia though they be. This knowledge was instrumental in proving the continental drift theory and it is perfectly reasonable to expect the pole to flip again in the future. Mr. Dvorak might not be far off the mark.

Joseph L. Pasquale
Digilog
Montgomeryville, Pennsylvania

ENGINES ALSO STOPPED

According to John C. Dvorak's article "Bizarre Time Capsule Befuddles Experts" (March 1987), when the computers ceased to function almost everything that is operated by a computer stopped . . . but, "the old diesel engines still worked."

Sorry, John! Not only do the "old diesel engines" use an electrical transmission based on an alternator and electric motors, many also have three to five microprocessors controlling the diesel and electric motors.

Daren Dance
Blackfoot, Idaho

TIME SAVER

DEC PROFESSIONAL has great technical and system management information! The "Let's C Now" column, by Rex Jaeschke, and *Introduction to VAX/VMS*, by Terry C. Shannon, have saved hours of my time.

David A. Bouras
Program analyst
St. Lukes Medical Center
Chicago, Illinois

Editor's note: "Let's C Now" is a regular feature in DEC PROFESSIONAL. *For further information on* Introduction to VAX/VMS, *see page 105.*

POSSIBLE SOLUTIONS

I have two possible solutions to Mr. Piotrowski's function key problem (*DEC PROFESSIONAL*, February 1987, "DCL Dialogue," p. 116-120):

1. Purchase a CIT 224. The keyboard enhancement setup allows function keys F6-F20 to operate in a VT200 mode.
2. Use SET TERM/APPLICATION_KEYPAD. This allows use of the DEFINE/KEY using the numeric keypad. Addressing Mr. Piotrowski's problem:

```
$SET TERM/APPLICATION_KEYPAD

$DEFINE/KEY PF4 "SET TERM/DEVICE =
  VT200"

$DEFINE/KEY KP7 "SET TERM/DEVICE =
  VT100"
```

I thoroughly enjoy "DCL Dialogue." It's a concise, informative, and insightful column.

Glenn H. Myers
Analyst Programmer
Dallas, Texas ■

CORRECTION

It has been brought to our attention that there is an error in the caption in Table 1 of Philip A. Naecker's article "VAXSTATION/RC-PLUS" (March 1987). The caption should read "Steps in replacing the H9278-A Q-bus backplane on a VAXstation." Please accept our apologies.

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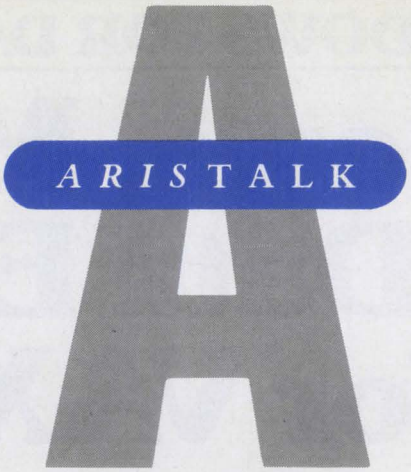

THE GREAT PARTESCAPE

QUERY:

Bruce Merkle: I've been attempting to use the new PARTESCAPE VMS V4.4 solution, to avoid having to read single characters of input in that situation. DEC claims to have "solved" the problem. Well . . .

DEC's solution calls for including the additional buffer length needed in the P4 parameter of the $QIO. This seems to make the read length that much longer, so that I can't terminate the read when I want to after, say, four characters. But after allowing an extra 10 for any possible escape sequence, my P4 parameter is 14, and that's how many characters the $QIO expects to read. Therefore, there's no termination after four characters are read as I had hoped.

Prior to VMS V4.4, I could have accomplished the same "solution" simply by adding 10 to my P4 read length parameter. Then my field clearly would have been long enough to hold all of any valid Escape sequence.

Am I missing something or is the V4.4 solution not a solution? I'd be glad to hear from anyone who has tried V4.4 PARTESCAPE.

REPLIES:

Stephen A. Smith: I haven't yet tried it but, based upon your description of the problem, it sounds like you may be performing the $QIO incorrectly.

First, the DEC "solution" is implemented as part of the VMS V4.4 terminal driver; therefore, you should be using P2, not P4, for the buffer size. DEC's description of the solution is to say that a new item code for the item-list read, TRM$_ESCTRMOVR, specifies the number of bytes in the read buffer to be reserved for the escape terminator. The P2 parameter (which specifies the size of the read buffer) should include the number of bytes to receive data and the number of bytes reserved for the Escape terminator overflow.

The key phrase here is "item-list read." You must be using the IO$_READ VBLK function code with the IO$M_EXTEND modifier to perform an item-list read. Additionally, you must specify the TRM$_ESCTRMOVR item code (with an immediate value indicating the overflow buffer size) as part of the P5 item-list buffer. See the *VMS V4.4 I/O User's Guide* (Volume I) for the particular formats.

Prior to VMS V4.4, there was no TRM$_ESCTRMOVR item code, so the driver used all of the read buffer for data. Prior to VMS V4.0, there was no item-list read (if my memory serves me), and the applications program had to handle escape sequence parsing/additional character reads in the case of SS$_PARTESCAPE.

Bruce Merkle: Thanks for your input on PARTESCAPE. Since I first entered my message, I did find out about the item-list read. After trying dozens of combinations, I've come to the same conclusion as before.

You must add the length of the escape "overflow" you intend to allow to your P2 read length parameter. Though the read terminates perfectly upon entry of an escape sequence, the length issue is not resolved.

I want to read four characters of input, terminating either immediately after the fourth character is entered or upon receipt of a number of terminators (including escape) defined by me.

I chose to allow eight characters for

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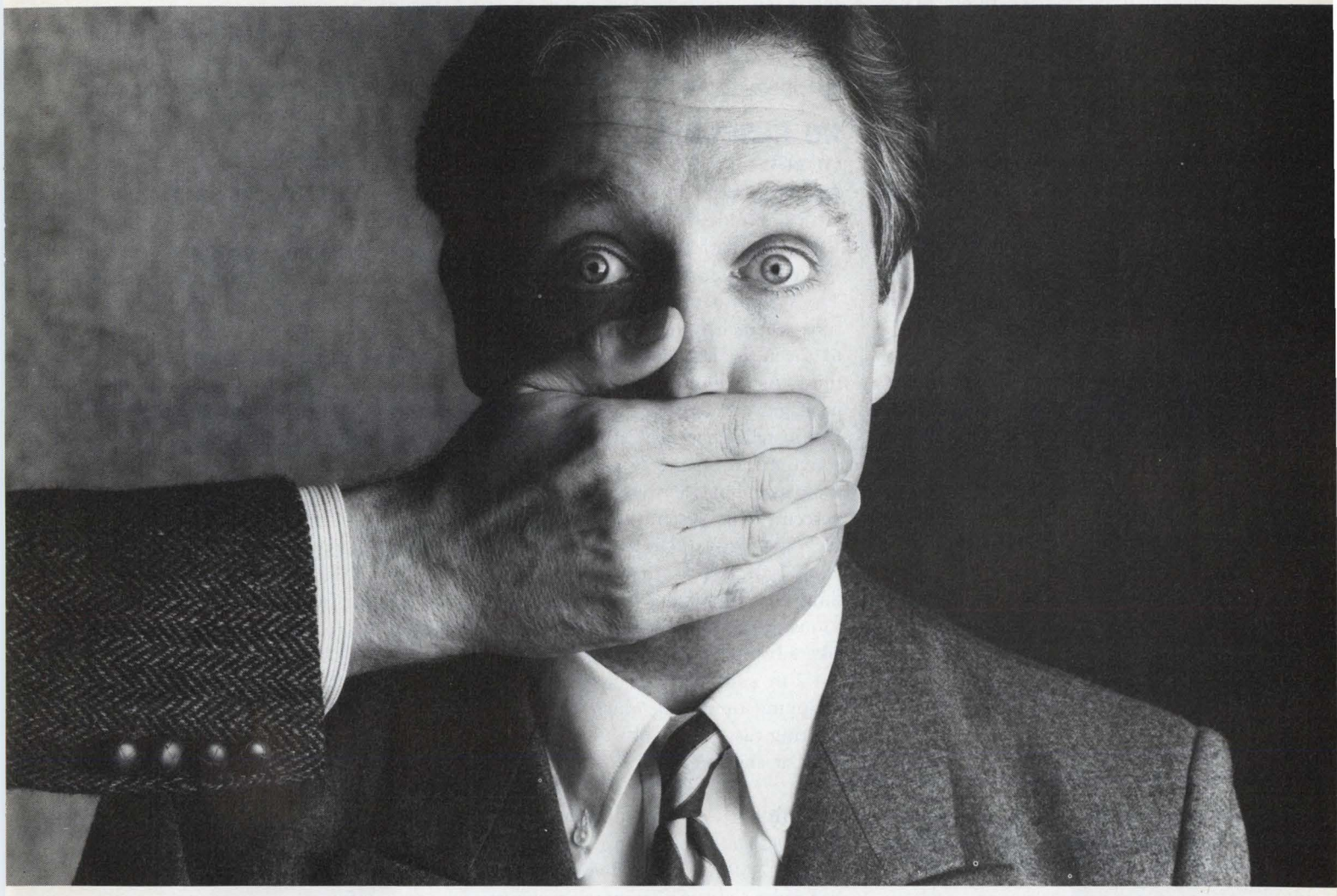

Among our largest customers are ~~General Electric, Westinghouse, Bankers Trust, Lotus Development Corp, Exxon.~~ And the ~~U.S. Department of the Navy.~~

Big institutions can be very close-mouthed about the competitive edge they get from a powerful tool like VTERM/220. So while they'd prefer that we not name names, we can still tell you the reasons why we have more satisfied users than all our competition combined.

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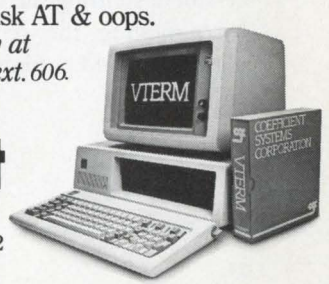

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the escape sequence. The documentation says that this number must be included in P2 in addition to the space required for the data to be read. Therefore, in my example, P2 must be 12.

The $QIO now will *not* terminate after four characters of input; rather 12 characters will be read before the operation terminates, unless, of course, I enter a terminating character.

I'm still puzzled. If this V4.4 capability is functioning as intended, then I still maintain that the exact same effect could be achieved prior to V4.4 simply by increasing the P4 read length parameter in a non-item-list-style $QIO read.

Lew Gulick: Having done the same thing as you as far back as VMS V3.2, I haven't noticed the new PARTESCAPE feature. My old utility for X characters read seems to work fine in the new versions. I'm wondering whether you've investigated this, because the old way of getting the extra characters is set to expire in future versions. If so, I certainly want to do some testing myself now.

A VT220 ON THE RACKS, PLEASE

QUERY:

Samuel Cohen: We're looking for a rack mounted VT220 compatible. Has anyone seen one? I think we'd even settle for a rack mounted VT100 compatible, but it also has to be ANSI 3.64 compatible!

REPLIES:

John T. Davies III: For rack mounted VT100s we buy conversion kits from ID Systems, at (614) 766-0440. I can recommend these kits. At DEXPO West '86 in San Fransisco, I saw Teleray (612-941-3300) terminals that are rack mounted and VT220 compatible. I can't recommend these personally, however, because I never used one.

Stanley D. Huhman: We've been very successful in splitting the VT220 plastic case by removing the screws hidden by plastic caps and putting it back together with a steel plate between the two halves. We cut a hole in the plate to match the groove in the terminal where the two halves meet. This makes a nice looking rack mount, is well balanced and we don't have to pay more for a rack-mount tube.

NO RESPONSE!

QUERY:

Lawrence Berez: I'm having problems with a site that's currently running a VAX 11/730 with an RL02/RA80 and 2 MB of memory, and MCBA DIBOL packages. The system has a very poor response time when chaining from one program to the next; i.e., closing and opening files. As we all know, the MCBA packages are written for relative files. I've installed the majority of the most active menu images to try to decrease the pause, but only by about 20 to 30 percent. This system is running VMS V3.5 and pre-DIBOL-83. Is there any hope? Is the increase in memory the only thing that I must do? Is there anything I must do to the user's AUTHORIZE to take advantage of the new memory?

I'm sure that the system is not swapping or paging much now, considering that it has only 10 to 12 users on it at any one time.

REPLIES:

Antonio Collins: You mean a 730 actually runs at 2 MB?! Call Midwest Systems and order 3 MB of Camintonn memory — these boards are only $595 each and you'll be amazed at the difference in response time (we have a 730 running *MASS-11,* which also chains its images).

PS. I don't work for Camintonn or Midwest Systems.

Jonathan M. Prigot: The two things that I would do after installing the new memory is to run AUTOGEN so that VMS can take advantage of the increased memory and, adjust your users' WSQUOTA and WSEXTENT.

Scott Goehring: We ran (or should I say jogged) an 11/780 from 1978 until last June on only 1.75 MB of memory! It ran OK until we upgraded to VMS V4.0, then the memory demand became too great (two or three jobs plus system processes resident at one time, and lots of swapping). We didn't use the system very heavily, however.

Now we have a MICROVAX II with 5 MB. It's faster, has more storage, and requires no air conditioners (and no three-phase power either).

KISS LASERS FOR MENTAL HEALTH

QUERY:

David Thomas: Just wondering if anyone out there is using a laser printer other than a LN03 or LN01 with *WPS-Plus/VMS*? We're a mental health agency and had received a QMS Kiss laser printer with a Ziyad dual-bin sheet feeder as a donation and have been trying to get it to work. So far we've been semi-successful; it will print the document from *WPS,* but won't feed the first sheet out of the main tray and all successive sheets from Bin 1. Also, the document will print with double spacing only; it won't single space.

We've found the printer table utility (PTU.EXE), but because it's undocumented for *WPS-Plus/VMS,* we're not sure how to use it. The documentation is available (according to DEC) with *WPS* for Rainbow, PRO and DECmate software, but does us little good. We're in the process of trying to find someone in our area who has the documentation, but so far we've been unsuccessful.

REPLIES:

Jonathan P. Heritage: Instructions on how to modify the print tables for *WPS-Plus* can be found in the July, 1986 DECUS U.S. Chapter SIG Newsletters on page OA-3-1 through OA-10-1. These instructions aren't specific to VMS, but to *WPS-Plus.* I've used these instructions together with my *WPS-Plus/POS* instructions to put together an HP Laser Plus table that works (including math and Greek). I still have two or three errant characters, but everything else seems to work fine. ■

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Next time you take off, take the DEC™ connection.

Talk about convenience for the DEC user. TI's TravelMate™ 1200 is display, printer and communications all rolled into one lightweight, go-anywhere package that emulates a VT-100™ video terminal. With it, you can access DEC computers from just about any remote location as long as there's a phone handy.* Perfect for on-the-go DEC communications.

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The TravelMate 1200 with VT-100 emulation capability also carries an impeccable pedigree — a 15-year heritage of reliable, rugged design and dependable operation. After all, it's a

member of the Silent 700 Series of Portable Data Terminals family from Texas Instruments. It's definitely a terminal you can trust.

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TEXAS INSTRUMENTS

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*In locations where a phone jack is not accessible, the optional acoustic coupler may be required.

DATELINE DEC

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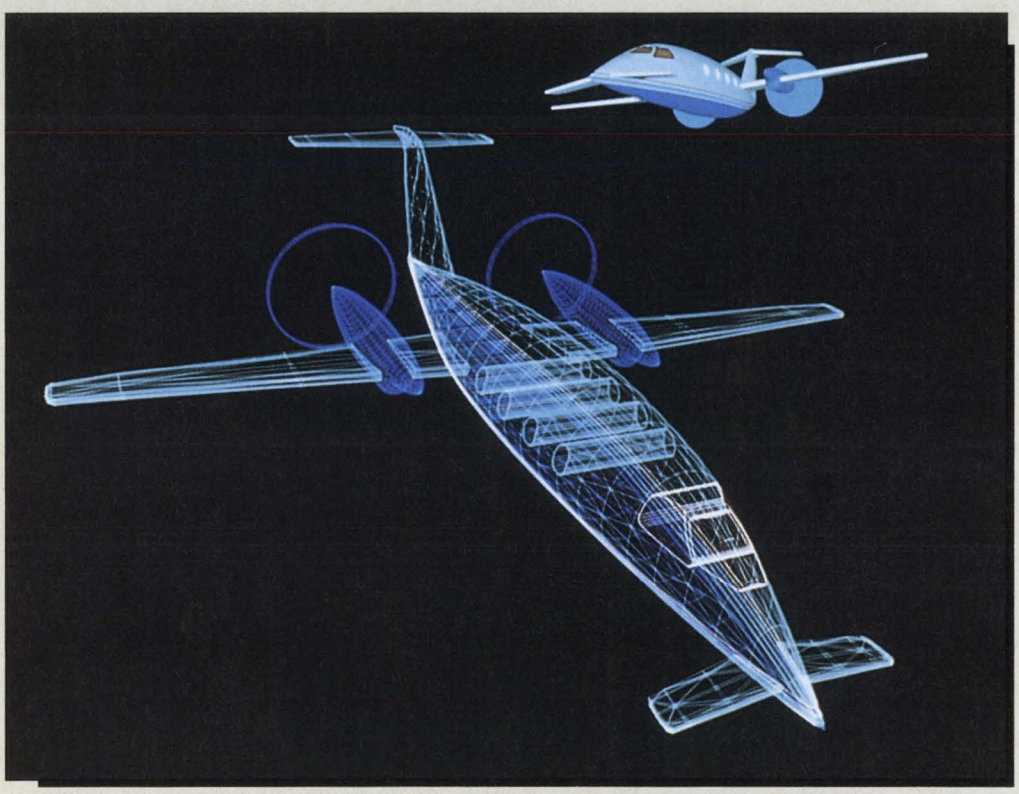
The PS 390 Color Graphics Terminal Makes It A Colorful World

Evans and Sutherland (E&S) of Salt Lake City, recently invited *DEC PROFESSIONAL* to view its new PS 390 color graphics terminal, which includes a high-resolution color display screen, keyboard, mouse, image control panel, and a dedicated processor with 1 MB of memory. The PS 390 connects to DECnet over an optional Ethernet interface.

Evans and Sutherland put its PS 390 hardware-based image enhancement technology, Shadowfax, in a custom VLSI chip. According to E&S, this chip allows the PS 390 to use a raster display technique while achieving the image detail normally associated with calligraphic displays.

The combination of the Shadowfax algorithms and the raster display allows the PS 390 to obtain images with exact endpoint matching, anti-aliased lines and depth cueing. These features give the PS 390 an effective resolution of 3500 x 3500 on a 1024 x 864 screen, according to E&S.

A viewing of the PS 390 confirmed the quality of its images. With anti-aliasing turned off for a wire-frame drawing, detail lines had the



The PS390 displays dynamic, anti-aliased wireframe images and locally computed shaded images on a single raster display.

traditional jagged quality of raster display. When the antialias algorithm was applied, the details took on a more precise look.

Depth cueing was dramatic. By turning one of the dials on the control panel, lines toward the "back" of the drawing gradually became lighter, making the image easier to orient in space. Other dials on the control panel allow the user to rotate the image on any axis or zoom in on part of it, all in real-time.

The PS 390 displays surface drawings, in addition to wire-frame pictures. The surface drawings use shading techniques with any number of "light sources" defined by the user. For surface drawings, however, the display is not updated in real-time. It took about 30 seconds for the PS 390 to recompute a surface drawing each time a change to it was requested.

E&S says the PS 390 can display 16.7 million colors (we decided not to start counting). The base system costs $43,200. More information is available from E&S at P.O. Box 8700, 580 Arapeen Drive, Salt Lake City, UT 84108; (801) 582-5847.

—Charles Connell

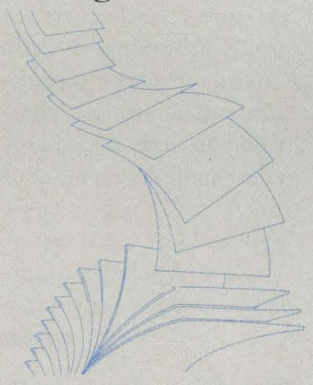
Software For Education Market Basket Aids Qualified School Market

DECPAGE Produces Text And VAX NOTES Provides Conferencing

DEC added the *DECPAGE* software and *VAXNOTES* software to the Education Market Basket, a program that offers a selection of VAX/VMS and MS/DOS software at special prices for qualified educational institutions.

DECPAGE produces high-quality printed text from word-processed documents using Digital's LN01 and LN03 laser printers. It also can produce integrated text and graphics with either the LN03 printer supporting SIXEL-based graphics or the LN01s printer supporting ReGIS-based graphics.

Using a variety of fonts and typefaces, *DECPAGE* is useful in processing documents in an educational environment, such as preparing memos, reports, letters, directories, scholarly papers, newsletters and overhead transparencies.



VAX NOTES software is DEC's computer conferencing software that gives users the ability to open discussion on any topic, monitor topics and replies, and write replies to topics created by other participants.

VAX NOTES titles all topics and replies and keeps them in chronological order, making it easy to locate specific subjects. Each participant has a personal "notebook" which tracks the conferences of special interest.

The licenses for *VAX NOTES* and *DECPAGE* are available to schools at half the commercial license price. The actual price depends on the processor model.

Digital introduced the Education Market Basket in the Spring of 1985 to make software more affordable for schools. The Market Basket contains 29 selections for VAX/VMS based processors and six selections for MS-DOS based processors.

Applications range from administrative to academic, including *ALL-IN-1* office automation software, a package of six popular VAX programming languages, two computer-based education (CBE) software tools for developing and delivering courseware on VAX systems, several languages for research in artificial intelligence, and other programs commonly used in education.

All Market Basket software is available at substantially less than the commercial price. To qualify, an institution must be nonprofit and operate lawfully as an accredited college or university; a vocational, technical or trade school; a state or local school system; or an independent secondary school.

Disks That Aren't, Are Super Fast

An Idea From Micros Comes To VMS

Microcomputer users are familiar with RAM disks, but the idea isn't as common in the minicomputer world.

The term "RAM disk" is somewhat of a misnomer. Not a physical device at all, it's a piece of software that sets aside an area of memory to act as a disk drive. After a RAM disk has been created, users may treat it as if it were an external device. Because all I/O takes place within memory, there's no input or output at all during I/O to that disk.

The advantages are obvious. No waiting for drive head movements, no disk rotational latency. Programs that require a lot of I/O to scratch files, sorting for example, can be speeded up considerably by keeping that I/O within memory. Real-time applications may also find uses where any unnecessary waiting time should be eliminated.

RAM disks also come with some disadvantages. The greatest of these is also obvious: loss of memory. Dedicating an area of memory to a RAM disk removes that memory from the operating system and the users. The computer should have enough extra memory that the loss of some will not

be felt severely. Another problem, that is not apparent immediately, is the insecurity of data in a RAM disk. If the computer stops running, the data in the RAM disk can disappear because the information isn't on a disk.

EEC Systems in Sudbury, Massachusetts, recently announced the first RAM disk software for VAX/VMS systems. They call their product *Turbo-Disk/VMS* and sell it for $2,500 (for a MICROVAX) or $3,500 (for larger VAXs). EEC recommends its use on systems with at least 4 MB of memory. The software runs at system startup and creates a disk with the name VMA0, whose size is determined by the system manager. After the RAM disk is created, users treat it exactly as any other disk.

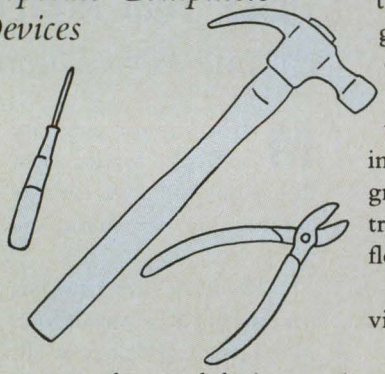
I/O to a RAM-disk is very fast, and if you have such a need, *Turbo-Disk/VMS* looks like a helpful product. Keep in mind, however, that until you transfer data from a RAM disk to a real disk, the data could evaporate during system crashes.

For more information, contact *Turbo-Disk/VMS*, EEC Systems Inc., 327 Boston Post Road, Suite E, Millbrook Park, Sudbury, MA 01776; (617) 443-5106.

—Charles Connell

New DEC Integration Tools Control Systems On Factory Floor

Three New Tools And Two Enhancements Link Corporate Computers With Manufacturing Devices



Three integration tools and two enhancements announced by DEC link corporate computing devices with other control systems on the factory floor as well as with devices used in the engineering design process.

Three new integration tools include *DECSCAN, VAX DEC/MAP* and *Distributed Numerical Control (DNC) Application Services.* Enhanced tools include *BASEWAY* and *BASEVIEW.*

DECSCAN is a shop-floor device I/O interconnect product that consists of a hardware controller and support software. It provides the capability for linking intelligent plant floor measurement and control devices to industrial VAX systems. The *DECSCAN* controller provides the industrial VAX BITBUS interface that supports multiple remote devices up to eight miles away from the IVAX system over twisted pair wiring.

DECSCAN's easy-to-use *Software TOOL Kit* enables you to create data acquisition and control applications in a simple menu-driven format. A *DECSCAN* controller with software drivers is priced at $3,000. The *DECSCAN Software Development Tool Kit* costs $2,600 and a single-user license is $200 for a total of $2,800.

Digital plans to support MICROVAX II-based systems, including the Industrial VAX, with a DEC/MAP product. The VAX *DEC/Map* products are based on the Manufacturing Automation Protocol (MAP) version 2.1 specification. They enable VAX family computer systems to interconnect and communicate with other factory floor automation equipment that supports the MAP specification.

Distributed Numerical Control (DNC) Application Services are a combination of software tools and customized services that link the VAX with multiple NC controllers. Then parts programmers can load NC or CNC programs directly from a computer to a particular NC controller, eliminating the need to load programs physically on the controllers with paper tapes, floppy disks or tape cassettes.

DNC Application Services include modules that enable computers to communicate with many widely used NC controllers. They consist of a menu-driven manager that stores parts programs and loads them directly into NC controllers, server software that links IVAX systems to NC devices and a device connection service that provides customized protocol emulators.

BASEWAY enables applications to communicate with area control, intelligent, factory-floor devices from multiple vendors. Enhancements include new device support for Texas Instruments' and Siemens' programmable controllers, and new functions: data access by logical name, unsolicited input from Programmable Logic Controllers (PLC) and off-line PLC Programming support.

BASEVIEW translates engineering drawings created on Computer-Aided Design (CAD) workstations for display on standard terminals for viewing by production personnel. Enhancements include the ability to form compound documents, support for VAXstation windowing software and the ability to annotate graphic drawings.

Floating Point Systems' M64 Processors Available With Two VAX Systems

New Agreement Allows DEC Customers To Order Both In Single Transaction

Because there are many complex engineering tasks taxing the speed and cost-effectiveness of a single processor, Floating Point Systems recently has entered into a marketing agreement with Digital Equipment

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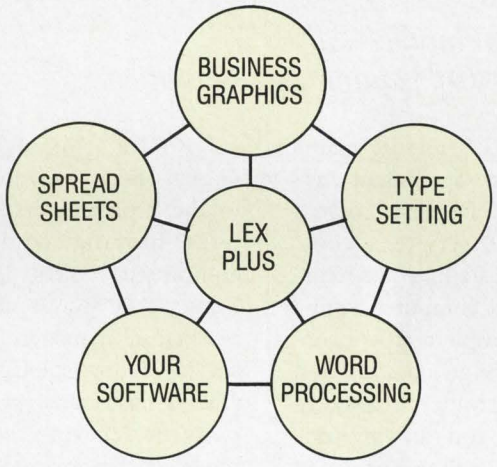

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Corporation to provide two high-performance computing systems.

The larger of the two new packages combines a large-scale VAX 8550, 8700 or 8800 system with a powerful Floating Point Systems M64/60 processor that can execute at 38 million floating point operations per second (MFLOPS).

The smaller packages uses a VAX 8200 computer and a Floating Point Systems M64/30 processor that can execute at a rate of 12 MFLOPS.

The agreement gives DEC customers the ability to order both the VAX system and the Floating Point System's processor in a single transaction from Digital. Previously, the systems had to be ordered separately from each company.

The systems are targeted at engineering, scientific and technical users in such industries as aerospace, automotive, petroleum and transportation, who perform large analysis batch jobs or who require rapid turnaround time on small analysis jobs.

Prices for the VAX 8550-, 8700- or 8800-based systems depend on the system used and its configuration. A VAX 8550-based system using an M64/60 begins at $1 million.

Prices for the smaller 8200-based system with the M64/30 processor start at $330,000.

"Some large finite element analysis jobs can tie up a conventional large computer for a day," explained Don McInnis, manager of DEC's Engineering Systems Group. "The M64/60 processor can run jobs of that sort in an hour. It runs in parallel with the VAX system, so large computational jobs do not degrade VAX performance or make the VAX system unavailable to online users."

McInnis said either of the two packages can be used as a standalone system or the FPS processors can be shared by a number of other VAX systems either in a local area network or in a VAXcluster.

"The VAXcluster approach has two advantages," he said. "First, it assures that the FPS processor will have a high utilization rate, making it a cost-effective purchase. Second, it distributes the cost of the powerful processor across a greater number of users."

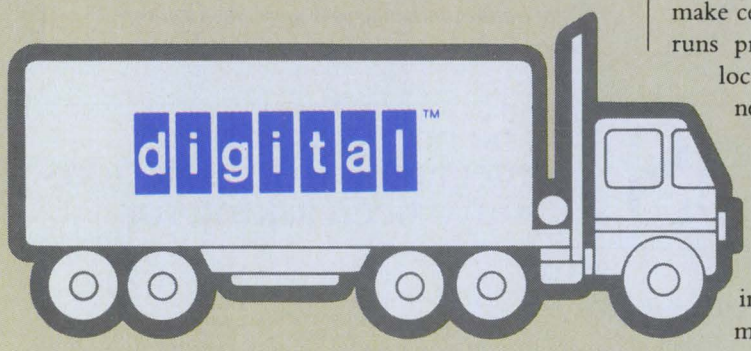
The Floating Point Systems M64 series of processors runs the most widely used engineering and scientific application packages, such as *MSC/NASTRAN* and *ANSYS* for finite element analysis and *FIDAP* for computational fluid dynamics.

DECmove Service Takes Over During Computer Facility Moves

Digital Handles All Aspects Of Equipment Relocation

For DEC's on-site maintenance agreement customers, Digital offers DECMOVE service, a complete deinstalling and reinstalling of computer equipment, complete risk insurance coverage, coordination with customers' moving schedule and an environmental survey of new customer locations.

"With this service, Digital offers a total solution to the problems associated with moving computer equipment," says Derrin Fund, DECMOVE service marketing manager. "This single-vendor solution increases customers' productivity by relieving them of move supervision and coordination responsibilities."



Fund adds that DECMOVE service is a result of Digital's close attention to customer requests. "The development of this offering, like most Digital service products, was customer-driven and customer-oriented. Our customers asked us to help them by providing a service like this, and we worked with them to meet their needs."

Under the service, DEC manages all aspects of the customer's move, including transportation and any necessary interim storage of computer equipment. To make certain the equipment runs properly at the new location, Digital engineers verify equipment operation prior to dismantling and they run diagnostics after reinstallation. To minimize impact on the customer's operations, DEC surveys the customer's new site to ensure that environmental and power conditions are satisfactory.

Digital provides insurance on all moved computer equipment for every risk except war and nuclear disaster. Damaged equipment manufactured or supported by Digital is repaired or replaced immediately.

"Now, DECMOVE service enables customers to move in an efficient, cost-effective manner — even on weekends or during the night, with minimal system downtime while the move is in progress," says Fund.

The DECMOVE service is a custom-quoted contract service based on specific customer needs, equipment weight and distance travelled. For an additional fee, arrangements can be made for after-hours and weekend moves at the customer's request. ■

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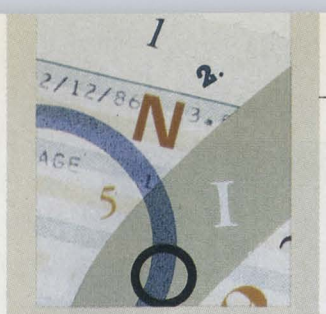


PRINTERS

NON-IMPACT PRINTERS

By Philip A. Naecker

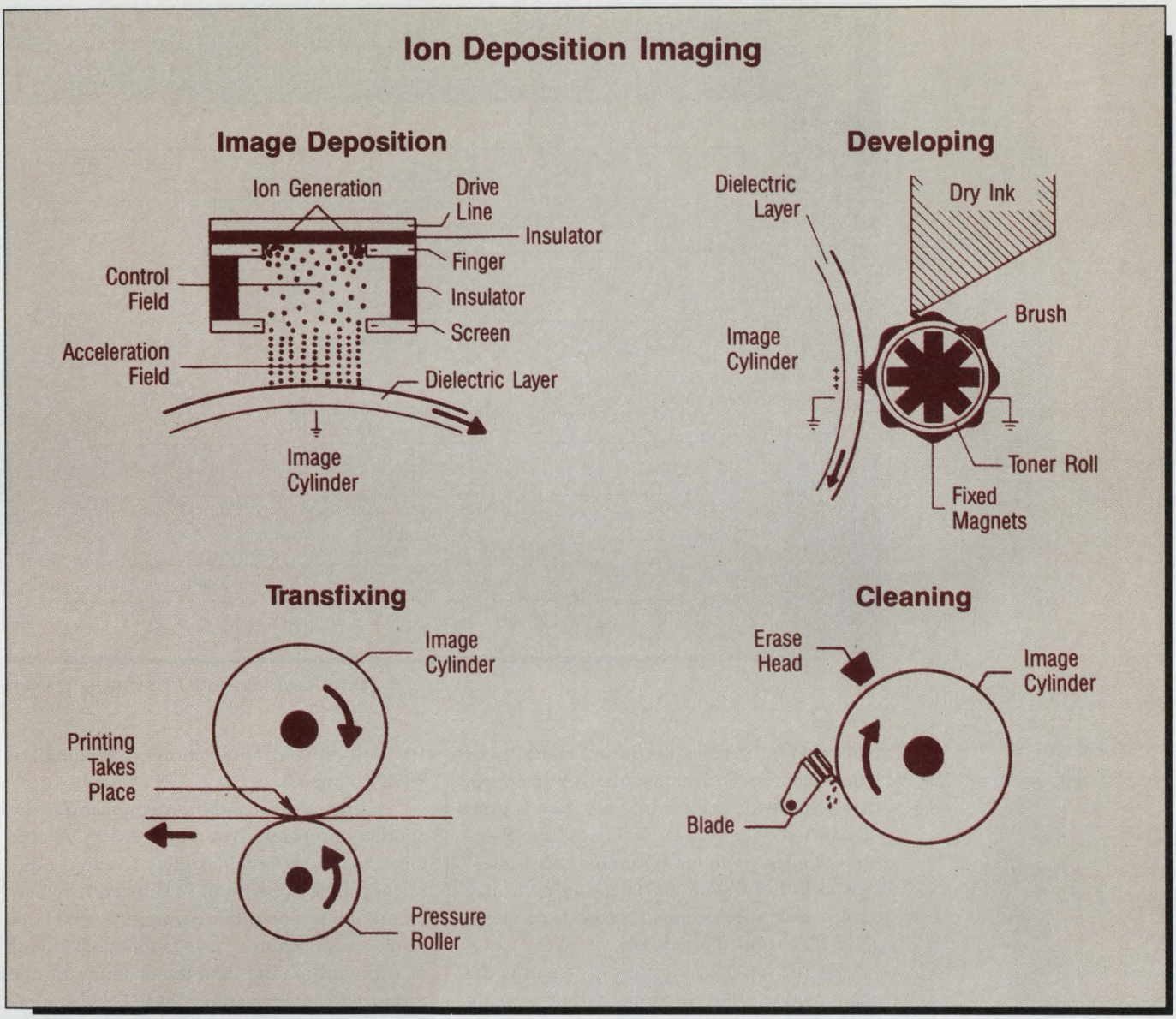
Out Of The Computer Room And Into The Office.

The 1980s were going to usher in the "paperless office" according to the computer gurus of the '70s. Electronic mail systems notwithstanding, most organizations actually are using their computers to generate more paper now than they were a few years ago. In addition, consumers of computer-generated paper documents now want improved readability, quieter printing devices and mixed text and graphics, not just all uppercase line printer output. Fortunately (or perhaps because of this), low- and medium-range printers have become more sophisticated and powerful during the same time period, offering a breadth of capabilities that would have cost hundreds of thousands of dollars a few years ago. Advances in consumer electronics, lead by the personal copier, have spilled over to spawn an entire market for high-quality imaging systems that didn't exist five years ago. And new technologies are just beginning to be explored.

Types Of Printers

We can divide printers into two broad classes: impact and non-impact. Until a few years ago, virtually all printers were impact printers. That is, an image is created by striking the paper with a hard object that transfers ink from a ribbon, like in a typewriter (remember those?). There were a few non-impact printers around, mostly raster-dump devices that used a video/thermal process to image a CRT screen, or expensive laser or electrostatic printer/plotters found in large DP shops. A few lucky universities had one of Xerox's experimental electrostatic or laser printers with some graphics capability built in. But by and large, printing was done by a mechanical impact process. It was noisy, relatively slow, expensive, heavy, limited to fixed character cells and prone to mechanical failure. Many of the higher speed impact printers are running today, and mechanical printing techniques still have a lot to offer in the way of speed, carbon copies and cost effectiveness. But printing definitely is moving in the direction of the non-impact technologies.

Why is non-impact printing a big deal? It depends on your needs and on which technology you examine. First, non-impact technologies are quiet. There are no hammers striking printheads, printwheels or pins. That makes non-impact technologies ideal for distribution outside the computer room and into the office, without the need for sound hoods. Second, because there are no hammers and often no printheads, there tend to be fewer moving parts in a non-impact technology; sometimes no more than that required to move the paper through the printer. This generally makes non-impact printers more reliable and less expensive to service. Finally, and perhaps most important, non-impact printers tend to have greater resolution and thinner line widths than impact printers. (Plotters have better absolute resolution than most laser printers —



as good as 1/1000th of an inch — but the size of the line or dot placed by a plotter is much larger than a pixel on even the lowest cost laser printer.)

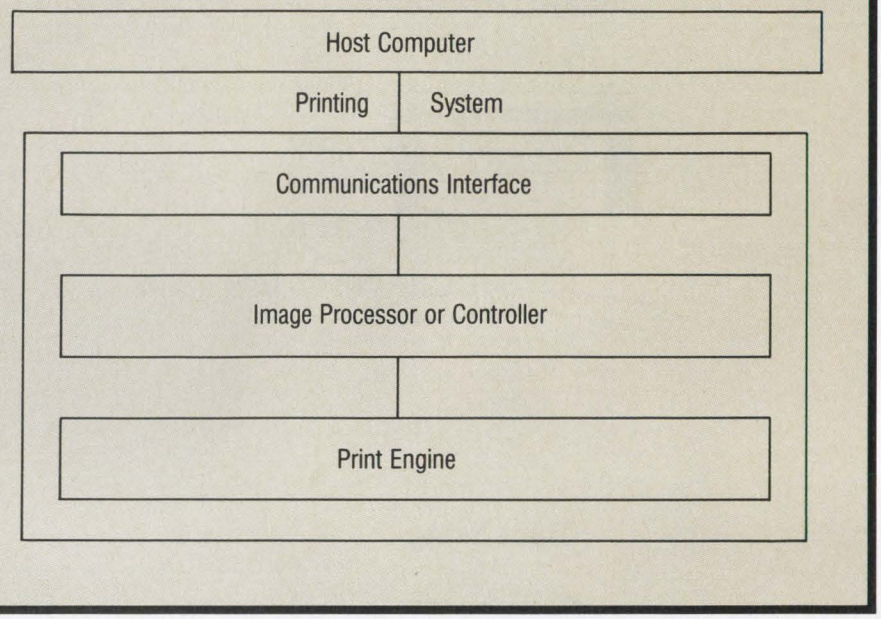
Parts Of A Printing System

Have you ever noticed that many non-impact printers, even though they're from different manufacturers, look the same on the outside? Guess what? They *are* the same, and not just on the outside. What you've seen is several different printers based on the same print engine.

A printer really is a *printing system*, built from components that can be bought from other manufacturers or custom built by the printing system manufacturer (see Figure 1). The data enters the printing system via the communications interface, is processed by the controller to turn it into a format acceptable to the printer (often a video signal), and the image then is placed on the paper by the print engine.

For printers above the lowest price range, there may be options available for the communications interface other than just a standard RS-232 port. Many of the larger printers support both parallel and serial interfaces as well as various mainframe interface protocols.

FIGURE 1.



A generalized non-impact printing system.

Networks of various kinds are available for larger printers, including Ethernet interfaces that help turn a printer into a network print server. A very big printer will have large quantities of memory in the communications interface to buffer incoming data, and even may have a disk subsystem to allow it to queue print files from the network.

At the heart of a printing system is the print engine, the component that actually makes the spots on the paper. It doesn't really care how the rest of the printer decides where the dots belong. The dots are used to create lines and characters in essentially the same technique used by a dot matrix printer. As we'll see, there are many different kinds of non-impact print engines, with laser printers currently being the most popular. The engine is the portion of the printer most likely to be manufactured by another company — Ricoh, Xerox, Canon and others. There are many good reasons why, including the fact that it's a difficult technology and economies of manufacturing scale are important, so it's cost effective to build print engines for many different users and applications (including, of course, copiers).

Using a print engine manufactured by another company gives a printer vendor (the OEM, technically) the flexibility to adopt a different print engine should a substantially better one come along. For example, several laser printer manufacturers have families of systems incorporating more than the products of one print engine manufacturer. IMAGEN Corporation uses print engines from three different manufacturers. "We look for the engine with the best match to our product line in terms of price/performance," says Daniel B. Curtis of IMAGEN's Product Marketing department. "We fill a hole in our product line by looking for the engine that has the right price, good availability and is very reliable."

IMAGEN is able to switch easily from one manufacturer's engine to another because of its controller design. Although the print engine may be the heart of a printing system, the controller is the brain. To a printing system, the hard part is not necessarily getting the dots on the page, but figuring out where they belong, and IMAGEN's controllers are designed so that they can be used easily with

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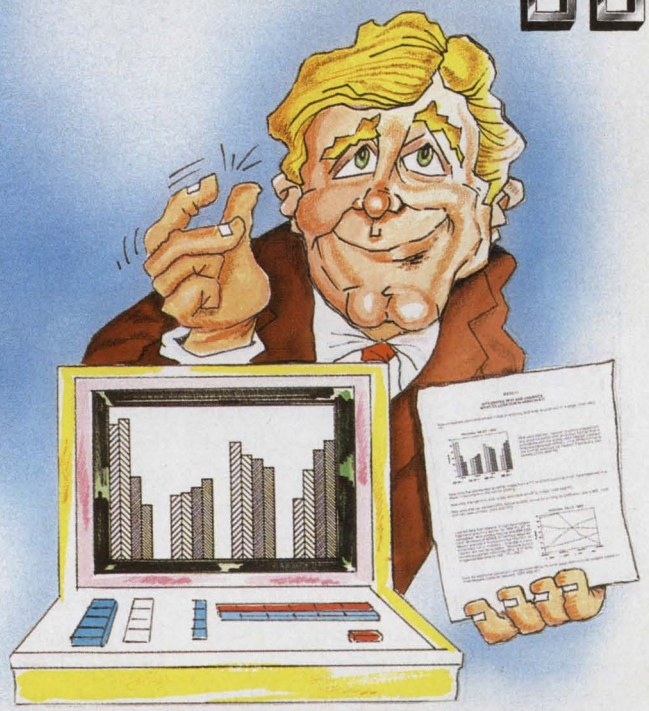

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Page Description Languages

It wasn't so long ago that computers printed everything on a monster called a line printer. It was considered quite a revolution when the character set jumped from 64 to 96, providing lowercase letters and a few extra symbols. All printed characters were taken from this single character set (although we could sometimes overstrike for various effects) and characters were placed only in specific locations or "cells" within a page, and only in a single orientation. Since the hardware was limited, it wasn't essential to have a means of compactly describing things like fonts, line drawings or other graphical objects outside the range of the hardware.

Early page description languages soon began to evolve. The first, like RUNOFF (now called DSR — Digital Standard RUNOFF) and UNIX's troff were concerned principally with text formatting. These utilities used commands imbedded in the text to control pagination, headers and footers, indentation, automatic numbering of sections and the like. A mix of word processing and page description, DSR and troff allowed users to control the overall format of a document but still were limited by the confines of character cell printing. Further, since the commands are imbedded in the text by the user with a standard text editor and the formatting is all done in a batch mode, these simple document description tools have languished in the age of "what you see is what you get" word processing.

Dot matrix printers and early, expensive electrostatic and electrophotographic printers started to lift some of the restraints established by earlier printing hardware. Initially, escape sequences were provided to give users access to the more powerful graphics and text capabilities of the next generation of printers, but they had severe limitations. Escape sequences tended to be device dependent, and managing escape sequences explicitly in a document tended to be tedious at best and nearly impossible at worst.

Enter page description languages (PDLs). PDLs allow you to describe the format of a document, much like DSR and troff, by imbedding commands in the text. However, today's PDLs have shed most of the limitations of the earlier systems by explicitly including tools for manipulating all sorts of graphics, scanned images, fonts of any size and form, printing in any orientation, and many other capabilities desirable in preparing an attractive document. Most important, modern PDLs are specialized computer *languages* in which programs can be written to describe the operations to be performed on the data (i.e., text) of the document.

PDLs have many roots, but certainly two of them are Knuth's TEX and Xerox's PRESS and INTERPRESS. TEX (rhymes with neck) was developed by Knuth and others at Stanford University as a means to accurately describe mathematical texts and other documents with many equations and special formatting requirements. Knuth wanted to improve the quality and attractiveness of the final output, as well as make it easier for the writer to generate and edit technical documents. TEX is organized with the "smarts" in a host computer program connected to a physical printing device using a device driver.

This structure allows TEX to be improved constantly and to be implemented on many different output devices, including dumb as well as smart devices. There also are different dialects of TEX, and users can customize TEX using it's powerful macro capability. Since TEX is a complete document preparation system, not just a document description language, it includes a sophisticated capability for functions that otherwise might be incorporated in the word processing software, such as a very powerful hyphenation system. The rights for TEX have been assigned to the American Mathematical Society and you can get a copy with associated hardware drivers for your VAX or other computer by contacting the TEX Users Group, C/O American Mathematical Society, P.O. Box 6248, Providence, RI 02940. DECUS also has a variety of TEX tools available through the Library and the Languages and Tools SIG.

INTERPRESS grew from Xerox's PRESS, a language used internally by Xerox and implemented on a few of it's early Xerographic printers. Like TEX, INTERPRESS is a full programming language specifically designed for producing images on paper. Like Xerox's laser printers, INTERPRESS has been a pioneer among PDLs but has failed to capture the low-end printer market. For a variety of technical and marketing reasons, INTERPRESS has not taken off as the standard in PDLs and only a few high-end laser printers currently support it. The only INTERPRESS products currently available depend on an XNS or Ethernet environment.

The trophy of "industry standard" is being strongly courted by *PostScript*, produced by Adobe Systems Inc. The founders of Adobe Systems are refugees from Xerox's Palo Alto Research Center, and they have dished their former employer a slice of humble pie. *PostScript* burst onto the printing scene with the introduction of the Apple LaserWriter, and *PostScript* output now is produced by many popular Mac- and PC-based word processing and electronic publishing packages, as well as many minicomputer- and

Continued . . .

TABLE 1.

Printing Technologies

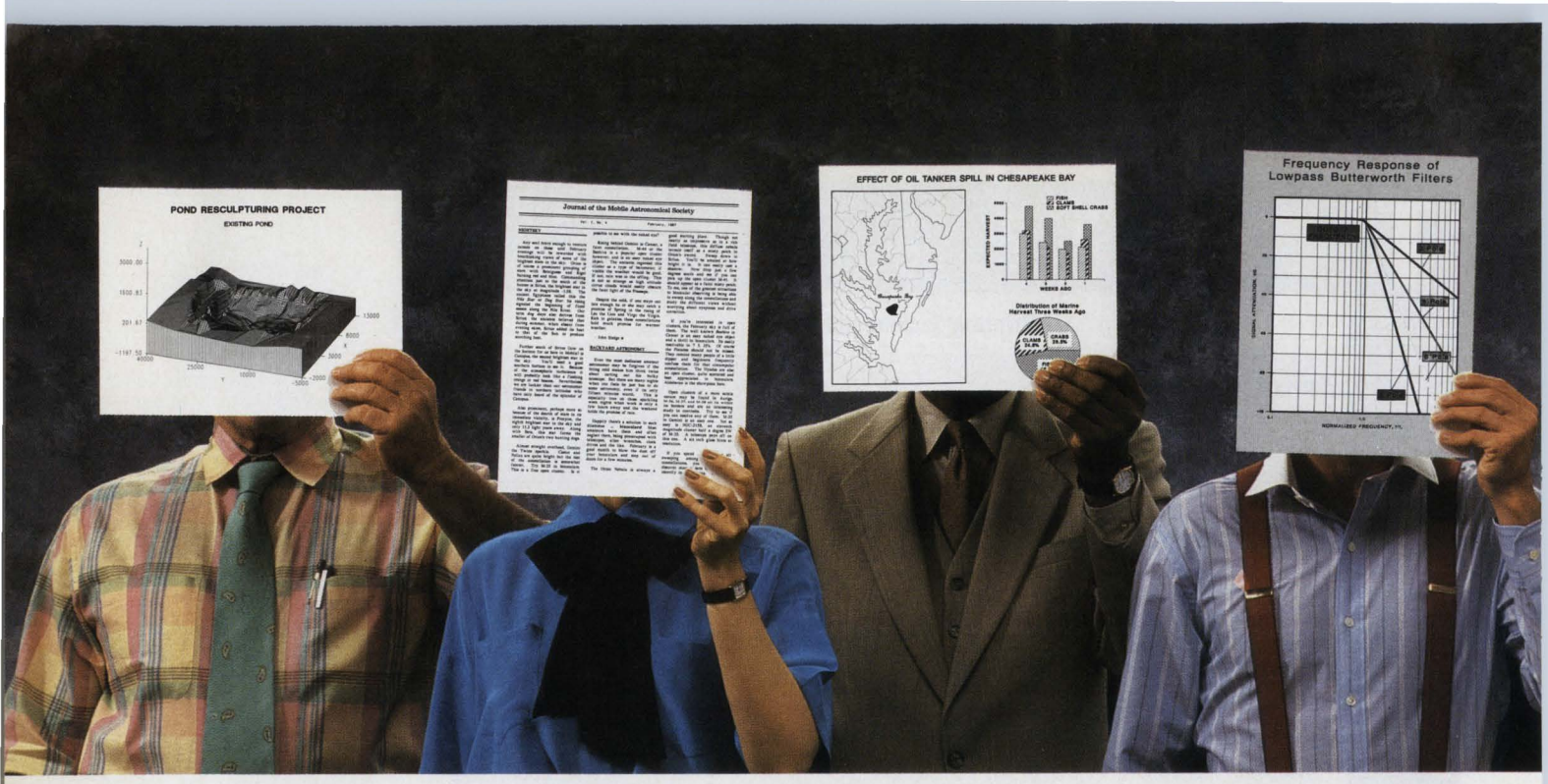
Printing Method	Approximate Resolution (dpi)
Electrophotographic (various imaging methods)	
Semiconductor Laser and a rotating polygonal mirror	300-600
Light Emitting Diode Array	150-250
Liquid Crystal Shutter	150-250
Ion Deposition	240
Electrostatic	200-400
Ink Jet	100-250
Thermal Sensitive Paper	<100
Resistive Transfer	200
Thermal Transfer	200
Electro Erosion	200
Phototypesetting	1500+

several different print engines. "The way our image processor is set up, it's not terribly difficult to change from one engine to another," explains Curtis. "We have a separate personality module for each engine . . . We just change one board and leave the rest of the image processor alone. Sometimes, as in the case of the different Canon engines, we can just change an EPROM."

The controller translates the data coming from the computer into a form easily used by the print engine. The problem generally is one of translating a vector or object-based graphics and text protocol (e.g., "draw a line from here to there," "put a circle of radius 2.6 at this location" or "write these letters along a vertical line") into a group of pixels. Controllers for plotters, especially electrostatic plotters, have been solving this problem for years, although at more expense and slower speed than current-generation controllers. Older controllers for high-speed non-impact printers didn't have vast quantities of fast memory cheaply available, so those printer controllers had to process the data as it came in, resulting in limitations on text orientation, font changes and so forth. The problem is manageable if all that's being printed is fixed-pitch text, because the number of characters and character cells is relatively small.

To solve fully the vector-to-dot- matrix problem requires a full page bit-map, with one memory bit for every pixel on the page (in black and white, no gray scale). With 300 dots per inch, the arithmetic works out to just under 1 MB of memory if the printer doesn't quite use the full width of a standard 8½- by 11-inch page of paper; memory to cache the instructions from the host computer and controller programs adds a bit more. Multiply by four if the printer needs to do gray scale or 16 colors, and multiply by "a bunch" if the printer is producing large format documents. (Obviously, a 200 dpi, 24- by 36-inch plotter doesn't use the full page bitmap technique, but the basic function of the controller still is the same.)

Controller hardware and capabilities vary considerably with the target market of the printer. Consider the controllers manufactured by NBS Southern Inc. Designed for high-volume printing, these controllers can keep up with engines capable of printing 300 pages per minute. They use 2 MB of memory for storing fonts and ASCII data coming in from the host, 2 MB for each of two bit maps (one



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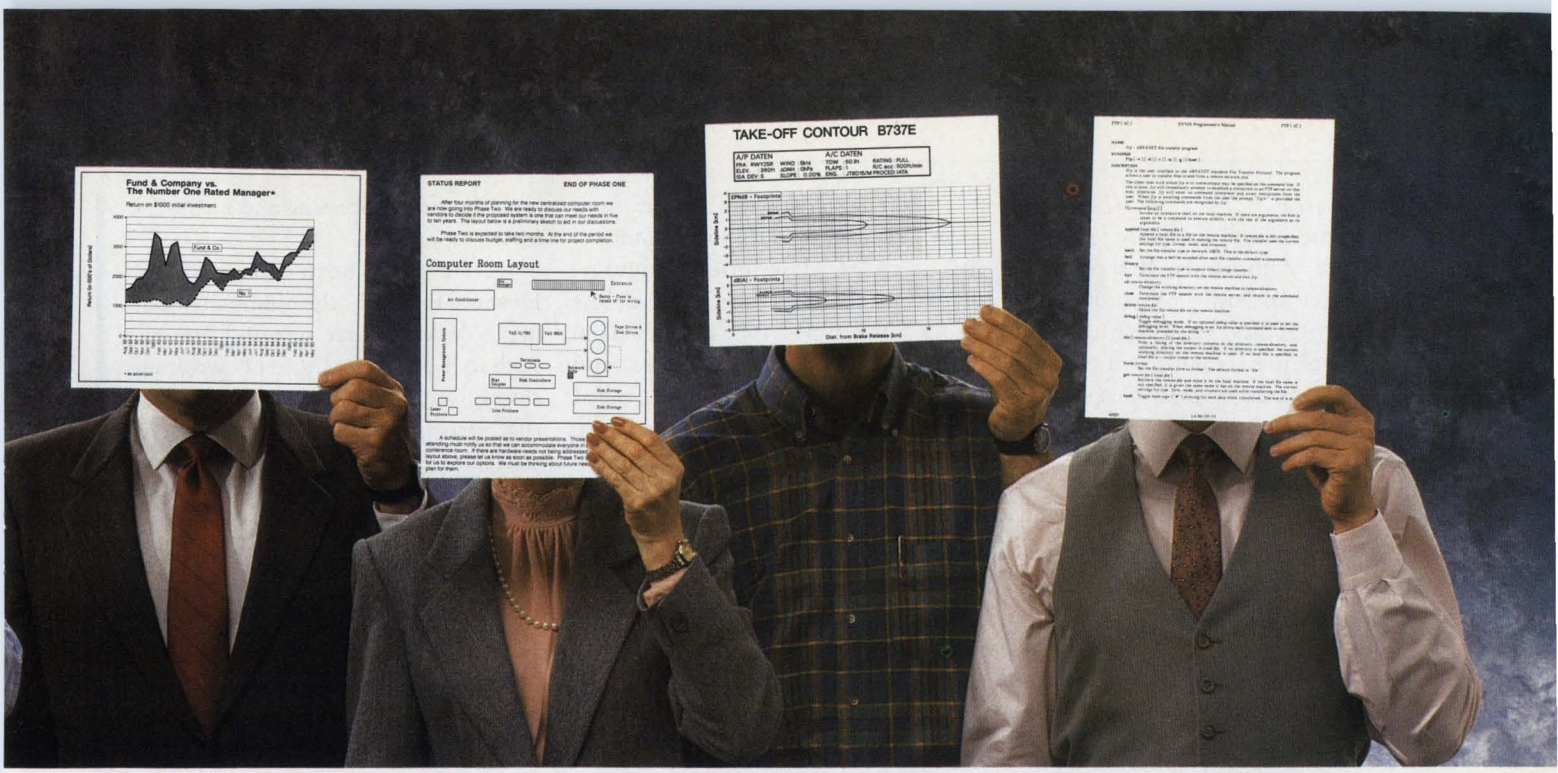

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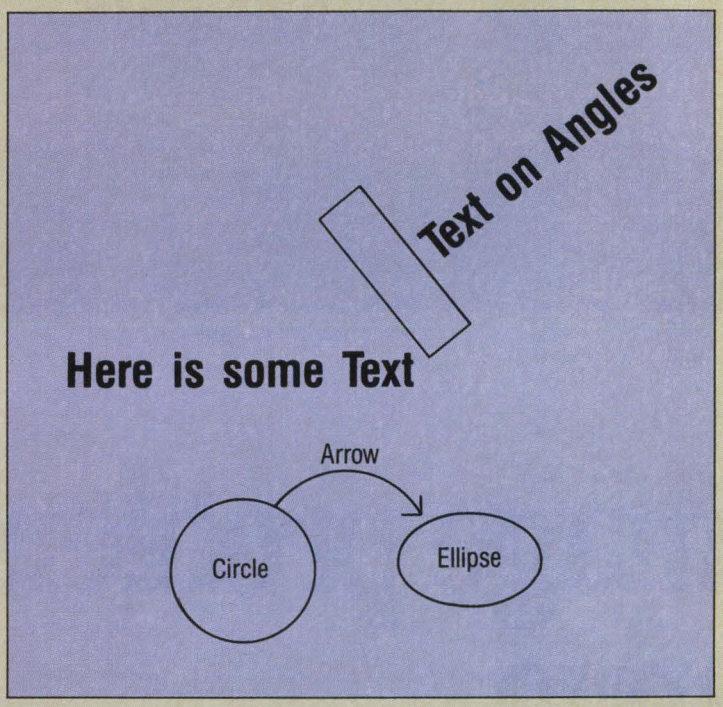
mainframe-based software systems. *PostScript* commands describe the appearance of entire pages of mixed text and graphics. They also are independent of the resolution of the output device, making a *PostScript* document easily ported from a low-end PC-based word processing program with "draft" output on a low-speed laser printer to a high-speed laser printer or an extremely high-resolution phototypesetter.

Unlike TEX, organized on the host-and-driver model, *Postscript* is designed to be implemented entirely in the printer. Literally dozens of devices now support *PostScript*, as well as probably hundreds of software packages. Adobe licenses the *PostScript* language to printer manufacturers who then implement the language in their printer controller. Digital has adopted the *PostScript* language for it's low-end printer, a new model of the LN03, and for its medium-speed printer, the Print Server 40. (In the LPS40, *PostScript* is implemented in the MICROVAX running ELN that serves as the controller for the printer.) *PostScript* is output from a number of popular word processing packages in the DEC marketplace, and soon will be offered on more. DEC software now generates *PostScript* output from its UIS windowing software on workstations and most likely will support *PostScript* in future windowing and screen management products.

But the PDL Wars are far from over. Printer manufacturer IMAGEN has a page description language, *imPRESS*, that has been around the block a few times. IMAGEN has taken its experience with *imPRESS* and created a new, higher order PDL called document description language (DDL).



As the name implies, DDL describes the format of a full document as opposed to describing a single page at a time. In this sense, DDL is more like Knuth's TEX than like Xerox's INTERPRESS. Another important difference is that DDL separates the document layout from the text of the document itself, simplifying the task of generating both parts. The fact that DDL describes multiple pages also saves processing time by creating an image that may be reused (e.g., a page heading with a company logo). DDL also supports composite objects, which are print objects composed of both graphic primitives and other print objects, another processing and memory-saving construct.

DDL has been adopted by Hewlett-Packard, the company that made desktop laser printing famous with its LaserJet. IMAGEN is working closely with software vendors to get DDL incorporated into their products, and is pushing hardest in the low-end market, the space that all of the PCs and most of the laser printers occupy. "When you're trying to establish a new standard — especially competing against an established product like *PostScript* — you need as many applications as you can get working, as fast as you can," says Resa Quinn of IMAGEN.

DEC, as usual, isn't exactly at the leading edge of PDL support. DEC has formally adopted *PostScript* at the low end and is hinting at support for INTERPRESS at the high end. The software companies seem willing to support multiple PDLs, so ease of implementation in the hardware, the power of the language and the efficiency of marketing departments seem to be the deciding factors. For it's part, Adobe says that new versions of *PostScript* are expected to include color and gray-scale support, higher performance printers and support for non-printing devices like displays. IMAGEN's DDL is pushing the envelope with page independence, allowing a document to be printed in any order, automatic memory management and automatic scaling of bitmaps to utilize enhanced resolution devices. ■

The forms overlays can include complex objects such as logos or signatures . . .

printing and one being created) and another 2 MB for forms overlays. The forms overlays can include complex objects such as logos or signatures, and multiple forms can be stored or even enabled simultaneously. Managing these objects at speeds of 300 ppm is not an easy task. Ben Warren, NBS Southern's vice president of engineering, explains, "We looked at the 68,000 processors and realized that we could generate only about 20 pages per minute using that approach. We had to develop a different controller architecture and decided to use the 2916-bit slice microprocessor together with some coprocessors for handling the interface and such." A floppy drive in the controller stores microcode and fonts.

Close to the other end of the spectrum, DEC's original LN03 printer didn't have enough memory to cache a full bitmap and instead used various memory compression techniques to store a full page image. This approach limited the complexity of graphics on printed pages on the original LN03 model, even with an extra RAM cartridge. The LN03-Plus printer resolved the limitation by adding over 1 MB of memory, allowing full 300 dpi graphics to be printed.

Mixed Text And Graphics

Alas, printers don't live by text alone. Printing text and simple graphics formats (like the character cell-based SIXEL format supported by the DEC LN03) is one thing. Printing mixed text and graphics with multiple fonts and multiple text orientations is something else.

For starters, the most reasonable way to transmit such complicated page descriptions between the host and the printer (short of transmitting the whole bit map, an impractical task) is to use some sort of page description language (PDL) (see Box 1). Page description languages like *PostScript* from Adobe Systems Inc., *Interpress* from Xerox Corporation, and *DDL* from IMAGEN describe a page in terms of large graphic and text objects instead of in terms of bits, and thus are more compact. However, the trade-off is that the translation of PDL-to-bits must be done by the printer controller, and that's no easy task.

To shorten the product development life cycle for the integration of controllers processing *DDL* with new print engines, IMAGEN has developed a VLSI chip that implements much of the *DDL* interpretation. "We now have a Raster Image Processor (RIP) on a IBM PC compatible card," explains Resa Quinn, marketing communications manager at IMAGEN. The card looks like a printer interface to the PC and generates video output suitable for the print engine. "The first version of the card is compatible with the Canon engine, and we're working on versions for other engines as well." The VLSI implementation means that only the video interface to the print engine must be changed for different printers. "We think this is a good way to get *DDL* out in the market and available, and it helps IMAGEN address the low-end, PC-based market. Until now our printers have been used principally with the VAX and similar larger machine environments."

A common requirement for high-volume non-impact printers is local forms generation. By locally generating the graphics (mostly straight lines) that make up the form, the transmission and translation overhead is reduced. Different controllers handle this task differently. In some, forms are downloaded using what basically are ANSI escape sequences for graphics, similar to those found on DEC's VT100 series of terminals. In the case of NBS Southern's newest controller, controller-

Laser printers span nearly the entire printer price range . . .

resident forms are managed using an IBM PC for form creation and storage.

Selling the same print engine with different controllers occurs not only in the laser printer arena but happens in other non-impact technologies as well. For example, DEC remarkets a color ink jet printer from Tektronix and calls it the LCP01. DEC's controller is a MICROPDP-11 that's nearly as big as the printer itself and fits underneath it. The controller allows the LCP01 to understand DEC-specific graphics languages by translating the image into the printer's native graphics protocol. The software for the PDP-11 is downloaded from the VAX each time the PDP-11 is powered up, which theoretically will allow DEC to support new and enhanced graphics protocols in the printer.

Electrophotographic Imaging Technologies

The technologies for putting marks on the paper are as varied as the printer controllers. Table 1 lists a few of the currently available and soon-to-be-seen printing technologies.

Electrophotographic methods are the most familiar and have the most proponents at the moment. Based on well-developed copier technology, these methods differ only in the means used to illuminate the photosensitive drum or belt (see Box). The laser method uses a rotating mirror to cause a beam of laser light to scan the imaging surface. The beam turns on and off to expose individual pixels selectively, which then are used to transfer dry powder toner to the paper. Laser printers span nearly the entire printer price range, from relatively low-cost ($2,000) semiconductor laser systems with a six page per minute capacity to powerful gas laser systems that can print literally hundreds of pages per minute and cost more than $100,000.

In the LED array method, a strip of light-emitting diodes is produced on a strip of semiconductor material using standard semiconductor manufacturing techniques (photoresistive etch microlithography), which can be very accurate. The resulting strip of LEDs is brought close to the surface of the photosensitive drum to expose individual pixels.

The Liquid Crystal Shutter (LCS) process uses a similar microlithography technique to manufacture closely spaced arrays of individually addressable shutters. These LCSs turn opaque or transparent in response to electric fields, and can be opened and closed rapidly. A single bright lamp behind the shutter thus can be used to expose all the pixels in a scan row simultaneously.

In both LED array and LCS printers, there literally are no moving parts except those required to feed the paper. The rotating mirror of the laser printer and the associated timing logic are eliminated. LED array and LCS printers aren't big in the market yet, but their simplicity holds a promise of high quality at lower cost than that of today's laser printers. Also, the fact that the LED or LCS array can grow with the width of the paper means that this type of imaging system potentially can handle wider paper, as wide as that currently available in electrostatic printers.

Other Imaging Technologies

Ion deposition and electrostatic printers use toner similar to that used in the electrophotographic process, but take a more direct approach to placing the electric charge on the rotating drum or belt. Instead of a photographic method employing a light beam to interact with the surface of the drum and generate a charge, an ion deposition printer simply "shoots" the charge directly onto the drum, using a magnetic lens to control the placement of the charge. The Mercurion printer manufactured by NBS Southern uses

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There are two kinds of ink jet printers in use, the continuous-flow design and the drop-on-demand design.

this process in its line of medium-resolution, high-speed (240-dpi, 80-ppm) printers.

Electrostatic printers, a technology championed by Versatec, a division of Xerox, use fine wires, called nibs, to place the charges directly and precisely. Versatec printer/plotters for many years have found broad use in the Computer Aided Design field because electrostatic technology lends itself to use with wide paper; simply extend the row of nibs and voila! — a wider printer.

There are two kinds of ink jet printers in use, the continuous-flow design and the drop-on-demand design. Both generate flying droplets of ink, but the continuous-flow design uses magnetic or electrostatically charged ink, which then is deflected in flight using a mechanism similar to the yoke on a CRT tube. The droplets, needed to make spots on the paper, are allowed to travel straight ahead, while the droplets that otherwise would end up on white spaces are deflected to a gutter. The drop-on-demand design generates ink droplets only when they're needed, so there's no need for a deflection mechanism or a gutter. The most expensive ink-jet printers have many jets and can print fully formed characters in a single pass of the print head, whereas the less expensive printers have only one jet and must make multiple passes, making them slower (perhaps only 15 cps) and reducing the quality of the printing.

But ink jet printers have one big advantage over some of the other non-impact technologies — they can use colored ink. Using separate channels for each of the subtractive primary colors (yellow, cyan, and magenta) plus a black channel, a color ink-jet printer can print a document rapidly with mixed text and color graphics.

Traditional thermal printers are rather passé these days. They use a heat-sensitive paper exposed either to a hot-wire printhead (similar to a dot matrix printer printhead) or to an array of fixed-position heating elements. In addition to the fact that the heating requires time that slows down the printer, the heat-sensitive paper is a problem to store. It degrades over time after exposure, and the images are not high in contrast.

Resistive transfer printers avoid many of the problems of traditional thermal printers by heating the ink rather than the paper. A special film ribbon, similar to the film ribbon found on many typewriters, has ink that melts rapidly when heated by a tiny electric current. The melted dots of ink are transferred by pressure to the paper, and the resulting image is of high quality. The technology was pioneered by IBM, which is currently the only manufacturer producing this type of printer.

Electro-erosion printers are another IBM-only technology. These printers employ a special paper with a thin silver film overlaying a black image surface. An electric current delivered by wires similar to the nibs in electrostatic printers causes the silver layer to evaporate (or be eroded away). This process exposes the underlying black image layer, and images are formed by familiar dot matrix principles. The paper is expensive and the process slow. However, the high contrast of the image makes it a good master for offset printing, which is where IBM has been using it in-house.

Thermal printers also can generate color graphics mixed with text, and obtain resolutions that approach those of ink-jet printers.

Another non-impact printing technology of note is phototypesetting. However, because phototypesetting lacks the graphics capabil-

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ity of the various dot matrix approaches, it doesn't seem to hold great promise for the future except in a specialized publishing niche.

Fonts, Fonts, It's In The Fonts

Most of the non-impact techniques we've discussed are fundamentally dot matrix in operation, and one of the primary parameters of quality in any dot matrix technology is the "jaggedness" of the characters and figures. For an arbitrary geometric figure, there are a number of techniques that can be applied to increase the apparent smoothness of the lines. The first of these, called anti-aliasing, involves removing pixels on the corners of objects or on the corners of the "stairstep pattern" to make the line on top of the eye more uniform in shape. You can expend considerable effort in hardware and software to anti-alias an arbitrary geometric figure or set of lines.

Another technique involves reducing the intensity of some of the pixels and increasing the intensity of others, thereby countering the apparent unevenness of the image. However, few of the current printing technologies are capable of gray scale (a pixel either is off or on, black or white) so intensity games are unavailable.

A Look At Laser Printer Engines

If two laser printers are rated at 300 dots per inch, does it matter which printing engine they use?

The heart of a laser printing system is the print engine, the device that actually puts the marks on the paper. Although the printer controller determines how "smart" the printer is and manages such functions as interpreting page description languages, the print engine is the primary determinant of operating cost and speed. (In complex documents, the controller may be slower than the engine, but that's the exception rather than the rule.) Here are some of the operative differences that may be found in apparently similar laser printer engines, using the Ricoh and Canon engines as examples.

Electrophotographic Method

Laser printers may differ considerably in their technique for applying toner to the paper. Using a semiconductor laser as the light source, a beam of light is scanned across the imaging surface. The imaging surface is rotated steadily past the light source as the light is scanned from side to side and turned on and off rapidly. The scanning generally is accomplished by a rotating mirror with multiple flat sides, each side responsible for a single scan line per rotation. In the Canon engine, a metal drum is used as the imaging surface; in the Ricoh, it's a metalized belt.

The two engines differ significantly in what happens at the point illuminated by the laser. In the case of the Canon engine, the laser light causes a photoelectric effect that leaves behind a small electric charge, the charged area being a single pixel in size. As the drum continues to rotate, the charged spot attracts toner powder from a reservoir, and the excess toner is removed by a charged wire. The toner is transferred to paper by contact, and the paper then is fed between heated pressure rollers. Both engines feed sheets at a maximum of eight pages per minute, and requirements on preheating the pressure rollers limit both to about 20 seconds for the first page.

In the case of the Ricoh, the belt is charged early in its rotation, before it's exposed to the laser light. The laser causes the metalized belt to discharge in the spots where it's struck by laser light, and toner sticks only to the spots that have not been exposed by the laser. Thus, the Canon printer is positive-writing and the Ricoh is negative-writing. The difference will become evident in the darkness of the image, so the negative-writing Ricoh has a definite advantage when the image is dense — the image will be darker and more uniform than that from a positive-writing printer.

Maintenance Philosophy

The Canon engine has the same approach to maintenance and consumables that was so successful in its personal cartidge copier line — a single maintenance cartridge that's replaced about every 3,000 pages. Everything is changed at once — the drum, the toner, everything. It's a very simple operation. The fact that the entire toner transfer system is enclosed in the cartridge theoretically would make it possible for Canon to produce color toner for its laser printers as it has for its copiers. (You can't use the copier cartridges in the printer; the toner is completely different.)

Ricoh, on the other hand, uses multiple replaceable units, including the imaging belt (called the OPC, organic photo conductor), a cleaning pad for the rollers, a filter, a toner cartridge, a toner collection bottle that fills with excess toner, a shield glass for the imaging laser and two corona units to place charges on the OPC. It's definitely more complicated than the Ricoh engine, although each item is trivial to

Most printing is the creation of characters using a particular font. Even much of what is shown in a figure (a business chart or graph, for instance) consists of ordinary characters. So, one of the most attractive opportunities for improving the quality of the printing is to improve the apparent resolution of the font. Fonts may be stored in a printer controller in several ways, including as full bit maps, as outlines or as mathematical representations (usually splines). Each method has advantages and disadvantages in terms of processing time required to process the characters, capability to scale or rotate the font, and storage required in the controller. The methods also have different advantages with respect to anti-aliasing.

A font that's stored as a full bit map or outline can be customized, offline, by either software or a human being, to absolutely maximize the apparent resolution. However, scaling such a font (changing it from, say, 15 pixels high to 17 pixels high) might result in considerable aliasing and distortion in the appearance of the characters. Fonts stored mathematically may be rotated and scaled arbitrarily, but that scaling may require inordinate amounts of processor time, and the resulting characters never may be as good as a full bit-

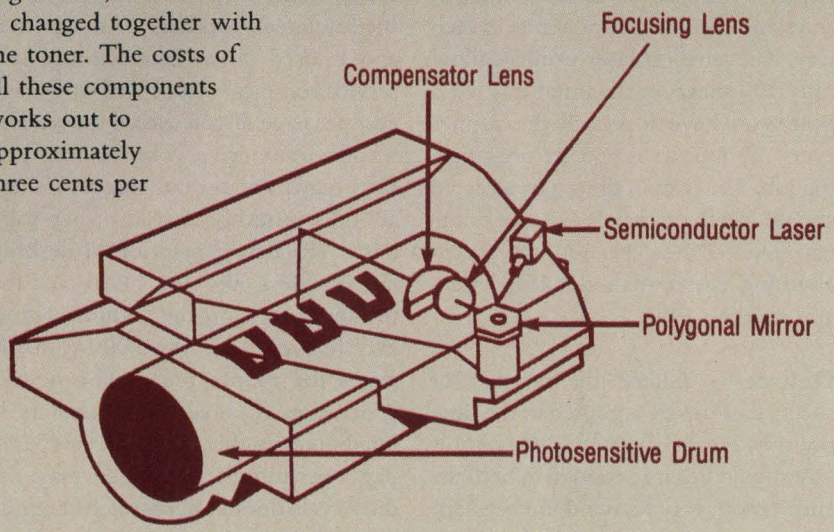
install and the control panel tells you which one to replace. The fact that the Ricoh toner is poured into a bin (instead of kept inside a removable cartridge) means that shipping a laser printer that's been used could get a little messy if it's tipped during shipping, and adding toner can get messy too if you don't follow the directions. All in all, most would agree that while the Ricoh certainly isn't difficult to maintain, it's harder than the "one thing to fix" approach of the Canon.

Of course, there are advantages to the Ricoh approach. The Ricoh needs a toner change only every 6,000 pages as compared to 3,000 for the Canon and the belt is changed every 10,000 pages or so, whereas the Canon drum is changed together with the toner. The costs of all these components works out to approximately three cents per page for the Ricoh versus approximately four cents per page for the Canon. Of course, you need to factor in the cost of paper, the capital cost of the printer and any expected service to get the true cost per page.

Maintenance every 3,000 or 6,000 pages may seem pretty minimal, but the next generation of desktop laser printers already has hit the market with ratings of well over 10,000 pages between replacement of consumables.

Paper Handling

OK, so you've decided that it's not a big deal whether you change one widget or two each month, and you don't really care about positive or negative imaging because they both look the same to you. Well, what about shuffling paper? The Canon engine holds 100 sheets in the input tray (although you can buy accessories that significantly boost that number) and puts the output in a tray face up, 50 sheets at a time. The face-up output bin means that your pages are in reverse order (unless you feed them to the printer backwards — a difficult feat — or you buy another attachment to stack the pages face down). Reordering your pages isn't a big deal if you print letters and short memos. But if you print 250 sheets of reports and you want it in order without tending the output tray for overflows, you may think differently.



The Ricoh engine holds 250 sheets in the input tray and 250 sheets in the output tray, face down. Of course, there's a down side in that the heavier duty cycles and other design decisions result in a slightly larger footprint and a taller and heavier printer. Some of the newer engines, including a newer Ricoh, far surpass the paper handling capacity of either of these "first generation" printers. And if you start to move up to a mid-range printer, things like output stackers, joggers and collaters become available.

The engine your printer uses can make a difference. ■

map font designed for a particular resolution.

Font design is an art and a science and takes into account such factors as the size and shape of pixels, how the toner or ink blurs at the edges, whether the system is positive or negative imaging and many other parameters. As this art/science is improved, the apparent quality of non-impact printers also will improve, even if the absolute resolution of the printer does not change. The quality of output and graphics capabilities of the new generation of printers, especially those using a PDL, exceeds the demands of most users. Notes IMAGEN's Curtis, "Unless you are a typographer, you probably will never notice the difference between fonts that are 'bit-tuned' and fonts that are not."

Many experts in the field think that the software for electronic publishing now needs to catch up with the capabilities of the printers. It's not advantageous to have exquisite fonts if the overall document format is clumsy and cluttered with excessive use of font changes, poor justification, and the like. Thus, the market for non-impact printers is growing rapidly as new software for electronic publishing becomes available. It seems inevitable that new printers that are faster, smarter, and have improved paper-handling soon will make the current generation machines seem ho-hum. "You mean it only prints 15 pages a minute with at a mere 600 dpi? How can you stand it?"

Glossary

Resolution — Usually expressed in dots per inch (dpi), the resolution is a good starting point for quantitatively measuring the quality of the print and graphics image. Memo-quality printing starts somewhere around 120 dpi, a low-end laser printer is 300 dpi, and high-quality laser or other printers can produce 600-plus dpi. A phototypesetter (like the one used to produce the text in this magazine) produces images with approximately an 1800 dpi equivalent resolution. Most non-impact printers have square pixels, but some have rectangular pixels, where the resolution is different in the vertical and horizontal dimensions.

Printing Speed — Most non-impact printers are now page printers, so the printing speed is quoted in pages per minute (ppm). A low-end laser printer can generate 6 ppm, a medium-range printer 8—15 ppm and a high-speed non-impact page printer can generate 80 ppm or more. A speed of 10 ppm is about the same as 600 lines per minute on a line printer. However, if you're generating a lot of graphics or are heavily using a page description language, the speed of the controller may be more important than the speed of the print engine.

Input — Check the number of input trays and the number of sheets in each tray. The smallest laser printers allow only 100 sheets in the input tray. At 8 ppm you have to check the printer every 12 minutes if you are printing a big job. The sizes of the paper accepted should meet your needs — some printers (like DEC's LN03) don't accept anything larger than standard letter-size sheets.

Output — Check the number of sheets that can be accepted in the output tray. For small printers, the output tray should be large enough to hold the entire input tray to avoid unnecessary operator intervention. Are the sheets stacked in the order in which they were printed or are they output in inverse order? If your requirements include high-volume printing, does the printer have a jogger, a capability for inserting tab dividers or other positive job separation techniques?

Duty Cycle — This rating measures the intended workload of the printer and is used when determining field service contract costs as well as average cost per page. If you exceed the recommended duty cycle, your service company may increase your charges if these are on a monthly instead of per-page basis. The first generation of desktop laser printers, like DEC's LN03 and the printers based on the Canon engine, had duty cycles in the 3,000 to 6,000 pages per month range. The newest generation of small laser printers is rated much higher — 10,000 to 15,000 pages per month. Needless to say, the duty cycle doesn't matter if you're going to print only a few pages a day.

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101 Continental Blvd.
El Segundo, CA 90245
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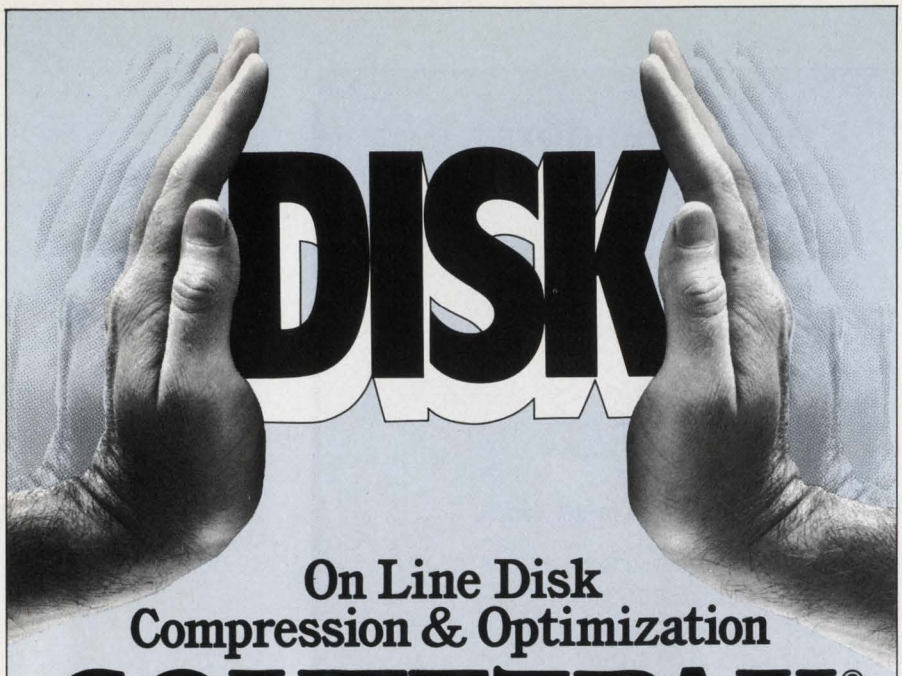

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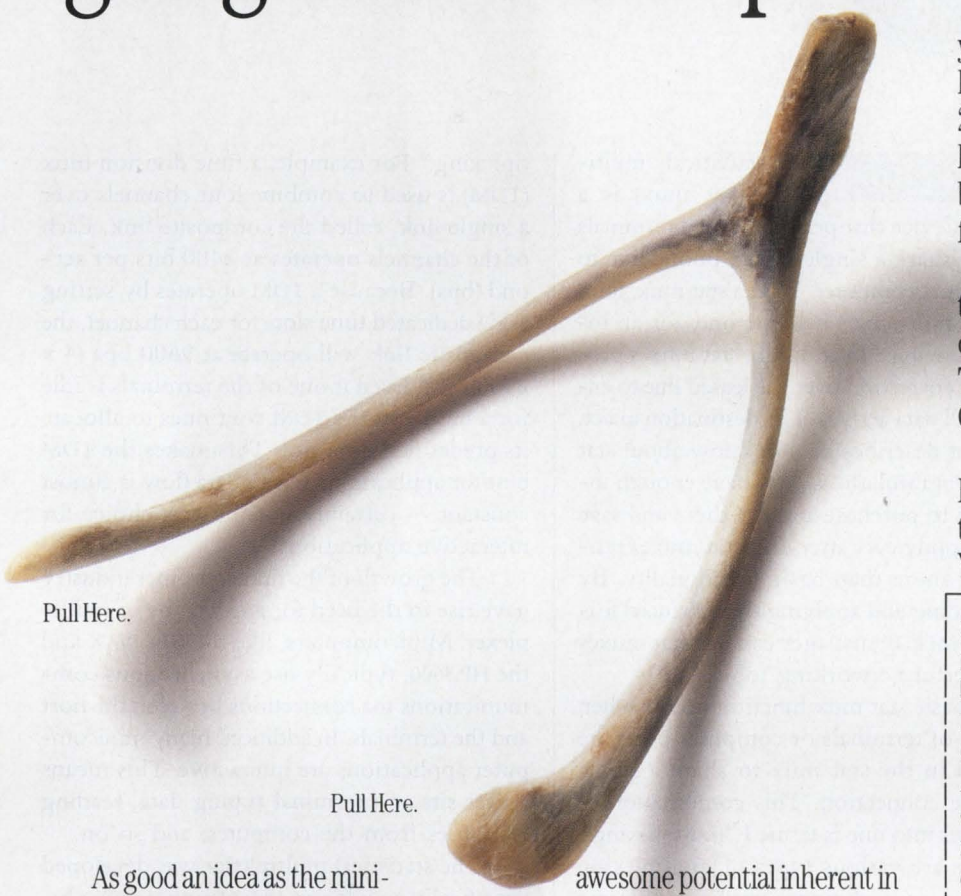

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MULTIPLEXERS

STAT MUXES

By Byron Henderson

Putting Your PCs On A 'Party Line.'

The statistical multiplexer (stat mux) is a neat little device that permits several terminals or PCs to share a single leased phone line to a remote host computer. With a stat mux, four, 16, 32 or more lines become one, for an instant cost savings! In addition, stat muxes provide error correction over the leased line to ensure that all data arrives at its destination intact.

If that describes all you know about stat muxes, congratulations. You have enough information to purchase and use them and save money happily ever after. But stat muxes provide a lot more than basic functionality. By understanding and applying the enhanced features, the MIS/DP manager can use stat muxes as a powerful networking tool.

The basic stat mux function occurs when a number of terminals or computer ports are combined in the stat mux to share a single leased line connection. This combination of several lines into one is termed "multiplexing."

There are various types of multiplexing techniques used for different applications. One common method is called "time division multiplexing." For example, a time division mux (TDM) is used to combine four channels over a single link, called the composite link. Each of the channels operates at 2400 bits per second (bps). Because a TDM operates by setting aside dedicated time slots for each channel, the composite link will operate at 9600 bps (4 x 2400 bps). Even if one of the terminals is idle for a moment, the TDM continues to allocate its predefined time slot. This makes the TDM best for applications where data flow is almost constant — certainly not the best choice for interactive applications!

The growth of the minicomputer industry gave rise to the need for a new type of multiplexer. Minicomputers, like the DEC VAX and the HP 3000, typically use asynchronous communications for connections between the host and the terminals. In addition, many minicomputer applications are interactive. This means a user sits at a terminal typing data, reading responses from the computer, and so on.

The statistical multiplexer was developed specifically to address these applications. Instead of rigidly defining a set time slot for each channel, access to the composite link is provided only when the channel has data to send. This results in a tremendous increase in efficiency. Returning to our earlier example, replacing the TDMs with stat muxes allows the four channels to run at up to 9600 bps over a single 9600 bps link.

The secret of this efficiency is the interactive nature of the typical minicomputer appli-

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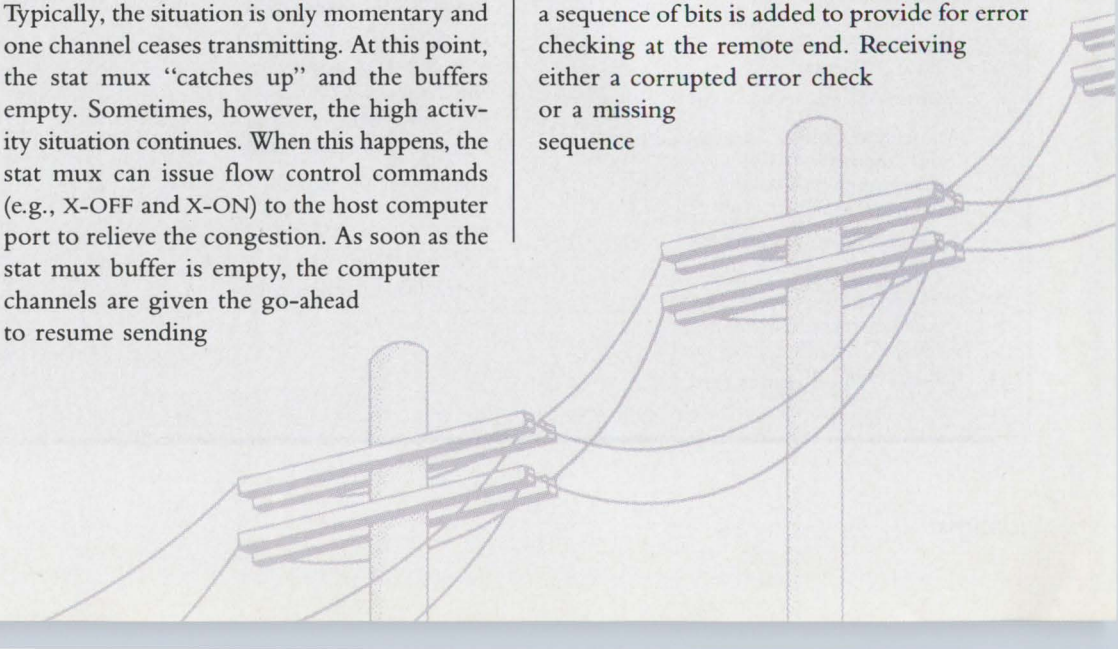
The VAX, like most minis, doesn't provide protocols between terminal and host.

cation. Even though a connection between a terminal and a host may be rated at 9600 bps, the line rarely is used to full capacity. Occasionally, the host will send a full screen of information using the full 9600 bps capacity of the connection. But before the next screen is sent, a human user typically will "process" the information by reading the screen. Even the fastest readers don't approach 9600 bps (about 5,500 words per minute). In addition, the line is not used to full capacity whenever the user is typing. A blazing typing speed of 120 words per minute translates to a mere 100 bits per second. The stat mux makes use of these low levels of activity on one channel to transmit data from another channel. Thus, all four users in our example enjoy what appears to be their own 9600 bps connection to the host. The key to this juggling act working is the statistical probability that not all channels are operating at full bore all the time.

An occasion may arise when more than one channel attempts to transmit data at 9600 bps simultaneously. Since our composite link itself is only running at 9600 bps, the stat mux must act to prevent data loss. It accomplishes this by buffering some data from both channels for a moment, temporarily reducing the effective data rate of each to about 4800 bps. Typically, the situation is only momentary and one channel ceases transmitting. At this point, the stat mux "catches up" and the buffers empty. Sometimes, however, the high activity situation continues. When this happens, the stat mux can issue flow control commands (e.g., X-OFF and X-ON) to the host computer port to relieve the congestion. As soon as the stat mux buffer is empty, the computer channels are given the go-ahead to resume sending data. The user should notice no more than a temporary pause in the computer output. Again, because of the high speed of the average connection, this pause isn't objectionable.

In addition to this interactive quality of minicomputer applications, the "protocol-less" nature of their communications also is addressed by the stat mux. Protocols are, in essence, a set of communications rules that describe how to "package" data, where to "address" the packages, the "shipping" of them to the correct destination and what to do if one of those packages doesn't arrive. Some common protocols are IBM's System Network Architecture (SNA) and X.25, the international networking recommendation.

The VAX, like most minis, doesn't provide protocols between terminal and host. Thus, there's no way to guarantee the safe delivery of data between host and terminal. This isn't a serious problem when the terminal is only 50 feet or so from the host. But when a modem is used for communication over a leased phone line, noise can cause corruption of data. The stat mux adds its own protocol to the data it receives from either host or terminal, allowing error-free delivery of the data packages or frames. Each frame receives a header indicating its channel destination, and a sequence of bits is added to provide for error checking at the remote end. Receiving either a corrupted error check or a missing sequence



Glossary

Asynchronous — Having a variable time interval between successive bits, characters or events. In data transmission, this usually is limited to a variable time interval between characters and often is known as start-stop transmission.

Bell Systems T1 Carrier — The T1 is capable of handling 24 voice channels (each link is approximately 64 kilobits) multiplexed together using a time division multiplexing (TDM) method. Some T1 multiplex vendors now can view the 24 channels as a one channel link providing approximately 1.5 megabits of bandwidth.

CCITT — The Consultive Committee International Telegraph and Telephone is an advisory committee established under the United Nations to recommend world-wide standards.

Frequency Division — The process of dividing a channel into frequency bands. It's the creation of several or many narrow bands from one wider band.

Packet Switching — A means of operating a data network or data communications system for a number of users, in which addressed "packets" are routed by system facilities. A user sends a message (packet) by means of a leased or dialed telephone line to the nearest "packet switching exchange" where it is buffered, checked and retransmitted over a high-speed circuit to the packet switching exchange that serves the person receiving the message. At the destination exchange, it's sent over local telephone lines. This provides a high-speed data service to users without enough traffic to justify leased lines and it makes good use of the high-speed circuits. Systems also may include reformatting facilities to permit different types of equipment to be connected.

Statistical Multiplexing — A term applied to time division multiplexing in which scanning is limited to devices that have messages to send or receive at a certain time. It's used to improve circuit use by eliminating time slots that otherwise would be allocated to inactive devices. This type of system also can modify scanning according to priorities.

Synchronous — Having a constant time interval between successive bits, characters or events.

Systems Network Architecture (SNA) — IBM's standardized relationship between its virtual telecommunication access method (VTAM) and the network control program (NCP/VS).

Time Division Multiplexing (TDM) — A method of multiplexing in which the use of a single channel for the transfer or transmission of data is allocated in turn and in rotation for a short period of time to each of several sending or receiving units. From a user's point of view it causes the channel to appear to be allocated exclusively for their transfers. It's accomplished by an electronic scanner that has a scan rate such that a specific, synchronized unit of data is sent or received in each time slice. In its simplest form, time division multiplexing is accomplished by allocating time slices to all connected receiving/sending units whether or not they actually are involved in a data transfer.

X.25 — A CCITT recommendation relating to the interface between a packet switching network and a packet-mode DTE (a computer). It describes the interface on three levels. Level 1 deals with the circuit interface between a DTE and a DCE; it's currently the same as that of CCITT V.24. Level 2 deals with the "frames" in which packets are sent. It defines the beginning and ending flags, an error-detection frame check sequence (FCS) and the method of sequencing frames. Level 3 deals with the "packet-level" interface. It covers setting up and clearing virtual circuits, error conditions and interrupts, and packet sequencing.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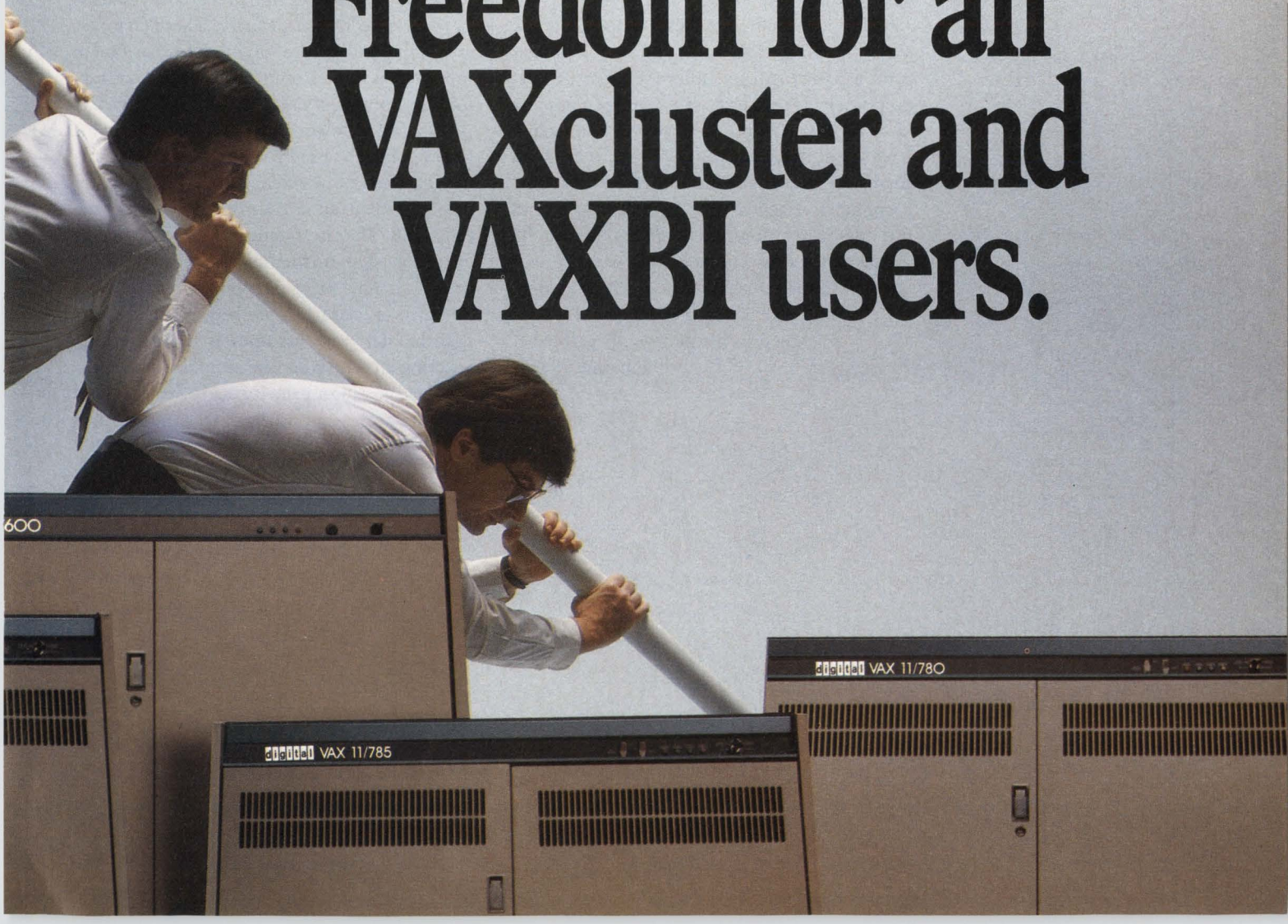

number results in retransmission of the corrupted or missing frames, which have been held in a buffer at the originating unit until confirmation is received that the frames arrived intact. Because this addition of protocol occurs only between multiplexers, the connection between host and terminal remains "transparent." Changes aren't required either to host or terminal to allow their use with the stat mux.

LINK EFFICIENCY and error control are the basic characteristics of the stat mux. They are made possible by the built-in intelligence and protocol the stat muxes use to communicate. But there are additional benefits to the user that are byproducts of the basic stat mux function. These additional features are the "bells and whistles" that differentiate one product from another and make the stat mux more than just a cost-saving device. In fact, stat muxes can form the core of a sophisticated communications network by virtue of their built-in interfacing flexibility, and by their diagnostics and control, modem integration and modular expansion capabilities.

The interfacing flexibility functions of the stat mux relate to the ease with which the stat mux adapts to many different types of host computers. Although most minicomputers lack protocols for data transmission, many have idiosyncratic methods of controlling information to and from terminal devices. DEC computers attached to VT100 terminals send out cursor positioning characters that can be mistaken for flow control. This works fine if the terminal is attached directly but some intelligence is required in the stat mux to keep data from being garbled if the connection is remote. Hewlett-Packard hosts use a special "pacing" scheme that segments data into 80-character "blocks." These blocks have their own inquiry/response characters (ENQ/ACK) that can slow throughput to a snail's pace unless the stat mux "spoofs" the characters. Even the simple case of an inexpensive line printer that uses the DTR method of flow control can give the MIS/DP manager fits if the printer must be connected to a host that only understands the X-ON/X-OFF flow control method. A stat mux can act as translator, handling X-ON/X-OFF at the host and converting to raising and lowering of DTR at the printer. In addition, the stat mux can convert the host's 9600 bps line speed to the printer's 1200 bps rate. In this way, the stat mux may be used to make incompatible equipment work together well (besides saving online charges).

Control And Diagnostic Functions

The stat mux provides a wide variety of control and diagnostic functions that can enhance the performance of a network. By virtue of the intelligence built into the stat mux, the system operator may designate certain channels as possessing higher priority. These channels are "sampled" more often, allowing them more access to the composite link and increasing the amount of data transmitted at the expense of their lower-priority neighbors. This function may be used to good advantage in allowing users of interactive applications faster response than spooled printers sharing the same link. The latest generation of stat muxes goes one step further by providing "automatic" channel prioritization. Whenever only one or two characters are sent from a terminal, the stat mux assumes that this is data awaiting an echo response from the host. This data is given high priority, as is the one- and two-character response back from the host. If the same channel receives a block of 500 characters from the host, this is recognized as a lower priority. In this way the stat mux adjusts to keep interactive response times as short

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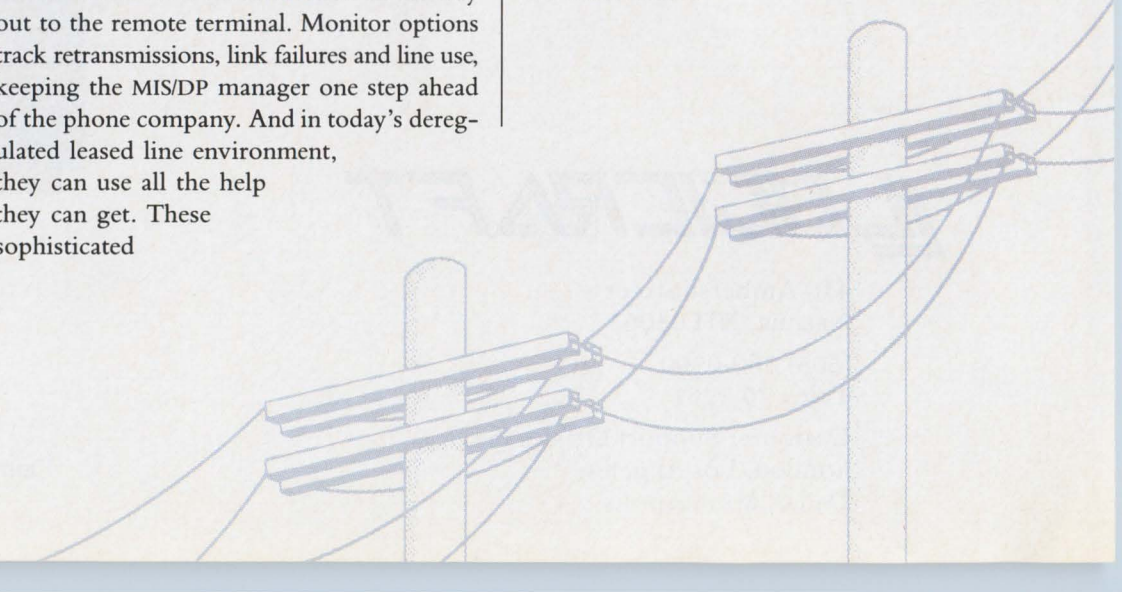
Another application where the stat mux can improve response is in the use of satellite links. Many leased lines today employ satellite transmission for at least part of their length. These satellite hops add a significant delay for which the stat mux compensates by allowing a pipelining effect. Several data frames may be in transit between multiplexers at any time. This increases line capacity and reduces the apparent round-trip echo delay.

Line capacity also may be improved by the addition of data compression capabilities to the basic stat mux function. Data compression reduces the amount of data actually transmitted between muxes, either by eliminating repeated characters and recreating them at the other end (run-length) or by translating commonly used sequences of characters into shorter messages (encoding). Many encoding algorithms are dynamic, allowing new codes to be created based on the type of data being sent at the moment. Both techniques increase line capacity by reducing the number of characters that must be transmitted between muxes.

A stat mux network also can be a tremendous help in diagnosing transmission problems. Most stat muxes are equipped with various loopback and data integrity tests to check the line from the local connection all the way out to the remote terminal. Monitor options track retransmissions, link failures and line use, keeping the MIS/DP manager one step ahead of the phone company. And in today's deregulated leased line environment, they can use all the help they can get. These sophisticated diagnostic and control functions are a byproduct of the protocol the stat muxes use to communicate. Test and monitoring information is transmitted in a special frame to the other mux, where it's acted on. Configurations may be done even at the local end, then downloaded transparently to the other end. This permits complete network control without sophisticated help at the remote site (which might be an office, classroom, etc.).

A NEW FEATURE found in a few products is the "integrated" modem. To be sure, integral modems have been available for some time. Too often, however, these only were modems sharing the same enclosure and power supply with the mux. There was no facility permitting control and diagnosis of these modems from the stat mux operator's terminal, and no way for the intelligence of the stat mux to influence modem operation. Today, integrated modems can be configured, tested and monitored by the stat mux. Some manufacturers even provide models with enough intelligence to permit automatic dial backup of failed leased lines. If a leased line failure occurs, the mux recognizes the problem because of its built-in protocol. It then commands the modem to place two dial telephone calls (to replace the four wires of the leased line connection) and data is transmitted "around" the failed leased



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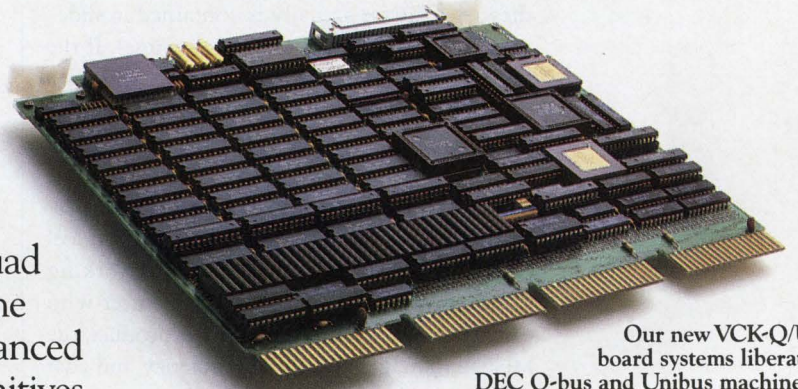

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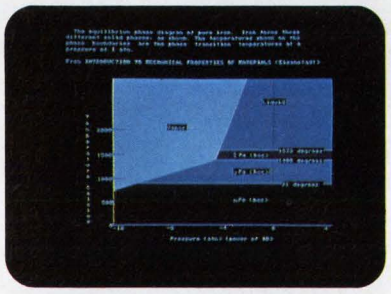

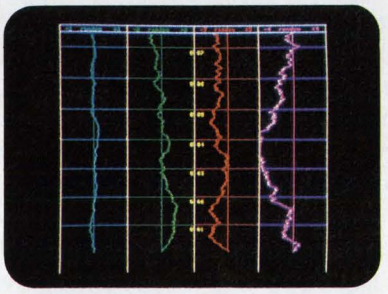

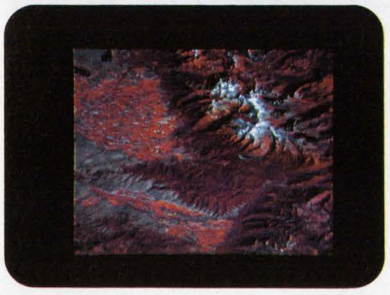

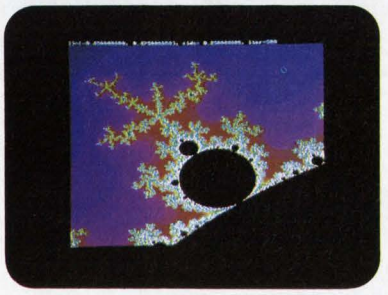

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line. If the leased line is restored, data is returned to it and the dial calls are terminated. All of this takes place without operator or user intervention, meaning that this stat mux function pays for itself when a leased line fails, by eliminating late night complaints.

Modularity is another aspect of the latest generation of stat muxes. Beyond adding channels (changing a four-channel to an eight-channel by adding a printed circuit board, for instance), today's stat muxes support application modularity. The software of these stat muxes actually is contained in slide-in cartridges (much like a video game). If the MIS/DP manager wishes to change or add a function, he simply slides out the old cartridge and slides in a new one. In this way, enhancements easily can be added in the field. This feature has proved popular with some MIS/DP managers who need stat muxes today but feel their needs may move to X.25 networking tomorrow. By choosing a manufacturer who offers both functions in a modular product, the MIS/DP manager gains the efficiency and cost savings of statistical multiplexing today without sacrificing future flexibility. Modularity permits the use of new technologies without making the initial hardware investment obsolete.

Some of the new technologies that stat muxes are addressing include high-speed links, synchronous applications and switching. New transmission technology from the phone companies has made 56 kilobits per second (Kbps) lines widely available at competitive rates. These high-speed links allow the transmission of more data between the stat muxes. This 56 Kbps technology also complements the growing presence of high-speed user applications such as CAD/CAM and file transfer.

Stat mux buyers should be wary, however, of 56 Kbps stat muxes that merely are old designs running faster. True high-speed capabilities include Direct Memory Access (DMA) for more efficient use of the processing power of the stat mux, as well as optimized protocols for keeping these wider bandwidth "pipes" full of data.

Synchronous Applications

Synchronous applications also impose special requirements on stat mux functions. Unlike most asynchronous applications, sync hosts often employ their own protocols between the host and terminal device. These protocols handle polling, remote diagnostics, and so on. In addition, these protocols typically are very sensitive to any delays added by the transmission equipment (in this case the stat mux). Thus, the sync environment is different from the typical async mini environment that stat muxes originally were designed for. This fact has led many MIS/DP managers to run separate sync lines for hosts such as IBM, while using stat muxes for the async applications. If both applications could share the same leased line, however, tremendous cost savings would result.

It was this cost savings potential that led to the development of synchronous handling features in today's stat muxes. Typically, these features fall into two categories: protocol-sensitive and clear-channel techniques. Clear-channel techniques allocate a portion of the composite link bandwidth to the synchronous channel, regardless of its activity. In this way, the stat mux functions more like its distant cousin, the time division mux. This technique results in minimal delays on the synchronous channel, but leads to limited bandwidth for the async channels sharing the same composite link.

In contrast, the protocol-sensitive technique allows for dynamic allocation of bandwidth. The stat mux recognizes the data patterns on the sync channels, transmitting only useful data over the composite link; "pad" and "fill" characters are discarded. In order to avoid the danger of "underunning" the remote host or terminal, most sync stat muxes use a buffer preload technique. When a useful data frame is recognized on the sync channel, a small amount of buffer capacity if reserved at the remote stat mux. This buffer capacity is used to hold the first few bytes of the sync frame to allow more of the frame to "arrive" at the remote mux before it's output to the attached host or terminal. This helps eliminate host polling time-outs that might occur as a result of small delays caused by the stat muxes. Protocol-sensitive techniques provide the highest priority for sync data while allowing full use of the composite bandwidth for async

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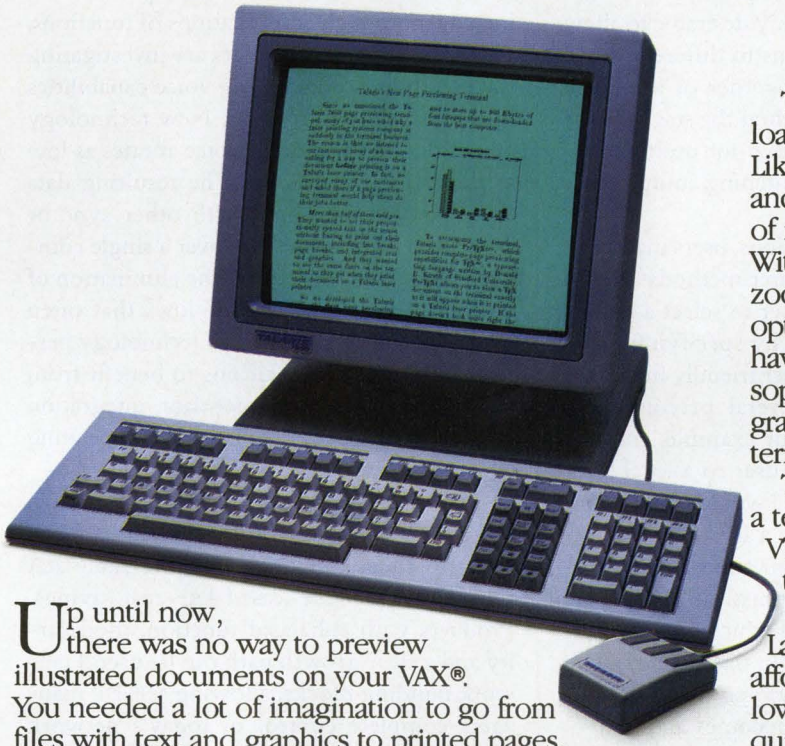

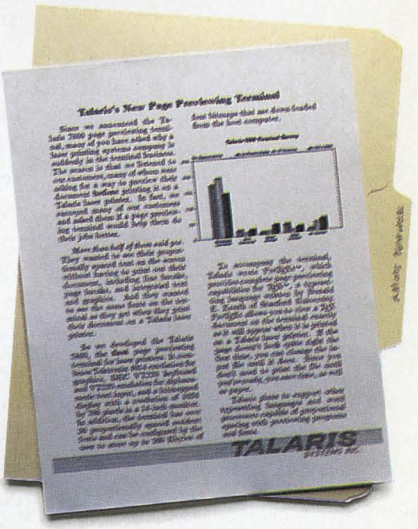

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data when the sync channels are idle. This permits the cost-effective combination of sync and async channels through a single pair of stat muxes without impacting performance too severely.

Another interesting network enhancement available with stat muxes is the addition of switching functions. In today's multiple host, multiple vendor, multiple remote site environment, it's often highly desirable to allow users to make connections to different hosts. These may be located together or at widely separated sites. By providing the stat mux the capacity to switch, the need for multiple terminals or for external switching equipment is eliminated.

In most implementations, users may select a destination by one of three methods: Matrix switching permits the user to select a remote multiplexer and channel by specifying them. Class selection is more user friendly in that the user may pick from several preconfigured classes of connection. For example, entering VAX 1 might switch the user to a local host, while keying in CHICAGO would cause a connection to be made over a leased line to the remote location. A third method, pre-set destination is used for unsophisticated users and simple printers, neither of which can "type in" their desired connection. In this case, a system operator-defined connection is made anytime the terminal or printer becomes active.

TWO BASIC TYPES of switching stat muxes are available to users. One type combines switching and stat mux functions in a single unit with multiple remote links. These units typically are used at a host site where a large number of channels must be connected to several different remote sites. The disadvantage of this approach is the cost and complexity of the central site stat mux.

Another approach gaining in popularity is the use of a separate stat mux switching hub in conjunction with a number of standard stat muxes. The switching hub acts as the central point in a "star" network topology. The switching functions can be added inexpensively to existing stat mux links, allowing for an easy "growth path." The main disadvantage is in the restriction to a "star" topology only. In both cases, these switching methods also allow for centralized control and diagnostics of the entire network. By using one of these switching techniques, MIS/DP managers can build a sophisticated network from the basic stat mux building blocks.

THE FUTURE OF STATISTICAL multiplexers will include more such combinations of functions. A number of manufacturers are investigating the possibility of including voice capabilities in their stat mux products. New technology allows the digitization of voice at rates as low as 9600 bits per second. The resulting data then may be combined with other sync or async data for transmission over a single composite link. This allows for the elimination of multiple leased lines and tie lines that often exist between two sites. Such technology permits even smaller operations to benefit from the cost savings of voice/data integration formerly available only to large users operating T1 networks.

By choosing their products carefully, MIS/DP managers can add tremendous flexibility to their networks with the same stat muxes that provide leased line cost savings. Products with enhanced function, modularity and a clear growth path can be useful network building blocks, allowing MIS/DP managers complete control of today's network while guaranteeing the safety of their hardware investment for the future. — *Byron Henderson is director of marketing development at MICOM Systems of Simi Valley, California.*

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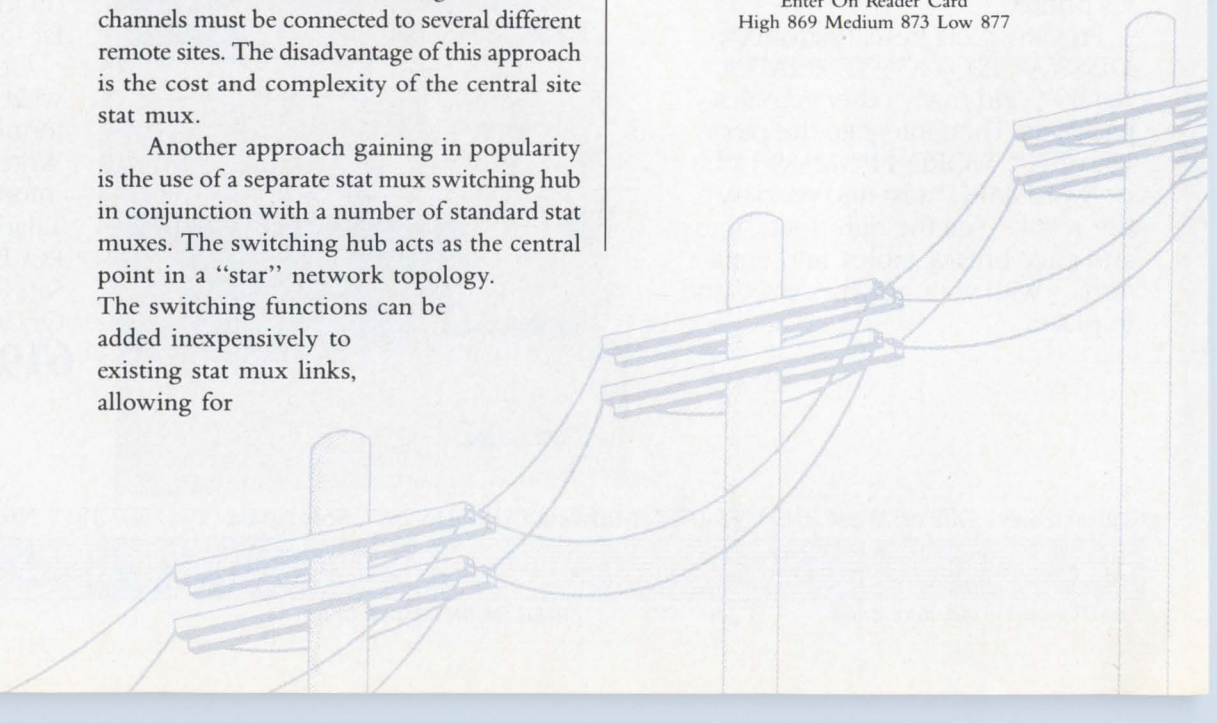

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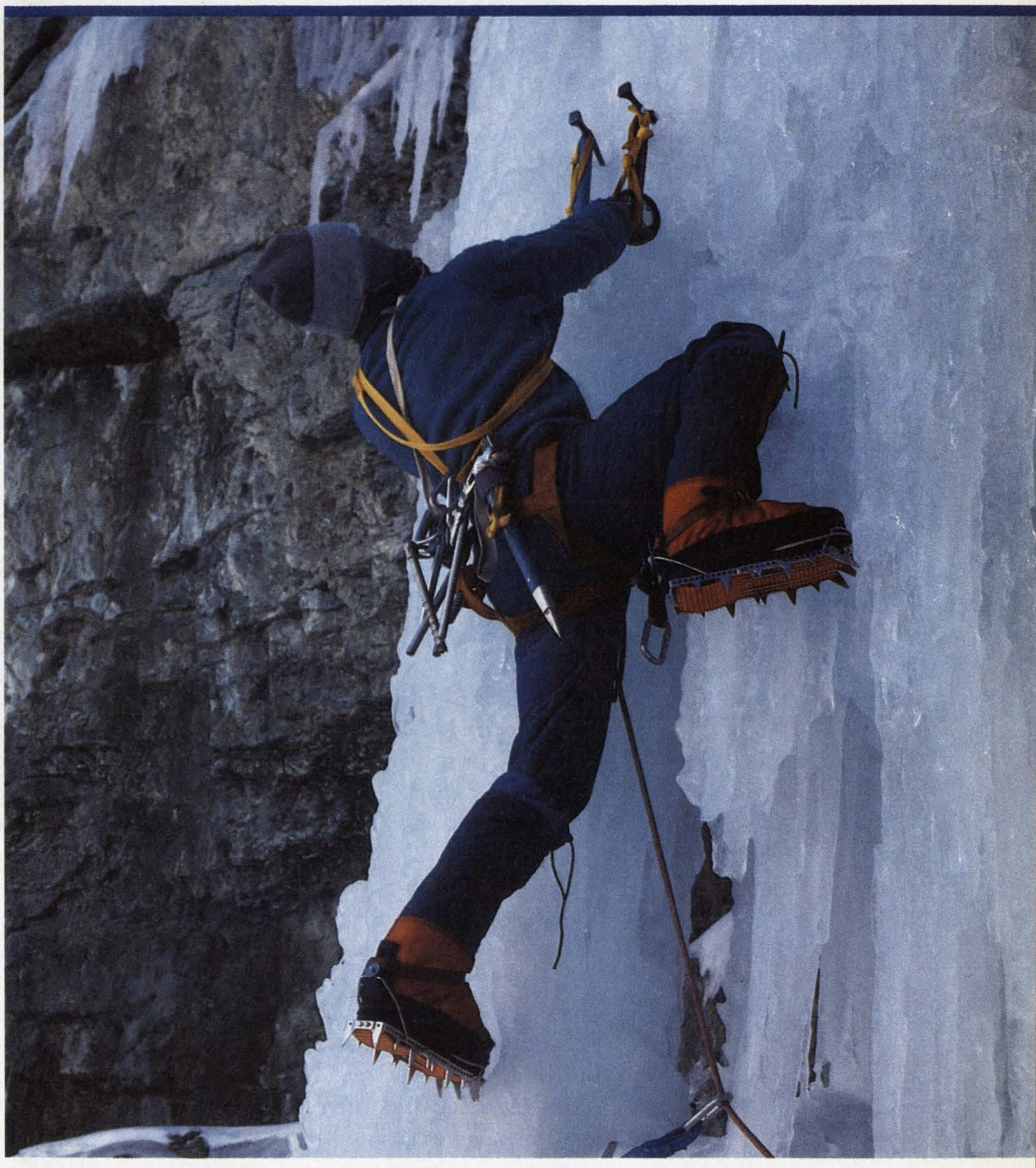

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OPTICAL DISKS

OPTICAL ARCHIVING SYSTEMS

By Steve Osterlund

Some Critical Issues In Designing A Disk-Based Optical Storage System.

In designing one of the first commercial optical archiving systems (encompassing an optical disk drive, controller and interface) for the VAX, Aquidneck Syatems International, North Kingstown, Rhode Island, had to address several key issues relating to the integration of optical storage into currently existing applications. These are issues any OEM or end user also must face when implementing an optical disk-based storage system.

Why Optical Disk Storage?

In optical disk recording, a high-intensity laser beam permanently changes the surface of the disk to store data. The sharp focus of the laser beam permits extremely high densities. One double-sided 12-inch removable optical disk can hold 976 MB of data or more per side — roughly equivalent to the storage capacity of 11 to 15 2,400-foot, 6,250 BPI magnetic tapes.

The primary advantage of optical disk-based storage is reduced data storage cost. Optical disk-based systems are a lot less expensive than paper, tape or hard disk storage in terms of hardware investment, media costs and manpower costs related to archival data storage and maintenance.

A handful of optical disk systems has been implemented for the VAX computer so far, because the requisite elements of optical storage technology — reliable media, drives, controllers, interfaces and software — have become mature only recently. The first of these issues addresses using an optical disk-based storage system to emulate an existing storage device, such as magnetic disk or magnetic tape.

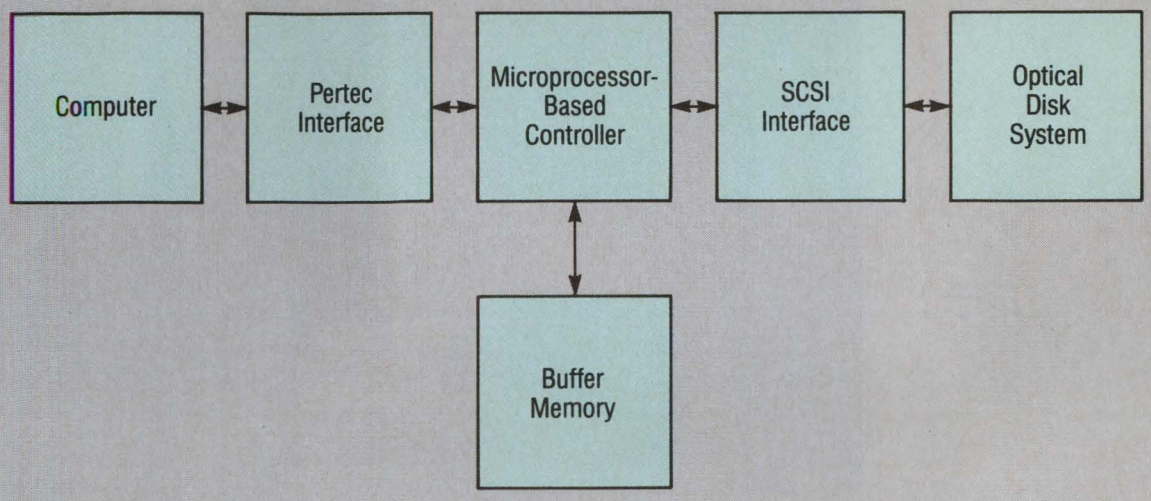
What To Emulate

Presently, one of the most effective ways to incorporate an optical disk storage system into an existing computer environment is to emulate either a disk or a tape drive. Although it is possible to write a specialized optical disk driver, this driver would require costly and potentially risky modifications to the VMS operating system and to any user applications software.

So, emulation is desirable. The question is, what should the optical disk-based storage system emulate? A recent survey of mainframe users indicated that, if they had a choice, most would prefer optical disk systems that emulated magnetic disk. We can sympathize with these users who are probably envisioning a storage device with the speed and flexibility of a hard disk drive and the capacity to store a gigabyte of data online. Unfortunately, optical disk, at present, cannot deliver hard disk performance.

First, the write-once nature of today's optical disk does not allow computer operating systems and file management operations to update, delete, rewrite directories, write temporary scratch files and relocate data at a high speed like a magnetic disk. Although it physi-

FIGURE 1.



Aquidneck OAS 100 optical archiving system.

cally is a disk, the optical disk shares more of the characteristics of magnetic tape and its role in archiving operations, where data first is configured on standard magnetic disk and then saved to tape (or now, optical disk).

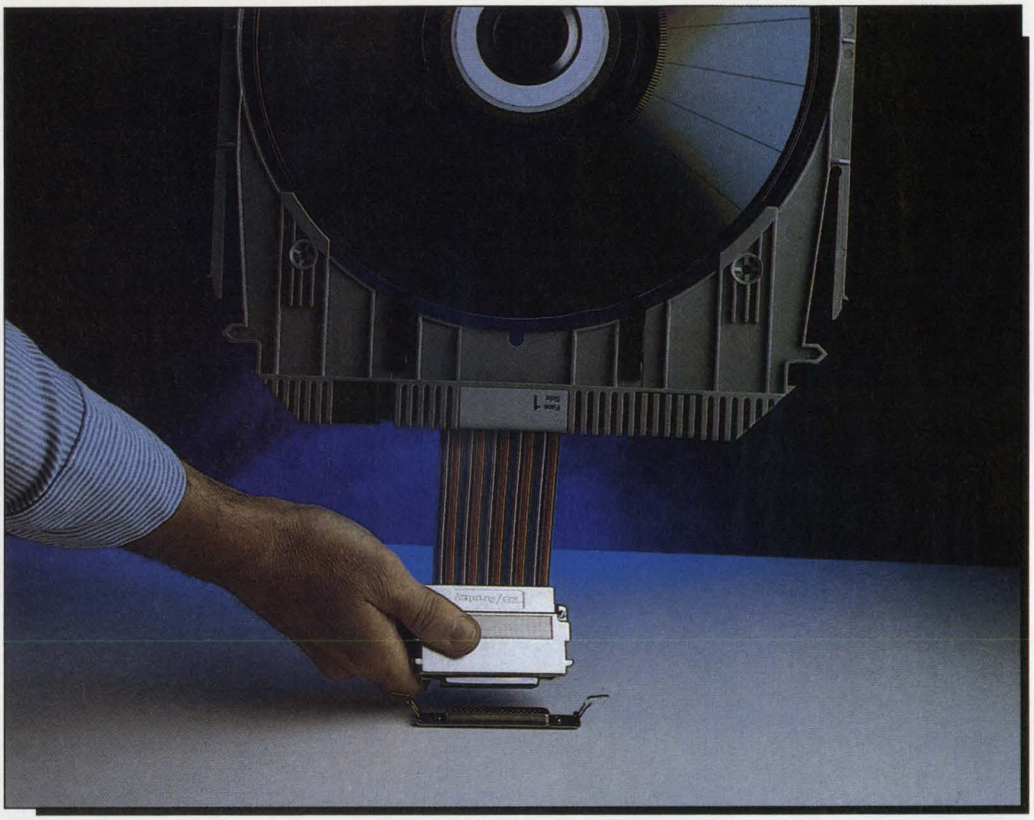
Optical disks also have longer seek times than magnetic disks for several reasons. It takes the single optical laser read/write head longer to traverse the larger 12-inch platter because all of the hardware required in the head (laser, optics, and focusing servo) makes the head too massive for rapid acceleration and deceleration. This means that average seek times over the entire disk are slower.

Although average access times are slower, the density of data on the platter (40,000 tracks of 25 KB each on one side of a 12-inch platter, for example) allows very fast track-to-track seek times, often faster than magnetic disk. When the system is working on a data set in one physical location on a disk, optical has a speed advantage because of this dense track format.

Despite optical disk's quick track-to-track access times, magnetic disk is still difficult to emulate successfully. Rapid access to data is facilitated in a hard disk drive by stacking as many as 10 platters, each having its own read/write head. Due to the cost and complexity of optical read/write heads, stacking of optical platters is not currently a practical option.

Furthermore, optical disk does not compare favorably with hard disk in terms of write speed. Since the laser beam must change the physical nature of the media each time it writes a bit, more time is needed to transfer the required amount of energy. Therefore, the relative motion of the optical head and the disk surface is slow in comparison to hard disk.

For data Bit Error Rates (BER) to be equivalent to those of magnetic disk (in the region of 10-12), optical disk drives verify that



data is written either while or immediately after it is written to the disk. This "write-with-verify" procedure reduces data throughput rates. With one technique, the disk drive writes and then reads for verification on alternate rotations. With another, the laser beam is split, so that writing and verification can occur on the same rotation. In the first case, throughput is slowed because writing occurs every other rotation. With the second technique, a slower disk rotation speed is needed to allow time for proper verification.

Finally, a major difference in operating characteristics results from the fact that optical disk is a write-once medium. Once written on, the optical disk cannot be altered and, therefore, is not the medium of choice when frequent editing and updating of information is required.

The advantages of hard disk versus optical disk for file serving applications should not obscure the tremendous advantages of optical disk for pure data storage — exceptional data density (resulting in an outstanding cost per megabyte of data stored), removability of rugged, durable media for off-line storage, and a life expectancy measured in decades, rather than years.

With these kinds of advantages, Aquidneck concluded that write-once optical disks are suited best for long-term archival storage of massive amounts of data — an application that currently is served by magnetic tape. Therefore, a tape emulating system seems to be the best fit for optical archiving.

Not only is optical disk a cost-effective means of data archiving that equals or exceeds tape, but it offers significant performance advantages versus tape as well.

Software Vs. Hardware Solution

The VAX user wishing to implement an optical disk-based storage system must decide between software-intensive driver packages, which may impose a high overhead penalty on the mainframe computer, or a ready-to-use, standalone optical disk-based tape emulator that is transparent to the computer system.

Aquidneck chose to design a standalone hardware system that emulates an industry standard tape drive and can be connected to a VAX computer using standard cables. The

Aquidneck OAS 100 optical archiving system consists of a Pertec interface, a controller based on the Motorola 68010 microprocessor, 192K of memory buffer, a SCSI interface and an optical disk drive (see Figure 1).

The standalone tape emulating hardware requires no modifications to the operating system or applications software. This is particularly important for scientific and technical installations where a lot of money has been invested in applications software.

The hardware-based system has been designed to solve the logistics problems related to conversion from tape-based to optical disk-based archiving by providing three modes of operation — online, pass-through, and off-line (see Figure 2).

In the online mode, the optical archiving system is controlled through the host's existing tape software. In the pass-through mode, the unit allows the host computer to access an optional, user-attached nine-track magnetic tape drive, in order to provide continuity of existing tape read and write operations. The off-line mode provides the user with the capability to control the same magnetic tape unit and an optical disk drive for tape-to-disk or disk-to-tape data transfers without requiring host computer intervention.

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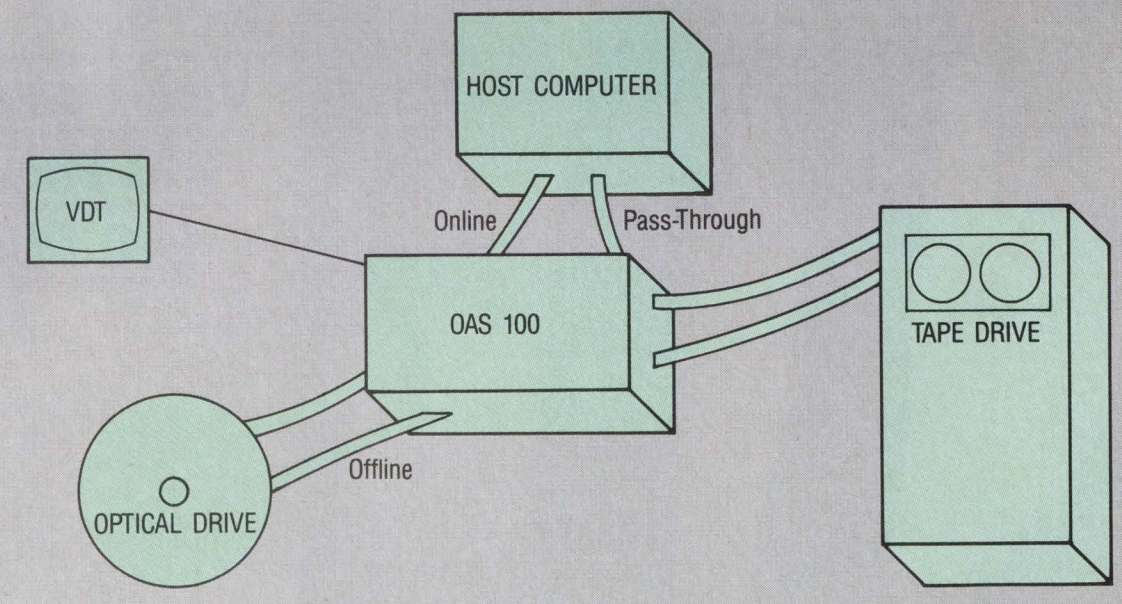
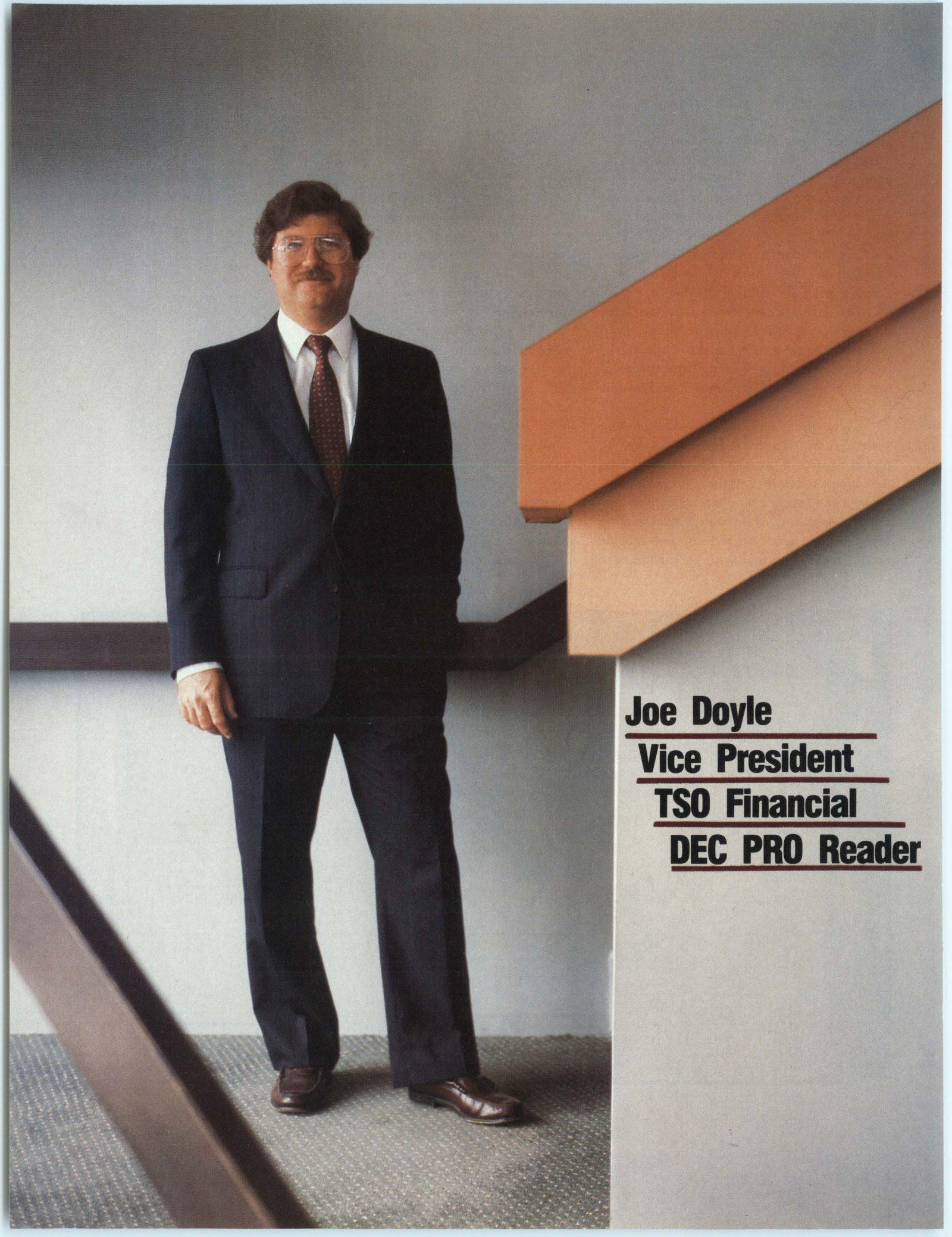
The three modes of operation allow for an orderly transition to optical storage. It is not necessary to convert all of one's tapes immediately to optical disk. New archival files can be written to optical disk as they occur; old files on tape can be accessed as needed; and conversion of tape to optical disk can be accomplished in off-hours or as a background project without involving the mainframe computer in any way. The extensive utilities provided with the system make it easy to keep track of the archival data.

Because the tape emulation hardware can

FIGURE 2.





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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:

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"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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be used with any computer compatible with industry standard tape drives, it will be possible to use optical disk as a universal medium for the transfer of data between different makes of computers, just as tape has been used for years.

Optimal Directory Structure

The final issue to consider is the directory structure of the data on the optical disk. A well-designed one can improve the performance and reliability of an optical disk-based archiving system.

Aquidneck's intent in creating the directory structure for the optical disk-based tape emulator was to minimize directory overhead and wasted space, and insure the highest degree of data integrity.

Logically, the optical tape images are arranged in a contiguous, sequential manner as is the data on magnetic tapes. (A tape image represents the contents of a single transferred tape. A tape image may vary in size, so that a single disk may be configured to appear as hundreds of small tapes or a single one billion byte tape.) But the optical disk drive controller can take advantage of random access characteristics of the disk form of storage.

Operations that don't involve the transfer of data — such as rewind, search for file mark, space record, etc. — are accomplished by the controller with only an internal directory manipulation. Such operations can take place hundreds of times faster than similar operations with magnetic tape.

The tape emulating system actually has two directories: a conventional high-level directory that treats optical tape images as single entities and an embedded directory structure dispersed among the data that describes the specific record structure of the current tape image. The embedded directory can reduce directory seek times dramatically.

By making the high-level directory a separate structure independent of the embedded directories, it is possible to mix different types of applications on the same disk. While one directory structure may be optimized for magnetic tape emulation, others may be optimized for compressed image data. These multiple directory structures are all identifiable by way of the higher level directory.

The embedded directory structure separates the record data from the physical record structure so that data can be packed and partially written blocks can be avoided. Only two bytes of internal directory overhead are required to derive the location and length of each record.

The directory structure also encompasses an efficient system of bad block mapping. Since write-once optical media cannot be positively certified error-free, a meticulous system of bad block mapping is required to insure that data actually is written to optical disk, and verifiable.

In the tape emulating system, bad block mapping information is distributed along with the embedded directories. To minimize directory overhead, bad block addresses are expressed in terms of relative block offsets rather than absolute addresses.

Understanding Write-Once Is Basic

Because most potential users of optical disk-based storage systems have not fully explored the implications of a write-once storage medium, there is a natural and widespread expectation that optical disk drives should serve as a replacement for magnetic disk drives. We have found, however, that many of the most promising applications for optical storage are those currently being served by magnetic tape.

There are two other issues that VAX users must take into consideration to insure that a given optical archiving system will fulfill the cost and performance benefits of the medium:

1. What are the methods employed to interface the system to the mainframe?
2. Will the directory structure provide maximal efficiency, data storage capacity and data integrity?

Again, the resolution of these issues hinges on an adequate understanding of the write-once technology. *—Steve Osterlund is engineering manager at Aquidneck Systems International, North Kingstown, Rhode Island.*

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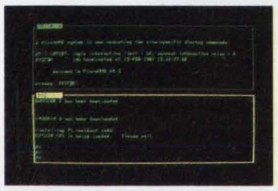

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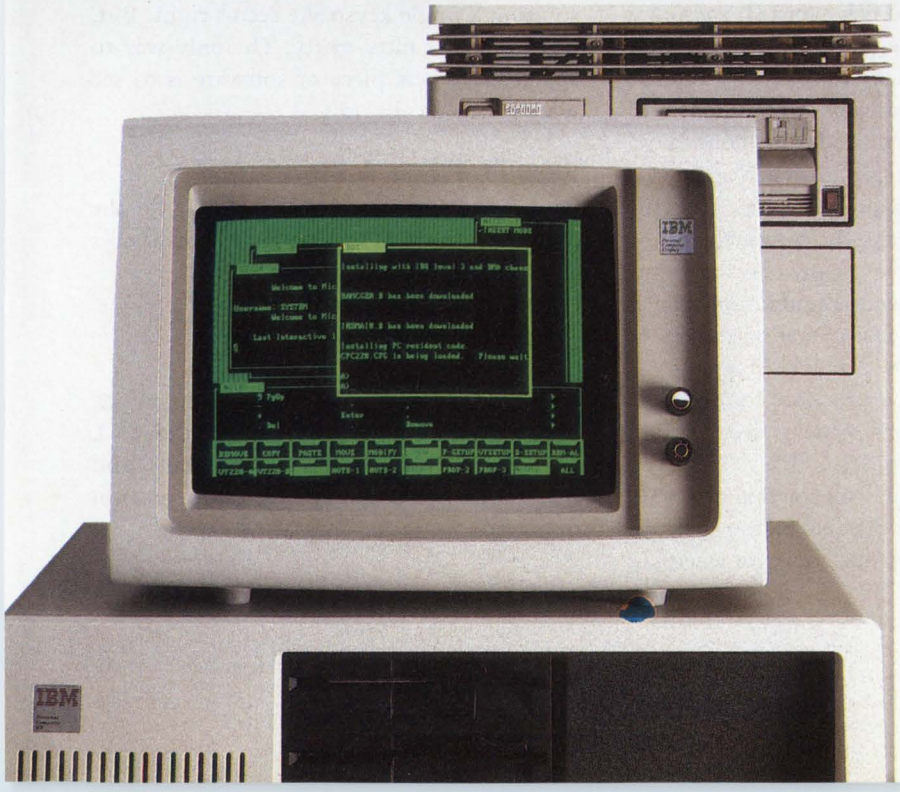

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VAX

UDKs IN VMS V4

By Eric M. Ross

This Feature Executes DCL Commands, Command Procedures And Programs In One Keystroke.

VAX/VMS V4.0 introduced user-definable terminal keys. This feature reduces the time taken by the operator command input. You may argue that the amount of typing could have been reduced under VMS V3.x using DCL shorthand (symbols defined for long command strings). It's true that the concepts are similar, but the definable keys offer more than shorthand notations. Defined keys are useful when ergonomically designed simple and user-friendly man-machine interfaces are important. For example, you may decide to use a few definable keys and, to further assist the operator, have ergonomically designed plastic keyboard templates that highlight the keys or in the case of a large specialty installation, purchase custom keytops (see page 77). It's not necessary to remember cryptic symbolic commands or be a quick typist. It's also not necessary to put the user through extensive drills to assure his ability to type in appropriate commands automatically in response to changes in the system under his control.

This is important when one inherent system requirement is a quick response from the operator. For example, the terminal may be used on a shop floor or in any other environment where the operator's attention span is limited by demands from other machinery or equipment under his control. A typical environment would have processes controlled by a real-time computer system that requires quick operator responses.

You'll find many uses for this new VMS feature, even outside the demanding environments of chemical plants, conveyor assembly lines and other industrial or military settings. I use it to organize my daily programming work. For example, I associate several different definitions with a few definable keys. The set of current definitions that are in effect depends on the current state of the keyboard. When I put the keyboard into System Management state, the keys associate with DCL commands frequently used for system management. In the Program Development state, the same keys execute frequently used commands for compiling, linking, working with CDD data definitions, etc. In the Network Management state, a few keystrokes establish a dial-in asynchronous DDCMP DECnet connection to a remote system, etc.

These small units of work are not interdependent enough to be encompassed by a command procedure, but they are repetitive, so using a single keystroke seems right. But, let's get to the nitty-gritty: The only way to appreciate a new piece of software is to see what it can do for you.

How To Define A Key

To define a key, a new qualifier /KEY for the DCL command DEFINE is used. For example:

```
$ DEFINE/KEY PF1 "$ SHOW
  SYSTEM "/ECHO/TERMINATE
```

When this key definition is in effect, pressing the PF2 key results in the DCL $ SHOW SYSTEM command being issued and the corresponding system information displayed.

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The DEFINE/KEY command defines peripheral keys on certain terminals. The feature is supported for DEC native terminals VT52, the VT100 line, the VT200 family and higher models with the LK201 keyboard.

All definable keys on the VT52 are located on the numeric keypad. For VT100-type terminals, all the keys on the numeric keypad plus the four arrow keys are definable.

For terminals with the LK201 keyboard, there are three groups of keys that you can define: the keys on the numeric keypad, the editing keypad and the function key row at the top of the keyboard.

Function keys F1 through F5 are reserved for Hold Screen, Print Screen, Set-Up, Data/Talk and Break. These functions are vital for the terminal operation and terminal-host communications; the keys are unavailable for redefinition.

Some keys are always definable, like PF1 through PF4 on the functional keypad of VT100-type terminals (this includes VT220S). Numeric keys on the numeric keypads are unavailable for definition by default. They can be made available by issuing either a SET TERMINAL/APPLICATION or a SET TERMINAL/NONUMERIC command.

The definable keys feature offers further conveniences for application designers, programmers, system managers and end users. At the least, you may find it useful for performing frequently used and long-to-type DCL commands at a single keystroke. Partial or complete DCL command strings and whole command procedures can be associated with a single keystroke. The key definition can be made dependent on the previous keystrokes through the mechanism of the "current state of the keyboard." You can make up several different equivalence strings for the same key.

Only one of several definitions of the key will translate into a particular equivalence string contingent on the current keyboard state. For example:

```
$ DEFINE/KEY
  /SET_STATE=GOLD/LOCK/LOG/ECHO/ERASE PF1
  "!*** STATE:GOLD ***"
$
$ DEFINE/KEY
  /SET_STATE=SILVER/LOCK/LOG/ECHO/ERASE PF2
  "!*** STATE:SILVER ***"
```

In this example we've associated the PF1 key with an arbitrary string, GOLD, as a new keyboard state designator. A PF2 keystroke will change the keyboard state to SILVER. Now, if you type in PF1, the keyboard state will be changed to GOLD and all the key definitions associated with the GOLD state will go into effect. We could have defined more than two different keyboard states and arbitrarily called them RED, BLUE, SYSTEMPARAMETERS or anything. Now, any definable key may be associated with two or more keyboard states and optionally translate to different strings:

```
$!
$ DEFINE / KEY / ERASE / ECHO
  / TERMINATE / IF_STATE = GOLD
  MINUS "SHOW SYSTEM"
$!= = = = = = = = = = =
$!
$ DEFINE / KEY / ERASE / ECHO
  / TERMINATE / IF_STATE = SILVER
  MINUS "SHOW USERS"
$!= = = = = = = = = = =
$!
$ DEFINE / KEY / ERASE / ECHO /
  / TERMINATE / IF_STATE = (SILVER, GOLD)
  PERIOD "@SYS$SYSTEM:SHUTDOWN"
```

PROGRAM 1.

```
$!-----------------------------------------------------------------
$ set terminal/application_keypad
$       define/key -
  /set_state=SHOW_PARAM/lock/log/echo/erase pf1 -
"!===*** SHOW_PARAM's ***===>>> Depress < - > for HELP"
$
$!-----------------------------------------------------------------
$       define/key -
  /set_state=SET_PARAM/lock/log/echo/erase pf2 -
"!===*** SET_PARAM's ***===>>> Depress < - > for HELP"
$!-----------------------------------------------------------------
$ define/key -
  /set_state=RED/lock/log/echo/erase pf3 "!!!===*** RED ***===!!!"
$!-----------------------------------------------------------------
$       define/key -
/set_state=BLUE/lock/log/echo/erase pf4 "!!!===*** BLUE ***===!!!"
$!-----------------------------------------------------------------
$ dk = "define/key/log/erase/echo"
$
$ DkSho = "'dk' /IF=SHOW_PARAM"
$ DkSet = "'dk' /if=SET_PARAM"
$ dkr = "'dk' /if=RED"
$ dkb = "'dk' /if=BLUE"
$ dkn = "'dk' /if=NOSHIFT"
$! set key/log/state=noshift
$
$
$
$!+++
$!      Show and Set States:
$!---
$
$ DkSho         KP1 "Sho Def"
$ DkSet         KP1 "Set Def"
$!
$ DkSho/term    KP2 "Sho Proc"
$ DkSet         KP2 "Set Proc / Priv = "
$!
$ DkSho         KP3 "Sho Users"
$ DkSet         KP3 "Reply/bell/UserName = "
$!
$ DkSho/termin  PERIOD "Dir /Date/ Size"
$ DkSet/termin  PERIOD "Search "
$
$ Def/Key/term/Noecho/erase/If_State = SHOW_PARAM -
                KP4 "@[ross]diskspace"
$ DkSet/term    kp4 "Purge/keep= "
$
$ DkSho         KP5 "Show Log / Table = "
$ DkSho         KP6 "Show Translation / Table = "
$
$ DkSet         KP5 "Help Define "
$ DkSet         KP6 "Help Assign "
$
$!+
$!      On-line HELP for key definitions
$!-
$ DkSho/Term    KP7 "Show Key/brief/all/stat = SHOW_PARAM
$ DkSho/Term    KP8 "Show Key/brief/all/stat = (SET_PARAM, RED, BLUE)
$
$ DkSet/Term    KP7 "Show Key/brief/all/stat = SHOW_PARAM
$ DkSet/Term    KP8 "Show Key/brief/all/stat = (SET_PARAM, RED, BLUE)
$
$ DkR/Term      KP7 "Show Key/brief/all/stat = SHOW_PARAM
$ DkR/Term      KP8 "Show Key/brief/all/stat = (SET_PARAM, RED, BLUE)
$
$ DkB/Term      KP7 "Show Key/brief/all/stat = SHOW_PARAM
$ DkB/Term      KP8 "Show Key/brief/all/stat = (SET_PARAM, RED, BLUE)
$
$!      HELP files:
$
$ def/key/erase/noecho/term/if=SHOW_PARAM MINUS "Type [ROSS]SHOW_PARAM.TXT"
$ def/key/erase/noecho/term/if=SET_PARAM  MINUS "Type [ROSS]SET_PARAM.TXT"
$ def/key/erase/noecho/term/if=RED        MINUS "TYPE[ROSS]RED.TXT"
$ def/key/erase/noecho/term/if=BLUE       MINUS "Type [ROSS]BLUE.TXT"
$
$
$!-----------------------------------------------------------------
```

In this example, when you type in the keypad's minus key, either the SHOW SYSTEM or SHOW USERS DCL command will be executed, depending on whether the current state is GOLD or SILVER. The current state in our example may be changed either through the PF1 (GOLD key) or the PF2 (SILVER key). You also may use a $ SET KEY/STATE = NEWSTATE DCL command to establish a new current keyboard state.

The established key definitions can be extended to the VMS utilities DEBUG, MAIL and Systems Dump Analyzer.

An extensive example of key definitions is given in Program 1. The HELP files (obtained via the keypad minus key) for the SHOW PARAMETERS and SET PARAMETERS keyboard states are indicated in Program 2. *—Eric M. Ross is president of Ross Digital Research Inc., a New York-based consulting firm.*

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PROGRAM 2.

```
        Help Files - SHOW_PARAM.TXT and SET_PARAM.TXT
SHOW_PARAM.TXT:

================================================================

        SHOW_PARAM State Key Definitions:

----------------------------------------------------

        1 _______ Show Default
        2 _______ Show Process
        3 _______ Show Users
        4 _______ Show Disk Space Summary

      < . >_____ Directory / Date / Size

        5 _______ Show Logical / Table =
        6 _______ Show Translation / Table =


_____________________________________________________

SET_PARAM.TXT:

================================================================
        SET_PARAM State Key Definitions:

----------------------------------------------------

        1 _______ SET Default
        2 _______ Set Process / Priv =
        3 _______ Reply / BELL /UserName =
        4 _______ Purge / Keep =

      < . >_____ Directory / Date / Size

        5 _______ Help Define
        6 _______ Help Assign

_____________________________________________________
```

Synctronics' Replacement Keytops

Here's a clever idea: a set of numeric keypad replacement keytops for EDT. Synctronics is a neat little outfit in San Diego. I visited them and really was impressed with the homemade robotics they're using to do the imprinting. The characters are transferred to the blank injection-molded keytops using an offset process involving a little rubber dome. The inks are epoxy and bonded into the surface of the key for permanence.

Removing keys from an LK-201 requires a small screwdriver, a single-edged razor and approximately 10 minutes. The photos say it all. The finished product is a big improvement to the keyboard. *—Dave Mallery*

ARTICLE INTEREST QUOTIENT
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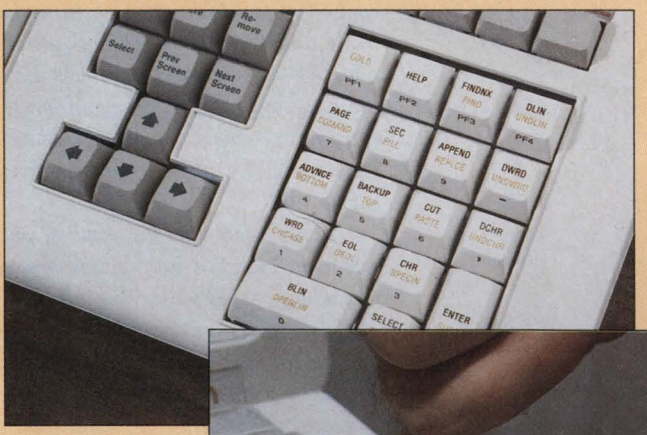
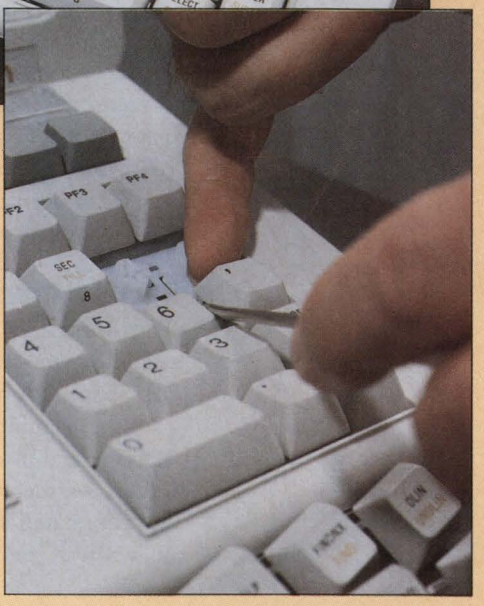
High 864 Medium 868 Low 872





Keys are extracted by putting pressure on the little hook appendages on the side of the keys, and lifting.

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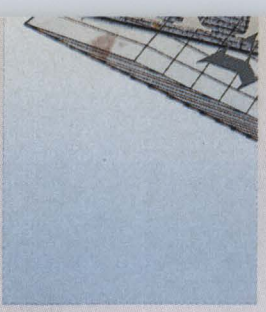

IBM

MAINFRAMES

By Charles Connell

Will DEC Challenge IBM?

It's 1990. You're the MIS director for a Fortune 100 company. Your computer room has been filled with cabinets labeled "IBM" for the last 20 years. Your present collection of mainframes isn't keeping up with your needs, however, so you're shopping for $5 million worth of new computers.

The IBM salesman stops by, blue suit and white shirt crisply pressed as always, to talk about what equipment you'd like to order. Instead of your normally cordial exchange, you ask some tough questions: "Why can't my departmental computers run the same software as my mainframes? Why can't everyone's personal computer access data on the larger machines? Why are my mainframes generally difficult to use?"

After listening to his answers, you call a DEC salesman. His shirt isn't as well pressed, but what he's selling makes sense. You purchase two clusters of DEC's largest processors for the MIS group and DEC mid-range machines for several departments. You also install DECnet/Ethernet to tie it all together: Everyone now can use electronic mail from his PC and read data on the MIS cluster. You stop playing golf with the IBM salesman.

This scenario is IBM's nightmare and DEC's fantasy. How likely is it?

The Mainframe Market

The mainframe market can be defined as those users who purchase large computers for business applications, including MIS reporting, payroll, accounting, general record keeping, banking and insurance operations. This is the largest segment of the computer industry. Approximately 60 percent of all money spent on hardware and software is spent in the mainframe market, according to Frederic Withington, a consultant to the Arthur D. Little Company of Cambridge, Massachusetts.

Within the mainframe market IBM gets approximately 70 percent of the sales, estimates Craig Symons, vice president of The Gartner Group of Stamford, Connecticut. Symons finds that another 15 percent of the mainframe dollars goes to vendors of IBM plug-compatible machines (mainly Amdahl), with the remaining 15 percent shared by DEC and everyone else.

Because of DEC's small share, its growth potential in this area is enormous. An increase of even a few percentage points could double its market revenue.

Industry analysts have a wide range of opinions about DEC's ability to steal these percentage points. Some think that DEC's recent tarnishing of IBM's image on Wall Street is a dark sign for IBM's hold on mainframe sales. Others maintain that DEC will gain only in other, non-mainframe markets. Analysts agree on one point however — DEC has several large hurdles to overcome if it hopes to sell more computers to mainframe users.

Joining The MIS Culture

One of DEC's largest obstacles is that its sales force often doesn't understand mainframe customers. DEC traditionally has placed an emphasis on selling to OEMs and scientific users. This has resulted in an overriding reputation for DEC salespeople: They only know how to talk "techie."

Sales to the mainframe market, on the other hand, are controlled by direct contacts with upper management in Fortune 100 companies. What these managers want is a sales-

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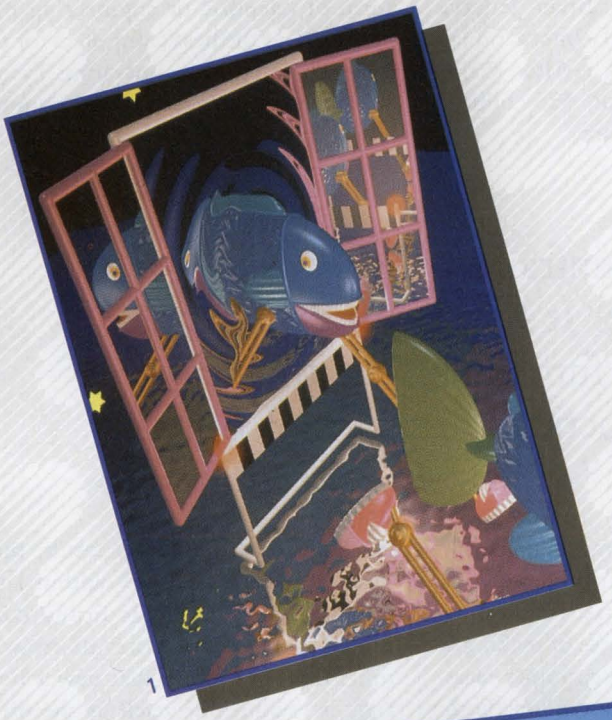
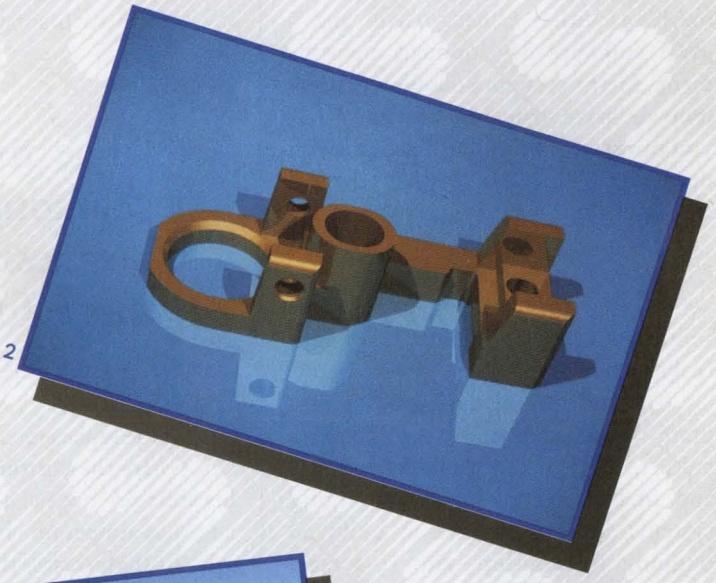
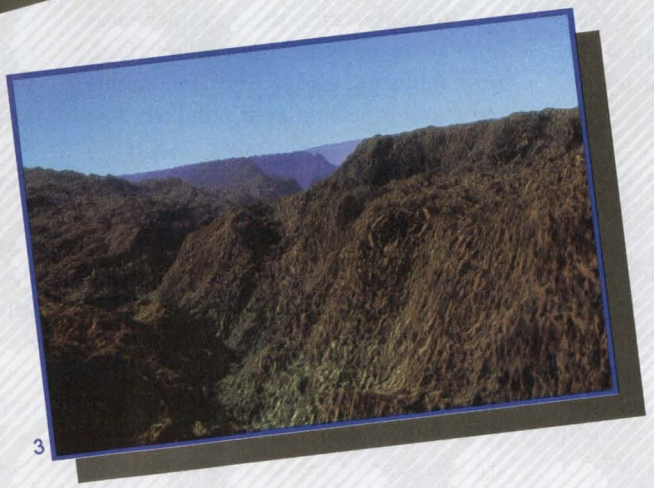


1



2



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person who understands their companies' problems and offers complete solutions. They want a vendor who says, "We know what kind of computers and programs you need to run your business. We'll bring in the hardware, install it in the computer room, write some custom software, get it running and assign five of our people to work with you for as long as you own it." IBM does this.

DEC, however, often says something like, "We can give you a 10 MIPS machine with DECnet, TCP/IP and a great software development environment. After you figure out how to hook it up and have strung the Ethernet cable, you can start writing the programs you need. You'll love our virtual terminal run-time library and the new QIO calls."

MIS managers don't mind paying a fair amount of money to a computer vendor, but they want to pay it for a solution, not for a computer that might *become* a solution.

DEC salespeople must *learn* to integrate themselves into the business culture. They need to understand MIS and financial reports and accounting systems. And they have to build an ongoing relationship with customers centered around these topics. In short, DEC salespeople must learn to play golf.

Service

Another area where DEC lags behind IBM is service: DEC's approach often is fractious.

"When you call IBM and tell them your computer is broken, they send someone over and fix it," says Symons. "When you call DEC, they send out a hardware guy who tells you it's the software, then a software guy who tells you it's the hardware. After DEC has decided whether the problem is hardware or software, they argue with you about what kind of service contract you have. IBM, on the other hand, fixes it, then talks about who's going to pay."

To compete at the highest level of mainframe sales, DEC must change its service tendencies and adopt a "customer first" mentality. This means delivering first-rate, rapid repairs to users who may not understand the difference between hardware and software, and who don't always know what kind of service contract they have.

Getting In The Door

Another large problem for DEC is the installed base of software for IBM mainframes. According to Brian Jeffery, managing director of International Technology Group of Los Altos, California, there is about $25 billion invested in such software.

DEC's inroads to the mainframe world also can come by the side door. Large corporate customers may be committed to IBM in the central MIS processing room, but use other computers in other parts of the company. Two examples are engineering computing and office automation.

Most large corporations do some form of scientific or engineering processing, and the best computers for this have an interactive operating system with strong programming support. These needs point to a VAX, not a machine from IBM. As a result, there often are scientific users within large corporations who are as firmly committed to their VAX as the MIS crowd is to its IBM. In a somewhat newer field, DEC is establishing itself as the office automation leader with its *ALL-IN-1* software. Corporate departments that buy a system for this need are likely to choose DEC as their supplier.

This "departmental presence" will help DEC when the mainframe users in the corporation speculate about other vendors for their needs.

MIS managers have just begun to consider computers from companies other than IBM, and DEC is at the top of the alternate list. As Jeffery puts it, "Some people in the MIS world have started to think the unthinkable." DEC has an opening, albeit a small one, into IBM's turf.

How DEC takes advantage of this opportunity will have a significant impact on its growth.

> "The mainframe market is changing. It's still concerned with business functions, but the way those functions are carried out is evolving." . . . Rose Ann Giordano

In the replacement mainframe market, where the customer is happy with his software but needs faster hardware, DEC has almost no chance of making a sale. In these cases, the customer faces high costs for switching vendors, both from rehosting his software and retraining systems personnel. It's unlikely that such a customer will buy a VAX, even if he thinks it's a nicer computer.

Rose Ann Giordano, DEC's vice president for consultant and information systems marketing, argues however that this obstacle is diminishing. "The mainframe market is changing," she says. "It's still concerned with business functions, but the way those functions are carried out is evolving. Many batch jobs are being rewritten so they're interactive. When this happens, it's Digital's forte." She also believes that computing is moving closer to the user. "Some operations that always were done at a central site are moving to departmental computers or to a combination of mainframe and minicomputers. Again, Digital is strong for these applications."

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TPU

THE THREE FACES OF EVE

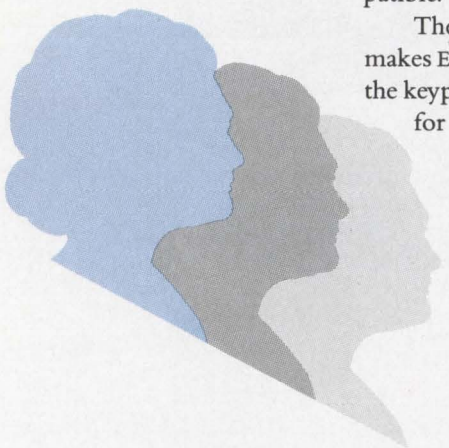
Richard L. Cook, Ph.D.

An Overview Of The New VAX Editor.

This brief overview of EVE was written to show the beginner how to get started with full-screen editing using EVE and to show the experienced user of VAX full-screen editors why EVE will become the editor of choice for most users who have access to an ANSI terminal such as a VT100 or VT220. This is one in a series of reports used at the University of Colorado to show users of the VAX how to perform statistical computing tasks using packages such as SPSS-X *and* SAS.

One facility that is available to interactive users of mainframe computers is the full-screen editor. Most file editing operations are more efficient and can be done faster and with fewer mistakes using a full-screen editor. EDT has been the default editor on the VAX for several years and it provides users with a line-oriented and a full-screen mode of editing with the line mode as the default. When changed into full-screen mode, the keypad on the right side of the keyboard is switched to application mode and the keys are used to implement various editing functions. For full-screen editing, the user's terminal must be a DEC VT52, VT100, or VT200 series terminal or compatible.

The use of keypad keys as function keys makes EDT relatively easy to use, but it ties up the keypad so that it can't be conveniently used for the entry of numeric data. EDT also is not as powerful as some of the competing full-screen editors, although it certainly implements the capabilities needed by users most of the time.



One competitor to EDT that is popular among some VAX users is EMACS. EMACS, which exists in various public-domain and private incarnations, uses various control and escape key combinations and sequences to implement an extensive list of editing functions while freeing up the keypad in the process. These commands are, however, more difficult to remember and this especially is a problem for the beginner. EMACS is based on a LISP-like language and functions can be written by the user, but this requires programming skills.

DEC has, however, responded to this challenge with a formidable new entry in the editing market. With release 4.2 of VMS, DEC introduced the Text Processing Utility (TPU), a text manipulation language. DEC also introduced an editor that is written in TPU and that serves as a basic full-screen editor and as an interface to TPU. It is because of this interface that the editor is called the Extensible VAX Editor or, since DEC is not a company to let a good acronym go to waste, EVE.

EVE, as we'll see, provides the user with a friendly and easy-to-use front end that uses function keys to implement basic editing commands. A command interface provides more of the common editing operations. And, finally, the user ultimately has access to the TPU language for writing complex or specialized functions — or even for modifying EVE herself. These are the three faces of EVE.

The following sections provide an introductory primer on the use of EVE. It is intended for the user who is new to full-screen

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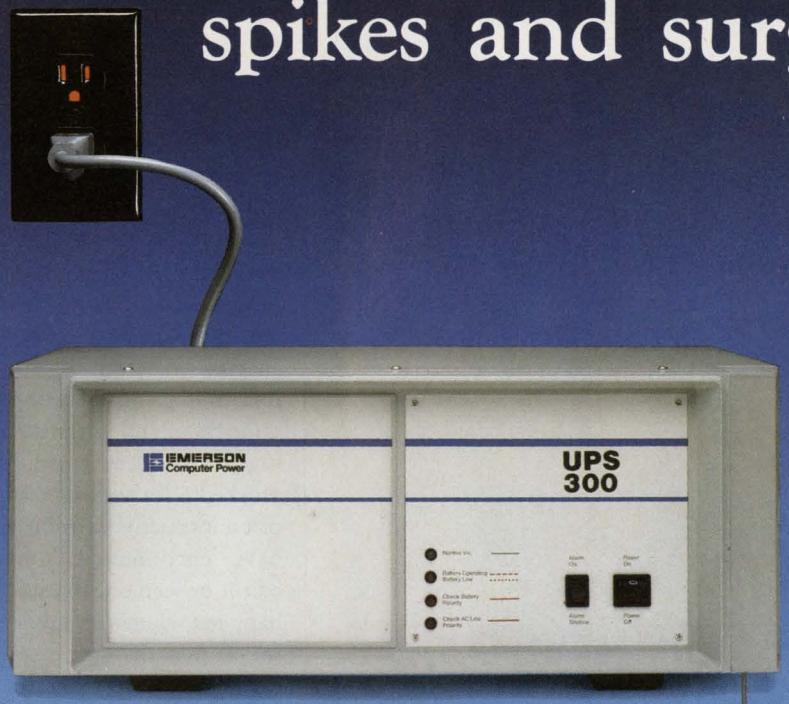

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editing and for the user who is familiar with one of the other full-screen editors. EVE is as powerful as any of the other editors available on the VAX, but vastly more friendly than most. Although there are some restrictions on what terminals can be used with EVE (see below), EVE is arguably the best choice for most file editing operations on the VAX.

Beginner's Overview

First, a few words for the newcomer to full-screen editing (the experienced user can skip this section although it would be worth glancing at the sample EVE display screen below). While it is important that you be able to use a line- and character-oriented editor, such as EDT in line mode, most editing tasks can be done faster and with fewer mistakes using a full-screen editor. If you've worked a lot with personal computers or on interactive terminals you probably have encountered some full-screen editor or seen one in use. What typically happens when you invoke such an editor is that the screen of the terminal clears temporarily and then the file you have asked to edit appears on the screen and there may be a session "status" line at the bottom of the screen. With some editors there may be an intermediate step in which a menu of command options appears. Using a basic example of a batch command file for the *SPSS-X* program, the terminal screen in an EVE editing session might look like Figure 1 at the start of an editing session.

Figure 1 is an example of a set of commands that will perform a statistical analysis of a small data set using the *SPSS-X* program; it's not the most generic way of using *SPSS-X*, but it does represent the sort of file a beginner might set up when first learning how to use the program. What is important to note in Figure 1 is that you are able to look at several intact lines from the file being edited. Using a few simple commands, to be discussed below, you can move the cursor and make corrections or changes to the text or data anywhere on the screen. Most terminals would

> . . . terminals vary widely with respect to intelligence and the language they speak.

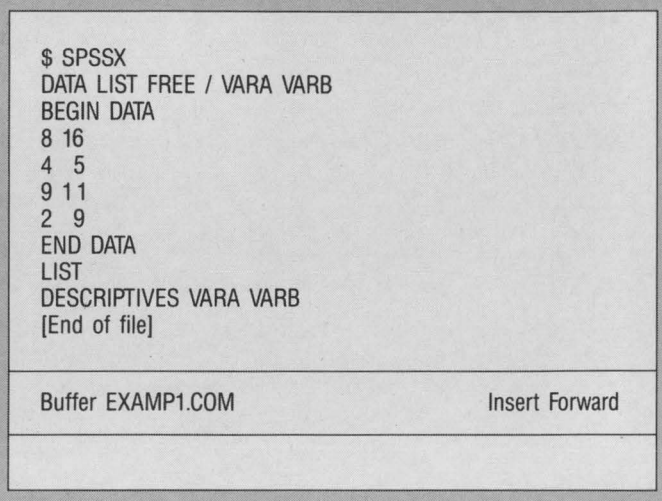
display 80 columns and 21 or so lines from your file. There are a few more things on the screen in the example. The line that reads "[End of file]" simply indicates that there are no more lines in the file.

Full-screen editors normally will include commands that make it possible to perform such operations as deleting a word or deleting one or more lines with the "gap" being closed automatically. You also can select a section of text, "cut" it out, and "paste" it elsewhere in your file. Many of these operations, such as selecting a section of the file prior to performing some other operation, will use reverse video on the terminal's screen to emphasize what's being done.

The kinds of operations described above all depend on the ability of the terminal to "talk" to the editing program. That is, the computer sends the terminal a special string of characters indicating what operation to perform such as clearing the screen or deleting a line and closing the gap. The user might, in turn, use arrow keys to move around within the file to indicate a section to be deleted and the computer will need to keep track of this so it can be highlighted and so the right material can be deleted at the user's request.

It should be clear, then, that these functions assume a certain amount of what we might loosely label "intelligence" on the part of the editor and the terminal if they are to have a meaningful conversation with each other. As with people, however, terminals vary widely with respect to intelligence and the languages they speak. Terminals that

FIGURE 1.



will work with EVE are described in the next section, where the experienced user, who may have skipped this section, will rejoin the discussion.

Terminals And EVE

There is a trade-off between the ability of an editor to work with a wide variety of terminals and the complexity of the editor. DEC has worked with standardization groups, including the American National Standards Institute (ANSI), in developing standards for computer equipment and software. One such set of standards for video display terminals and EVE is designed to work on any terminal that meets this ANSI standard.

Not surprisingly, DEC terminals manufactured in recent years meet this ANSI standard and, in particular, the VT100 and the VT200 series of terminals provide a superset of ANSI capabilities. The older VT52, on the other hand, does not meet the ANSI standard, although some terminals, such as the GIGI graphics terminal, can operate in either VT52 or ANSI mode. It's also worth noting that while EVE will run on any ANSI terminal, it has been optimized for the VT100 and the VT220. Certain kinds of operations will be slower on other terminals depending on such factors as how the screen is refreshed.

Because of the popularity of DEC computers and terminals, many other manufacturers make terminals that are said to be VT100 or VT220 compatible. To the extent that this is true (100 percent compatibility can be an elusive goal) these terminals and others that meet the ANSI standard should work with EVE. It's also worth noting here that a VT200 series terminal can emulate a VT100, a VT52, or a Tektronix 4010/4014. The following discussion assumes that a VT200 (used from here on to refer to the VT220, VT240, and the VT241, which are the current models in the series) is being itself.

In addition to having the right kind of terminal, the VAX you are using must know the terminal's characteristics. On some systems, terminal identification will be automatic. You can use the VMS command "SHOW TERMINAL" to see what your terminal looks like to the system. The display will show many terminal characteristics, but the first line will indicate the "Device_Type:" as in the following:

```
Terminal: _LTA2:
Device_Type: VT200_Series
Owner: Richard Cook
```

The terminal in this case was a VT241. An ANSI terminal would indicate ANSI_CRT in the next to last line of the display and this would be the minimal requirement for the use of EVE.

If you think you have an EVE-compatible terminal, but it doesn't show itself as being at least an ANSICRT then your VAX may not be doing automatic terminal identification. Use the VMS "SET TERMINAL/INQUIRE" command to perform this function. When this command is issued, the VAX actually sends a string of special characters to the terminal asking it to identify itself. The terminal will respond with an identification string and if this process is successful all you will see is a new VMS $ prompt. Another "SHOW TERMINAL" then should confirm the terminal type.

Basic EVE Editing Capabilities

EVE ordinarily is invoked by entering the VMS command "EDIT/TPU file.ext" where "file.ext" is the name of an existing file or of a new file you want to create. Remember that EVE is the default front-end editor for the TPU language. If you name an existing file, EVE will confirm the number of lines read from the file; EVE also will print a confirming message if you are editing a new file. You can exit from EVE with a CTRL-Z (or F10 on a VT200) and a new (or first) version of the file will be written and the number of lines written and the name of the file will be confirmed.

The first thing to try as a new EVE user is pressing the HELP key. This key

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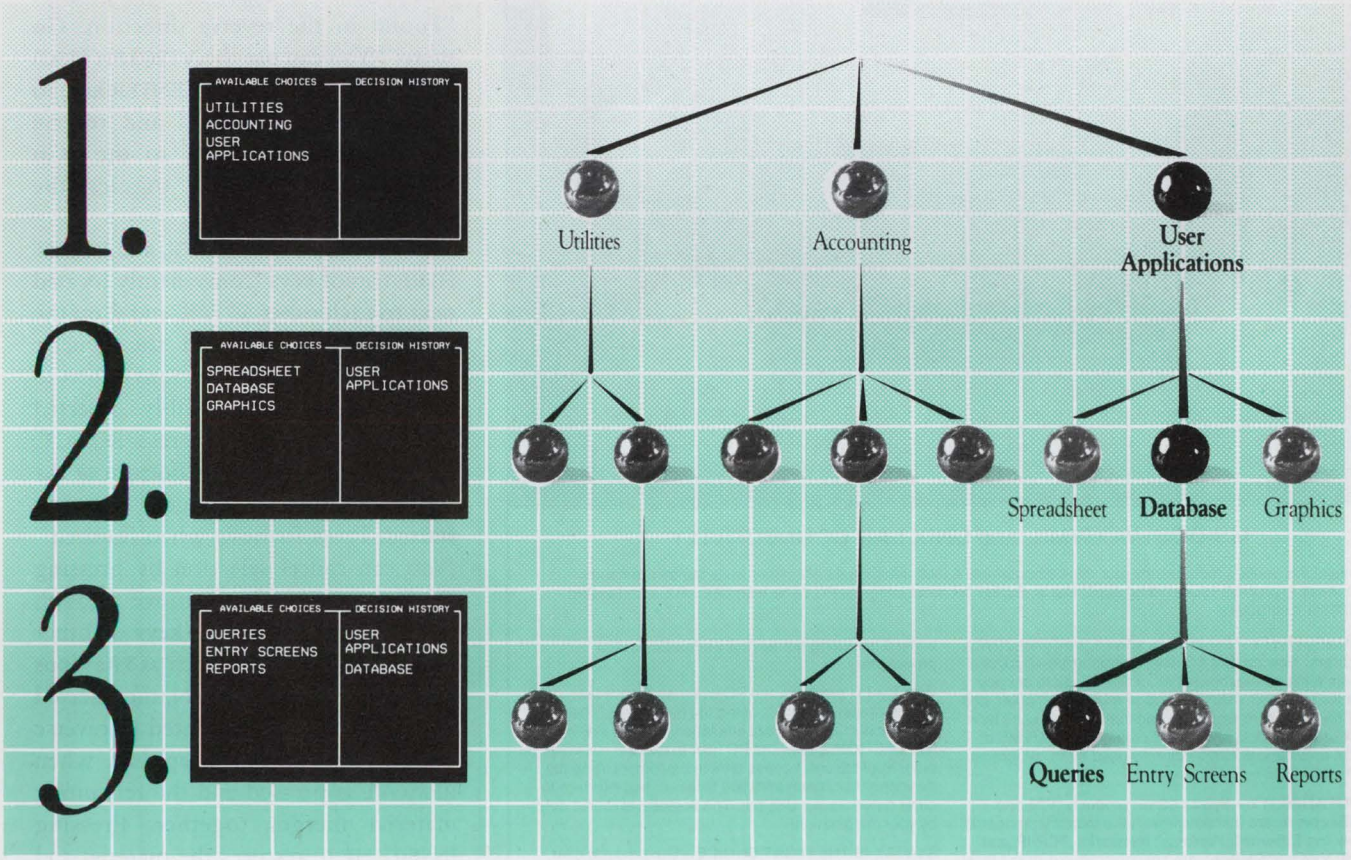

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is labeled as such on a VT200 type keyboard and is labeled PF2 on VT100 and compatible keyboards. In either case, you will see a display of the predefined editing function keys for the kind of terminal you are using. As can be seen in Figure 2, VT100 terminals use the numeric keypad to define functions while a VT200 series terminal has a separate editing keypad with labeled keys. EVE predefines fewer functions than EDT, but there still aren't enough keys to go around for the basic functions on a VT100 keyboard.

While in function key help mode, you can press a key to find out more about what it does, but the functions of most of these keys is straightforward, particularly because of the help EVE gives you when you use one. If, for example, you press FIND (PF1 on the VT100) you will be shown a "Forward Find:" prompt at the bottom of the screen. If the string cannot be found in the forward (default) direction but can be found in the reverse direction you will receive the rather obvious prompt "Found in the reverse direction. Go there?" You can use the VT200 F11 (ESC) key (or the VT100 keypad ENTER key) to toggle between forward and reverse modes. Answering "Y" to the "Go there?" question also toggles the direction.

The SELECT, REMOVE, and INSERT HERE trio of keys (conveniently located next to each other as 7, 8, and 9 on the VT100 keypad) perform the generic operation of selecting sections of text to be removed and possibly inserted elsewhere. When you press SELECT, EVE confirms this at the bottom of the screen with the message "Selection started. Press Remove when finished." (You can cancel selection by pressing SELECT again). As you move through the text with the arrow keys or other movement commands such as PREVious SCREEN or NEXT SCREEN, the selected material will be highlighted in reverse video. The material disappears when REMOVE is pressed and the remaining material merges together. Pressing INSERT HERE restores the material and you can move the material elsewhere since it stays in a buffer until the next REMOVE. You also have the option of putting the removed material into another buffer as described below.

Another useful movement command uses the VT200's F12 (BS) key (" - " on the VT100 keypad) to move to the "end" of the current line or the "end" of the next line if you are already at the "end" of a given line. But (and this is a big but and the reason why "end" was in quotes) note that if you are in the "Reverse" direction mode, the "end" of

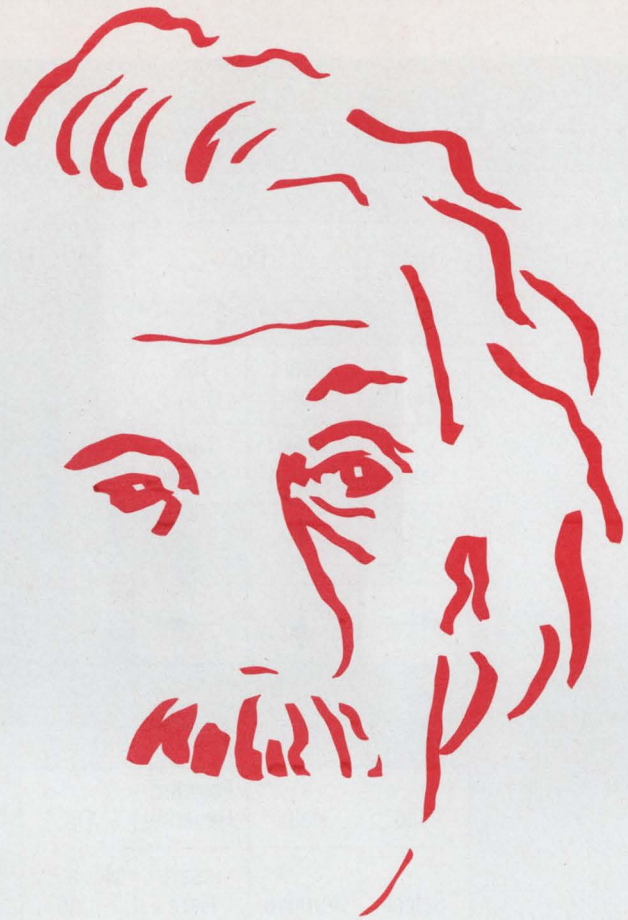

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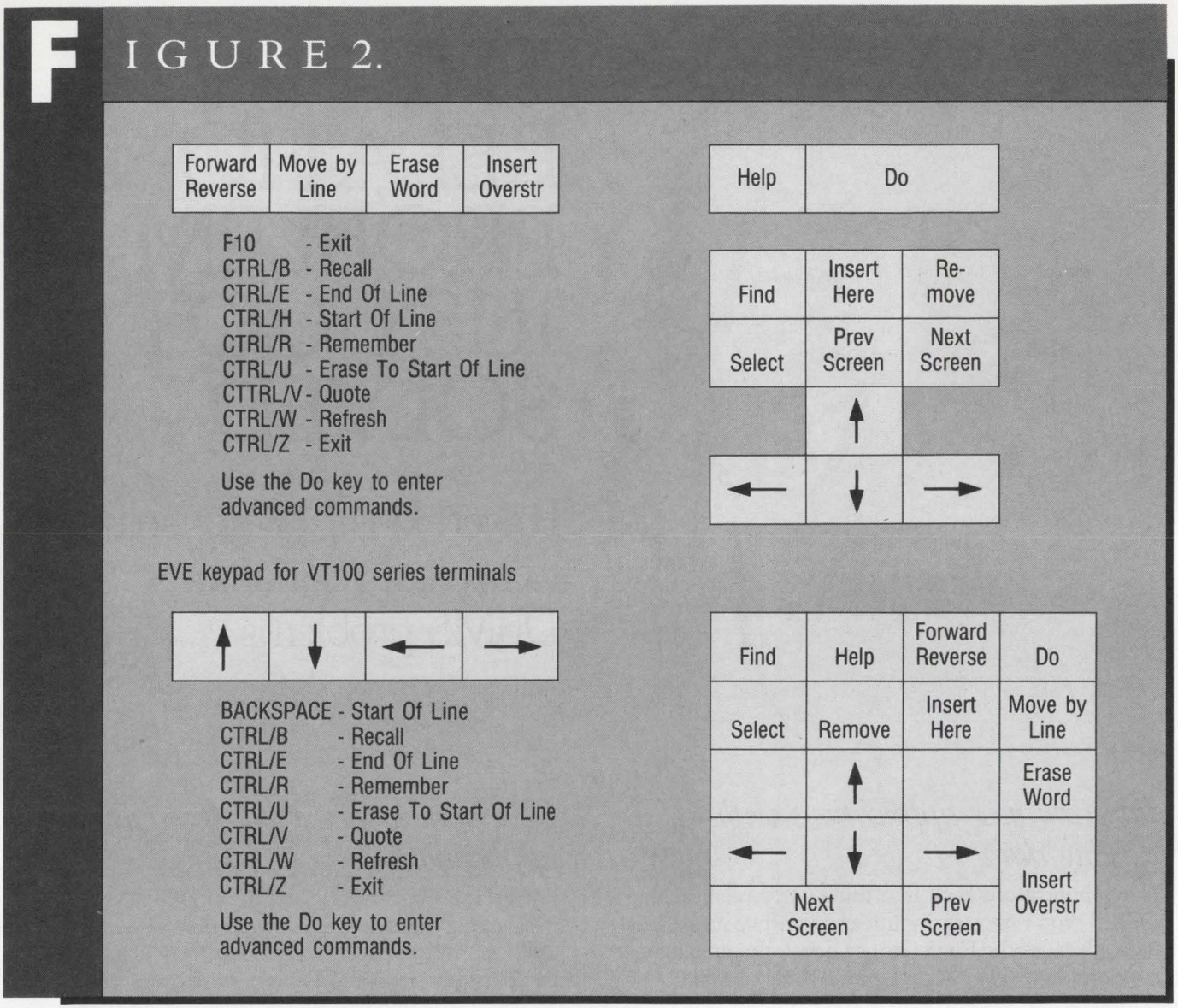
FIGURE 2.



the line is the "back" end and F12 or " - " moves you backward through the file one line at a time. You can go to the end (no quotes) of the current line with CTRL-E or to the beginning of the current line with CTRL-H (alternatively "BACK SPACE" on the VT100 keyboard only).

Another key of special interest is the "INSERT/OVERSTRIKE" key (F14 on the VT200 and the "ENTER" key on the VT100 keypad). This key toggles EVE between the default insert mode, in which characters that are typed are inserted at the cursor position and overstrike mode, in which the characters at the cursor are replaced as new characters are typed. While the insert mode of operation is desirable for many kinds of editing, overstrike can be extremely valuable for some editing operations. Making corrections to a data file is a prime example because you can type the correct data over the incorrect data without having to first delete the incorrect data.

The above is a brief introduction to most of the keys used to implement the most basic editing functions. Two more will be described below, but if you are new to EVE the above is enough to get started with before we encounter a more sophisticated side to EVE's personality.

Beyond The Basics

There certainly is more to editing than the "key" operations that already have been presented. One key, not yet described, has the generic-sounding name of "DO" on a VT200 (or the less generic-sounding "PF4" on a VT100) and DO definitely does a lot. If you press DO, you will be prompted for a

One very useful DO command is DCL, which gives you access to the VAX's Digital Command Language.

"Command:" at the bottom of the screen. Since you don't know any commands yet, it would be reasonable to type the word "help" (which can be abbreviated to "h") and press the return key. You'll be introduced to a much more complex (but not necessarily complicated) side of EVE in the form of a listing of all the other commands you could have entered besides "help".

It would go far beyond an EVE primer to talk about more than a few of these commands. Of course, some are fairly obvious, such as BOTTOM and TOP, which move you to the bottom or top of the file, respectively. You can SET the RIGHT MARGIN, FILL a PARAGRAPH, MOVE BY WORD, and much more. All of the predefined keypad commands also can be used as DO commands.

To hint at some of the possibilities DO opens up, let's assume you want to move forward or backward one word at a time (a keypad EDT function). You could press DO, enter the DEFINE KEY command and, when asked by EVE, enter the MOVE BY WORD command. EVE then would ask you to choose a key and you could pick a key that hasn't been defined or that you want to redefine. F17 through F20 or any of the keypad keys would do on a VT200 and unused keypad keys or the duplicated arrow keys would be reasonable choices on a VT100. Try it — it's even easier than it sounds.

Note that DO commands can be abbreviated. If your abbreviation is not unique you will be told so and the alternatives will be displayed in a second display window that will appear on the screen. REP is not sufficient for distinguishing between REPEAT and REPLACE, for example. If you enter REP as a command, the "choices" window would show these options and the cursor would be positioned for adding the distinguishing E or L.

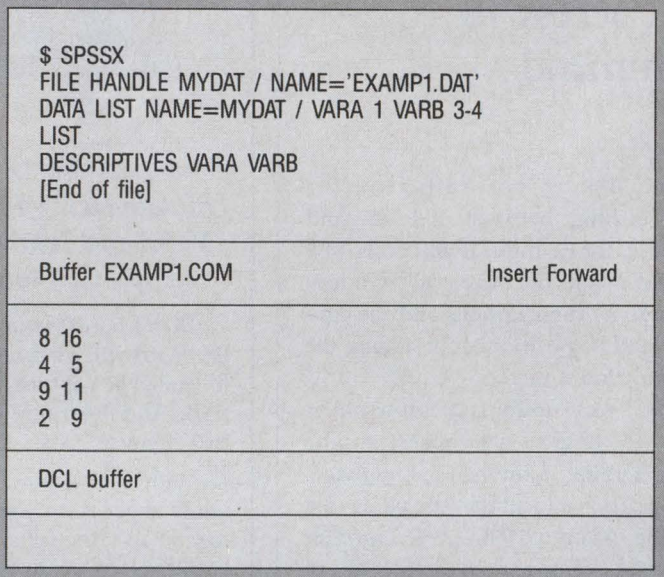
One very useful DO command is DCL, which gives you access to the VAX's Digital Command Language. Perhaps you've forgotten the name of a file you want to INCLUDE (another handy DO command) in the file you're editing. You can press DO and then enter the command "DCL DIR". Once again, a second window is displayed on the screen and this time it contains the results of the DIR command as if you had entered DIR at the VMS $ prompt. Unlike the choices window, the DCL window will not go away until you use the DO command ONE WINDOW (for which ON is a sufficient abbreviation).

If you have lots of files, the output from the DCL DIR command may scroll beyond the part of the screen allocated to it. You could DO the command OTHER WINDOW (or OT) to move to the DCL window and then use the screen keys (or any of the movement keys or commands) to scroll through the window. Or perhaps you entered the command "DCL TY MYFILE.TXT". You could SELECT text from your file, REMOVE it, use DO to move to the OTHER WINDOW, use DO to get back to ONE WINDOW, and finally INSERT the text into your original file.

Figure 3 is an example using DO to check the column locations of data in a separate file for use in a variation on the *SPSS-X* run presented earlier.

The second window in this exam-

FIGURE 3.



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ple was produced by pressing DO and then entering the command "DCL TY EXAMP1.DAT".

Editing In The BUFF

Extracting something from the DCL window and moving it to the original window is a simple example of the use of EVE's multiple buffer capability. The DCL buffer is created automatically, but you can create other buffers with the DO command BUFFER followed by a name of your choosing. By default the screen will clear and you will be in an empty buffer with that name (or you'll see a screen from the buffer if text has already been entered into it during the current editing session). You might, for example, enter a new buffer and then INCLUDE some external file and REMOVE some information from it. The BUFFER command followed by the name of the original file (only enough characters from the name to distinguish it from other buffers including EVE's special buffers are needed) would take you back to that buffer where you could INSERT the information.

Note that you also can choose to work explicitly with two files in two windows that are on the screen simultaneously as was the case when the DCL command was used above. The TWO WINDOWS command splits the screen and by default you'll see two windows; you then can issue movement commands to view two different sections of the same file. The GET FILE command brings an external file into the current window replacing the current file. You also can enter EVE without specifying a file name and use two GET FILE commands in two windows.

Teaching EVE New Tricks

A detailed discussion of EVE's more powerful features isn't appropriate in a primer, but a few hints at these capabilities are in order. Assigning EVE command definitions to keys was mentioned earlier, but more complex key and command sequences also can be assigned to keys. If you press DO and enter the command LEARN, EVE will ask you to press the keystrokes to be remembered and to press CTRL-R to remember them. EVE then asks you to press a key to be associated with that sequence. It's easy and EVE provides helpful messages along the way. Try adding a few spaces to the front of every line in a file as a trivial example.

EVE's ultimate power comes, however, from the ability to access the TPU programming language directly. You can extend EVE herself by writing your own procedures in TPU. This isn't the place for going into the details, but a simple example of a TPU procedure is the following:

```
procedure eve__time
dandt := fao("!%D",0);
message (dandt);
endprocedure
```

This procedure uses the VMS Formatted ASCII Output (FAO) facility to

store the current date and time in "dandt" (an arbitrary variable name standing here for Date and Time) and "message" prints the result at the bottom of the screen.

Of course, if you have gone to the trouble of defining keys, remembering keystrokes, or writing special procedures, you might want to save these capabilities for use at a later time. This can be done with the SAVE EXTENDED TPU command. This produces a "section" file that is your own personalized version of EVE. You also have the option of using a startup file of commands written in TPU in a manner similar to the use of the EDT initialization file.

Because EVE is written in TPU, you even can rewrite EVE or use the TPU source code as a model for your own editor. The dedicated EDT user even might be thinking about writing an interface that looks like EDT, but adds all the power of being able to access TPU. It's certainly possible, and DEC already has done it! I haven't mentioned it until now simply because I wanted the experienced EDT user to get to know EVE first; the switch will be worth the effort.

Getting Started

Documentation on how to use EVE and TPU can be found in DEC's *Guide to Text Processing on VAX/VMS* and the *VAX Text Processing Utility Reference Manual*, and you'll want to refer to these manuals eventually. EVE is easy enough to learn, and I would suggest sitting at a terminal and having a go at it. I've only mentioned a few of the options and capabilities for using EVE, but this should be enough for the beginner or advanced user to get started. I used to be a dedicated EDT user, but I've seen the light and reformed my ways. EVE is the only way to go. —*Richard L. Cook, Ph.D., is a statistical computing consultant at the Social Science Data Analysis Center, University of Colorado, Boulder, Colorado.*

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COMMUNICATIONS

TRANSFERRING FILES

By Dr. G. Ronald Dalton and Jim Ogles

Moving Files Between PCs And Large Computers Is A Pain In The Neck That Can Be Reduced.

Transferring several files from a PC to a larger computer, like the VAX or an IBM mainframe, is at best a pain, but one that can be reduced greatly if you know how. In general, the transfer involves typing a command line like:

```
CREATE VAXNAME.EXT
```

on the VAX plus a command line like:

```
SEND B:PCNAME.EXT
```

on the PC at the start of the transmission of each file. It also involves waiting for the transmission to be completed before the procedure can be repeated for the next file.

Take heart! When your program has outgrown the capacity of your PC and you must move the collection of files to a larger computer, there is a simple, painless way to do it. It involves a small PC program that copies the individual files into a large library-like file. You then move this single, large file to the larger computer. Then you use a second small program on the large computer to make a copy of each small file from the large file. Thus, you can take advantage of the first program to string the files together automatically into a single file that is moved easily, and then use the second program to cut the large file back automatically into individual files.

The key to the process is having the first program write the word "File_Break" and the file name (e.g., B:File_1.Ext) at the head of each file as it is placed in the big file. The second program looks for the word "File_break" to find the start of each new file. It then uses the file name (in this case File_1.Ext) to create a file into which the contents of the small file are placed. Note that the device letter and the colon (e.g., B:) are removed by the second program because the PC device name will cause problems if it is used as part of the file name on the larger computer.

In order to tell the first program what files to string together you must create a file called Lib_List, for example, which contains the names of the files to be included in the big file. One easy way to do this is to use the DIRECTORY command to create a file with file names in it and then use an editor to clean up the file so it will contain a list of the files to be strung together. The contents of such a file might look like:

```
B:File_1.Txt
A:File_2.Txt
B:Cut_File.Pas
. . . .
Cat_file.Pas
. . . .
```

It is interesting to note that the work described here is the first step in the building of a Text-Library utility program. Some of the additional features that should be added include the ability to list the names of the files in the library, copy a file from the library to an external file, delete a file from the library and insert a file into the library after checking for duplication. All of these features could be made faster if the files were strung together in blocks of 512 bytes. In addition, an index should be added at the start of the library file to give the names and location, in blocks, of each file. This directory and the block structure would make all of the operations faster.

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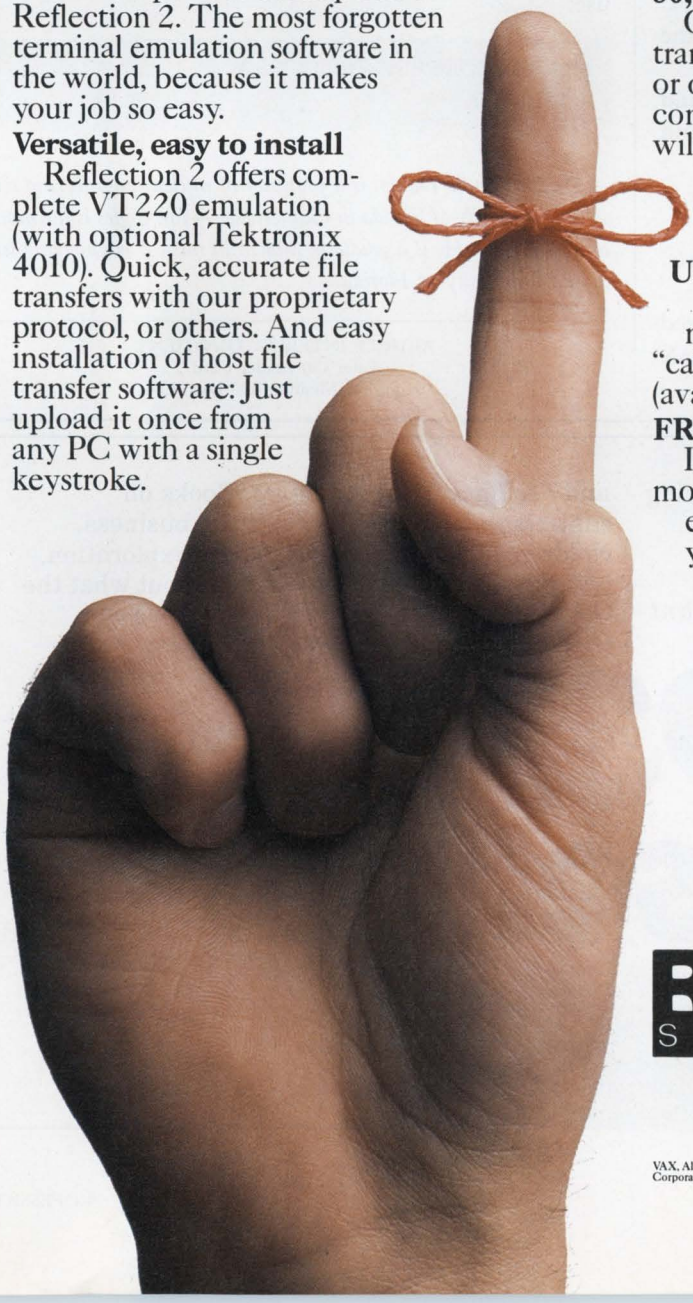

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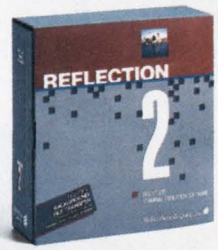

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ENTER 235 ON READER CARD

Many of these features have been deduced from using the Library Utilities marketed by DEC for its PDP-11 and VAX systems.

The first program has been used to string together many files that have been transferred to a VAX and a PDP-11/34 using the utilities EDT (in the INSERT mode), CREATE and KERMIT, with EDT working best. The second program then has been used to curt the files apart with no problem. The first program is written both in PASCAL (Program 1a), and BASIC (Program 1b); the second is written in PASCAL (Program 2a), and FORTRAN (Program 2b).

Translating PASCAL Programs

The following are some notes on the translation of PASCAL programs from the IBM PC to the VAX:

1. The Assign statements become Open on the VAX.
2. The Close statements may contain disposition information on the VAX.
3. The Lstring becomes Varying on the VAX.
4. The [0] character in an Lstring can be altered on the PC but it cannot be on the VAX, you must use the SubStr or the Concat functions to alter strings on the VAX.
5. Redirection of standard input on the PC using <infile and >outfile uses the ASSIGN filename.ext SYS$$INPUT and ASSIGN filename.ext SYS$$OUTPUT on the VAX.
6. Text lines on the PC can be up to 255 characters, but only 133 on the VAX.
7. The PC meta commands such as $Debug+, $Line+ etc. cannot be used on the VAX.
8. The PC uses [Public] to describe variables that are stored in a fixed area and are available to all modules. The VAX PASCAL uses [Global] for this purpose.
9. The PC uses Libraries of . . . Obj files in a slightly different way.

On the VAX use:

```
LIBRARY/CREATE  libname.OLB
LIBRARY/INSERT  subname.OBJ

LINK mainfile.obj,libname.OLB/LIB
```

On the PC use:

```
LIB.EXE libname.LIB+subname.OBJ
LINK.EXE mainfile.OBJ,libename.LIB
```

after using:

```
LIBRARY/DELETE SUB1
```

use:

```
LIBRARY/COMPRESS=(BLOCKS:3)
MYLIB.OLB
```

—Dr. G. Ronald Dalton is a professor of nuclear engineering science at the University of Florida in Gainesville. —Jim Ogles is the manager of a PDP-11/34. He is a graduate student in nuclear engineering science at the University of Florida.

ARTICLE INTEREST QUOTIENT
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PROGRAM 1a.

```
Program Cat_list ( Input, output );
{
     Run this program with the call:
     Cat_list <Lib_List  >Big_F.Lib

Where Lib_List contains the names of the files to be strung
together, and Big_F.Lib is the name of the file where the results are
to be placed.

}
Var  In_Name : Lstring(20);
     In_File : Text;
     A_Tine  : Lstring(255);


Begin
  Begin
    ReadIn ( In_Name );
    Assign ( In_File, In_Name );
    Reset  ( In_File );
    Writeln( 'File_Break');
    Writeln( In_Name );
    While ( EOF ( In_File ) = False ) Do
      Begin
        ReadIn ( In_File, A_line );
        Writeln( A_Tine );
      End;
    Close ( In_File );
  End;
End.
```

Cat_List.Pas in PASCAL for the IBM PC.

PROGRAM 1b.

```
900  REM  This is the program Cat_List.Bas
902  REM
905  FB$ = "File_Break"                        ' File_Break message.
1000 OPEN "Cat_LTst" FOR INPUT AS #1           ' Open the list of file_names.
1002 OPEN "Big_F" FOR OUTPUT AS #3             ' Open the output file.
1004 REM
1010 IF EOF ( 1 ) = -1 GOTO 1130               ' Quit reading list file at EOF.
1020 INPUT #1, INN$                            ' Get a file name from file_names.
1026 REM
1030 OPEN INN$ FOR INPUT AS #2                 ' Open file_name.
1050 WRITE #3, FB$                             ' Write "Break_File".
1060 WRITE #3, INN$                            ' Write file_name.
1062 REM
1064 PRINT "WORKING ON FILE : "; INN$          ' Put file_name on screen.
1070 IF EOF ( 2 ) = -1 GOTO 1110               ' Check file_name file for EOF.
1072 REM
1080 INPUT  #2, ALINE$                         ' Read a text line from file_name.
1090 PRINT #3, ALINE$                          ' Write a text line to Big_F.
1100 GOTO 1070                                 ' Go back for another text line.
1102 REM
1110 CLOSE #2                                  ' Close the file file_name
1120 GOTO 1010                                 ' Get another file_name.
1122 REM
1130 CLOSE #1                                  ' Close the file_names file.
1140 CLOSE #3                                  ' Close the output file, Big_F.
1150 END
```

Cat_List.Bas in BASIC for the IBM PC.

PROGRAM 2a.

```
Program Cut_file ( Input, Output );
{
This program reads the file "Big_F.Lib", cuts it and writes it out
into a series of individual files.

}

Var  A_line,                              { A line from Big_F.Lib }
     B_line  : Varying [133] of Char;     { A file name }
     A_len,                               { Length of A_line }
     i       : Integer;
     InFile,
     OutFile : Text;
     First   : Boolean;

Procedure Start_a_new_File;  { This procedure opens a new file }

Begin
  ReadIn ( InFile, A_line );

  If ( A_line[2] = ':' ) Then  { Cut off 'B:' }

    Begin
      A_len := Length ( A_line ) - 2;
      B_line := Substr ( A_line, 3, A_len );
    End;

  If ( First <> True )
      Then  Close ( OutFile, Disposition := Save )
      Else First := False;

  Writeln('Processing file : ', A_line );
  Open ( OutFile, A_line, History := New );
  Rewrite ( OutFile );

End; { of Start a new file }
Begin
 First := True;   { Is this the first file ? }

 Open ( InFile , 'Big_F', History := Old );
 Reset ( InFile );

 While ( EOF ( InFile ) = False ) Do  { Read InPut File }
   Begin
     ReadIn ( InFile, A_line );

       If ( A_line = 'File_Break') Then  { Get Filename.Ext }

         Start_a_new_File

       Else  Writeln ( OutFile, A_line );  { just do another line }

   End;    { of While EOF(InFile) = False }

  Close ( InFile, Disposition := Save );  { Close the Junk.Lib file }
End.
```

Cut_File.Pas in PASCAL for the VAX.

PROGRAM 2b.

```
C     This is a FORTRAN 77 version of the CutFile program.

C     It is assumed that the user has taken steps to assign
C     the name Big_F.Dat to the large library file that contains
C     many files.

      Program CutFile

      Character Aline(132)*1, Outfil*25, Brkstr*10
      Integer Alen, i
      Logical First

C     Initializes the variable First and and opens the file Big_F.Lib.
C     The program then enters a while loop structure
C     that repeats while there are lines in the source file.

      First = .TRUE.
      Open ( UNIT = 1, FILE = 'Big_F.Lib', STATUS = 'OLD' )

    1 Read ( 1, 2, END = 9 ) Alen, ( Aline(i), i = 1, Alen )
    2 Format ( Q, 132A1 )

      Do 3 i = 1 , 10                ! Reads the First 10 characters
        Brkstr(i:i) = Aline(i)       ! into a string variable
    3 Continue                       ! for easier comparison.

C     Enters a 2 way branch that either changes the output file
C     or writes the line to the output file, depending on whether
C     the file break line is present.

      If( Brkstr .EQ. 'File_Break' ) Then
         Do  33 i = 1, 27
           Aline(i) = ' '            ! Blank out Aline.
   33    Continue
      Read ( 1, 2 ) Alen, ( Aline(i), i = 1, Alen )
      If (Aline(2) .EQ. ':' ) Then   ! Cuts off the device name
       Do 4 i = 1, 25                ! and Read the file name
       Outfil(i:i) = Aline(i+2)      ! into a string variable
    4  Continue                      ! for easier use.
       Else
          Do 5 i = 1, 25
            Outfil(i:i) = Aline(i)   ! Copy full file name
    5     Continue
      EndIf

C     Enter a 2 way branch that closes the finished file
C     except for the case of the First = True.  Then a message
C     is sent to the terminal, indicating the processing of
C     a new file.  The new file is opened as unit 2.

      If ( First ) Then
         First = .FALSE.
      Else
        Close ( UNIT = 2, STATUS = 'KEEP' )
      EndIf

      Write ( 6, * ) 'Processing File: ', Outfil
      Open ( UNIT = 2, FILE = OUTFIL, STATUS = 'NEW' )

      Else
    6  Write ( 2, 7 ) (Aline(i), i = 1, Alen )
    7  Format ( 1X, 132A1 )
      EndIf

      DO 8 i = 1, 132          ! Blanks the Aline variable
        Aline(i) = ' '         ! prior to the Reading of
    8 Continue                 ! a new line.

      GoTo 1                   ! Go and read another line.

    9 Continue
      Close ( UNIT = 1, STATUS = 'KEEP' )
      Stop
      End
```

■

Cut_File.For in FORTRAN for the VAX.

DBMS

SEARCHMATE

By Peter M. Smith

A New Database Package For Storing And Retrieving Memos, Reports, Articles And Other Essential Textual Documents.

One of the more difficult yet persistent problems in information management is how to process textual (unstructured) material. Much of the information that we deal with on a daily basis is in the form of memos, reports and articles. There's a vital need to store and retrieve this information. While there are many excellent "traditional" database systems on the market, these usually work in the "record and field" mode, dividing information into records with fields that can be indexed readily for fast retrieval. When faced with an unstructured memo, these systems cannot cope well despite ingenious solutions based on key words, pointers or abstracts.

A new product called *SEARCHMATE* (formerly *IRIS/DB*) from Automated Office Systems Inc. of Albuquerque, New Mexico, has entered into the field. *SEARCHMATE* is designed as a document search and text retrieval system integrated into the VAX environment. *SEARCHMATE* has broad applications in any area that require instant access to a textual database of documents. It can be used, for example, in law offices where voluminous litigation records need to be stored, or for personnel files where resumes and personal information about individuals can be accessed, or in a research environment where there's a chronic need to index articles, reports and references.

We've been using *SEARCHMATE* for more than one year from beta test through its current release (version 1.3). The product is powerful, extremely useful, cost effective and, perhaps most impressively, a delight to use because of a well-designed user interface.

Document Structure

The basic element of a *SEARCHMATE* database is the document. Each document has two distinct parts: formatted fields and the free form text. The formatted fields can be considered a "rubber stamp" at the top of every document. At least two fields are required. For example, Number and Name, or Name and Date.

There are few limitations on the length or type of these fields, but they must be unique. Up to 15 formatted fields are allowed, including dates, names of authors, subject of reports, etc. These fields allow for sorting documents, for example, by date or author and provide "greater or less than" comparisons. Formatted fields can be changed or expanded, or additional fields can be added at any time.

The bulk of the document, the free-form text, follows after the formatted fields. There's no limitation on the length or structure of this text, which is a major advantage when faced with a pile of reports that need to be stored and indexed; *SEARCHMATE* can incorporate all these reports, whatever the length. You can "add it all" to the database. However, one useful feature allows the text to be organized into two named sections, if required. For example, one of the named sections in the report may be Abstract, another Authors, and then the remainder the Text itself. This allows word searches to be restricted to the named section. The sections can be printed out in the columnar report writing feature as described below.

Text can be added to *SEARCHMATE* by

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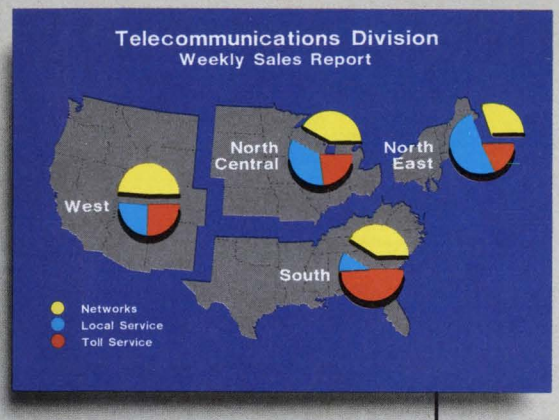

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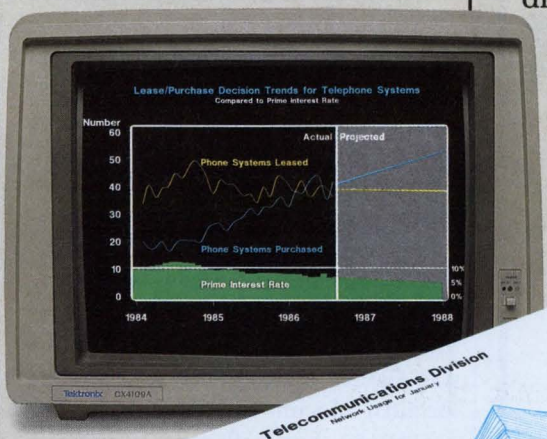

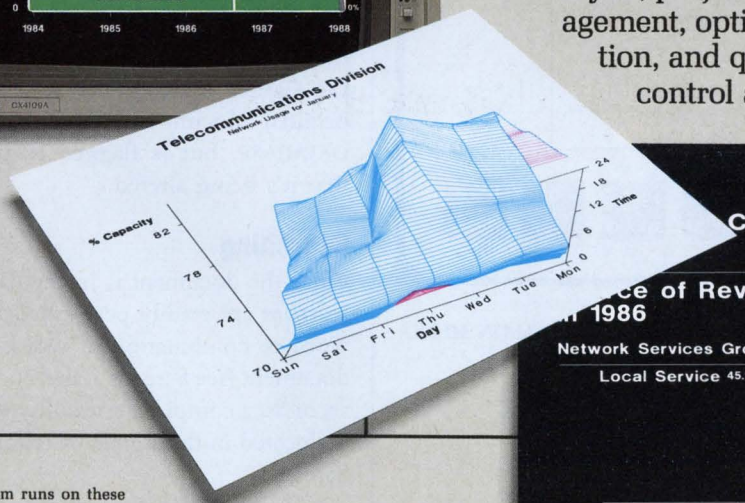

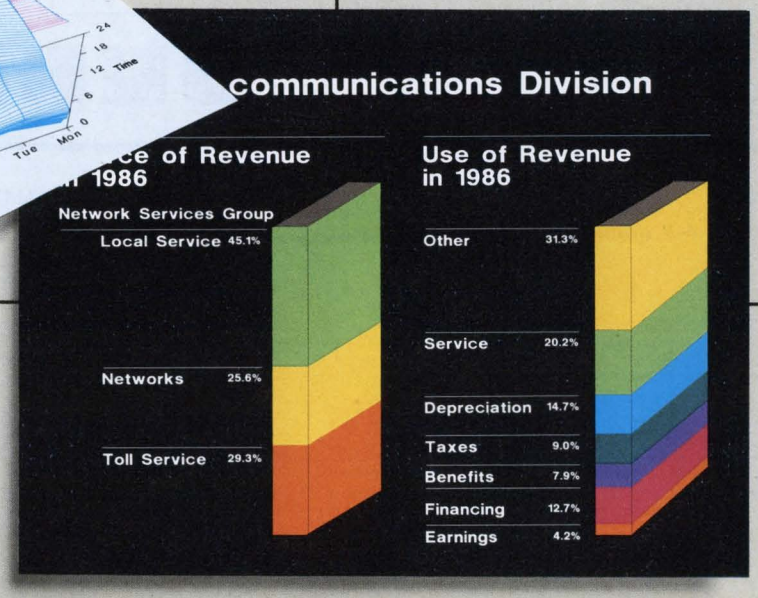

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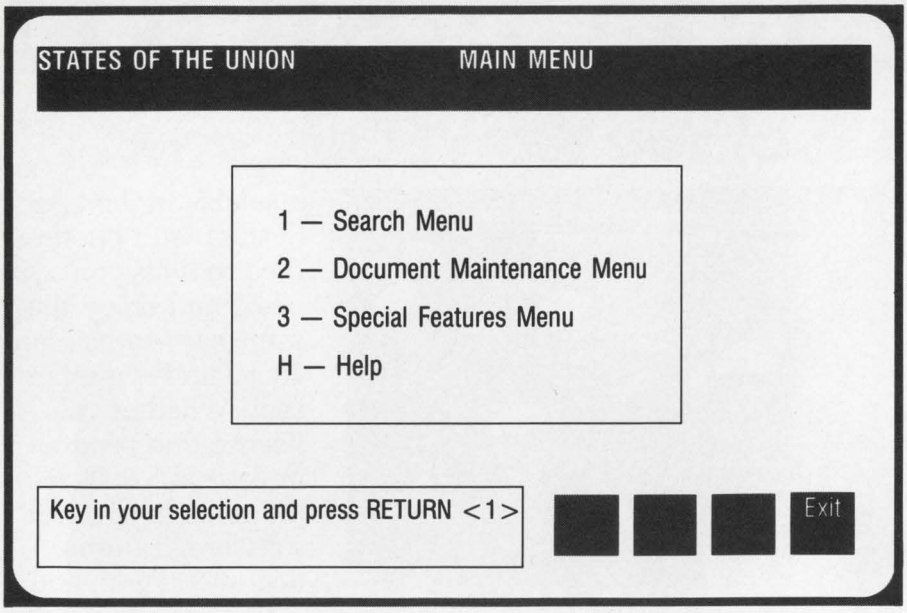
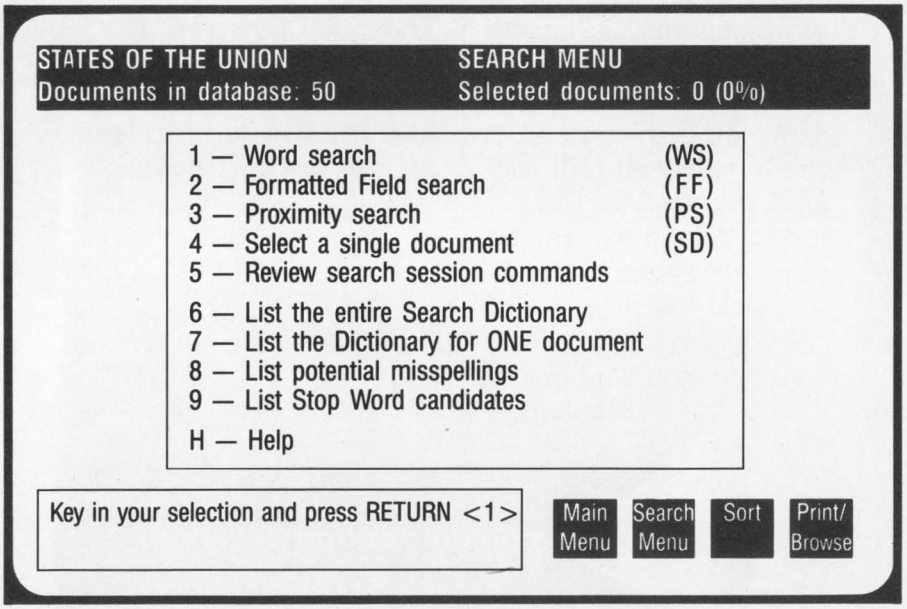
The SAS System runs on these minicomputers: Digital Equipment Corp. VAX™ 8xxx and 11/7xx series under VMS™ and MicroVAX II™ under MicroVMS™; Prime Computer, Inc. Prime 50 series under PRIMOS®; and Data General Corp. ECLIPSE® MV series under AOS/VS. The SAS System also runs on IBM 370/30xx/43xx and compatible machines under OS, CMS, DOS/VSE, SSX, and ICCF; IBM XT/370 and AT/370 under VM/PC; and IBM PC XT and PC AT under PC DOS. Not all products are available for all systems.



Screen 1. THE MAIN SEARCHMATE MENU. The four boxes bottom right indicate the four PF1-4 keys. Read-only users cannot access Option 2. The STATES database is provided by SEARCHMATE for demos and testing.



Screen 2. THE SEARCH MENU. In most menus, the PF1 key returns to the MAIN MENU. Options 6-9 allow review of the Dictionary contents.

direct keyboard entry or by uploading from any of the common word processing systems or optical readers. The link from a DECmate, for example using the document-to-host mechanism, is remarkably easy and a fine instance of integrated software design.

SEARCHMATE indexes documents in batch mode because each document is scanned word for word and each word is added to a dictionary with pointers to the original document. This is CPU intensive and usually takes place overnight, although it can be scheduled at any time. *SEARCHMATE* provides a list of more than one hundred stop words, which are not indexed. These are the common adjectives, prepositions or conjunctions. Each database can have its own list of stop words, and words can be added or deleted readily.

SEARCHMATE uses three "boxes" (see Figure 1). The INBOX is where text is entered and edited. The editor for documents in the INBOX uses the *WPS+* keyboard, although without all the functionality (it is, in fact, an enhanced EDT). Documents then are moved to the OUTBOX where they wait for insertion into the DATABASE itself, where the text is searched and stored. It is the move from the OUTBOX to the DATABASE that takes time. During insertion, each document is date-stamped, which provides support for archival integrity. Once a document is in the DATABASE, it's readily moved to the INBOX for further editing, and then reinserted into the DATABASE. During this process, the original document remains in the DATABASE, but is flagged to indicate that it's being altered.

Searching

Once the document is in the database, searches are readily performed for any word or combination of words in the document (see Screens 1 and 2). Within seconds, a complex series of words can be located in thousands of reports (see Screen 3).

When the documents are selected, one keystroke puts you into Print/ Browse mode and allows you to view

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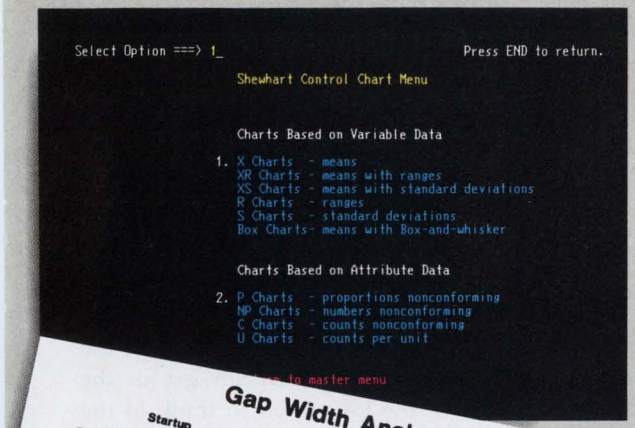

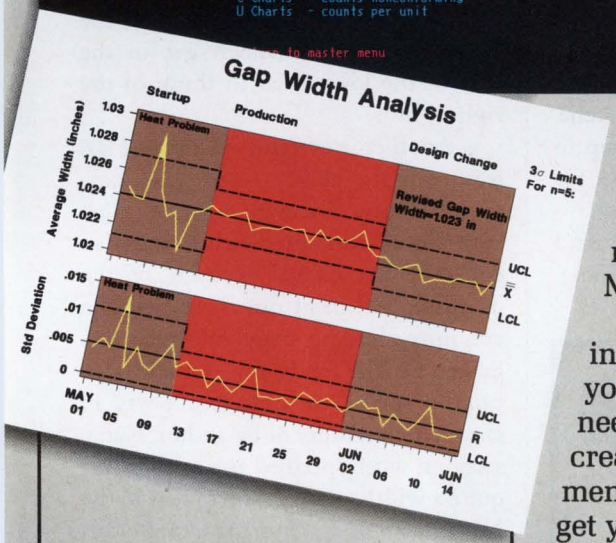

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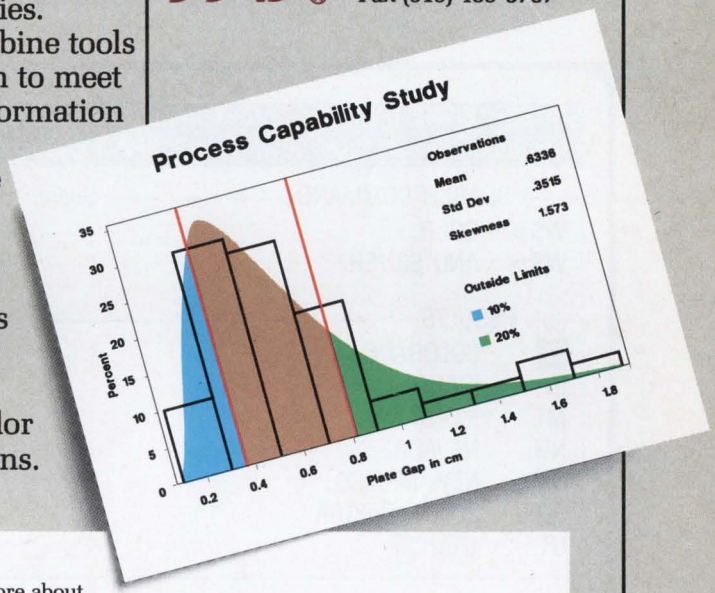

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the text (see Screen 4). You then can scan through the document looking for the hits. These hits are highlighted on the screen (see Screen 5). Another keystroke will bring you back to the Search mode to allow for further defining of your selection.

If you over-define your search and reduce the selection beyond what you require, it's easy to retrace the search to the prior results. In the Print/Browse mode, documents can be printed in their entirety or only the hits may be printed, or just a section of the document. The user may specify two printers: a system printer and a local attached printer port is the normal arrangement.

One of *SEARCHMATE*'s strongest features is its user interface. These search and print sequences are menu driven with good help and error messages. The help is much improved in version 1.3, and the help screen can be printed. User-defined help screens also can be added. It's easy to find what you're looking for in the *SEARCHMATE* database (once you realize that this is a radical way of thinking and that every word is available for your inquiry).

Searches on words can be combined with various logical operators like AND, OR and NOT, and root words also can be used. For example, POLY! will give polymer, polymeric, polystyrene, etc. During a search you can jump to formatted fields and search these, for example, to limit the date range.

There's an even more powerful search mode called Proximity Searching, where words can be defined to have a certain proximity to each other, thereby ensuring that word relationships are maintained. All these searches require practice, but are fast, efficient and fun to do. In other words, rarely does the *SEARCHMATE* mechanism get in the way of the logic used to think of the right words.

Another powerful *SEARCHMATE* feature is the ability to produce columnar reports. These are reports that list some or all formatted fields, and also some of the named sections of the database, and print out these fields in columns for hard copy reference (see Screen 6). The fields, for example, also can be sorted to arrange reports in chronological order or by author. Name sections, when specified as a column, require a width, and free-form text in the Name section is rejustified to fit this width. This provides a powerful mechanism for listing the contents of a database. For example, Date, Author and Abstract can form a report, where Abstract is a named field.

Another powerful *SEARCHMATE* feature is the ability to produce columnar reports.

```
STATES OF THE UNION                WORD SEARCH
Documents in database: 50          Selected documents: 7 (14%)

 SEARCH COMMAND                    Searched    Found
 WS> GOLD                             50         10
 WS> AND SILVER                       10          7

 RESULTS
 CO   COLORADO
 ID   IDAHO
 MT   MONTANA
 NV   NEVADA
 NM   NEW MEXICO
 SD   SOUTH DAKOTA
 UT   UTAH

 Key in search or RETURN to Browse
 [Recall Result] [Browse Up/Down] [Recall Command] [Main Menu] [Search Menu] [F F Search] [Prox Search]
```

Screen 3. A SEARCH SESSION. Out of 50 documents, 10 contain the word "gold" and of these (using the conjunction "and") seven contain "silver." The documents are listed below the search commands. The three new key boxes (bottom center) refer to the inverted T arrow keys of the VT240 keyboard. The left-hand arrow, thus, will return the selection set to the "gold" documents. The up/down arrows scan the list of documents. A RETURN shows the text of the selected document (see Screen 4).

VAX Interface

SEARCHMATE is well integrated with the VAX in its use of the *WPS+* keyboard, and also in terms of its disk assignments and security features. Unlike traditional databases, each *SEARCHMATE* database requires a separate UIC (UICs should be in a block of numbers; e.g., 500).

One of the options when creating a *SEARCHMATE* database is "open to the world," which allows any user to access

FIGURE 1.

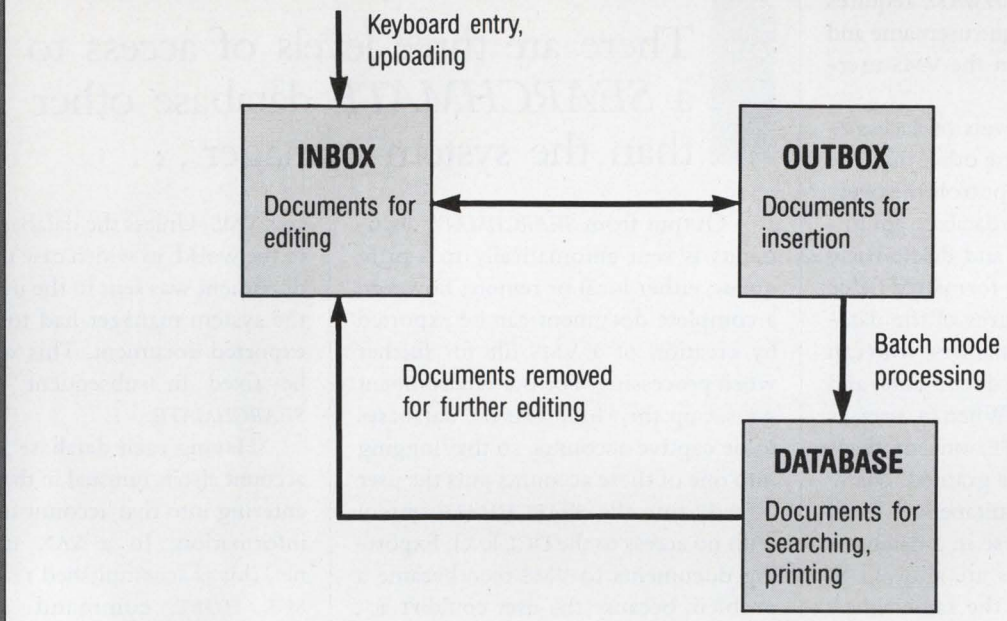


Figure 1. INFORMATION FLOW — Transfer among the "boxes" is affected by one simple option choice.

FIGURES 2a. & 2b.

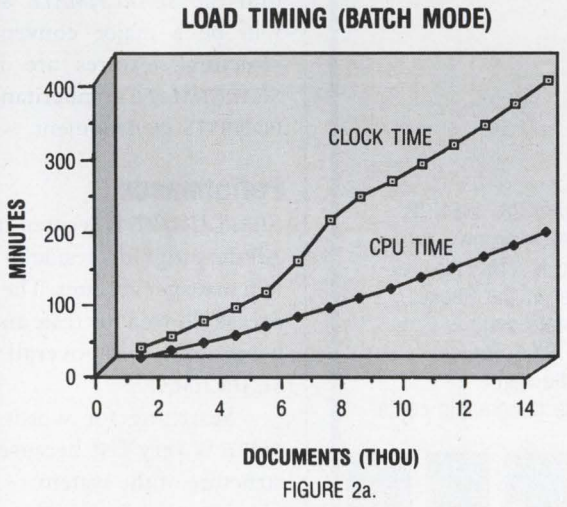


FIGURE 2a.

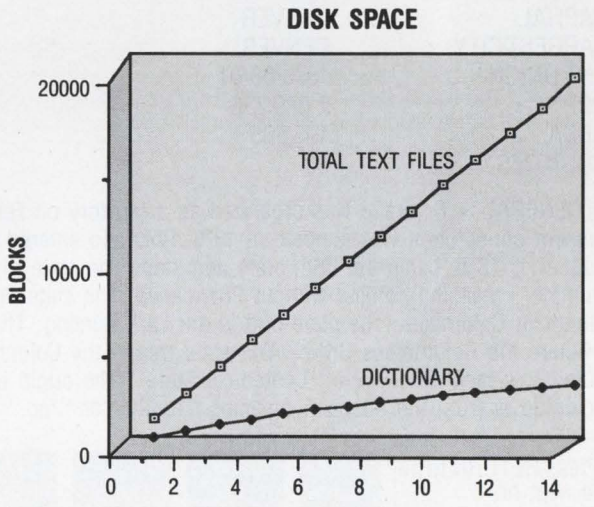


FIGURE 2b.

Loading of 14,000 single-page documents on a VAX 8200. Disk space (blocks) and batch loading times. As more and more documents are loaded, there will be fewer "new" words and the growth curve for the dictionary will become flat over time.

the database without restrictions. This will be used when *SEARCHMATE* is integrated into *ALL-IN-1* and when that package provides the preliminary security. Otherwise, *SEARCHMATE* requires each user to have a unique username and password distinct from the VMS username and password.

There are three levels of access to a *SEARCHMATE* database other than the system manager who controls the overall VMS integration: the database administrator, who can add and delete users to the database, change formatted fields and change other features of the database; the database maintainers, who can add, delete and change documents; and the read-only users. When a user is added to *SEARCHMATE*, one of these three privilege levels is granted. Many users, of course, simultaneously can search, print and browse in a database, although no two users are allowed to update a document at the same time.

There are three levels of access to a *SEARCHMATE* database other than the system manager . . .

Output from *SEARCHMATE* documents is sent automatically to a print queue, either local or remote; however, a complete document can be exported by creation of a VMS file for further word processing. For our environment we set up the *SEARCHMATE* databases to be captive accounts, so that logging into one of these accounts puts the user directly into the *SEARCHMATE* system with no access to the DCL level. Exporting documents to VMS then became a problem because the user couldn't access VMS. Unless the database was open to the world, in which case the exported document was sent to the user account, the system manager had to extract the exported document. This wrinkle will be fixed in subsequent releases of *SEARCHMATE*.

Having each database in a unique account also is unusual in that it requires entering into that account to access the information. In a VAX using DECnet, this is accomplished readily by the SET HOST command and, even more popularly, defining the global symbol to SET HOST and LOGON, with the password leaving the user's *SEARCHMATE* name and password to take care of security. However, in future releases of *SEARCHMATE,* the databases will be available without the need to log into the *SEARCHMATE* account. This will be a major convenience. These structural features are indicative of *SEARCHMATE*'s inheritance from the PDP/RSTS environment.

STATES OF THE UNION QUICK BROWSE
CO COLORADO Page 1

Top of Document

DOC : CO Text last inserted: 1986/08/25
STATE : COLORADO
CAPITAL : DENVER
LARGEST-CITY : DENVER
ENT-UNION : 1876/08/01
POP : 2,889,735
AREA : 103,595
COUNTIES : 63

<GENERAL> Colorado was organized as a territory on February 28, 1861. Its present constitution was adopted in 1876. Colorado entered the Union on August 1, 1876, being the 38th state admitted. The state motto is "Nil sine Numine," meaning nothing without Providence. The state flower is the Rocky Mountain Columbine. The state bird is the Lark Bunting. The state song is "Where the Columbines Grow." The state tree is the Colorado Blue Spruce. Colorado's nickname is the "Centennial State." The origin of the name Colorado is from the Spanish, meaning "ruddy" or "red." The geographic center

Press RETURN to go to next hit | Print Docmnt | Up/Down 15 | Resume Search | Main Menu | Search Menu | F F Search | Prox Search

Screen 4. TEXT BROWSING. This is the first entry to the "print/browse" mode, giving the top of the document and the formatted fields. Note the date stamp on the top-right. The section <GENERAL> is an example of a named section of text. Hitting RETURN gives the first hit for the word searched (see Screen 5).

Performance

SEARCHMATE is written in VAX BASIC. All the programs reside in a master system manager account. The system manager is allowed to create and delete databases and has overall control of *SEARCHMATE*.

Searching for words in *SEARCHMATE* is very fast because of the basic structure of the system — searches take place on the dictionary, and then they point to the documents. The laborious effort of creating the dictionary entries takes place, as has been mentioned, in the background. Disk storage obviously

SEARCH PERFORMANCE

The following searches were performed on the database. The number of documents searched was 14,182 and the configuration was a VAX 8200 with 8 MB of memory and one RA81 disk. There were seven other users on the system at the time.

1. Single word searches: four single word searches were performed. The "word" is designated by "a," "b," etc. The words used in the search are not important except that they occur with a different frequency in the database.

Word	Documents Found	Elapsed Seconds
a	13	2
b	154	2
c	3055	4
d	6017	5

2. Multiple word searches: Three multiple word searches were performed. The same "a" and "b" words used above were combined in this test.

Word	Documents Found	Elapsed Seconds
a AND b	1	2
c AND d	1,220	5
a AND b AND c AND d	0	5

3. Root word searches: The following root word searches were performed. The "words with this root" column is important because a root word search is essentially a multiple word OR search. Thus, this column is the number of words that were searched individually with the results OR'ed together.

Root Word	Words with this root	Documents Found	Elapsed Seconds
DISCUSS!	5	57	3
DISC!	19	96	3
DIS!	61	340	7
DI!	118	714	22
D!	633	6,849	268

depends on the nature of the documents. If the documents are very different, then the dictionary will increase quickly. If the documents have much similarity in words, the dictionary will increase less. The database itself will increase uniformly as more documents are added (see Figures 2a and 2b). In our experience, running *SEARCHMATE* on a busy VAXcluster had negligible impact on performance.

Design Considerations

The most interesting aspects of *SEARCHMATE* arise when designing the database: Which stop words should we add to the list supplied? The more stop words, the faster the document insertion process and the less disk space occupied by the dictionary. Should numbers be included? Simple numbers in the text usually need not be indexed in data-intensive reports, and can be added to the stop list by using the 1!, 2!, 3! . . . convention.

In *SEARCHMATE*, you can review the dictionary contents, listing all the words to compare for misspellings, rapid pinpointing and references (see Screen 2). How should we distribute information between formatted fields and the text? Which named fields should we describe in the body of the text? These depend on how discreet the section will be and if it's to be used as part of a columnar report.

SEARCHMATE supplies some guidance on building and designing the database. It's elementary, but still necessary to collect documents together,

SEARCHMATE
Automated Office Systems Inc.
Western Bank Building
P.O. Box 100
Albuquerque, NM 87103
(505) 842-1247
Price: $5,000 for a single database license on PDP-11s to $19,500 for a multiple database license on VAX 8500 (or larger) systems.
Enter 728 on reader card

entering a few into the database with a prototype design, and performing searches and report writing before finalizing the structure.

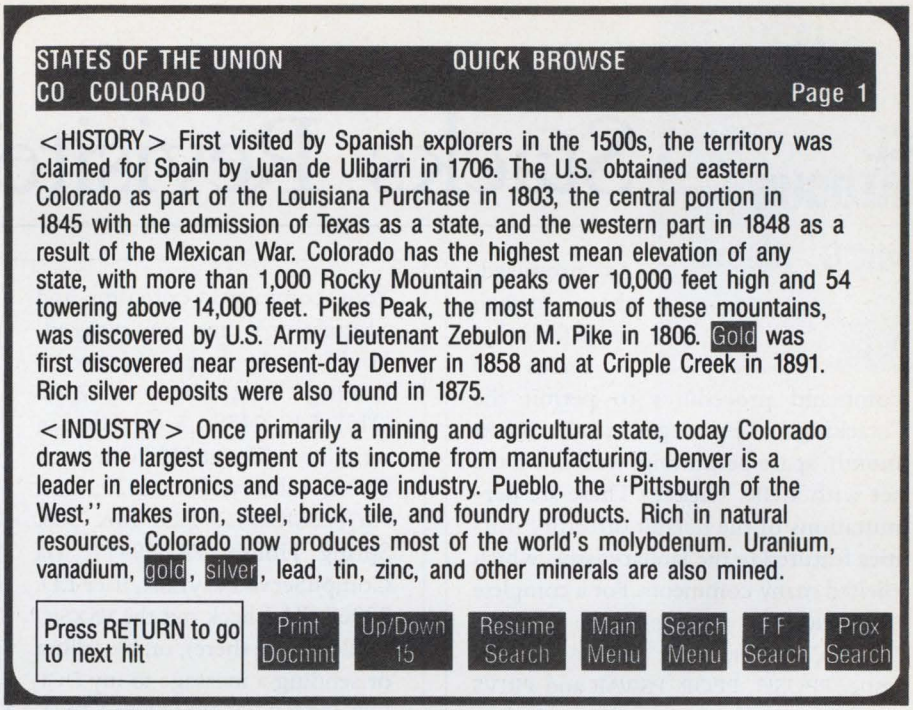
Futures

SEARCHMATE is a new product on the VAX, and although substantially complete, is evolving quickly. Version 2.0 should be available this summer. It promises major enhancements, mainly in the area of database access from user accounts, following the more expected method of accessing the database from those accounts rather than logging into the unique *SEARCHMATE* account.

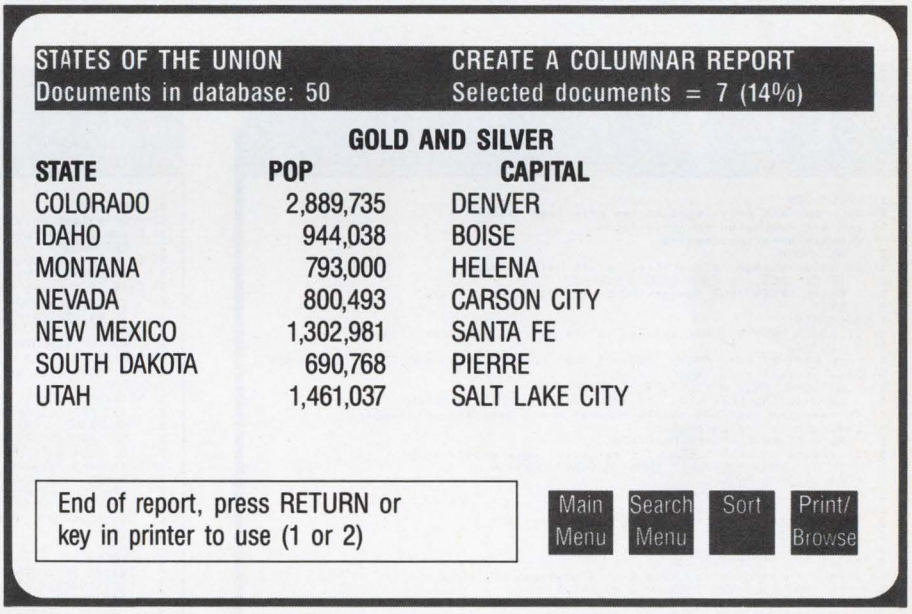
Another promised feature is a Learn mode — equivalent to a command program allowing users to store and reuse a sequence of commands. At the moment, creation of a columnar report, for example, has to be repeated step-by-step every time. Command sequencing would lead to allowing routine searches and tailored applications. A host-language interface allowing custom-modification of the system also will be available. However, since the menus and system structures have been designed and tested carefully, programmers may be advised to turn to other applications in traditional databases that require their skills. It would be hard to improve on this product's design, and the various functional enhancements considered indicate a healthy evolution.

SEARCHMATE is a powerful answer to the problem of text storage and retrieval. It's well-designed and its user interface requires minimum programming support. It also runs effectively and efficiently on VAX systems. Minus a few promised enhancements, this product comes complete and ready to work, and users can begin searches and queries with minimum instruction. The menus, the help and the error messages are clear, and the pricing is reasonable. — *Peter M. Smith is group leader of research information systems at Johnson Wax, Racine, Wisconsin.*

ARTICLE INTEREST QUOTIENT
Enter On Reader Card
High 847 Medium 851 Low 855



Screen 5. VIEWING THE HITS. Note the hits are highlighed. The left arrow key will allow printing of the documents or parts of it on either of the printers selected by the user.



Screen 6. A COLUMNAR REPORT. Using the seven hits on "gold and silver" a sorted report of some or all the formatted fields, or named sections, can be prepared. Here only three formatted fields are shown.

DCL DIALOGUE

Kevin G. Barkes

Stacks Revisited

As promised, this month we're featuring a series of command procedures to permit the "stacking" of privileges in DCL. (Next month, space permitting, we'll finish the set with a UIC stacker.) These are permutations of the default directory utilities featured in the January issue, which elicited many comments. For a complete discussion on the operation of DCL "stacks," please refer to the January issue. PPUSH, PPOP, PSWAP and PRIVS are pretty much conceptually equivalent to their set default counterparts.

PPUSH.COM is fully commented. A study of that procedure should provide the reader with a decent idea of the way to handle privilege stacking. There are a few other items that must be noted, however.

PPUSH will accept DEFAULT as a parameter. This will reset the user's privileges to those assigned to the global symbol LOGIN_PRIV, which is intended to be set in the user's LOGIN.COM file. PPUSH will create its own LOGIN_PRIV symbol for the DEFAULT parameter, if it was not previously defined, using the current privilege state for the values.

Because setting privileges to NOALL results in the privilege-identifying lexical functions returning a null string, the procedures explicitly assign "NOALL" whenever this situation is encountered.

The string containing all possible privileges causes a DCL token overflow

Your comments, criticisms and suggestions are encouraged. You'll get the fastest response by leaving a message on ARIS (215) 542-9458. You also can write my office at 4107 Overlook Street, Library, PA 15129; *DEC PROFESSIONAL*, P.O. Box 503, Spring House, PA 19477; via CompuServe EasyPlex, user I.D. 72067,341 (check out the VAXSIG while you're there); or, by calling or sending a message to my DCL BBS, SYS$OUTPUT (412) 854-0511. If your local FidoNet BBS isn't carrying the national VAX echo-mail conference, ask the SYSOP to contact me at FidoNet 129/38.

PROGRAM 1.

```
$! PPUSH.COM
$! Save current privileges to the privilege "stack"
$! and set requested new privileges.
$! Disable error processing
$    SET NOON
$! If no privilege is specified, print help message
$    IF P1 .NES. "" THEN GOTO CHECKPRIV
$    WRITE SYS$OUTPUT "Usage: PPUSH <priv(,priv2,priv3)>"
$    EXIT
$ CHECKPRIV:
$! If LOGIN_PRIV was not defined in the user's login.com file,
$! do it now:
$    IF F$TYPE(LOGIN_PRIV) .EQS. "" THEN LOGIN_PRIV == F$GETJPI("","CURPRIV")
$! Save current privileges
$    ORIGINAL_PRIV = F$GETJPI("","CURPRIV")
$    IF ORIGINAL_PRIV .EQS. "" THEN ORIGINAL_PRIV := NOALL
$! In case the user put spaces between the commas and privileges,
$! concatenate the parameters:
$    P1 = P1+P2+P3+P4+P5+P6+P7+P8
$! If resetting with "DEFAULT", set privileges accordingly:
$    IF P1 .NES. "DEFAULT" THEN GOTO SET_NEWPRIV
$    P1 = LOGIN_PRIV
$! "Clear" current privileges
$    SET PROCESS/PRIV = NOALL
$    WRITE SYS$OUTPUT "Resetting default privs:"
$  SET_NEWPRIV:
$! Try to set the requested privileges:
$    SET PROCESS/PRIVILEGE = ('P1')
$! If the command fails, exit with a message:
$    IF .NOT. $STATUS THEN GOTO NO_PRIVS
$! Initialize the "stack" if procedure hasn't been used before:
$    IF F$TYPE(P_NUM) .EQS. "" THEN P_NUM == 0
$! Increment the stack:
$    P_NUM == P_NUM + 1
$! "Push" the old privileges on the stack
$    'PRIV 'P_NUM' :== 'ORIGINAL_PRIV'
$    WRITE SYS$OUTPUT "Privileges enabled: ''P1'"
$    EXIT
$! If the new set privs failed, restore the original privs.
$  NO_PRIVS:
$! "Clear" all privs:
$    SET PROCESS/PRIV = NOALL
$! Restore original privs:
$    SET PROCESS/PRIV = ('ORIGINAL_PRIV')
$    WRITE SYS$OUTPUT "Privileges not assigned."
$    EXIT
```

PROGRAM 2.

```
$! PPOP.COM
$! "POP"s last privilege from privilege stack.
$! Disable error processing
$    SET NOON
$! Save current privs:
$    ORIGINAL_PRIV = F$GETJPI("","CURPRIV")
$! Exit if nothing to pop; otherwise, pop
$    IF F$TYPE(PRIV_'P_NUM') .EQS. "" THEN GOTO NO_POP
$    IF F$INTEGER(P_NUM) .GT. 0 THEN GOTO DO_POP
$ NO_POP:
$    WRITE SYS$OUTPUT "No PUSH to POP!  Stack pointer: ",P_NUM
$    EXIT
$! "Pop" the last default from the "stack"
$ DO_POP:
$! "Clear" all privileges
$    SET PROCESS/PRIV = NOALL
$    NEWPRIVS = PRIV_'P_NUM'
$    SET PROCESS/PRIV = ('NEWPRIVS')
$    IF .NOT $STATUS THEN GOTO DO_ERROR
$! Decrement "stack"
$    P_NUM == P_NUM - 1
$    CPRIVS = F$GETJPI("","CURPRIV")
$    WRITE SYS$OUTPUT "Current privs: "
$    WRITE/SYMBOL SYS$OUTPUT CPRIVS
$    EXIT
$! Handle errors:
$ DO_ERROR:
$    WRITE SYS$OUTPUT "Invalid privs ",PRIV_'P_NUM'
$    SET PROCESS/PRIV = NOALL
$    SET PROCESS/PRIV = ('ORIGINAL_PRIV')
$    CPRIVS = F$GETJPI("","CURPRIV")
$    WRITE SYS$OUTPUT "Privs remain:"
$    WRITE/SYMBOL SYS$OUTPUT CPRIVS
$    P_NUM == P_NUM - 1
$    IF F$INTEGER(P_NUM) .EQ. 0 THEN EXIT
$    WRITE/SYMBOL SYS$OUTPUT "Next item on stack: ",P_NUM,". ",PRIV_'P_NUM'
$    EXIT
```

when attempts are made to write it to SYS$OUTPUT. Therefore, WRITE/SYMBOL is used in the procedures. The only exception is in PPUSH, where a normal WRITE statement is used to display the privileges enabled by the passed parameters, which are concatenated into P1. (By the way, the answer to last month's trivia question — How long is the string containing all possible privileges? — is 261 bytes.) DCL hackers are encouraged to modify the procedures to format the display so that the privilege list doesn't extend off the right side of the screen or wrap unaesthetically.

On the plus side, PPUSH et al. permit the restoration of privileges to an identical, previously set state. This is possible for two reasons: privileges are saved in the global symbols PRIV_(number), and a SET PROCESS/PRIVILEGE = NOALL is executed to "erase" all current privileges prior to resetting. This permits a greater degree of accuracy and control than by using the F$SETPRV( ) function, although procedures using that lexical generally are smaller and, therefore, will execute faster.

There's a piper to be paid here, though. Even more so than the original stack procedures, PPUSH is a voracious user of DCL symbol space. This issue was raised by Jeff Templon, A. Smith, Craig Dickinson and others on ARIS and in a number of letters.

When a privilege or default is "popped," the symbol space isn't freed automatically. Depending on the point of view, this either can be a bug or a feature.

Assuming the procedures are used in a normal environment (that is, a concerted effort is made not to exceed the available symbol space), DCL should be able to handle the situation with no problem. Popped values decrement the stack pointer, so the previously assigned symbols are reused. An occasional "pop" reduces the possibility of space problems.

By not deleting popped symbols automatically, the user can reassign the stack pointer manually, recovering previously "lost" stack entries. For example, if you are five deep in the stack (the pointer symbol P_NUM is 5), accidentally pop to 4 and want to return to the previous settings, you can do it by manually assigning the symbol P_NUM = = 5 and doing a PSWAP.

Popped entries can be deleted simply by adding to PPOP the line:

```
$ DELETE/SYMBOL/GLOBAL
  PRIV_'P_NUM'
```

prior to decrementing the stack. Use DIR_'D_NUM' if you insert the modification in original POP.COM file.

Mr. Dickinson wrote a simple procedure that quickly deletes the "stack." It's similar to the DIRS.COM (and PRIVS.COM) procedure, except that the symbols are deleted rather than displayed.

Mr. Smith noted that a simple SHOW/SYMBOL/GLOBAL DIR_* or PRIV_* will perform the same function as DIRS.COM and PRIVS.COM. This wildcarding was introduced in VMS 4.4. The original procedures, written by Don Libes, were designed to operate under VMS 3.x, prior to the introduction of this capability. Also, the DIRS and PRIVS "commands" display the stacks in reverse numerical order. Still, it's a fast shortcut, and we thank Dickinson and Smith for their observations.

A quick perusal of the *VT220 Pocket Programmer Guide* failed to solve the problem posed by Philip J. Piotrowski ("Questions, Answers and Comments," February 1987) regarding changing the hardware setting of a VT220 without having to go into the terminal's setup mode. On page 25, under Received Codes (Compatibility Level) is a list of the various escape sequences that will set the VT220's level of compatibility. By using the techniques outlined in the March column, it's a simple matter of assigning a WRITE SYS$OUTPUT (escape sequence) to one of the function keys, or better still, to execute a command procedure that does both a hardware setting and a "SET TERMINAL/DEVICE = " command. I don't know how I missed it the first time out. Thanks to Ray Howard, Glenn H. Myers and others for their suggestions. (Sorry I didn't respond directly, Glenn, but I didn't have your return address.)

And while on the subject of terminal manipulation, Pat Murphy dialed into ARIS with several pertinent observations about the March column, for example, he wondered why I used [0,32] and, therefore, four bytes to assign the symbol containing the escape sequence.

The answer's simple: I don't remember. I think it has something to do with a client site using non-standard terminals that required several nulls to follow the escape code. In any event, it was a habit I picked up a long time ago and never lost and, as you noted, seems to have no effect on the operation of the procedure. You can be certain I'll be more cautious when using bit-position and size modifiers in the future!

In his ARIS discussion, Mr. Murphy reported that he uses a procedure similar to USETERM.COM, but one that uses the DCL lexical function F$GETDVI to get the terminal type. "That way," he explains, "you can differentiate between VT100/200/52 series and more, and can branch to a different set of symbol definitions for each."

This is an excellent point, and one that I covered in a continuing series on lexicals in our sister publication, *VAX PROFESSIONAL*. It should be noted that none of the DCL procedures that appear here are "definitive." They're intended to stimulate your creative juices and beg for modification and customization to your site. Initially, I was surprised by the intensity of some of the reactions to the column. Now that I've learned to roll with the punches, it's a great experience. Every month I learn a new trick or two and, hopefully, you do as well. —*Kevin G. Barkes is a specialist in VAX systems software, management, tuning and training, in Library, Pennsylvania.*

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High 828 Medium 832 Low 836

PROGRAM 3.

```
$! PSWAP.COM
$! "Swap" privileges previously stored on privilege stack
$! Disable error processing
$    SET NOON
$! Exit if nothing to "swap"
$    IF F$TYPE(P_NUM) .EQS. "" THEN GOTO NO_SWAP
$    IF F$TYPE(PRIV_'P_NUM') .EQS. "" THEN GOTO NO_SWAP
$    IF F$INTEGER(P_NUM) .GT. 0 THEN GOTO DO_SWAP
$ NO_SWAP:
$    WRITE SYS$OUTPUT "Nothing to SWAP!  Stack pointer: ",P_NUM
$    EXIT
$ DO_SWAP:
$    IF P1 .EQS. "" THEN P1 = P_NUM
$    IF P1 .GT. 0 .AND. P1 .LE. P_NUM THEN GOTO DO_SWITCH
$    WRITE SYS$OUTPUT "SWAP out of range!"
$    EXIT
$ DO_SWITCH:
$    ORIGINAL_PRIV = F$GETJPI("","CURPRIV")
$    IF ORIGINAL_PRIV .EQS. "" THEN ORIGINAL_PRIV := NOALL
$    SET PROCESS/PRIV = NOALL
$    NEWPRIVS = PRIV_'P1'
$    SET PROCESS/PRIVS = ('NEWPRIVS')
$    IF .NOT. $STATUS THEN GOTO DO_ERROR
$    PRIV_'P1' == ORIGINAL_PRIV
$    WRITE SYS$OUTPUT "Privs changed to:"
$    CPRIVS = F$GETJPI("","CURPRIV")
$    IF CPRIVS .EQS. "" THEN CPRIVS := NOALL
$    WRITE/SYMBOL SYS$OUTPUT CPRIVS
$    EXIT
$! Handle errors:
$ DO_ERROR:
$    WRITE SYS$OUTPUT "Invalid privs: "
$    WRITE/SYMBOL SYS$OUTPUT PRIV_'P1'
$    SET PROCESS/PRIV = NOALL
$    SET PROCESS/PRIV = 'ORIGINAL_PRIV'
$    WRITE SYS$OUTPUT "Privs remain:"
$    CPRIVS = F$GETJPI("","CURPRIV")
$    IF CPRIVS .EQS. "" THEN CPRIVS := NOALL
$    WRITE/SYMBOL SYS$OUTPUT CPRIVS
$    EXIT
```

PROGRAM 4.

```
$! PRIVS.COM
$! Displays contents of the PRIVS stacks
$! Disable error processing
$    SET NOON
$! Exit if nothing to display
$    IF F$TYPE(P_NUM) .EQS. "" .OR. -
     F$TYPE(P_NUM) .EQS. "STRING" THEN GOTO NO_PRIV
$    IF F$INTEGER(P_NUM) .GT. 0 THEN GOTO DO_PRIV
$ NO_PRIV:
$    WRITE SYS$OUTPUT "Nothing in stack."
$    CPRIV = F$GETJPI("","CURPRIV")
$    IF CPRIV .EQS. "" THEN CPRIV := NOALL
$    WRITE SYS$OUTPUT "Current privs:"
$    WRITE/SYMBOL SYS$OUTPUT CPRIV
$    EXIT
$! Display "stack"
$ DO_PRIV:
$    CPRIV = F$GETJPI("","CURPRIV")
$    IF CPRIV .EQS. "" THEN CPRIV := NOALL
$    WRITE SYS$OUTPUT "Current privs:"
$    WRITE/SYMBOL SYS$OUTPUT CPRIV
$    L_NUM = P_NUM
$ DO_LOOP:
$    IF F$TYPE(PRIV_'L_NUM') .EQS. "" THEN GOTO DEC_COUNTER
$    WRITE/SYMBOL SYS$OUTPUT "('L_NUM'.) ",PRIV_'L_NUM'
$! Decrement counter
$  DEC_COUNTER:
$    L_NUM = L_NUM - 1
$    IF L_NUM .EQ. 0 THEN EXIT
$    GOTO DO_LOOP
$    EXIT
```

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RSX CLINIC

By James McGlinchey

I respond to those questions that are 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.

SLIPPED DISK

QUESTION: *Is our system disk overloaded? We've noticed that the "I/O Counts" display in SHOW MEMORY indicates that our boot disk has 10 times more I/O activity than the other disks. Is this OK? Is there anything we can do about it?*

REPLY: The RSX system disk often is the most heavily used disk on the system. Offloading your system disk is a tuning tweak that yields many benefits for the time spent tinkering.

The RSX system disk is very busy, being the repository of the booted image, the privileged tasks, the libraries, the account file and the system utilities. Many things can be moved off your system disk, thus relieving it of an already heavy load.

Although any disk would be better than the system disk, a disk on a separate controller would yield a more noticeable improvement, because controller operations are handled in parallel by RSX. If you have a RAM disk, you'll see an even greater improvement; if you have a bulk RAM semiconductor disk emulator, better still.

You easily can move the utility work file Logical Unit Numbers (LUNs) to other disks. The language processors — MAC, F77, TKB, etc. — all have work files for use as temporary symbol space. Each of these processors has an "Improving XX Performance" chapter in its manual. Consult this chapter to learn which of the task's LUNs are the workfile LUNS. For the above mentioned processors, the work files are on the following LUNs:

```
TKB — LUN 8
MAC — LUN 9
F77 — LUNs 6 and 7
```

The REAssign command is used to reassign a LUN. For example, to reassign the Task Builder's LUN 8 to DL1:, insert the following command in your STARTUP.CMD file:

```
REA TKB 8. DL1:
```

Put your primary checkpoint file on a disk other than the system disk. The primary checkpoint file is the one created by the first Allocate Checkpoint Space (ACS) command in your STARTUP.CMD file. You may want to create a second checkpoint file on your system disk as insurance to be used if the primary checkpoint file overflows.

You certainly can move your nonprivileged utilities to another disk and install them from it, thus moving a large burden of overlay loading from the system disk.

The disk caching capability of RSX-11M-PLUS Version 3.0 also can be a major benefit here. You definitely want to cache most classes of I/O to your system disk, and probably the other disk as well. The performance improvement realized by the use of disk caching on your system will be noticeable. See the SET/CACHE commands in your manual for ways to tune the caching options; caching can be monitored by use of the two new RMDEMO (SHOW MEMORY) screens. I have the following commands in my STARTUP.CMD file:

```
SET DL0:/CACHE:(CREATE,READ_AHEAD)
SET DL1:/CACHE:(READ_AHEAD)
```

Caching of overlay reads, directory accesses and virtual I/O is enabled by default. You can vary the total number of blocks cached and the number of read-ahead blocks.

ON ACTIVE DUTY

QUESTION: *How can I find out if an RSX task is active? We are using M-PLUS 2.1E.*

REPLY: You're fortunate to be using M-PLUS. M-PLUS and MICRO/RSX have the mighty GIN$ directive, which can do a lot of useful things. Some say that it even can dissolve your beard, rotate your tires and stampede a herd of three-legged yaks simultaneously!

GIN$ is the powerful General Information Directive that can be used to determine a lot about your system. It

can be told to return information on many classes of objects, so read up on it first. You say you can't find it in your *RSX Executive Manual*? That's right — GIN$ currently is undocumented. Print out the file [11,10]DRGIN.MAC from your RSX distribution kit and you'll see that it's been nicely documented in the code. Look for it in the next release of the *RSX Executive Manual*.

The call you want is:

```
GIN$ GI.TSK, BUF, 8., NAM1, NAM2
```

where:

1. BUF is the name of an eight-word buffer.
2. NAM1 is first half of task's name, in Radix-50.
3. NAM2 is second half of task's name, in Radix-50.

On return, the third word of BUF contains the task's first status word from its Task Control Block (TCB). The first status word, T.STAT, contains the task's blocking bits. Bit TS.EXE, value 100000 octal, will be set if the task is *not* executing. The other bits in this word yield information on why the task is not executing.

The A-to-Z Base Product Marketing Group has informed me that requests for its publication, *The Hitchhiker's Guide to RSX* have totally overwhelmed its ability to reproduce and mail the document. Only existing requests will be honored. The book will be serialized and published by DECUS in the *RSX Multitasker* newsletter.

Thanks for your response. It's great to know that so many RSX readers are out there (and reading this column).

ARTICLE INTEREST QUOTIENT
Enter On Reader Card
High 839 Medium 843 Low 887

FROM THE LAB-#1

Dave Mallery

Telebit's 9600 Trailblazer

What would you say to 9600+ baud dial-up with error correction? Modems that work over the worst of dial-up conditions without error? Modems that work happily at 300-1200-2400 until they find their mates at the other end, and then crank up to as high as 14.4 Kbps?

The Trailblazer modem from Telebit Corporation, Cupertino, California, is such a beast. This is not your ordinary $399 AT/DT PC modem (except when you use it to call one!). The modem is built around a Motorola 68000 CPU and a TI 32010 signal processing chip. In DEC terms, the modem has almost as much CPU power as a 750. Squeezing blood from a stone is never easy, and getting 14.4 Kbps from your garden variety dial-up line makes that look easy.

The modem is easier to understand if you think of it as a computer. The port that connects to your terminal can be set to any speed or on auto-baud. (It auto-bauds on the letter *a* as in AT.) So your terminal can be set to 9600 and be connected to the modem and you can make a call to a 300 baud modem successfully. The actual data rate used over the phone line between modems is set when the modem determines what's at the other end of the call. After that, the modem analyzes the phone line characteristics to figure out how fast it can go. You're not concerned with this because the baud rate of your terminal has been determined.

In high-speed mode (Trailblazer at each end), the modems use a packet mode of transmission. Each packet is padded with a 16-bit Cyclic Redundancy Check (CRC) for error detection.

The Trailblazer Modem
Telebit Corporation
10440 Bubb Road
Cupertino, CA 95014
(408) 996-8000

Price: $1,345
Enter 732 on reader card

Retransmission is on request and is transparent to the user.

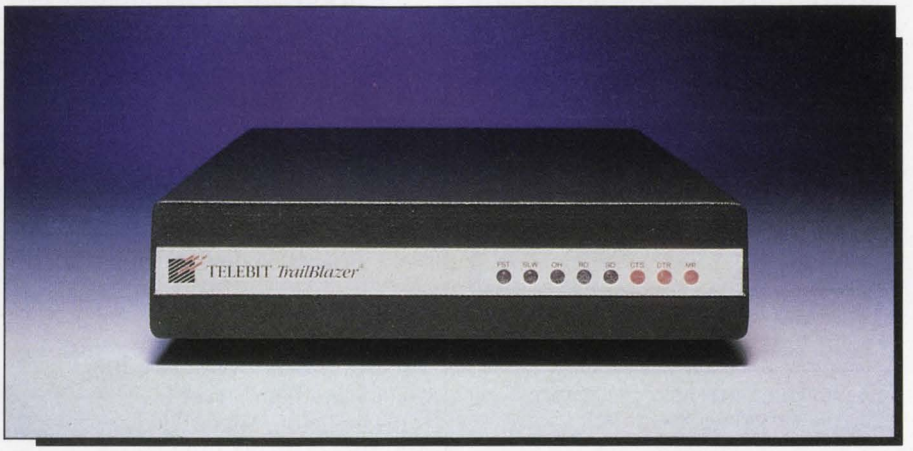
The high bandwidth over voice grade dial-up lines is accomplished through a truly sophisticated modulation technique. The available bandwidth is divided into up to 512 (usually about 400) carriers, each carrying two, four or six bits. The signal processing capabilities of the modem analyze the line and decide which carriers actually get through to the modem at the other end. In other words, the actual bandwidth achieved by the modem pair is different for every connection.

I'm writing this over dial-up. My terminal is at 19.2 Kbps baud as is the dial-in port. The modems have decided for themselves what speed to use but I'm not privy to that. I do know that when I do a SHOW SYSTEM or SHOW device, the rate to my screen is at least 9600 baud. The single character echoing shows a slight latency, as you might expect from packets. Whenever you do something that results in a large burst of data, you get the high bandwidth.

If I were a sophisticated file transfer package written to capitalize on the features of the modem, I could look at the modem's internal registers on the fly and adjust my data rates to suit the realities of the phone connection. I could query the modem for its measure of line quality and decide to redial if the measure weren't high enough.

A product like this has some productive uses. If you do file transfers on a regular basis over long distance, you could save long-distance time with a pair of these and justify their cost rapidly. They are optimized for high volume file transfer and the integral error detection/correction eliminates the need to purchase extra hardware for that purpose.

ARTICLE INTEREST QUOTIENT
Enter On Reader Card
High 802 Medium 806 Low 810



Introducing A Graphics Terminal That Can Draw As Fast As You Think.

An idea should go from your mind to your terminal display in just seconds. Unfortunately, no terminal can run with an idea as quickly as you can. Except one. The ForeSight Edition™4560 graphics terminal from Micro-Term.

With a non-stop drawing rate of 2 million pixels per second, your ideas will reach the screen with lightning speed the moment they strike—faster than any DEC VT220 and Tektronix 4010/4014 emulating terminal. But remarkable speed isn't its only feature. The 4560's razor-sharp, fully-formed black characters and soft-white overscanned background set a standard of readability that has yet to be seen on other DEC-compatibles.

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All ForeSight Edition alphanumeric and graphic terminals feature 2 year/90 day on-site warranties.

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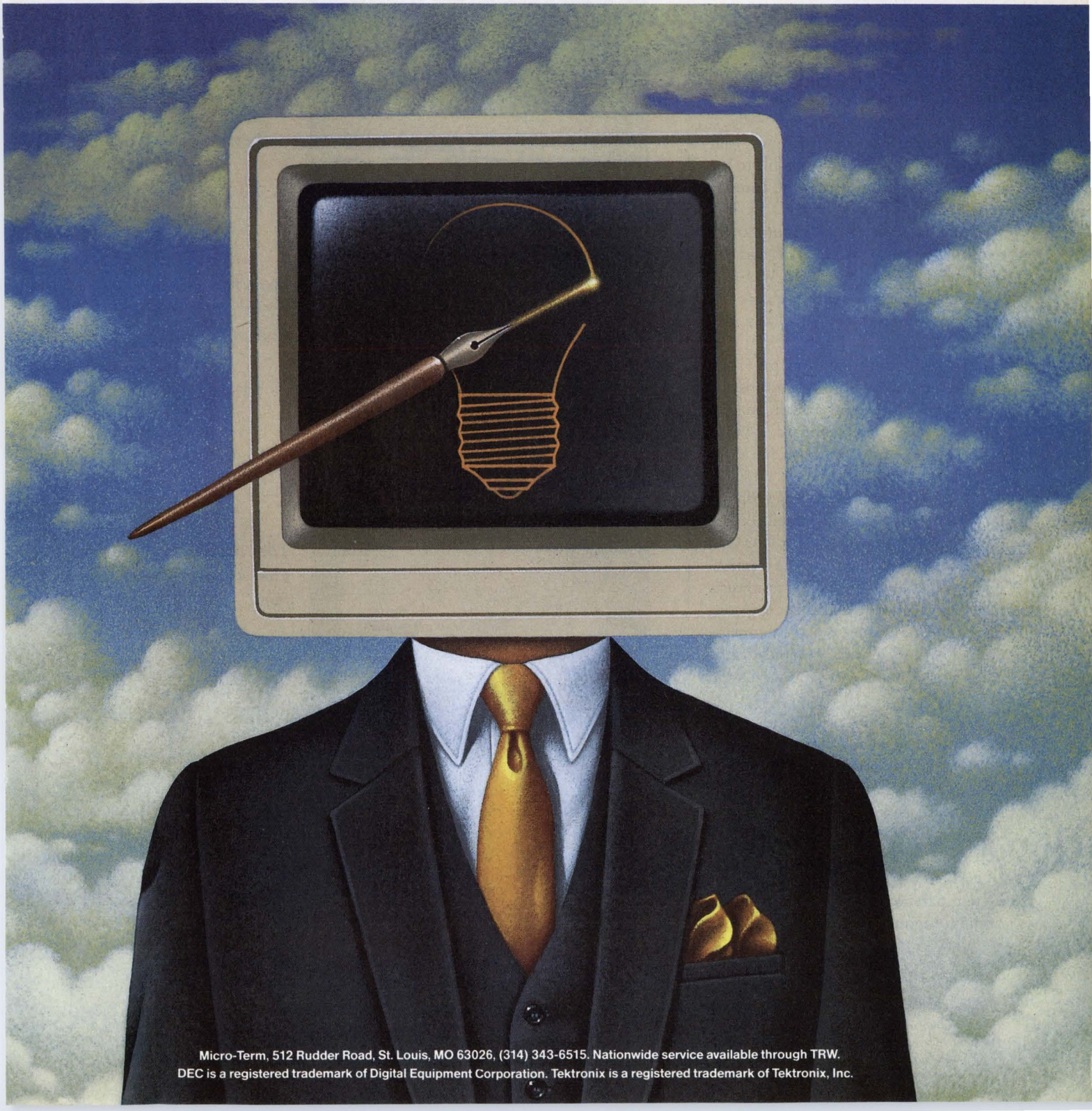
Solutions You Can See.
From The Company To Watch.™

ENTER 374 ON READER CARD



Micro-Term, 512 Rudder Road, St. Louis, MO 63026, (314) 343-6515. Nationwide service available through TRW.
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FROM THE LAB-#2

Dave Mallery

TI's TravelMate 1200

The TI TravelMate 1200 is the latest in a long line of portable terminals from Texas Instruments. I can remember lugging an early "portable" model to a San Diego DECUS symposium in the mid-70s. It was portable, but my arm grew four inches on that trip! Still I was able to log into my TI 70 from across the country and "remotely" save the day.

The line progressed through more realistic portable versions. This was still in the days when 300 baud was fast. Acoustic couplers were the rage because the now omnipresent RJ11 was still in the courts.

Today's implementation is a wonder of small sizing. This miniscule box contains a thermal printer, an LCD display, a reasonable keyboard, a PROM socket for an emulation cartridge and a 1200-baud modem.

Let's discuss the terminal with the VT100 emulation cartridge installed. The personality is contained on a PROM in a cartridge, that plugs into the terminal under the TI logo. The software consists of a menu-driven environment that controls a telephone directory for automatic dialing, coupled with a sophisticated command system for complicated login procedures.

These are accessed from the setup option of the main menu. The main menu also has an option for offline editing. The terminal can store 48 lines of text in its non-volatile memory and transmit the data later on command, so you can use it on an airplane.

The setup submenu is next. Under system parameters, you store the name of the computer you want to access. The system holds up to 10. For each of these 10 destinations, the next menu stores the name, phone number, login sequence and specific terminal configuration used for that computer; e.g., baud rate, parity, XON/XOFF, etc.

Some login sequences are maddening at best. Figure 1 is a good example — it's for logging into Dow Jones. The beauty of this terminal is that you can suffer through the setup once, and then have it "canned" forever in the terminal. I used this while in Florida to call back to our host VAX in Pennsylvania.

The menus are set up in such a way

The TravelMate includes a thermal printer, LCD display, keyboard and a PROM socket.

The VT100 emulation is in a PROM cartridge that simply plugs in.

The two (heavy) battery packs are inserted in the lower front.

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How the best just got better.

A series of small steps leads to the next generation. Here's a brief sample: "Soft" (remappable) keyboard, pop-up window menus, "hot key" switching, international keyboard support, user defined translation of characters, enhanced remote control features including error-free file transfer, "smart" modem support, a "phone book" feature, powerful user-programmable communication language, pre-written communication scripts for automated logon, file transfer, disk backup and mail delivery.

With more to come: Ethernet (LAT) support, including simultaneous sessions, is now in beta test. Additional network support is in development.

Poly-STAR software, priced from $200, is also fully compatible with poly-XFR and poly-SHARE software. Upgrades for poly-COM/220 and poly-COM/240 software are available.

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ENTER 50 ON READER CARD

that the process of accessing a machine is almost effortless and self-evident. You hit <RETURN> a few times and the work is done.

Emulating a 24-line screen on a 16-line LCD display is no mean feat. The first thing I do with a purported VT100 emulation is to run EDT. If it passes that test, I switch to MASS-11. After that, I'm fairly confident that the machine at least is usable. This terminal passed both tests. The screen size problem is handled by the up/down arrows, by sliding a window over the virtual screen image in the terminal's memory. It works. Remember, this terminal is for portable use. Don't expect it to be like the screen on your desk, but you actually can perform useful work with this box, using full-screen programs like MASS-11.

The TI TravelMate 1200 Portable Terminal
Texas Instruments Inc.
P.O. Box 2909
Mail Station 2240/LRC
Austin, Texas 78769
(800) 527-3500
Price: $1,295. VT100 Emulation cartridge — $200.
Enter 770 on reader card

This is the kind of device you give your sales force to file call reports from the field. It's for the peripatetic system manager to read his mail. It's for the person who can't afford to be out of touch.

I have a few problems with the keyboard arrangement. You have to play "keyboard chords" (CTRL/SHIFT/key) to get the keypad functions, but they're all there. You just can't squeeze a full VT200 keyboard into that tiny space.

The acoustic coupler option limits you to 300 baud — a real anachronism these days. The same goes for the direct-connect adapter. There's a nicad battery pack option available, which allows you to use the offline edit function on a plane.

The overall quality of the unit is high. Much pride and effort goes into its manufacture. TI's corporate philosophy about quality control is refreshing. (We had the pleasure of touring the plant in Temple, Texas, where these are made.)

In summary, I'm pleased with this terminal when I use it as intended: as a portable life saver. We have several, and will be integrating them into our sales force so our salespeople can give ARIS demos in the field and "pick up" their VAX mail.

ARTICLE INTEREST QUOTIENT
Enter On Reader Card
High 878 Medium 882 Low 886

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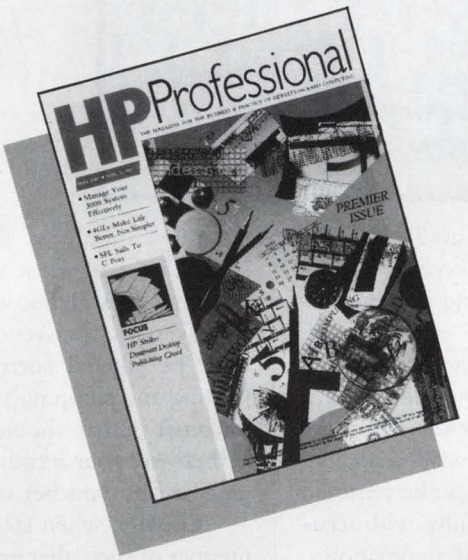

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HP Professional

FROM THE LAB-#3

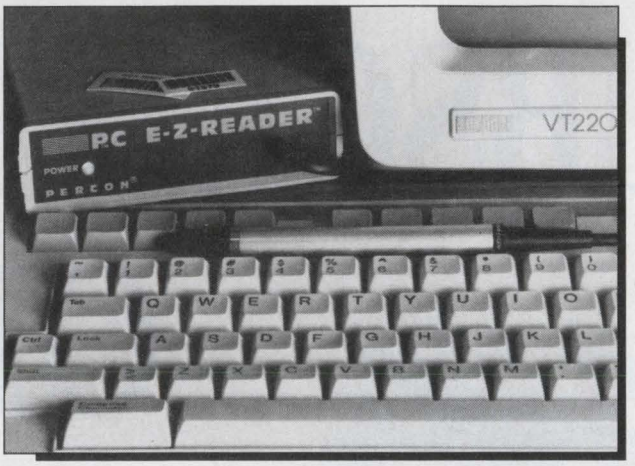
Dave Mallery

'Spotting' A Zebra: The PERCON E-Z Reader

Many years ago (more than I like to admit) I helped design a product at the Fall Joint Computer Conference. We were looking for bar code readers for a wholesale warehouse application. Bar code readers were in their infancy, and so were big-time commercial DEC applications. We were looking at this nifty box (with an 8008 microprocessor) that could read bar labels and put the result out in ASCII. I said to the president of the company, "Why can't you loop the terminal line through the reader and save me a port? Let's let it act as though I typed the bar code in through the keyboard." He agreed and a new model of a product was born. It became a best seller.

The PERCON E-Z Reader, from Peripheral Connections Inc. of Eugene, Oregon, is an example of a good idea migrating farther into a product. This reader is inserted into the *keyboard* cable. It literally types in the bar code!

This is a great idea in that it handles the problem of power, because power for the keyboard also is available on the cable. In the old days, keyboards were not intelligent devices and usually communicated in parallel (7 or 8 bits) with the terminal. Today, they communicate in simplex ASCII over two conductors.



The E-Z Reader is inserted into the keyboard cable.

Bar codes are (as we know from the supermarket) a way to encode a number on an object so that it can be retrieved later by machine; hopefully, with accuracy and a high level of automation.

But *you* don't sell soup! True, but are there turn-around documents in your operation? Are there high-value items that you must track through a process or a warehouse? Are there key numbers on transaction batches that must be entered correctly? Are there picking and shipping tickets and other documents that should be pulled together? Are your accounts payable items gathered by voucher number, etc.?

Usually, when faced with a batch number or such, that must be right, you turn to the tried and true check digit. Of course, you must rely on someone for the keystrokes. If the keystrokes are too much to ask, then the bar code is the answer. Whenever batches or transactions are labeled, at some point, the batch number can be encoded and printed economically, and affixed or included in the label.

There are some technologies that compete with bar code. First, there is optical character recognition (OCR). Typically, you find OCR labels on garment tags in department stores. Sometimes, the register is equipped with a wand and the data is captured at the point of sale. More often, the wanding goes on in a back room because the

FIGURE 1.

The UPC is the standard of the grocery industry.

readers are too expensive to attach to hundreds of store registers. Bar codes are not aesthetic enough for high-end retail.

The numbers printed on your checks are an example of magnetic ink character recognition (MICR). This is really a magnetic imprint technique that manages to make a mark that also resembles a number. This is expensive and seems to be limited to banking documents (where it is the mainstay). It also is probably the oldest of the technologies. (One of my early jobs involved writing real-time dependent 360 assembly code for an old IBM MICR reader. You had so many milliseconds to decide which stacker the check was to go to before it got pulverized.)

Currently, there are document scanners that can read printed text with few restrictions. These vary in expense in proportion to their ability to recognize different typefaces and spacing. They require massive microprocessor power and difficult algorithms. Good ones are expensive.

The lowly bar code label has some wonderful economics. It's easy to make on many dot matrix printers. Custom printers exist in abundance and variety. A label contains tremendous redundancy and can be damaged physically and still scan. Many different code schemes exist that have been optimized for different industries. The codes are industry standard. Bar code labels are size-insensitive. You can make them large or small. Since the scanner is looking only at light to dark transitions in the light reflected from the label, size is almost irrelevant. The readers can be cheap and have few components.

There are many reader types. There's the grocery store variety where you pass the label over the window and the intelligent, adaptive laser unit finds and scans it in real-time. This is the high end. The low end is the pen on the PERCON unit. With about five minutes of practice, anyone can achieve an almost 95 percent success rate on the first swipe. As an option, there's a slot reader available that can read bar codes imprinted on IDs, such as library cards or computer room keys.

The PERCON unit comes with a ROM that can handle Code 39, Interleaved 2 of 5, Codabar and ABC Codabar, and the UPC (grocery) code. You select the single code to be read by changing a dip switch inside the unit. Each code has different trade-offs.

The unit came out of the box cabled to the keyboard and was operational in about one minute. The data from the label is "typed" rapidly by the unit immediately after a successful read. The unit beeps to confirm the read.

I can't pass on the long-term time between failures for the unit. It has a small parts count and is designed conservatively. When we were doing the warehouse application (in the mid-70s) the biggest operational problem with the readers was operators dropping pens on concrete floors. They may have made better peripherals in the meantime, but I doubt they've made better operators!

PERCON E-Z READER
PERCON
(Peripheral Connections Inc.)
2190 West 11th Street
Eugene, OR 97402
(503) 344-1189
Price: $635
Enter 716 on reader card

PRINTER VENDORS
Intermec
P.O. Box 360602
Lynwood, WA 98046-9702
(206) 348-2600
Enter 725 on reader card

Printronix
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(603) 352-1130
Enter 717 on reader card

York Tape and Label Corp.
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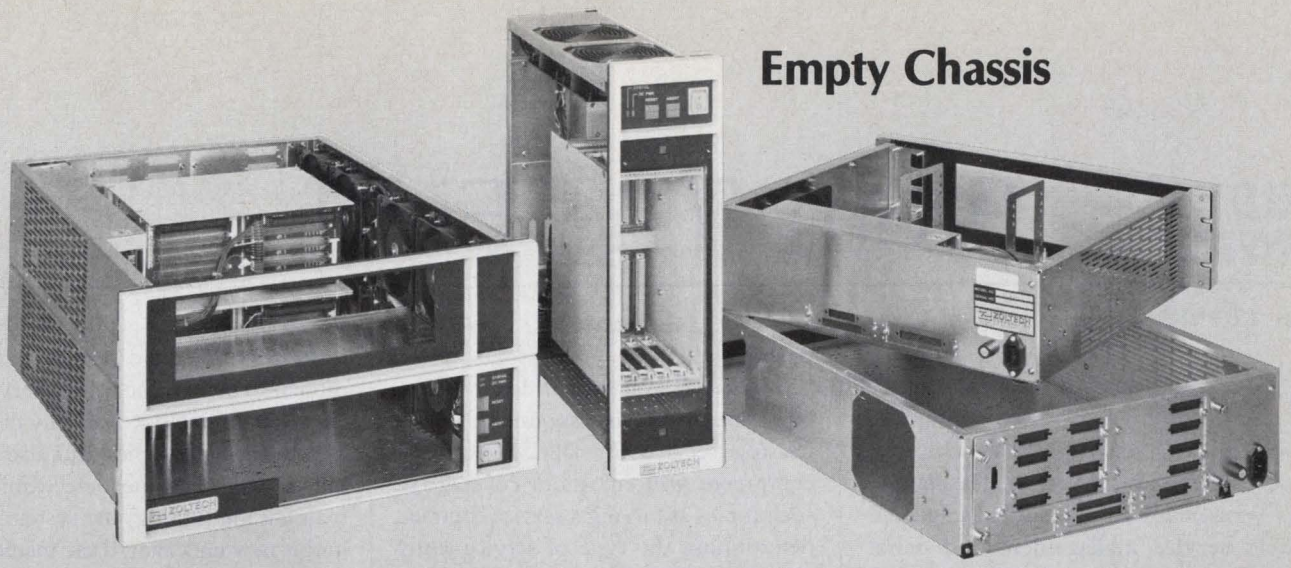
York, PA 17405
(717) 846-4840
Enter 721 on reader card

ARTICLE INTEREST QUOTIENT
Enter On Reader Card
High 837 Medium 841 Low 845



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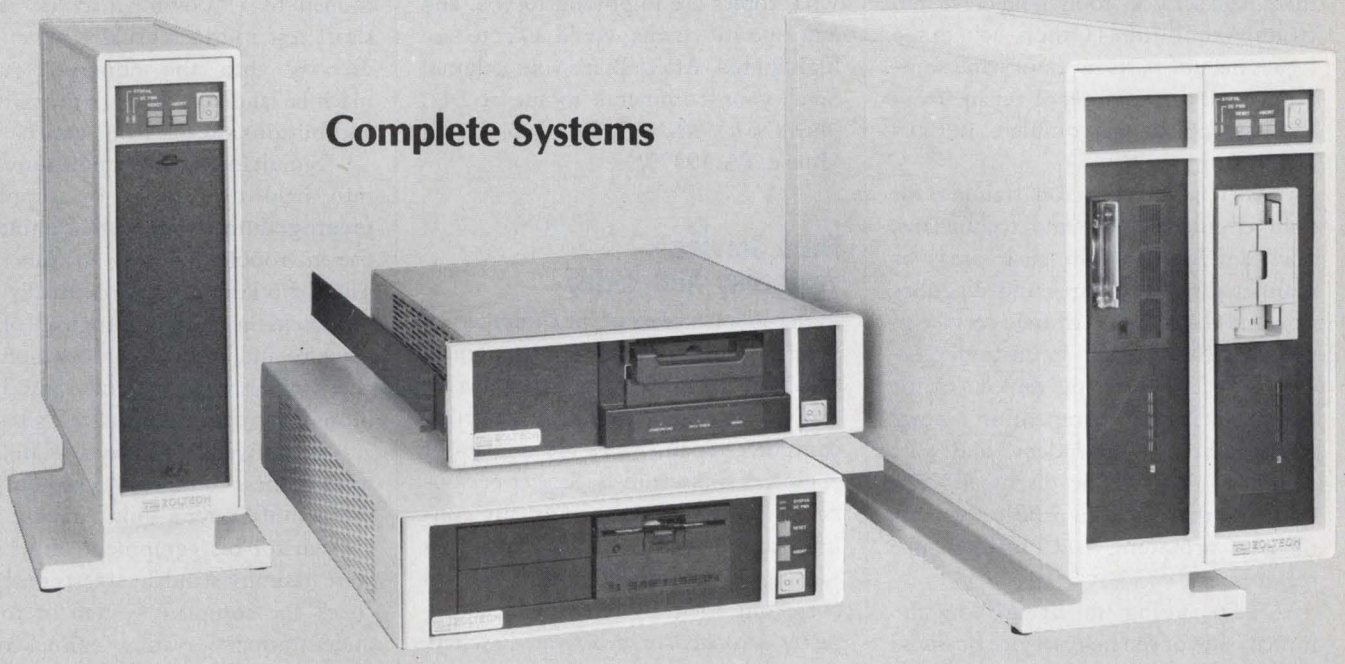

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FIELD SERVICE

Ron Levine

From The Field

As part of our continuing coverage of the DEC computer world, *DEC PROFESSIONAL* adds this new series on Field Service. The column is written for the DEC field engineer, field service management and depot support personnel, and for the independent and end user customer engineers who maintain DEC systems. We'll also provide useful information for the MIS and data processing managers charged with obtaining service for their company's DEC equipment.

Watch for in-depth evaluations of test and measurement equipment and other field service instruments. We'll uncover innovative applications for these field service "tools" and delve into trouble-shooting. Other scheduled topics include parts inventory and shipping practices, and depot repair, from PCB swapping to complete RECON facilities.

We'll also report on training for field engineers (FEs) and technicians, new developments in such areas as maintenance procedures and diagnostics, and the business of field service in general. Topics such as customer response levels, servicing mixed vendor environments and competition among manufacturer, independent, and part suppliers also will be discussed. You may find that we even profile a vendor or two providing DEC maintenance services.

We're going to bring you the human side of the field service business too, covering topics pertaining to FE careers, hiring and retention of field personnel, and customer relations problems.

The end user MIS or data processing manager who is responsible for purchasing service for DEC and related equipment will enjoy our coverage of such topics as buying a service contract, determining the type of service really needed and judging a service vendor's performance.

With your help we'd like to provide equipment-specific trouble-shooting tips from those on the "front line," and investigate the special problems and needs associated with the servicing of DEC equipment installed in specialized vertical markets.

To make "Field Service" the best it can be, we ask our readers to let us know what topics are important to you, and any specific items you'd like to see highlighted. After all, it's your column! Send your comments to me at *DEC PROFESSIONAL*, P.O. Box 503, Spring House, PA 19477.

Field Service — Yesterday And Today

In the 40-plus years of the computer industry, the role of field service engineer has changed drastically and continues to evolve. In the beginning all internal computer repairs were the domain of engineers and scientists. Service personnel played a limited role, usually confined to uncovering initial setup errors causing computer malfunctions, and correcting them by resetting an incorrectly activated or deactivated switch. Once done, the computer was restarted; at this point it was considered "repaired." Though this was at an elementary level, it still was service and the start of today's vast industry.

As first-generation computers began to appear outside the scientific laboratory, the field service technician came into being. The role of service had expanded to include not only checking and resetting switches, but also checking actual computer electronics and maintaining (PMing) the system. To aid in this new endeavor, basic maintenance aids (testing methods and tools) were invented.

By the time second-generation computers were installed, field service personnel were writing small maintenance routines to aid in the checkout and trouble-shooting of the machines. These routines soon became the backbone of the field service technician's trouble-shooting "technique" and the first line of defense when being summoned to a "down" machine. These short test routines usually were input directly into the computer using machine language through the switches and buttons on the front panel.

Simultaneously, manufacturers got into field diagnostics by supplying preprogrammed diagnostic routines for use in trouble-shooting malfunctions. These checkout procedures usually were written in the assembly language of each machine and provided a more thorough check of system units and a good deal more information on the test's results.

Primitive by today's standards, most of these routines checked out only the manufacturer's units, having been written for his equipment only. They were basically standalone tests unable to check the complete system or to run under normal operating (online) conditions. Even so, they were a tremendous improvement over the "home-grown"

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routines of the past. For the first time, canned diagnostics, tested and proved by the engineers and designers of the equipment, were available to aid in locating, correcting and testing malfunctions.

In the mid-1960s and continuing through the 1970s, integrated diagnostics (routines capable of checking out the entire computer system) came on the scene. These routines eventually ran "online," allowing the field service engineer to completely check out a system under normal operating conditions. The life of the field service technician certainly was improving!

In the 1980s, diagnostic programming really has taken off. Systems people now provide smart tests able to diagnose, pinpoint and suggest corrective actions to the operator. Interactive diagnostics are commonplace, employing prompts and screen menus that allow the field service engineer to select various parameters, choose specific tests and generate data. The FE inputs findings to the diagnostic program and, if the path taken does not result in a problem solution, the program suggests alternative actions until the problem module/subsystem is pinpointed.

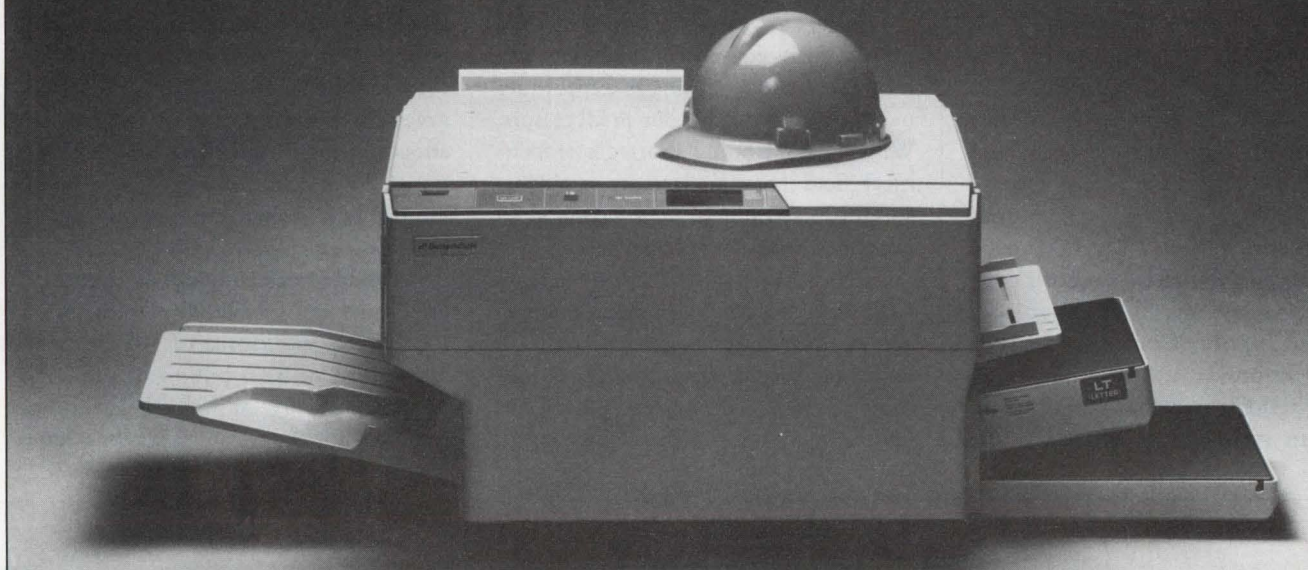
TODAY, WITH DATA communications available at many installations, these interactive and smart diagnostic programs have been combined with remote diagnostic modules to allow system checkout and trouble-shooting without ever traveling to the site. In fact, remote diagnostic capability is routinely expected by major customers.

DEC uses sophisticated remote diagnostics between field installations and a number of central DEC Customer Support Centers around the world. These centers are capable of directly performing system tests on the requesting site; the results are relayed to local DEC Field Service offices.

Using remote diagnostics not only reduces system downtime (trouble-shooting begins immediately and if a part is needed it can be dispatched with the FE), but it also helps alleviate the critical shortages of trained field person-

L A S E R P R I N T E R

Tough.



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LZR-2620	Bar codes and forms overlay
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LZR-2655	CAD/CAM plotter output, (plot 10) Supports Interleaf's RIPrint™
LZR-2665	Desktop Publishing Supports Adobe's PostScript™ and emulates Diablo 630.

As an authorized distributor of Dataproducts, MTI can help you choose the laser printer that best fits your budget and your application. Whether you buy, lease, or rent, MTI is your one source for all the computer and data communications equipment, supplies, accessories, service and applications expertise you'll ever need.

For more information on the Dataproducts printers, call the MTI office nearest you.

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nel. Fewer people are needed because of fewer trips to the customer site per problem, the right part is brought the first time, and the repair time at the site is shorter because the problem already has been diagnosed. In this way, fewer personnel can obtain higher levels of customer satisfaction.

One remote diagnostic problem called *VAXSIM* is provided free of charge by DEC to VAX Field Service contract customers. *VAXSIM* runs on the entire VAX family of computers. Operating in real-time mode, this program tracks data going into the system's error log and reports the error status of the system, alerting the customer if there's a potential problem. Other DEC diagnostic tools then can summarize the error condition and relay this information to a Customer Support Center for analysis and correction.

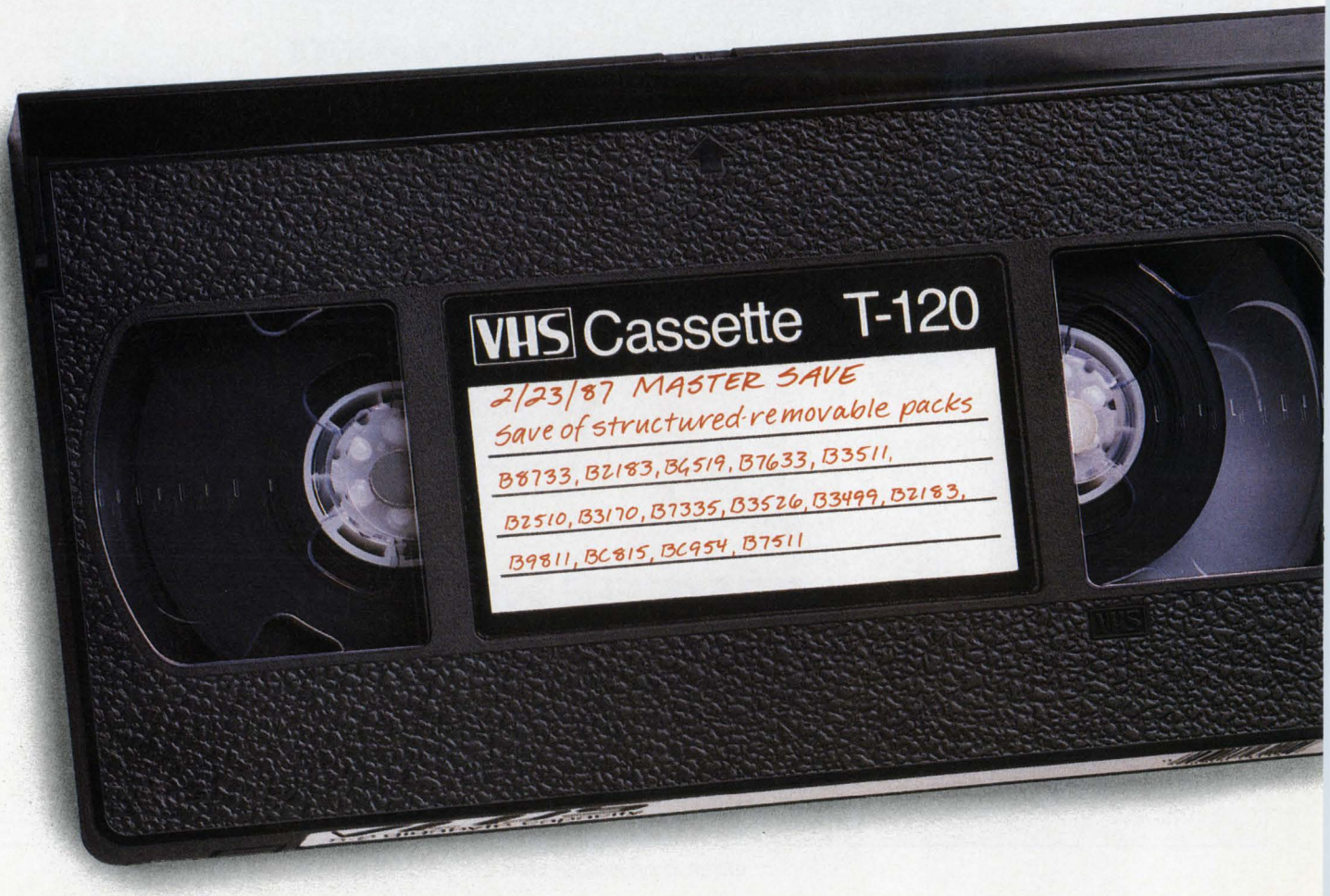
Yes, field service has come a long way from its beginnings. Today, the service industry is focusing on remote diagnostics with artificial intelligence — expert systems that contain the cumulative knowledge of the brightest field service personnel and are able to analyze and suggest solutions to system problems anytime, anywhere in the world. This capability is like having expert field engineers for all installed equipment, every minute of the day.

In recent years, the newest test and measurement equipment finding its way into the field has built-in capabilities never dreamed of by our predecessors. With the continuing shortages of technical field personnel, more problem-solving capabilities are being programmed into the test devices.

Even as advanced as the testing tools have become, computer technology is advancing faster, causing the FE to be on the lookout continually for more up-to-the-minute equipment. No matter how state-of-the-art his bag of tricks, the FE's job is not easy.

The '80s unquestionably have been the "field service years." The contribution of field service organizations to their respective companies' performance, profits and credibility finally has been recognized and brought to the forefront. Where service once was considered a necessary evil (as a cost center reporting to marketing), it's now run as a profit center in most companies, and indeed, during recent hard times within the computer industry, has contributed greatly to keeping many manufacturers afloat when sales (and thus new installations) have plummeted. It's now a multibillion dollar business within a business.

Field Service and Support accounts for 25 percent or 22,000 employees of DEC's total workforce of 101,000 and 30 percent or $2.6 billion of the corporation's $7.59 billion in operating revenues, for the fiscal year ending June



1986. During that time, Field Service and Support grew 20 percent on top of fiscal 1984's 23 percent, showing "steady growth in a soft market," according to a DEC spokesman.

During the 1980s, the third-party (or independent) service market grew to approximately $2 billion, and new fourth-party firms began to take hold. (Third-party maintenance firms now are taking somewhere in the neighborhood of 10 percent of the market from the manufacturers, and this is expected to increase substantially throughout the decade.) We also saw major manufacturers, such as DEC, Honeywell, Control Data, UNISYS and others begin to service equipment made by other manufacturers and/or go after third-party service markets on their own in order to cash in on this new, lucrative business.

Data processing equipment service and repair now is one of the top growth professions in the country. (According to the Labor Department there will be a 56.2 percent increase in this job category between 1985 and 1995.) And it's continually changing, becoming more technology-driven in the delivery of services as a means of combating the ongoing shortage of technical people. It also continues to expand from a strictly hardware-oriented skill to one that includes software, training and sales.

Why all of the newly acquired excitement in service? One reason is that it's almost a guaranteed large growth area. With more computer installations and larger numbers of units within each installation, there's a tremendous demand to meet the needs of the enlarging customer base. As the numbers and complexity of equipment grow, the customers expect more from their service vendor in the way of training and support (in addition to the traditional maintenance and repairs). And it is the one area that cannot be taken overseas!

Today, computer installations are becoming more complex (incorporating mixed-vendor systems, combined data and communications equipment, networking, etc.), and test and measurement devices and diagnostics are gaining additional sophistication. As this happens, the vendor needs, and the customer demands, better trained, more highly qualified individuals. That's why today, some of the best and brightest in the industry are going into field service.

Field service in the 1980s is an exciting, constantly evolving and quickly expanding segment of the computer industry — perhaps the fastest changing business within the fastest changing industry in the world. *—Ron Levine is an independent consultant and writer based in Anaheim, California.*

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LEGAL BUSINESS

Herbert Swartz

Software And Copyright

The Supreme Court has spoken, by deciding *not* to speak. The result? The legal side of software development for the next several years has been established.

Ever since our copyright scheme was enshrined in the Constitution 200 years ago, one fundamental principle has guided us: Copyright protection extends only to the "expression" in a work, not to the idea "embodied" in the work. What the work says — what the software does — is in the public domain. In short, a limited monopoly. The public is free to use the product, but for 75 years the author possesses five "exclusive rights": distribution, reproduction, display, public performance and the making of derivative works.

The key issue for software, of course, is reproduction (copying). With works on paper, the task of determining plagiarism or copying to "a substantial degree" (the legal term for infringement) has been relatively straightforward. The works, original and alleged infringing work, can be placed side by side, available for comparison by the naked eye. But with software, what's claimed to have been copied cannot be seen (the code); and besides, the very act of creating code is unfathomable to the average judge or jury.

All of which creates tension for the protection of intellectual-property rights in software. Court and jury are pulled by the desire to protect creativity as well as the money, time and effort that go into R & D; while conversely, anything that smacks of monopoly rings hollow. It's competitiveness that Americans revere.

The early cases involving copyright rights and software — what lawyers describe as "The First Generation of Computer Law" — posed no problem. The claimed infringers admitted they copied (indeed, outright duplicated), since their asserted defense was that copyright protection didn't apply to software. When that issue was resolved, the tension arose.

> ***". . . with software, what's claimed to have been copied cannot be seen . . ."***

Current cases involve software that is said to be different from the original work. How are court and jury to apply the old standard of "substantial similarity" to software? Also, certainly code is protected: It's clearly expression. But what else in the program is expression? In essence, where does expression end and idea begin?

Ironically, in retrospect, the similar approach that various federal courts have applied to the questions is remarkable. Courts rarely exhibit unanimity when faced with new legal issues. Yet almost all of the courts involved have said that protection of computer software extends beyond the source code to the structure sequence and organization of the program. The courts even have agreed on the appropriate catchwords (our legal system loves catchwords; they save further analysis): The "look and feel" of a computer program is protected.

The leading case for the thesis came out of the U.S. Court of Appeals for the 3rd Circuit (Philadelphia), in the Whelan Associates, Inc. vs. Jaslow Dental Laboratories case. Whelan owned the copyright to a program used to assist in the management of a dental laboratory. Jaslow developed a program in a different language but with similar functionality and structure. The court held that this infringed on Whelan's copyright even though the program wasn't copied directly. Whelan was the first case in the new line to reach the Supreme Court, but the Court refused to hear it. By its silence, the Justices have both given passive approval to "look and feel" and left the copyright/software tension to lower federal courts.

The course also has been set for the daily operation of the software industry. The race is swift, as illustrated by a recent decision by a federal district court in California. Copyright protection extends to the audiovisual appearance of a computer program (Broderbund Software, Inc. vs. Unison World, Inc). A software developer is free to market a program with the same underlying idea as another program unless the idea is expressed in such a way that the second program "looks and feels" substantially similar.

Critics of the course taken by the judiciary contend that overall software development will be impaired. In effect, for the development of each new product, its creators will have to reinvent the wheel. The judges fail to appreciate the amount of similarity that is inevitable from product to product as the software industry develops.

But the fact is that the critics have lost, and no change in judicial direction can be expected in the near future.

While for those involved in software development — whether in a large company such as DEC or in a startup company — the issue is the same: "Having a copyright policy is both prudent and expedient," in the words of attorney Richard Raysman of Brown, Raysman & Milstein of New York, author of *Computer Law: Drafting and Negotiating Forms and Agreements.*

Says Raysman, "A copyright policy should outline the responsibilities, requirements, and provisions for maintaining copyright in the software developer's intellectual property. The policy also should detail procedures and guidelines for instructing employees of the software developer as to how to prevent inadvertent infringement on the copyright of others and for designing and developing software that would prevent inadvertent copying of the structure or other feature of a competitor's software."

Clearly too, the software course settled on by the judiciary has accentuated the importance of R & D. Since large companies have more funds for this work than smaller companies, the latter would appear to be at a disadvantage. But when those forming a startup look for their equity money or venture capital, they commonly make their requests on the worth of the company's new product. Previously, an investor might have demurred, "Won't a larger company come along and also make the new product, and then market it better? What chance does the startup really have?"

"A very good one," now must be the answer. Being first bars competition.

For themselves and their investors, new companies also must consider altering their preconceived corporate strategy. No matter how tight the budget, R & D cannot be overlooked. The possibility of being locked out on a new product development is too broad. While equally as broad are the opportunities if a company's R & D is successful.

In the matter of copyright and software, lawyers have had their say. Software executives might take exception, but they hardly can afford to ignore the issues. *—Herbert Swartz, a graduate of Harvard Law School, is a veteran writer on computer law.*

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MANAGING YOUR MICROVAX

David W. Bynon

Managing Multiple MICROVAXs, Part 1

The advent of the MICROVAX, and now the recently released MICROVAX 2000 series, brought to reality Digital's conception of team computing, a distributed processing concept in which small work groups share a computer system (e.g., a MICROVAX II or MICROVAX 2000) configured to their specific application. The system is a part of the organization's overall computing strategy. The uniqueness of this type of computing system is that the computer itself is not "the system"; the network (DECnet) is the system. Digital has come closer than any other manufacturer to implementing a true distributed system where the computing functions are dispersed among several physical computing elements.

True, VAX/VMS represents a family of compatible products that can be operated standalone; most have been, and many still are. This is changing rapidly, however, as the single corporate mainframe style of computing gives way and the power is brought to the people. How will you manage all of those systems?

Where once you had only one system to backup, you now have 30. Before, you had one system on which to perform software updates, now you have 20. Software, data, maintenance, control and security all are issues that were difficult enough to manage with a single system; the issues multiply on distributed systems. What you need is a "Helper."

If you have multiple MICROVAXs or VAXs, you probably already have one helper — DECnet. DECnet is an incredible system that seamlessly connects multiple systems for the purpose of sharing data and other resources. Additionally, for the MICROVAX/VAX system manager, DECnet is an effective tool for managing multiple systems.

With DECnet, the system manager can:

1. Backup remote systems
2. Monitor remote systems
3. Perform file and directory maintenance on remote systems
4. Execute commands simultaneously on multiple systems

PROGRAM 1.

```
$!-------------------------------------------!
$! NETSYSMGR.COM                            !
[B$! Network System Manager V1.1   5 Oct, 1985  !
$! Copyright(C), David W. Bynon, 1985       !
$!-------------------------------------------!
$!
$       SET NOON
$!
$! Set up some symbols
$!
$       SAY == "write sys$output"
$!
$! Sign on message
$!
$       SAY ""
$       SAY "Network System Manager V1.1"
$       SAY ""
$!
$! Open the node name database and define an error trap
$!
$       IF "''P1'" .EQS. "" THEN GOTO OPEN_DEFAULT
$       OPEN/READ INFILE 'P1'
$       GOTO ERROR_SETUP
$ OPEN_DEFAULT:
$       OPEN/READ INFILE NODES.DAT
$!
$! Set up where to go if an error occurs
$!
$ ERROR_SETUP:
$       ON WARNING THEN GOTO NODE_PROBLEM
$!
$! Main processing loop
$!
$ MAIN_LOOP:
$       READ/END_OF_FILE=EXIT INFILE NODE
$       SAY "Copying SYSMGRJOB.COM to ''NODE'::"
$       COPY SYSMGRJOB.COM 'NODE'::SYS$MANAGER:
$       SAY "Executing the procedure on ''NODE'::"
$       TYPE 'NODE'::"TASK=SYSMGRJOB"
$       GOTO MAIN_LOOP
$!
$! Log the node name and time a problem occurred
$!
$ NODE_PROBLEM:
$       IF F$SEARCH("NETSYSMGR.LOG") .EQS. "" THEN CREATE NETSYSMGR.LOG
$       OPEN/APPEND OUTFILE NETSYSMGR.LOG
$       TIME = F$TIME()
$       WRITE OUTFILE "ERROR REACHING/MANAGING NODE ''NODE' AT ''TIME'"
```

PROGRAM 1. . . . *continued*

```
$       CLOSE OUTFILE
$       GOTO MAIN_LOOP
$!
$! Before exiting, close the data file
$!
$ EXIT:
$       CLOSE INFILE
$       SAY "Remote System Manager completed."
$       EXIT
```

PROGRAM 2.

```
$!-----------------------------------------------
$! SYSMGRJOB.COM V1.0
$!-----------------------------------------------
$       goto setup
$ JOB:
$!
$! *** ENTER THE JOB BELOW HERE ***
$!
$ SET DEFAULT SYS$SYSTEM            ! Example job
$ RUN AUTHORIZE
MODIFY SYSTEM/PASSWORD=SYSMGRPASS
EXIT
$
$!
$! *** LEAVE STATEMENTS BELOW HERE ALONE ***
$!
$! This command procedure works in conjunction
$! with "NETSYSMGR.COM"
$!
$       delete sys$manager:sysmgrjob.com;*
$       exit
$ SETUP:
$       set noverify
$       set noon
$       if f$mode() .nes. "NETWORK" then logout/brief
$       define sys$output sys$net
$       goto job
```

In recent months, ads for networking software have all begun to sound alike. Each promises a unique solution to your networking problem (even before the vendor knows what that problem really is). Each tells you the product is easy to use (that is, of course, if everyone is thoroughly trained). And that when you buy the product, you'll get all the technical support you'll need (but they don't tell you how long you must wait to get it).

No wonder user skepticism grows daily!

Properly implemented, network communications software is an effective way of sharing data and peripherals among diverse computer systems. A skeptic, on the other hand, is one who seriously doubts that such a capability exists.

(Now for the commercial)

WINS™ is not a panacea! It's a complete family of communications software products specially designed for skeptics. WINS ensures reliable data transfer and program access among dissimilar computers using a wide variety of operating systems. Transparently! And because of the way WINS software implements U.S. Government standard TCP/IP, it permits easy migration to any of the emerging OSI protocols you may need.

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But in the final analysis, Wollongong's reputation as an authority in the field of network communications is your best guarantee of continuing product performance and support. For example, when AT&T, DEC, IBM, H-P and CRAY each needed to implement TCP/IP on their systems they came to Wollongong.

So throw your skepticism overboard and call Wollongong today. We'll send you the information you need on WINS ... the *anti-skeptic* answer to present and future networking needs. Call 1-800-872-8649 (in California it's 1-800-962-8649) toll free. Or write The Wollongong Group, Inc., 1129 San Antonio Road., Palo Alto, CA 94043.

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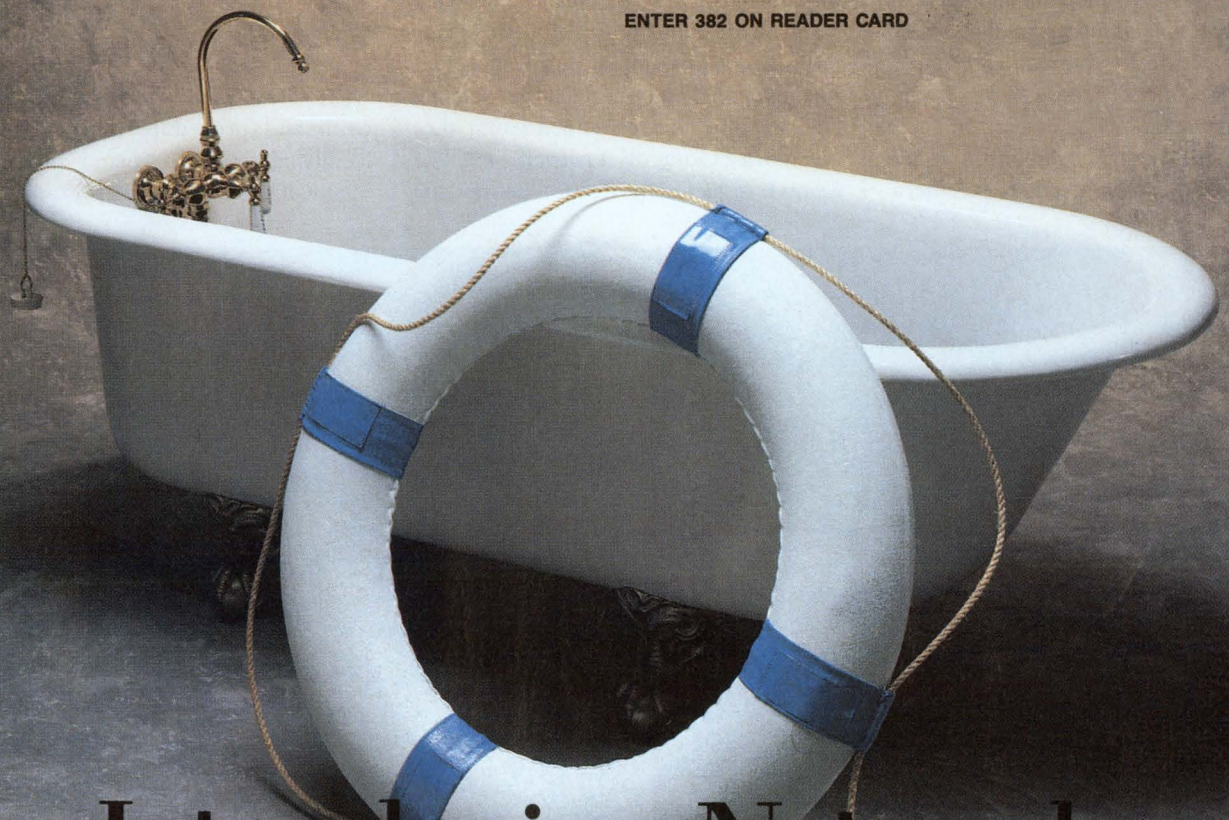

Introducing Network Communications Software For Skeptics.

5. Perform software updates on remote systems
6. Add, modify and delete user accounts on remote systems.

DECnet allows two or more programs, running on separate systems within a network, to perform task-to-task communications (i.e., programs may exchange information over a logical link). Task-to-task communications are similar to other types of I/O. A logical link (the I/O channel) is established between the two programs over which both tasks can send and receive data. The task sending the data is the source; the task receiving it is the target. These connected tasks may swap roles, or they both may send and receive data simultaneously. After a connection is made, there's no distinction between the task that initiated the connection and the task that accepted it. Thus, the task-to-task communication mechanism is a viable means to initiate tasks on remote DECnet systems.

The following command syntax, for example, can be used to execute a command procedure on a remote DECnet system:

```
$ TYPE
NODE::"TASK=PROCEDURE"
```

where NODE is the name of a remote DECnet node and PROCEDURE is the name of a VAX/VMS command procedure on the remote node. This command basically injects the named procedure into a DCL input stream. It's a useful and powerful DECnet feature.

Did you ever wonder how MAIL could send mail from your node to another or how PHONE could reach out and beep someone across DECnet? The answer is through known objects, part of the DECnet mechanism that permits remote task execution. Known objects allow the Network Ancillary Control Process (NETACP) to create a process from an inbound logical link request, then execute a command procedure or image located anywhere on the system. Known objects are defined using the Network Control Program (NCP). Known object identification defines an image/procedure name, object type, location and privileges for access for the NETACP.

System Management With DECnet

One of the primary benefits of using DECnet to manage multiple systems is the ability to perform most jobs from one terminal or workstation. Some obvious methods include the DCL SET HOST command and DECnet file operations; e.g., DELETE, COPY and RENAME. Performing tasks in this fashion, however, only saves you from having to run around from system to system. The problem of managing multiple systems (i.e., redundant tasks) still remains; thus, the reason for explaining DECnet task-to-task communication and known objects.

Using the task-to-task communication and known object features of DECnet, it's possible to automate many system management functions. NETSYSMGR.COM (see Program 1) is a command procedure that executes a locally defined command procedure, SYSMGRJOB.COM (see Program 2), on

EXAMPLE 1.

```
BIFF
SKIP
BUFFY
CHAZ
LIZ
TINKER
TAILOR
SOLDIE
SPY
```

EXAMPLE 2.

```
$! This "example" command procedure could be used to accept and execute
$! commands from a remote system. To execute this procedure, the remote
$! system would have to establish a logical link to this procedure. For
$! example (in FORTRAN):
$!
$!      OPEN (UNIT=lun, FILE='node::"TASK=$REMOTE_CMD"',
$!     2      STATUS='OLD',FORM='FORMATTED', ACCESS='SEQUENTIAL',
$!     2      RECORDSIZE=1024, CARRIAGECONTROL='NONE', SHARED,
$!     2      RECORDTYPE='VARIABLE' )
$!
$! "lun" is the file logical unit number, and "node" is the DECnet node
$! name of the of the system you want to establish a connection with.
$!
$! The remote system would send commands to this procedure via simple
$! write statements. For example (in FORTRAN):
$!
$!      WRITE (UNIT=lun, FMT='(A)') 'DCL_Command_String'
$!
$! To receive the response back from this command procedure, the remote
$! task must read from the I/O channel until it receives EOF.
```

EXAMPLE 2. . . . *continued*

```
$!
$!      REMOTE_CMD.COM
$!
$       SET NOVERIFY
$       SET ON
$!
$! Exit if not being executed via DECnet
$!
$       IF F$MODE() .NES. "NETWORK" THEN $EXIT
$!
$! Open output channel to SYS$NET
$!
$       OPEN/WRITE/ERR=EXIT/SHARED NET$CHANNEL SYS$NET
$!
$! Setup a read loop for command processing
$!
$ LOOP:
$       ON ERROR THEN CONTINUE
$       READ/ERR=EXIT NET$CHANNEL COMMAND
$!
$! Execute command, if available...
$!
$       IF COMMAND .EQS. " " THEN GOTO LOOP
$       @SYS$SYSTEM:EXECUTE/OUTPUT=NET$CHANNEL: COMMAND
$!
$! Terminate output
$!
$       WRITE/ERR=EXIT NET$OUTPUT "^E"  !<Ctrl/E>, DECIMAL 05
$       GOTO LOOP
$!
$! Close the I/O channel and exit
$!
$ EXIT:
$       CLOSE NET$CHANNEL
$       EXIT
$!
$! The following secondary command procedure (SYS$SYSTEM:EXECUTE.COM)
$! is required to execute the actual command.
$!
$! EXECUTE.COM
$!
$ 'COMMAND'
$ EXIT
```

multiple remote systems defined in NODES.DAT (see Example 1). The program assumes that DECnet proxy login access has been granted for the SYSTEM account in order to function correctly. The file NODES.DAT is a simple text file that can be generated with EDT. The functionality of this utility is limited to commands that don't require interactive use; for example, AUTHORIZE or SYSGEN. Using conventional program-

> ***"The task sending the data is the source . . ."***

ming languages likes FORTRAN, BASIC and C, it's possible to develop utilities with greater functionality and complexity. For example, a program could be developed to establish DECnet links to multiple remote VAX systems. A corresponding command procedure residing on each of the remote systems could be executed for receiving and executing commands typed at the local system (see Example 2). The result of such a program would be true simultaneous execution of a single command by multiple systems. The program would be responsible for parsing output from each of the remote systems to the local display.

In Part 2 of this article, we'll present an in-depth review of a new Digital product: *Remote System Manager* (RSM) V1.0. The functionality of this new product reaches far beyond the issues covered here. It's a fitting example of how capable and flexible DECnet and the Digital Network Architecture really are — especially for the MICROVAX and VAX systems manager. *—David Bynon is a VAX systems consultant based in Washington, D.C.*

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LET'S C NOW

The DECUS C Compiler

Rex Jaeschke

Editor's note: According to the DECUS Library staff, the C language and tools tapes are some of the most widely sought after. This month Mr. Jaeschke gives an overview of the C language kit.

The DECUS C kit contains a compiler, run-time system, and several executive interface libraries written by DECUS members. David G. Conroy wrote the compiler and it was modified by Martin Minow, Robert B. Denny, Clifford Geshke and several others. Minow also penned the RSX-11M and RT-11 run-time libraries with help from many friends; and he wrote

To support the DECUS C language, run-time library, or C programs, you need to understand and modify MACRO-11 and C source code. The documentation provided with the kit explains why . . .

both the RSTS/E and the VAX/VMS (for interface with VAX C) executive interface libraries. Denny created the RSX-11M executive interface library and Fred Fish came up with the portable math library.

The compiler supports the full C language except for enumerations, bit fields and a few other things added to the language in recent years. A file CBUGS documents known bugs and some are substantive.

This software comes without any support. To support the DECUS C language, run-time library, or C programs, you need to understand and modify MACRO-11 and C source code. The documentation provided with the kit explains why:

"DECUS C was first distributed to the 'wider world' on an RSX-11M SIG tape in 1978. It was first distributed to DECUS — as 11-SP-18 — in November 1980. The second release was submitted in July 1983 and resubmitted in November 1983 when we discovered that two accounts were omitted accidentally.

"Those of us who have been working with the compiler and run-time library for the past five years are quite aware of several design errors and limitations. Some of them have, on retrospect, turned out to be advantages. For example, the compiler was written in MACRO-11 — no C compiler was available to the original author. This has served as a barrier, preventing inexperienced programmers from 'fixing' and 'extending' the compiler to suit their own tastes and prejudices.

"For its implementers, DECUS C has been an interesting, challenging, and enjoyable hobby. But we are anxious to get on with other things and — noting that good quality C compilers are now readily available on DEC machines — we would like to point out to the DECUS C community that we do not plan further development of the compiler or run-time library.

"When you find a bug in the compiler or run-time library, either find a work-around or treat it as an opportunity to learn more about the inner workings of complicated programs. If neither alternative is reasonable, given your needs, you should not be using DECUS C."

The Set-Up

I installed the DECUS C compiler on a PDP-11/44 with 896K of memory running RSX-11M-PLUS V3.0 BL24D. The installation and test device was a removable pack RA60 drive. The tape drive was a TS11 (a cast-off by Noah).

The compiler, support tasks and tools were distributed on a 1600' nine-track FLX tape in a set of directories [5,*] and [6,*]. There were 1045 files in 13,540 blocks. While you can probably mess with individual directories, I found it much easier to restore the whole tape to a scratch disk preserving the tape's directory structures. Then my disk directories matched the many identified in the documentation files. Note that it may take an hour or so to copy the whole kit to disk.

Printed manuals in the kit (also included in .RNO form) provide comprehensive coverage of the run-time library and the procedures for using the compiler and assembler. Each supported operating system has its own directory of files for installation and documentation. Supported systems include RT11, RSX-11M (and M-PLUS), RSTS (RSX emulator), and VAX/VMS compatibility mode which requires either support for the PDP-11 instruction set in hardware (not in MICROVAXs or newer VAXs) or the layered product VAX/RSX.

The program library, accounts [6,1] through [6,7], offers a collection of tools, games, and other programs, mostly writ-

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ten in C. Although they are not needed for installation of the compiler, several programs in the tools account, such as KWIK, are used to build the documentation. In general, you should be aware that only the tools in [6,1] are tested. Each account contains a file named README.nnn describing the contents of the account.

Installation

After the kit was copied to disk, the only tasks left were to assemble and build the compiler XCC and the assembler XAS, and to place the header files and object library in the appropriate directories.

The compiler installation command file asks various questions about floating-point processor support, resident libraries, mapped versus unmapped system, and the like. The assembly and linking of the compiler and libraries took about 30 minutes on a medium-loaded system. The assembler installation followed the same lines except it only took 10 minutes to run. After you have built the compiler and assembler, you need less than 1,000 disk blocks to store the exectables, headers and library. The installation was straightforward and uneventful.

Everyone's Favorite, hello.c

In order to get the feel of the compiler and to test the installation, I entered the first program listed in K&R (except to be strictly ANSI conforming, I included the reference to the header **stdio**):

```
/* hello.c */

#include <stdio.h>

main()
{
        printf("Hello, world!\n");
}
```

Unless specified otherwise at installation, header files delimited by < . . . > are searched for in LB:[1,1] and those delimited by " . . . " are expected to be in your default directory. There is no mechanism (such as an -i switch) to specify search paths at compile time.

To compile this program, I used the following command:

```
XCC HELLO
```

The compiler executable image is called CC.TSK, except when installed using the RSX INS command. Then it gets the name, XCC. The compiler need not be INStalled to be used. You can instead use it as follows:

```
RUN CC
CC>HELLO
```

In that case, it prompts for a command-line. Either way, the compiler generates an assembler source file by the same name with type .S, provided no fatal compilation errors are encountered. The contents of **hello.s** are as follows:

```
/ Decus C patch level 9, Compilation date: "Mon Feb 02 00:07:52 1987"
        .psect  c~data
        .psect  c~code
_main:
        jsr     r5,csv~
        .psect  c~strn
.2:
        .byte   110,145,154,154,157,54,40,167,157,162,154,144
        .byte   41,12,0
        .psect  c~code
        mov     $.2,-(sp)
        jsr     pc,_printf
        tst     (sp)+
.1:
        jmp     cret~
        .psect  c~data
        .even
        .globl  _printf
        .globl  _main
        .globl  csv~
        .globl  cret~
        .psect  c~code
        .even
        .psect  c~data
        .even
```

Although it looks a lot like MACRO-11 code, it's not. Consequently, you must use the assembler provided with the kit. You must use AS, not MACRO 11. Because the compiler and the assembler both are written in MACRO-11, it is hard to see why the compiler generates another language source, but it does.

Normally, you'll want to generate object code instead. To do so, use the -a switch at compile time as follows:

```
XCC HELLO -A
```

Now you've created the .S file and automatically invoked the assembler. When AS terminates, the .S file is deleted. For this to work, the assembler AS.TSK must be installed as XAS. Of course, XAS can be run on its own to process arbitrary .S source files. Both the compiler and assembler were modelled after their equivalents in a UNIX environment which accounts for both the names CC and AS as well as the use of the file type .S for assembler source.

Last, we link the program with the supplied object library C.OLB using TKB to produce an executable file HELLO.TSK. When run, this task produces the following output, as expected:

```
>run hello
TT22> <return>
Hello, world!
```

By default, all C tasks, not installed using INS, prompt for a command line.

To get a feel for the size of many common run-time library routines, I checked the link map and the size of the executable task:

```
>DIR HELLO.MAP
...
HELLO.TSK;1          43.      C  01-FEB-87 23:58
...
```

At 22,000 bytes, it's a large file considering the utility of the program. In fact, without modifying the start-up and termination code supplied with the compiler, you can't have a task of less than 43 disk blocks. Even a source file containing an empty main function generates a task of 43 blocks. In addition to loading code to perform command-line (and therefore, possible file) processing, it also brings in the heap allocation routines.

Command-line Argument Processing

To check out the start-up code's treatment of **argc** and **argv**, I compiled the following program:

```
/* cmd.c */

#include <stdio.h>

main(argc, argv)
int argc;
char *argv[];
{
        int i;

        for (i = 0; i < argc; ++i)
                printf("argv[%d] = |%s|\n", i, argv[i]);
}

>RUN CMD
TT22> <return>
argv[0] = |tt22|
```

Because the task CMD was not installed, it's given the name of its host terminal at run time and this name is used as **argv[0]**, as shown:

```
>RUN CMD
TT22> THIS IS A TEST
argv[0] = |tt22|
argv[1] = |this|
argv[2] = |is|
argv[3] = |a|
argv[4] = |test|
```

Here all the command-line arguments are converted to lowercase:

```
>INS CMD/TASK=...CMD
>CMD ANOTHER TEST
argv[0] = |cmd|
argv[1] = |another|
argv[2] = |test|
```

If a task is INStalled, its installed task name is **argv[0]** and the command-line can either be given when the task is invoked or it can be prompted:

```
>CMD abcd ABCD "abcd ABCD" "tab          tab"
argv[0] = |cmd|
argv[1] = |abcd|
argv[2] = |abcd|
argv[3] = |abcd ABCD|
argv[4] = |tab          tab|
```

Casing within quoted strings and white space is preserved.

```
>REM CMD
>RUN CMD/CMD="THIS IS A TEST"
argv[0] = |this|
argv[1] = |is|
argv[2] = |a|
argv[3] = |test|
```

With more recent releases of RSX-11M and RSX-11M-PLUS, a command-line can be passed to an uninstalled task using the /CMD switch as shown. Although this doesn't require the user to be privileged to INStall the task, it doesn't allow quoted literals as command-line arguments. In any case, it's not a problem because DECUS C programs prompt for command-line arguments by default.

Command-line Redirection

Another carry over from the UNIX environment is the notion of command-line I/O redirection, that is, the ability to redirect either one or both of **stdin** and **stdout**. The following program demonstrates this capability:

```
/* toupper.c */

#include <stdio.h>
#include <ctype.h>

main()
{
        int c;

        while ((c = getchar()) != EOF)
                putchar(toupper(c));
}
```

To redirect **stdin** to a file so that toupper doesn't read from the terminal, use the < character:

```
>INS TOUPPER/TASK=...TUP
>TUP <TOUPPER.C
#INCLUDE <STDIO.H>
#INCLUDE <CTYPE.H>

MAIN()
{
        INT C;

        WHILE ((C = GETCHAR()) != EOF)
                PUTCHAR(TOUPPER(C));
}
```

As expected, the file **toupper.c** is read instead. Because **stdout** wasn't redirected, the output was still written to the terminal.

```
>TUP <TOUPPER.C >TEST.DAT
>TUP <TOUPPER.C >>TEST.DAT
```

These two examples redirect both **stdin** and **stdout**. In the first example, all output written to **stdout** is written to the file TEST.DAT. The second case opens the file TEST.DAT in append mode before writing to it. If the object of the >> "operator" does not exist, the file is created first. (The same capability, available under the UNIX and MS/PC-DOS operating systems, can be approximated under DCL using ASSIGN /USER_MODE with SYS$INPUT and SYS$OUTPUT.)

Preprocessor Limitations

A major obstacle in porting code to the DECUS C compiler is that preprocessor macros can't have arguments. For example:

```
/* args.c */

#define abs(a) (a) < 0 ? -(a) : (a)

main()
{
        int i;

        i = abs(7);
}
```

generates several compilation error messages and causes the source code to be expanded as follows:

```
main()
{
        int i;

        i =  (a) (a) < 0 ? -(a) : (a) (7);
}
```

It treats the macro definition as if it were:

```
#define abs (a) (a) < 0 ? -(a) : (a)
```

where a space occurs after the name **abs**.

Floating-point Support

When the compiler is built, you can specify whether or not you have floating-point hardware support. If you indicate that you don't (as I did because I will be moving this kit to an 11/23 without FPP), then the compiler generates code which calls FP routines. However, these routines don't exist in the library and any attempt to execute such code results in a run-time message. The following example shows the attempted use of an FP display routine inside **printf**:

```
/* float.c */

#include <stdio.h>

main()
{
        int i;
        double d;
        float f;

        d = 1.234;
        f = 1.234;

        for (i = -2; i <= 2; ++i)
                printf("d = %f\n", i * 3.12159);
}

>run float
TT22>
d = {dtoa?}
d = {dtoa?}
d = {dtoa?}
d = {dtoa?}
d = {dtoa?}
```

The compiler kit provides a reasonable evaluation and development system. However, because it is unsupported, won't be enhanced or fixed, and the proposed ANSI C Standard will significantly extend the C language and its run-time library, I caution against using the DECUS C system as a production compiler. Although it works with the utilities provided in C source form and code written allowing for the compiler's idiosyncrasies, there are many areas in which you

may encounter problems in porting code from commercial C systems.

A Reader's Opinion

Dear Rex,

I am a regular reader of your column and saw your recent request for comments from users of the DECUS C compiler.

I have used DECUS C running RT-11 and TSX+ for several projects. The first involved several machine-specific utilities. The DECUS C compiler provides a calling interface to FORTRAN routines from SYSLIB.OLB to manage special handler calls, rather than making you resort to assembler.

Overall, the compiler is pretty nice. In fact, it is one of the few C compilers available for RT11 and TSX+. Some drawbacks include the differences in variable name lengths allowed for automatics, statics and externals. Also, it doesn't support macros with arguments or some typedefs, mainly those involving pointers. Generally speaking, you can get around the typedef problems and some known bugs are documented.

In an unrelated matter, we recently purchased a copy of CrossRefC from the Software Development Factory (P.O. Box 1106, Hunt Valley, MD 21030; (301) 666-8129). It is a C-language cross-reference utility. The first pass generates a line-numbered listing for individual modules and a symbol table of externals for each. The second pass uses these symbol-table files to generate a cross-reference listing of externals and header files. We are running it on MS-DOS but it is sold in source form for $99 and is available for DG's AOS, UNIX and VAX/VMS.

I have found the package to be especially useful because I am using a symbolic debugger which allows breakpoints to be set by line number. It is also handy for maintenance work.

Author's note: I've had a copy of CrossRefC for a year or so now and have found it very useful. Since you get source with it, you can modify and/or enhance it as you like. It's well worth the price.

VAX C V2.3 Update

According to the VAX C folks, this release is finished and waiting for the availability of SCA V1.0, the new Source Code Analysis utility for VAX/VMS native languages. VAX C, which supports this tool, can't be released until V1.0 is. Although V2.3 has been available within DEC since January, it probably won't be shipped to customers until May or June. This release includes many of the new capabilities from the proposed ANSI C Standard including function prototypes. Stay tuned for more details.

Readers are encouraged to submit any C-related comments and suggestions to Rex Jaeschke, 2051 Swans Neck Way, Reston, VA, 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.*

To order "Let's C Now," by Rex Jaeschke, in updated form, see page 121.

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DEC NEWS

Bruce Feldman

New DEC Dual-Session Terminals Announced

Spreadsheet users now are able to view their computations on one portion of their terminal screens and a graph reflecting the results on another, thanks to a new series of terminals recently announced by DEC. The new VT330 (monochrome) and VT340 (color) generation of terminals includes workstation-like features that allow users to manage two computing sessions simultaneously, without burdening the host computer.

The VT330 and VT340 terminals operate up to five times faster than their VT240 and VT241 predecessors and have twice the resolution (800 pixel x 500 scan line). At $1,895 and $2,795 respectively, they're also priced lower.

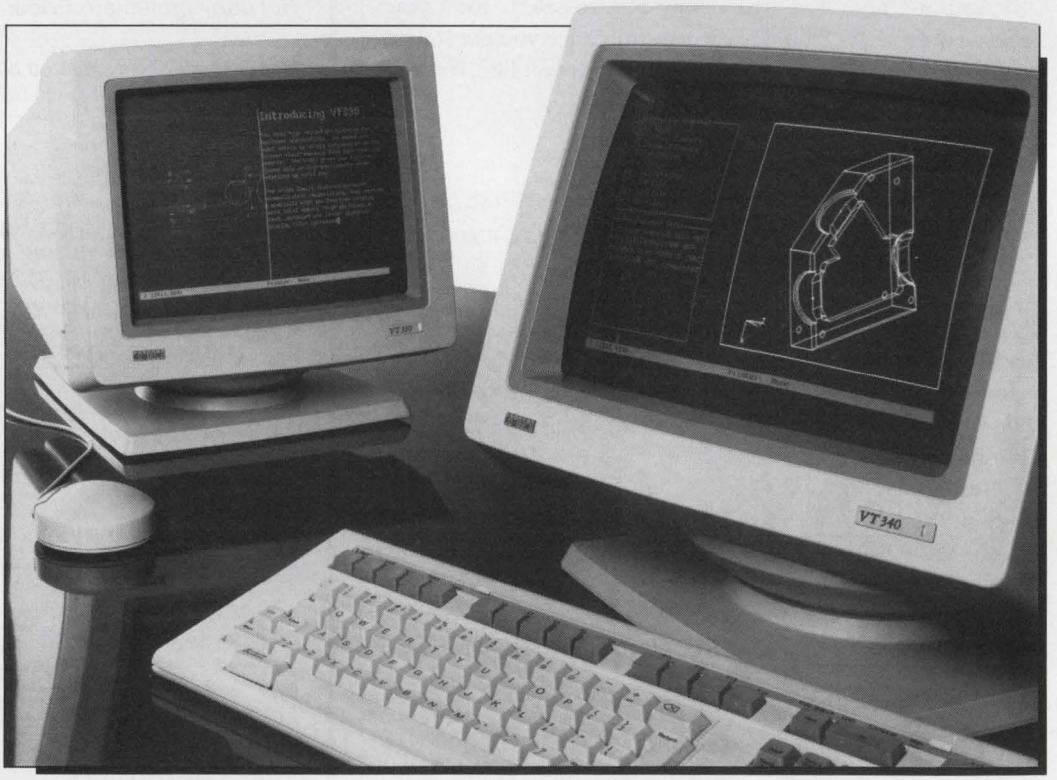
In dual session mode, the new terminals have completely independent setup characteristics for their split screen viewing. The screens can be split horizontally or vertically; there's no windowing capability within screens, however. Separate user-definable keys are included for each of the dual sessions.

A 19,000 character off-screen memory and local editing functions help offload the host system and improve response time. Local memory on single session mode ranges from one page at 144 lines to six pages at 24 lines. In dual session mode, local memory ranges from one page at 72 lines to three pages at 24 lines per session.

Dual sessions can be accessed running over a two wire setup or with DEC's *SSU* session support utility on the VAX. In this mode, the new terminals become the only terminals on the market that can run dual sessions over a single wire.

A built-in color editor on the VT340 allows users to display up to 15 colors from a palette of 4,096 colors, then save the settings for future use. VT330 graphics are displayed in up to four shades of gray. In addition, these terminals support the ReGIS, SIXEL and Tektronix 4010/4014 graphics protocols.

The terminals include a full bidirectional EIA RS232C communications printer port assignable to either session or shared between sessions. There also are three DEC 423 DECconnect ports — two for host communications and one for the printer. An alternate input device



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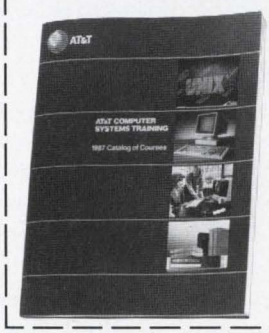

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port (MICRODIN connector) for a mouse, tablet or equivalent also is included.

DEC offers a one year warranty on parts and labor for the terminals, which, when viewed as part of the total cost of the system, can be seen as a price benefit in relation to some of its competition.

DEC incorporated the Dragon chip set from its MICROVAX computer and its VAXSTATION color graphics display for the terminals. The Dragon is a sophisticated, high-density chip set. The VT330 and VT340 implementations don't include the MICROVAX processor, however — something anxiously anticipated in the future.

The announcement keeps DEC's graphics terminal offerings abreast of the competition at a time when the DEC VT240 and VT241 were being outpaced by third-party products. The move, therefore, can be seen not as a bold stroke by DEC, but as a delaying action against the competition, pending future terminal offerings.

> ***"A built-in color editor on the VT340 allows users to display up to 15 colors from a palette of 4,096 colors, then save the settings for future use."***

Doesn't DEC Do Windows?

While most of the features on the new VT330 and VT340 terminals are merely evolutionary, the dual session mode is a really interesting idea. Coupled with the terminal's mouse, DEC has all the pieces in place to use modern windowing technology to give us multiple session capability.

Unfortunately, hardware support for this idea falls considerably short of what we should see in 1987. These days windows, not split screens, are the way to go. By limiting us to either a horizontal or vertical splitting of the terminal's screen, DEC took a giant step backward toward the old days of the "glass teletype."

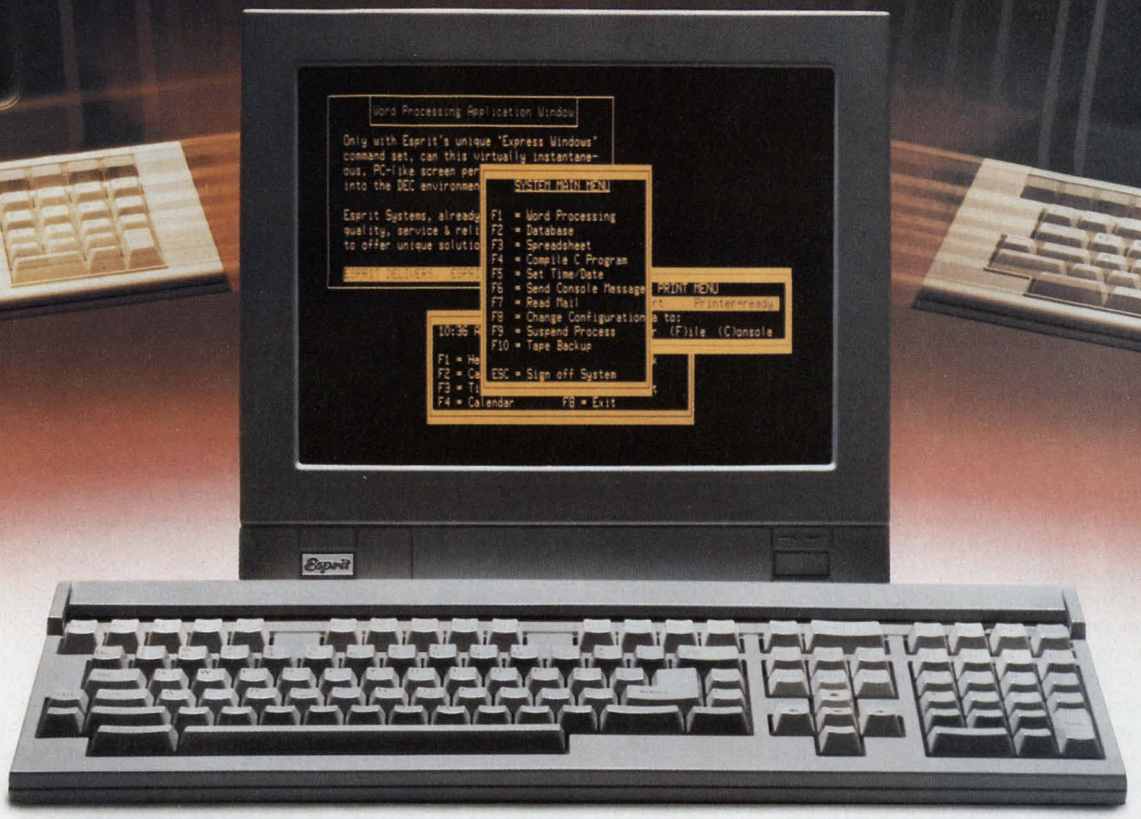
Anyone who's worked with a variable size/variable position window and the mouse driven features that usually come with that environment, finds it a refreshing way to work with multiple applications. Xerox pioneered and Apple exploited the mouse and window technology. Recently, DEC helped develop X Windows as a screen protocol and soon will offer it in other DEC products.

It takes two hands to do windows right. In this case, one just didn't talk to the other and clouded the view again.

The losers? The terminals, and those of us who'd like to see the light shine in and on DEC.

— Carl Marbach

CLEAR THE DEC'S



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DEC PROFESSIONALS

Ron Levine has more than 20 years experience working in the computer industry. He worked as a field engineer for Control Data, Scientific Data, Xerox Data Systems and Varian Data Machines. After spending nine years as a customer engineer, Ron went to Osborne & Associates, a computer-industry documentation development firm where he handled many of the company's major accounts.

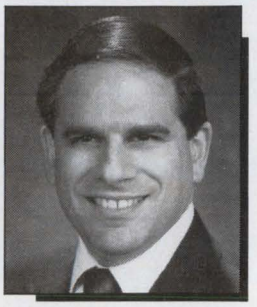
Since 1976 Ron has been an independent consultant and writer. Prior to joining Professional Press as a technical editor, Ron was the West Coast editor of *C/ESN*, a field service magazine.

Ron majored in Business Information Systems at Santa Ana College in California, and currently attends the University of California Riverside. He also is a part-time computer instructor at Fullerton College in California.

Victor J. Chorney has worked in data processing for 25 years and has held positions ranging from programmer to systems analyst, from remote system operator to systems programmer, from DP training manager to project manager. Vic has worked in many different application environments, including all areas of accounting (in which he holds a degree from Temple University), insurance, manufacturing, service industries and software development. He also worked at Digital for five years in a variety of positions in software services.

Vic currently is senior consultant in the Management and Technology Advisory Services department of Glickman, Berkovitz, Levinson and Weiner, a suburban Philadelphia accounting firm. He also is program chairman for the Delaware Valley Rainbow Users Group. Vic has an ongoing interest in microcomputers and has presented several sessions at DECUS and at various user-group meetings on relevant subjects.

Philip A. Naecker is a consulting software engineer based in Altadena, California. As West Coast editor, he keeps in touch with developments and activities in the DEC community on the West Coast. Phil writes about a variety of software and hardware topics, and especially is interested in databases, fourth-generation languages, software development tools, special-purpose processors, and workstations. He is a special technical consultant to the 4GL Special Interest Group (SIG) of DECUS, and is an editor of the DECUS periodical, *The Wombat Examiner.*



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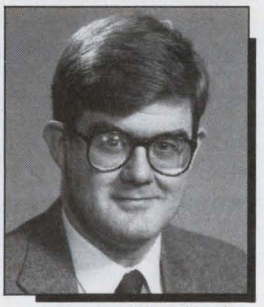
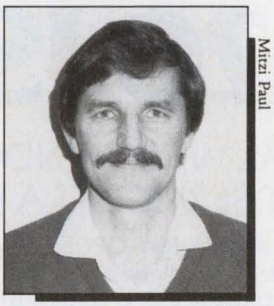


James McGlinchey



Mitzi Paul

Rex Jaeschke

Prior to becoming an independent consultant, Phil was manager of Information Services for a large engineering firm and was responsible for both hardware and software development in a mixed technical/commercial VAX shop.

Phil's education includes a B.S. degree from the California Institute of Technology and graduate work at the University of California Los Angeles.

James McGlinchey is an independent software engineering consultant specializing in the use of RSX and VMS in industrial and other real-time applications. An engineer by trade, Jim often can be found in waste water treatment plants and steel mills, up to his elbows in RSX system problems. Jim has spent more than 12 years as an RSX systems programmer. He is the author of many articles on RSX and its use, including "RSX Clinic," a regular *DEC PROFESSIONAL* feature. Jim maintains his home and consulting base in Essex Junction, Vermont.

Rex Jaeschke is a Reston, Virginia-based independent computer consultant, writer and lecturer. While he has experience in a wide variety of applications hardware and operating systems, his specialties are PDP-11 and VAX-11 environments and the C language. Much of Rex's current work is with PDP-11/73s and 11/44s in real-time, process control with RSX-11M-PLUS and RSX-11s, DECnet, FMS-11, FORTRAN, MACRO-11 and color graphics.

In the C arena, Rex is the co-founder and editor of *The C Journal*, a quarterly publication on the C language. He also is a member of the ANSI C Standard's Committee and writes regular columns on C and microcomputing. Rex received his education from the South Australian Institute of Technology.

A suburban Pittsburgh-based independent consultant, **Kevin G. Barkes** specializes in VAX/VMS systems configuration, operation, tuning, management and training, as well as VAX-based large-scale publishing systems.

Prior to forming his consulting business, Kevin was systems manager of a Mid-Atlantic legal and financial printing company, manager of a small typesetting firm, coordinator of a governmental information-referral agency, and city editor of one daily and two weekly newspapers. ■

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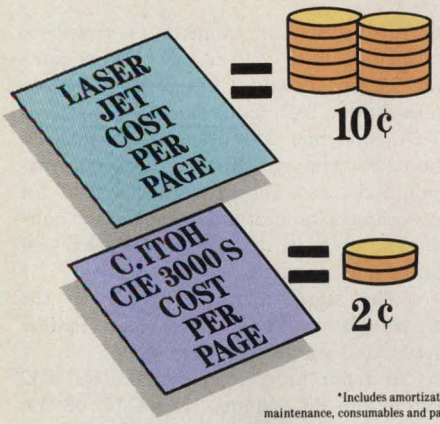

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By creating and modifying electronic forms, you virtually eliminate the high cost of stocking and keeping inventory of preprinted forms.

Not to mention being able to update and instantly print documents as you need them. Now, one small change won't mean your entire stock of forms ends up in the trash.

And with our array of multiple fonts and point sizes, plus proportional spacing, your company's documents will look like they were typeset and printed at great expense. But cost a great deal less.

Our printer manages up to 32 fonts on one page, with practically no limitation on font size. You can choose from 8 standard fonts—and add 24 optional ones—for your electronic forms and correspondence.

Express yourself. We give you a lot of artistic license. Our graphic arts features include line drawing, shading, reverse type and bit-mapped graphics—all the tools you need to print attractive forms. Even add logos and signatures for a personalized appearance.

Non-stop technology from C.Itoh. Ion deposition printing is durable and dependable. A revolutionary four-step printing process with few moving parts. This means very low monthly maintenance costs. In fact, about half what it takes to keep a laser printer going.

At a fast 30 pages-per-minute, it can print 20,000, 50,000 or as many as 150,000 pages a month, to keep you operating virtually non-stop.

	HP LaserJet	C.Itoh CIE 3000 S	XEROX 9700
Print Speed	8 ppm	30 ppm	120 ppm
Monthly Recommended Volume	3,000 pages	150,000 pages	1,300,000 pages
Engine Life	100,000 pages	5,000,000 pages	78,000,000 pages
Purchase Price	$2,995	$16,995	$313,635
Cost Per Page	$.1040	$.0212	$.0207

The CIE 3000 S uses plain bond paper in letter and legal sizes and form lengths from 7 to 14 inches. What's more, the CIE 3000 S is fully compatible with IBM and DEC, as well as a variety of other host systems.

Of course, C.Itoh offers nationwide service, with several on-site service plans to choose from, as well as an end-user support staff.

So, go ahead. Express yourself. Call or write C.Itoh today at (213) 327-9100. Phone toll-free at 1-800-843-6143. In California, call 1-800-323-2024. TELEX: 652-451. TWX: 910-343-7446. 19300 So. Hamilton Ave., P.O. Box 9116, Torrance, CA 90508-9116.

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C.ITOH
Image Systems Division

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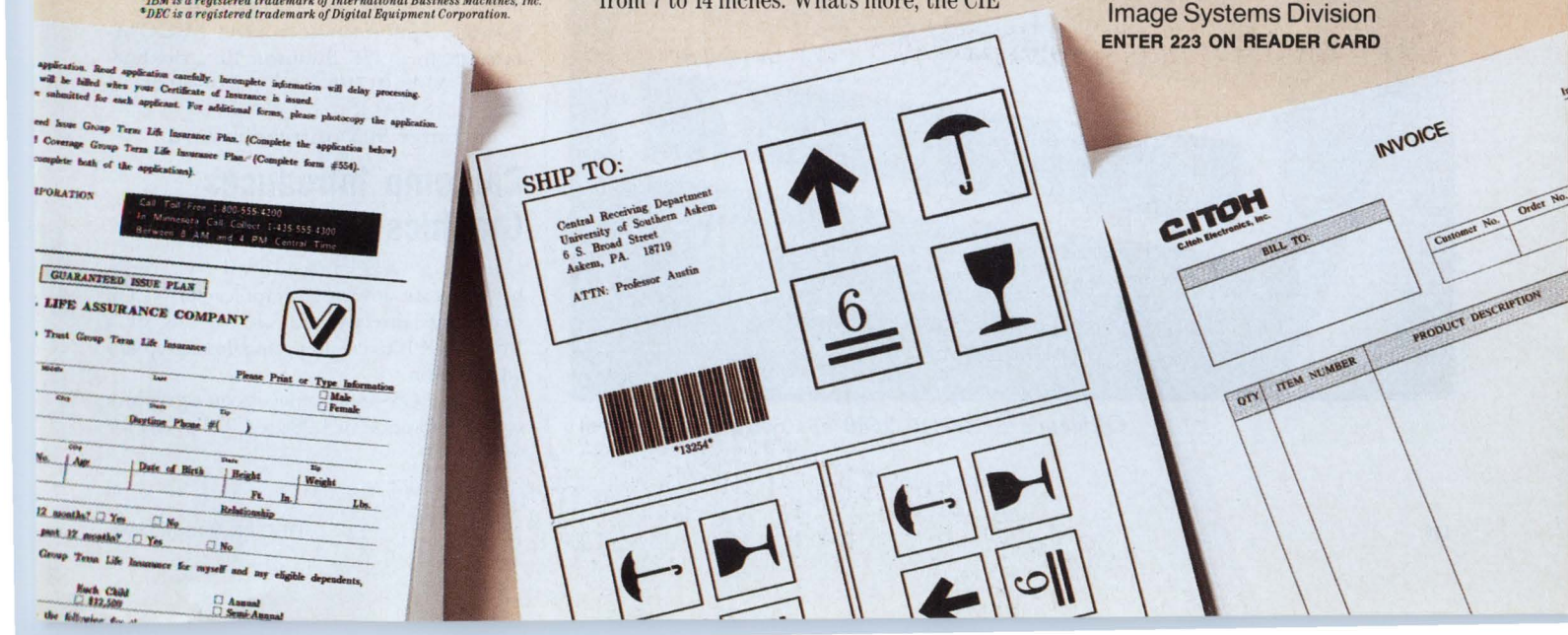


MARKETPLACE

Interlink Announces IBM To DEC Emulation

Interlink Computer Sciences Inc. has announced the availability of the first full-screen bidirectional terminal emulation package for IBM to DEC connectivity.

Interlinks's 327x Emulator permits DEC VT100/220 terminal users to connect to SNA applications in the IBM or compatible mainframe environment as if their terminal were a 3278 or other LU2 device. VTxx Emulator will allow IBM users to log into a VAX or RSX system, accessing most DEC applications, as if their terminal were a VT200/220.

Both systems also will include the first programmable "softkey" function, allowing users to preprogram up to 27 keys. With this softkey capability, Interlink Terminal Emulation users will be able to retrieve large amounts of data in a single keystroke.

Prices range from $5,950 for the 327x Emulator to $10,950 for the VTxx Emulator. For further information, contact Interlink Computer Sciences Inc., 47370 Fremont Boulevard, Fremont, CA 94538; (415) 657- 9800. TWX: 880 139 ICS FRMT UD.

Enter 900 on reader card

Okidata Introduces 9600 Bps Dial-Up Modem

Okidata has introduced a 9600 bps synchronous modem for use over dial-up or dedicated telephone lines. Featuring Automatic Adaptive Equalization provided by custom-designed components, the CLX96DP is ideal for use where public lines are of uncertain quality.

The new modem belongs to Okidata's CLX96 series of modems, targeted to businesses with existing or startup communications networks. The CLX96DP complies with IT&T Consultative Committee V.29 requirements for domestic and international 9600 bps synchronous data transmission and meets Federal Standard 1007 for government applications. It operates in half-duplex mode on dial up lines and half- or full-duplex mode on dedicated lines.

The suggested retail price of the CLX96DP is $1,495. Full maintenance, server and support are provided.

To find out more, contact Okidata, 532 Fellowship Rd., Mount Laurel, NJ 08054; (609) 235-2600. Telex: (710) 897-0792.

Enter 901 on reader card

Okidata's CLX96DP 9600 bps synchronous modem.

MICOM-Interlan Updates TCP/IP

MICOM-Interlan announces the availability of Version 1.1 of its TCP/IP networking software for use with VAX and MicroVAX systems running the VMS operating system. Version 1.1 boosts TCP/IP performance 30 percent over earlier versions and includes several new features that help programmers streamline the development of networked applications. The performance of the VAX or MicroVAX host is not affected by TCP/IP protocol processing since this is handled by a MICOM-Interlan NP series intelligent protocol processor that plugs directly into a VAX UNIBUS or MicroVAX Q-bus. The NP100 handles TCP/IP processing for VAX hosts, the NP200 for MicroVAXs.

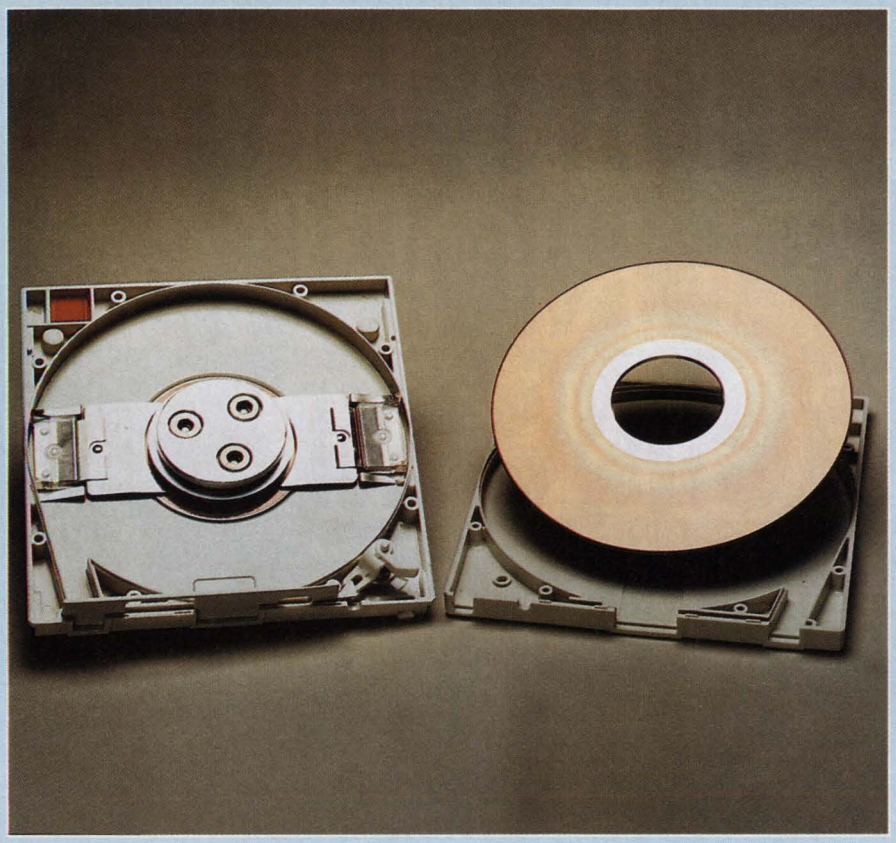
For more information, contact MICOM-Interlan Inc., 155 Swanson Rd., Boxborough, MA 01719; (617) 263-9929 or (800) LAN-TALK.

Enter 905 on reader card

CalComp Introduces Graphics Subsystem

CalComp has introduced a high-performance, low-cost graphics subsystem that plugs directly into the Q-bus of a MicroVAX II to create a standalone graphics workstation.

The CGS-4600 achieves color graphics with a resolution of 1,280 x 1,024 pixels for



Winchester Announces New Subsystem Family

A new family of Q-bus compatible Winchester disk subsystems has been announced by Winchester Systems Inc. Using twin drive Winchester technology, Winchester Systems offers a 5¼-inch 26 MB hard disk cartridge drive coupled with a high-performance 5¼-inch fixed Winchester drive. The company's new 26 MB DataSafe product family consists of five different models with capacities of 80, 110, 165 and 226 MB, including the Winchester cartridge. The systems run all standard LSI-11 and MicroVAX operating software. All storage is accessed as "DU" devices and the subsystem operates with DEC standard "DU" software drivers. The single dual-wide Q-bus controller implements the MSCP protocol, supports both 18- and 22-bit addressing and controls both the fixed and removable disk drives.

Quantity prices for 26-MB removable subsystems start at $4,995 in OEM quantities.

To learn more, contact Winchester Systems, 400 West Cummings Park, Woburn, MA 01801; (617) 933-8500.

Enter 950 on reader card

applications such as CAD/CAM, electrical and electronic CAD, mapping, command and control, simulation and animation.

The graphics engine card occupies a slot in the MicroVAX II and performs the complex graphics processing tasks that previously required a dedicated controller. As many as four of these cards can be installed in a single MicroVAX II, permitting multiple independent graphics workstations.

The CGS-4600 is priced at $6,995 for the complete subsystem with the 15-inch monitor, $9,495 with the 19-inch monitor. The graphics engine card purchased separately sells for $3,995.

More information can be obtained from CalComp Display Products Division, 65 River Rd., Hudson, NH 03051; (603) 885-8280.

Enter 902 on reader card

Polygen Introduces CENTRUM

Polygen Corporation has announced the CENTRUM Technical Information Management System, a unified computer-based research automation environment for the chemical and pharmaceutical industries.

CENTRUM is the first integrated research automation system targeted specifically at improving the productivity of chemical and pharmaceutical researches. CENTRUM provides scientific researchers automate the production of typeset-quality technical documents, such as research reports, papers, abstracts, patent applications and correspondence.

DEC is providing Polygen with technical consultation and prototypes of its family of personal graphics workstations. CENTRUM will run under the ULTRIX and VMS operating systems on the VAXstation 2000 and on other members of the VAX family.

For further information, contact Polygen Corporation, 200 Fifth Ave., Waltham, MA 02254; (617) 890-2888. Telex: 387 810 POLYGNUS.

Enter 906 on reader card

Stellar To Market Template's FIGARO

Template Graphics Software has signed a contract with Stellar Computer Inc., that gives Stellar the right to market a version of Template's FIGARO software product. FIGARO software is the first conformant implementation of the Programmer's Hierarchical Interactive Graphics Standard (PHIGS). It will be engineered by both Template and Stellar to fully integrate with Stellar hardware and standard software platforms such as X-windows.

FIGARO software is the first commercially available PHIGS implementation for end users, system integrators, and graphics computer manufacturers.

Template Graphics Software is a division of Megatek Corporation, located at 9645 Scranton Rd., San Diego, CA 92121; (619) 457-5359.

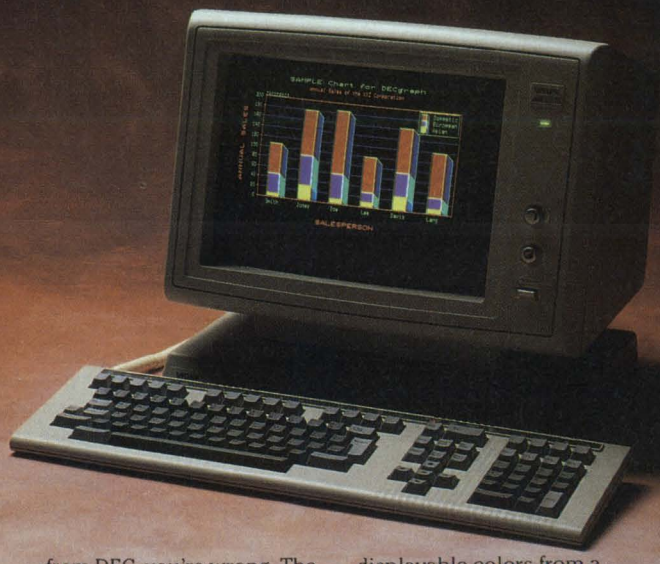
Enter 908 on reader card

Telcor Sets Standard In Dial Networking

Telcor Systems Corporation has been awarded a U.S. patent for its new data compression algorithm. Telcor can quadruple the asynchronous data transfer rates over any modem up to 38,400 bps over dial-up telephone lines for under $1,000 with its Accelerator 3124 modem attachment.

The Accelerator is available as a stand-alone data compression product that can be

NOW THE PRICE OF SUPERIORITY BEGINS AT ONLY $1395.



Here's our superior proposition: Invest a few minutes of your time and see how the VISUAL family of graphics terminals can deliver more performance for less money than you might expect.

For example, compare the VISUAL 241 color graphics terminal to the DEC VT 241.™ The VISUAL 241 gives you superior ReGIS graphics resolution on its non-glare screen; 30 programmable function keys, including 15 non-volatile; four displayable colors (16 optionally) from a palette of 64; two auxiliary ports; and a variable tilt display. All this plus enhanced Tektronix 4010/4014™ emulation not available from DEC.

Now, if you expect to pay a premium for graphics terminals that outperform those from DEC, you're wrong. The VISUAL 241 color graphics terminal is now only $1,895. The VISUAL 240, its monochrome companion, is now only $1,395. And for a limited time, we can make these exciting offers: buy only five VISUAL 240s and get one VISUAL 241 absolutely FREE! Or, buy five VISUAL 241s and get FREE color upgrades (16 displayable colors from a palette of 64) for ALL FIVE terminals!

If the prospect of getting more graphics terminal for less money is compatible with your way of doing business, it's time to call. Because the only way to see superiority is to see a demonstration. So call 1-800-VISUAL-C and see for yourself.

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Visual Technology Incorporated, 1703 Middlesex Street, Lowell, MA 01851, Telephone 1-800-VISUAL-C or 1-617-459-4903.
DEC™ is a registered trademark of Digital Equipment Corporation. Tektronix 4010/4014 is a registered trademark of Tektronix, Inc.

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attached to a modem or as a modem product. The Accelerator 3124 offers the end user both installation convenience and flexibility for $695. The Accelerator 2496 modem is a 2400 bps V.22 bis modem with built-in data compression that can quadruple data transfer rates up to 9600 bps on a dial-up telephone line for $995.

The Accelerator 3124 is available with data encryption standard (DES) security, callback and password security, a 17-digit master key and centralized network management capability for $895. The Accelerator 2496 is available with the same features for $1,195.

For additional information, contact Telcor Systems Corp., 12 Michigan Dr., Natick, MA; (617) 653-3995.

Enter 904 on reader card

Rugged's R/VS450 Introduced For Military

Rugged Digital Systems announced the introduction of its new R/VS450 ruggedized VAXstation 2000 systems and the R/625 ruggedized MicroVAX 2000 systems for battlefield deployment.

The R/625 contains a MicroVAX II processor and floating point unit, 2 MB of RAM expandable to 6 MB, 4 asynchronous ports and 2 removable half-height disk drives with a total capacity of almost 140 MB.

The R/VS450 provides the functionality of DEC's VAXstation 2000 system. In addition to the same system chassis as the R/625, it comes complete with a 1024 x 864 video controller with 128K video RAM, a ruggedized monochrome monitor, keyboard and a trackball or data tablet.

For more information, contact Rugged Digital Systems Inc., 328 Gibraltar Dr., Sunnyvale, CA 94089; (408) 747-1770.

Enter 907 on reader card

Racal-Vadic Unveils High-Speed Modem

Racal-Vadic has introduced its first rack-mountable 9600 bps dial-up modem. The VA9612 is a full-duplex asynchronous (9600, 1200 and 300 bps) or half-duplex synchronous (9600, 7200, 4800 and 1200 bps) high-speed modem with error control and Bell 212/103 compatibility. Maximum data throughput is assured by use of Racal-Vadic proprietary features, like the Dynamic Duplex technique.

The new VA9612, which installs in Racal-Vadic's industry standard MDS-I chassis, is an ideal central-site modem. As a companion to the proven 9600VP remote-site modem, it communicates at high data rates. Speed conversion enables a constant DTE interface speed of 9600 bps regardless of the line rate.

The VA9612 optimizes use of dial-up phone lines based on real-time data requirements and line quality. The Dynamic Duplex feature automatically switches line speed and direction as required by the application. Maximum line speed is adjusted up and down as line conditions allow.

Additional information may be obtained by contacting Racal Vadic, 1525 McCarthy Blvd., Milpitas, CA 95035; (408) 946-2227.

Enter 903 on reader card

Wyse Introduces ASCII, ANSI, Graphics Terminal

Wyse Technology has announced the first terminal to offer full ANSI, ASCII and PC compatibility plus graphics in one unit. The

product, WY-99GT, allows users to work in the ANSI/DEC VT220, multiuser personal computer or ASCII terminal environments. In addition, the WY-99GT's dedicated graphics coprocessor provides compatibility for the most popular graphics standards, including Tektronix 4010/4014, the PC-compatible Hercules and the IBM Color Graphics Adapter.

In the VMS/ULTRIX environment, the WY-99GT offers both VT220 compatibility and high resolution, plus graphics. In addition, the terminal provides dual-host connections, so users may switch from one computer environment to another without having to move or reconnect cables.

The WY-99GT is priced at $649.
For further information contact Wyse Technology, 3571 N. First St., San Jose, CA 95134; (408) 433-1000. FAX (408) 433-5612.

Enter 909 on reader card

Pedersen Offers Graphics Package

William A. Pedersen and Associates has announced the GRAPH220 business graphics software for the VT220 and comparable ANSI terminals. Users who previously could only view data as tables or needed more expensive graphics terminals now can develop and display business graphics on VT220s or compatible terminals without additional hardware. GRAPH220 runs as an application program under the VAX/VMS operating system.

List price for MicroVAX and VAX-11 systems is $795. For VAX 8000 series machines, the license lists at $1,495.
For further information, contact William A. Pedersen and Associates, 1037 North Fair Oaks Ave., Sunnyvale, CA 94089; (408) 734-9511.

Enter 910 on reader card

FormScan Introduces PageReader

The Palantir Corporation and FormScan Inc. jointly announced the introduction of FormScan's PageReader document conversion system. The PageReader system scans text from virtually any document and automatically converts it into the format of many leading word processors, PC word processing packages, electronic publishing systems and other office automation systems. Applications include litigation processing, office automation, database creation, typesetting and electronic publishing.

The PageReader converts documents into the specific formats required for systems such as IBM, Wang and CPT. PC word processing packages such as MultiMate, Samna Word, Displaywrite 2, 3 and 4, WordStar and WordPerfect also are supported. Conversion programs are available for Mass-11 and Digital's ALL-IN-ONE OA package on VAX computers. Forms reading capabilities and image handling features will be available soon.

The PageReader system costs approximately $52,000.
To find out more, contact Leonard Feldman at Palantir; (408) 986-8006.

Enter 911 on reader card

Dmi Ships New Products For VAXmate

Dmi has shipped its recently announced DM300 expansion system for the VAXmate. The DM300 provides disk, tape, memory and other AT compatible subsystems. It

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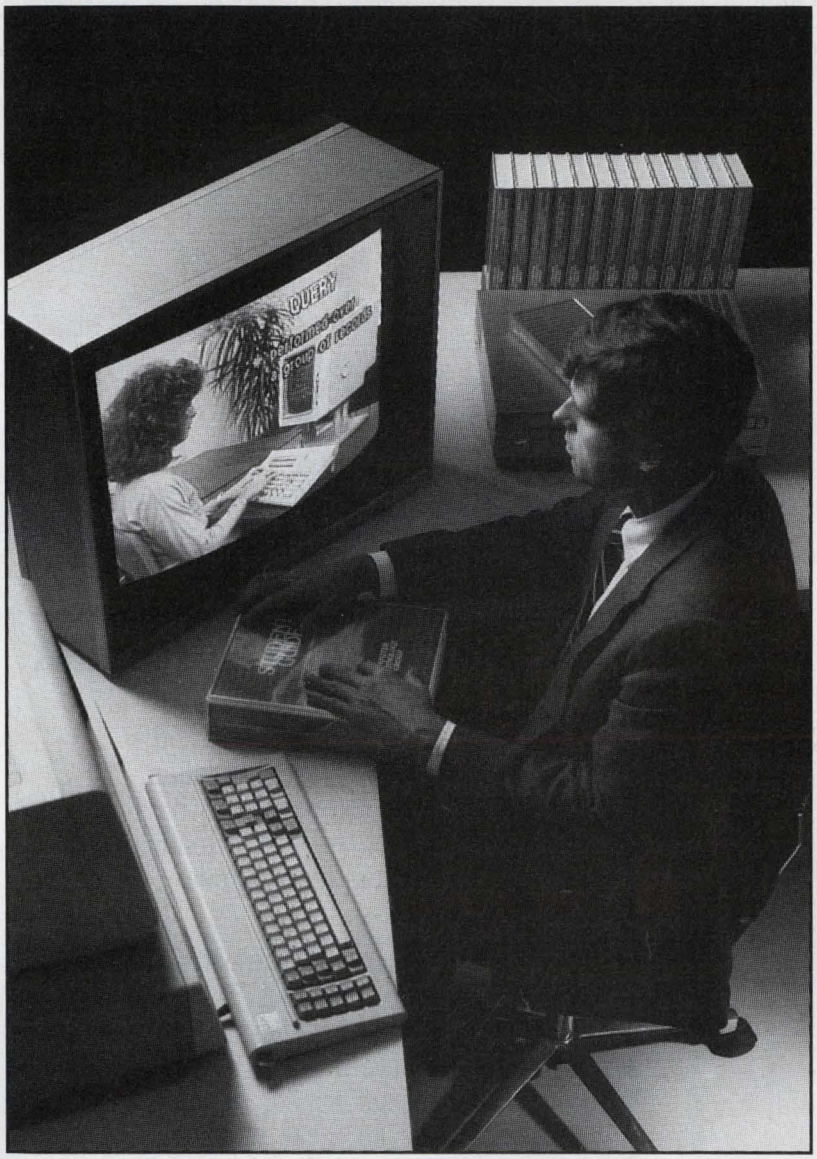

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UNIX Overview
UNIX Fundamentals for Programmers
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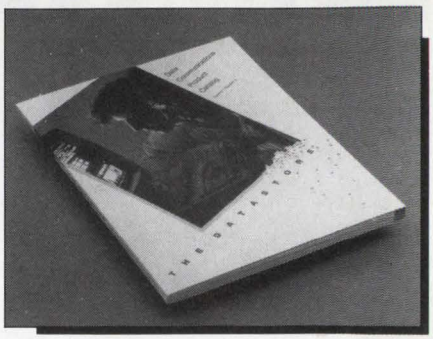
enhances the VAXmate by offering flexibility, price performance and ergonomic benefits to the end user.

The DM300 is a cool-running subsystem that mounts underneath the VAXmate to provide full disk and tape backup capability plus additional memory and color graphics features. A system master on/off switch provides conditioned power to the entire system with surge and EMI/RFI suppression. The DM300 accepts two standard AT compatible 5¼-inch peripherals, three IBM compatible add-on boards, including one long AT board and two short XT boards in addition to the built-in disk controller board.

Standard configurations start at $1595 for a 20-MB hard disk system.

For further information, contact dmi at 27635 Forber Rd., Suite H, Laguna Niguel, CA 92677; (714) 955-2422.

Enter 912 on reader card



A comprehensive data communications sourcebook from The Datastore.

Data Communications Sourcebook Announced

The Datastore has released a new edition of its Data Communications Sourcebook. The sourcebook is divided into 12 sections consisting of modems, multiplexers, terminals, printers, etc. Each product section is organized by manufacturer and provides detailed product descriptions, features, application diagrams and ordering information.

The Datastore provides presale application assistance for users implementing point-to-point or multipoint networks as well as system configuration, network design, and installation support. Through its DATACOMM KITTING Program, The Datastore will warehouse, test, configure, and drop ship equipment for users with planned multiple site installations.

For further information, contact The Datastore Inc., 119 East Kings Hwy., Kings Highway Commerce Center, Maple Shade, NJ 08052; (800) 533-4190, in NJ (609) 722-8000.

Enter 914 on reader card

System Industries Ships SI 9625

System Industries Inc. announced availability of its SI 9625 Tape Subsystem. The SI 9625 is a full-featured dual density backup solution that offers an enhanced 100 inches per second streaming capability and a 50 ips start/stop mode. It uses a 256K cache buffer to achieve optimum streaming performance, and features fully automated tape loading. The SI 9625 is fully compatible with TE16, TU45, TU77 formats, and can be interfaced to virtually any DEC minicomputer.

The SI 9625 comes complete with tape transport, integral formatter/controller, power supply and resident microdiagnostics.

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Here's a sample of what's included—

For use with TSX+ only:

CTRLC* Control-C another user's program when it hangs (instead of KILLing the job).
HANDMP* Write a snapshot copy of current handler memory to a disk file for later analysis.
HANLOD* Load a fresh copy of handler ("fixes" some hung device situations).
LDSHOW* Show another user's logical disk subset (or subdirectory) mounts.
PDUMP* Dumps out memory of TSX+ or of another user's running program.
SETOP* Sets operator console (terminal that OPERATOR messages go to).
SHOFIL* Lists all open files: file name, size, date, for each running program with job number and program name.
SQSY* Squeeze system disk from non-operator console terminal under TSX+.
TSBOOT* Reliably boot RT-11™ from TSX+ (for unsupported TSX+ devices).
TTPEEK* Most wanted utility! Displays what is being output to another user's terminal. Invaluable for locating problems with dialup users.
XSEND* Extended SEND command, sends to terminal whether or not logged on, time/date stamps message.
USAS* Show another user's assignments.

For use with either TSX+ and/or RT-11:

CMPRES Data compression program minimizes data transmission time or storage space.
COPBLK Generalized copy utility. Copies blocks, or byte strings, optionally concatenates at high speed.
CRSEG* Adds a segment to a directory (use with ?PIP-F-Device full).
CS Compute CRCs of files on a disk, or display names of those files that have changed since last run.
DIRBAK* Create a backup copy of a disk directory in case the directory becomes corrupted. A "must" program.
DIRDMP* Display directory in dump format (Octal, ASCII).
DIRRST* Restore a disk directory from the backup copy made by DIRBAK.
DMPMAC Convert binary file (e.g. TRANSF.SAV) to MACRO for downloading to a remote system.
DSKCOM High speed disk compare.
FIXDIR* Patches an invalid directory to ignore bad segments.
MTCOPY Copy between magnetic tape and disk files. Duplicate arbitrarily formatted tape (IBM, ANSI, DOS, etc.)
MTDUMP Dump a tape. Necessary tool for tape analysis.
NCRYPT Encrypt or decrypt a file with user specifiable encryption key for security of data.
SDIR Search through (possibly nested) subdirectories without having to mount them.
SEARCH High speed search and optional replace through wildcarded file(s) or devices. Many users' favorite program.
SEGSCH* Search for a file through a selected segment in a fouled up directory.
SET* Allows SET command of RT-11 handlers under TSX+ or TSX+ handlers under RT-11, also invaluable for debugging SET routines in handlers.
SETSHO* Display device handler set option values, and handler statistics, and SYSGEN configurations.
TRUNC Program to truncate a file to a smaller size.
UNDEL* Undeletes files selected by wildcards. Preserves original date. Works when CREATE command fails. Optionally uses DIRBAK file to locate unlocatable files.
YT Type a file backwards (for looking at the end of a file—where error messages are found).
ZFILE* Zeros a file/device/tape at high speed (for security reasons).

For use with RT-11 only:

BD Use BD to recover files on a disk when directory becomes unreadable (if DIRBAK has been run).
DLTEST Show CSR/Vector/Speed of DL-11's on system. Emit test pattern to a selected port.
SR For debugging a program which traps to 4 or 10. Dumps registers, stack, and instructions.
TC Display trace of EMTs when a program is run (decodes each EMT with directive name and argument values).
TERMSW Switch console to DL-11 port (no Multi Terminal Support required).
ZT Switch console to DZ-11 port (no Multi Terminal Supprt required).

*A user must have sufficient privileges to use this program

Other Products available for TSX+ and/or RT-11 include:

MAIL A comprehensive & user-friendly electronic mail system.
DE Driver The "Eagle" disk driver for adding a HUGE disk.
DU+ Driver for a HUGE MSCP disk.
TSX-NET "Transparent" communications between RT & TSX+.
ARCHIVE Tape utility for saving and restoring disk files and subdirectories in convenient "save-sets".
CT*OS Full-featured word processor (now supports complete multi-national character set).
JSAM Coming soon: multi-key ISAM for DBL 2.2 users.
TSX-Plus The user-friendly multi-user operating system.
DBL Dibol compiler for RT-11 and TSX-Plus.

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The Ramtek 4660 interactive imaging and graphics display terminal.

A wide variety of high-performance SI disk drives and controllers can be mounted in the same space-saving cabinet to provide additional online storage and data retrieval capabilities. A dual channel option enables two processors to connect to the same tape subsystem.

System Industries Inc. is located at 560 Cottonwood Dr., Milpitas, CA 95035; (408) 432-1212. Telex: 683-9138.

Enter 915 on reader card

Ramtek Shows Two New Product Families

Ramtek Corporation introduced two new graphic display product families. The Ramtek 432X and 466X series of products provides graphics and imaging functionality and performance previously not available in the marketplace.

The Ramtek 4327 is the first in the 432X series of high-performance 2-D color graphic display terminals designed for process control, finite element analysis, CAD/CAM and command and control applications. The products can be used with a variety of host computers through a number of supported standard interfaces and emulators. The Ramtek 4327 features graphic resolution of 1280 x 1024 pixels and can support up to 256 on-screen colors from a color palette of 16.7 million colors. The product can be configured with Ramtek's proprietary Transform and Draw Accelerator based on DataFlow processor architecture for high-speed graphic arithmetic processing (20 MIPs computational speed).

The Ramtek 4660 product is the first in the 466X series of high-performance graphic/imaging display generators targeted to meteorological, geophysical analysis, simulation, remote sensing, medical and process control applications.

To learn more, contact Ramtek, 2211 Lawson La., P.O. Box 58024, Santa Clara, CA 95052-8024; (408) 988-2211.

Enter 913 on reader card

Data Communications Computers Unveiled

Jupiter Technology Inc. has introduced the SYSTEM 1000 family of data communications computer systems that enable compatible and incompatible computer products to communicate freely.

The SYSTEM 1000 hardware is a multiprocessing, multitasking computer that allows a large number of the communications processing pathways to be created and used simultaneously. The 68000-based, UNIX-compatible Host Processor controls the configuration of Softblocks and Softwires, system administration, and network management. The 68000-based input/output processors control the device connections and dynamic data paths once they are determined by Softlink. All processors are linked in a VMEbus environment. The SYSTEM 1000 can be expanded to incorporate up to 14 MC68000 family processor modules.

For further information, contact David Kitchen, Rich Nagle or Don Bradley at Miller Communications, (617) 536-0470.

Enter 916 on reader card

UPS Efficiency Guide Available For VAXs

A new guide for rating the efficiencies of uninterruptible power supply systems for VAX System computers, titled *UPS — The Cost of Ownership*, is available from Solidstate Controls Inc.

The guide concerns itself with UPS annual operating costs. These costs include the actual cost of powering the UPS and the cost of the air conditioning or cooling required to maintain constant computer room temperature due to heat dissipation from normal UPS operation.

Typical operating efficiencies are charted for three UPS technologies: ferroresonant transformer (FERRO); solidstate control rectifier, pulse width modulation (SCR-PWM); and Powerbase transistor, pulse width modulation (PB-PWM). Efficiencies then are translated into UPS total operating cost and power cost savings tables, using PB-PWM technology as the basis for evaluation.

For a copy of *UPS — The Cost of Ownership*, write to Solidstate Controls Inc., Inquiry Handling Dept., Box 57, Dublin, OH 43017-0057; (614) 846-7500. Telex: 245-338.

Enter 918 on reader card

Ultimate Introduces UltiVAX II

The Ultimate Corporation recently introduced the UltiVAX II, a new product configuration based on the MicroVAX II minicomputer. The UltiVAX was designed and engineered by DEC to accommodate the Ultimate Operating System, an enhanced version of the Pick operating system.

The Ultimate Operating System coresides with DEC's VMS Operating System. A user may select either the VMS or the Ultimate environment, depending on application requirements. Simple commands move data easily between the two environments. To learn more, contact The Ultimate Corp., 717 Ridgedale Ave., East Hanover, NJ 07936; (201) 887-9222.

Enter 919 on reader card

SI Unveils Fast DSA Compatible Subsystems

System Industries Inc. has announced a family of advanced data storage solutions based on the new SI93 C-Series disk drive that features 1.1 gigabytes of unformatted capacity in a compact half-rack design. The SI93C delivers an average seek time of 15 milliseconds. Formatted capacity for each of these DSA-compatible drives is 844 MB, and data is transferred at a peak rate of 2.46 MBps.

Because the SI93C drives offer more capacity per spindle, fewer disk interface ports are required to support high-capacity arrays. For example, a six-drive SI693C provides slightly greater capacity than eight drives in DEC's SA482 scheme and uses two less controller ports to achieve the desired capacity.

To obtain additional information, contact System Industries, 560 Cottonwood Drive, Milpitas, CA 95035; (408) 432-1212.

Enter 920 on reader card

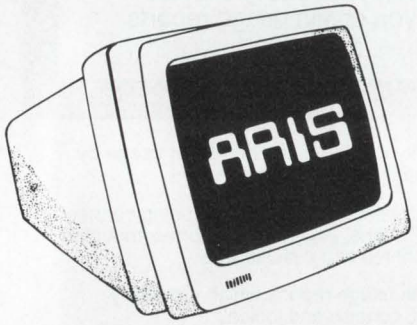
ProCode Speeds Programming 10 Fold

Beta test users of ProCode, Clyde Digital Systems' new code generator for VAX/VMS

From DEC PROFESSIONAL

FREE BULLETIN BOARD SERVICE FOR OUR READERS

WHO: Our on-line bulletin board is free to all subscribers.
WHERE: From your terminal to ours . . . just log in.
WHAT: It's called ARIS (Automated Reader Information Service). Dial in and "talk" to staff, advertisers, other readers.



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1. Set your VAX terminal to 7 bits, 1 stop, no or space parity. (300, 1200, or 2400 BAUD available)
2. Dial (215) 542-9458.
3. You will be asked to enter your subscriber number (it's on your mailing label) and your name.

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NEW MESSAGE CENTER
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systems, reported a ten fold increase in programmer productivity when using the newly released ProCode V2.0.

ProCode creates source code in several industry-recognized languages such as VAX BASIC, COBOL, FORTRAN, C, and Assembly code. The VAX BASIC source code generator is fully supported in ProCode 2.0.

The ProCode tool is menu driven and screen oriented. The user enters database design information, creates report or data entry screen images, and defines the logical procedures to be used. The system then creates 100 percent of the described application in error-free source code. No human coding is required. The system can produce many types of programs, including business applications, real-time data gathering and process control functions.

The system currently ranges in price from $55,000 to $85,000.

More information is available from Clyde Digital Systems, P.O. Box 4500, Provo, UT 84603; (801) 224-5306.

Enter 921 on reader card

System Chassis Can Use Any MicroVAX II

A new System Chassis that can use any MicroVAX II, PDP-11/83, PDP-11/53, PDP-11/73 OR PDP-11/23 CPU now is available from MDB Systems Inc.

The chassis allows system builders or users the flexibility of upgrading 11/23- or 11/73-based systems as their requirements grow into larger and faster systems that require the speeds of 11/83 or MicroVAX II CPUs.

The MLSI-BALL-2200 is priced at $1,950. Delivery is two to four weeks ARO. To learn more, contact MDB Systems Inc., 1995 North Batavia St., Box 5508, Orange, CA 92613-5508; (714) 996-6900. TWX: 910 593 1339.

Enter 917 on reader card

Memory Prices Slashed By Chrislin

Chrislin Industries has had a price reduction on most memory modules for the Q-bus, MicroVAX II, and VAX systems. The CI-1173 4 MB and the CI-1173-EDC 2 MB with Error Detection and Correction Code for the Q-bus have been reduced from $1,340 to $940 and $1,160 to $1,015 respectively.

Savings also are available for upgrading your MicroVAX II with CI-MIV16 16 MB. The CI-MIV16 was reduced in price from $4,595 to $4,195. The CI-V53 and CI-VAX4 for the 11/725, 730, 750, and 11/780, 785 also have been reduced from $675 to $555 and $1,640 to $965 respectively.

Prices have been slashed on many more items.

For further information, contact Chrislin Industries, Rd. 188, KM. 0.8, Industrial San Isidro, P.O. Box FF, Canovanas, PR 00629-1657; (800) 468-0736. Telex: 345-4170 CHRISLN PD.

Enter 922 on reader card

Multilingual Business Software Introduced

Digital Linguistix Corporation has introduced multilanguage business software designed for use by companies with international offices and/or multilingual personnel.

The DLC software operates in English, French and Spanish concurrently. The International Software System uses a single program set to execute all instructions and create a single database, regardless of the language used to enter information. The initial release of the software supports the VAX on DEC, and runs on up to 400 terminals.

DLC's multilanguage software package is fully integrated, allowing users the option of choosing in which language information is displayed. Language changes are made from a menu with a single keystroke. Reports can be run in any of the languages, with information being entered in one language and retrieved in another, even from remote locations.

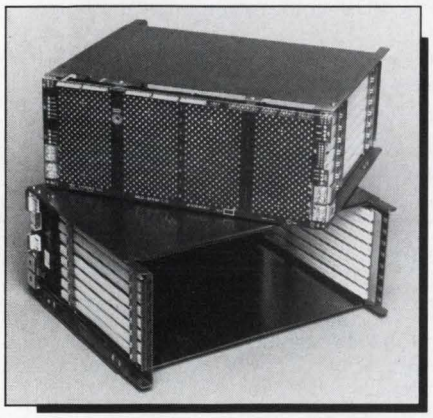
Single user, multiuser and site licensing pricing information, as well as VAR information kits, are available from Digital Linguistix Corporation, 10 Bloomfield Ave., Box 609, Pine Brook, NJ 07058; (201) 882-3630.

Enter 923 on reader card

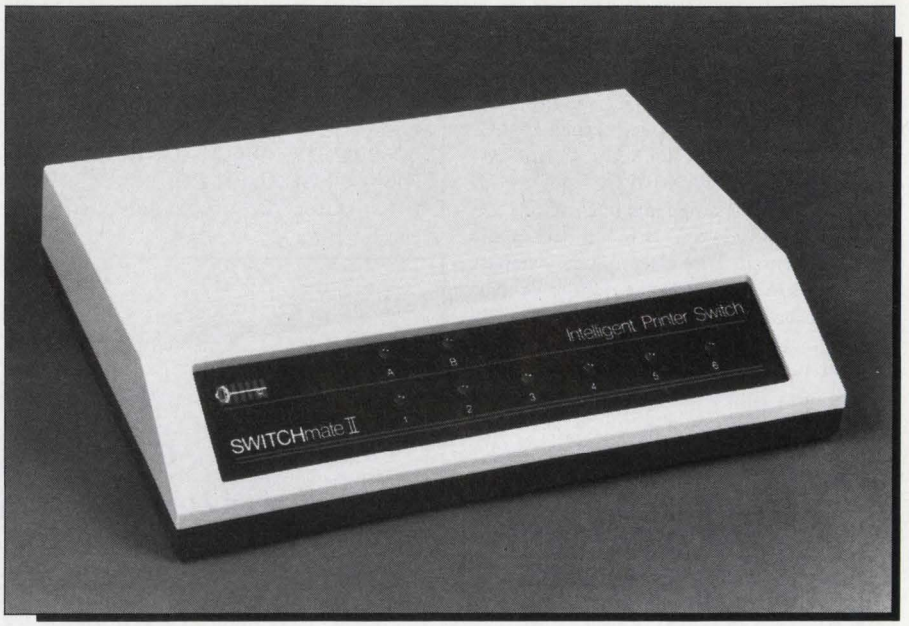
New Backplane Available From MDB

A new backplane/card cage assembly that accommodates MicroVAX II and PDP-11/83 CPUs now is available from MDB Systems Inc. It can house eight quad size or 13 functional dual size modules, or any combination of the two.

Designed for use by System Integrators or OEMs in their own chassis, the backplane also can accommodate dual or quad size LSI-11/23 and LSI-11/73 CPUs. Systems with these older model CPUs can be upgraded easily to more advanced and powerful systems by replacing CPU and memory modules with those with PMI or C/D interconnect schemes.



MDB Systems' new backplane/cardguide assembly is for all DEC CPU boards.



SWITCHmate II is the intelligent printer switch from Gold Key Electronics.

The MLSI-BPA84-C/D has a list price of $515.

For more information, contact MDB Systems, 1995 N. Batavia St., Box 5508, Orange, CA 92613-5508; (714) 998-6900.

Enter 933 on reader card

More Options With SWITCHmate II

Gold Key Electronics Inc. announced the release of its SWITCHmate II product, an intelligent printer switch that provides users with more printing options at reduced costs. The SWITCHmate II is designed specifically for compatibility within the DEC environment.

The SWITCHmate II handles printer requests automatically and transparently; the user can send the same print requests as when using a dedicated printer. If the shared printer is already printing, documents are queued automatically to print.

The SWITCHmate II also manages VAX queues to prevent "hogging" of the printer, prevents interference between print jobs by resetting the printer and returning to top of form, manages sheetfeeders whether or not the system is aware of their presence, reports all printer errors to the currently active system and prevents drop of connection until an error condition is corrected, and prevents connection to a printer not ready to print.

For further information, contact Gold Key Electronics Inc., P.O. Box 186, Goffstown, NH 03045; (603) 625-8518.

Enter 936 on reader card

Alisa Supports AppleShare File Services

Alisa Systems announced that it plans to support the Apple Communications Framework, including AppleShare File Server protocols in the next major release of its file server for VAX/VMS.

AlisaTalk connects to AppleTalk LANs via Ethernet and one or more FastPath bridges, manufactured by Kinetics Inc., of Walnut Creek, California. Multiple FastPath units may be connected to an Ethernet bus, enabling separate LANs to be logically connected. AlisaTalk can be used with existing DECnet Ethernet hardware, with DECnet and AppleTalk data sharing the same Ethernet cable.

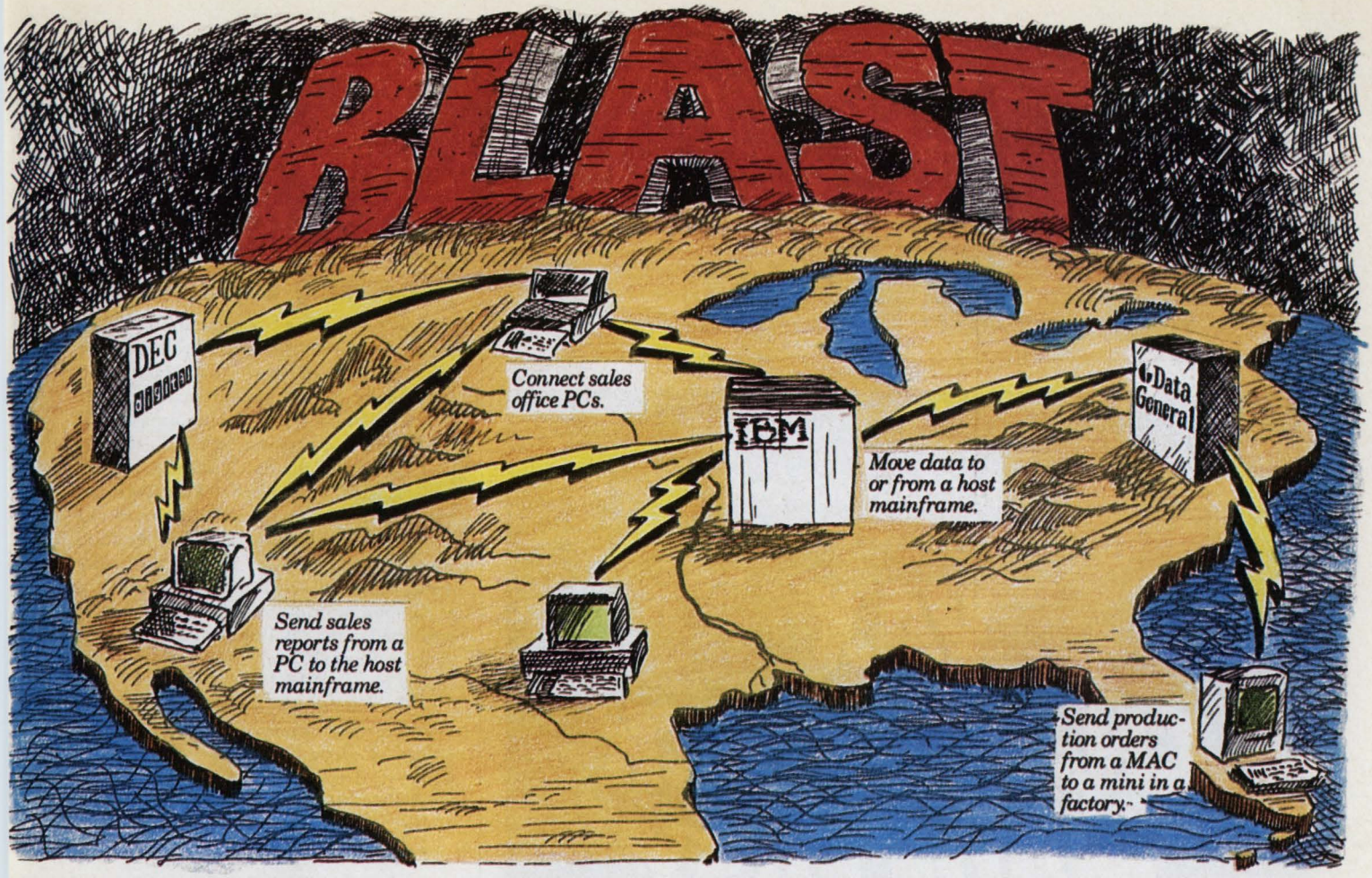
It is also possible to use a terminal port on the VAX as one end of a "half-bridge" link via RS-232 to a Hayes InterBridge or another VAX system at a remote location. Such support makes the VAX suitable as a "communications hub" for geographically dispersed AppleTalk networks.

For more information, contact Alisa System Inc., 221 E. Walnut St., Ste. 230, Pasadena, CA 91101; (818) 792-9474.

Enter 924 on reader card

C & C/COMENDEC Releases Q-ARC-01

C & C/COMENDEC announced the release of their new LAN interface board, the Q-ARC-01, for linking DEC microcomputer systems to the ARCNET network. This Q-bus compatible product provides an



THE AGE OF CONNECTIVITY IS HERE

Funny thing about critical information; it never seems to be available when you need it most. The sales data for a big meeting is in the branch office...in Alaska. Or in another computer down the hall. How do you access the data you need quickly, at low cost, and without resorting to unreliable methods such as XModem or Kermit or other relics from the Dark Ages?

BLAST IS THE MODERN SOLUTION, a high-performance asynchronous software package that solves the problem of transferring information between different computers, no matter what kind of operating system is involved.

"The BLAST product is one of the more exciting offers in this market."
-International Data Corporation

100% ERROR-FREE GUARANTEED. Better than simple PC-only software, BLAST runs on both computers in the link, assuring reliability and data integrity with a rugged protocol. Your data BLASTs through noisy phone lines, defective cables, PBXs, and all the other obstacles that hung up yesterday's products.

BLAST RUNS ON PCs, MINIS, AND MAINFRAMES, linking everything together for you. Whether 2 computers or 200; mainframes, minis, PCs and LANS all can share data, and BLAST translates between the different systems.

"If BLAST were a U.S. Marshal instead of a communications program, it would probably be known as the fastest gun in the country."
-Data Communications magazine

SAVE MONEY WITH BLAST! Your data travels much faster, saving as much as 50% on your phone bill. Should a connection get lost, BLAST will restart from the point of disconnection, rather than from beginning. Easy-to-use scripts let you automate sequences for repetitive tasks like polling remote sites. Plus, BLAST lets you use PCs as terminals to other computers.

NOW AND IN THE FUTURE, BLAST brings you total compatibility and connectivity for whatever data you need...wherever it may be. No other software offers such advanced power in a low-cost, easy-to-use product for such a wide range of computers.

JOIN THE THOUSANDS OF SATISFIED USERS LIKE EXXON, RCA, GENERAL MOTORS, AND AT&T. Just call your local dealer and tell him you want to have a BLAST! Or for more information, call us at (504) 923-0888 or (800) 24 BLAST.

BLAST is available for most popular systems $250/up: **PCs & Laptops**-MS-DOS; CP/M, Macintosh, Xenix. **Minicomputers and Mainframes-IBM** VM/CMS, MVS/TSO; **DIGITAL (DEC)**-VAX/VMS, PDP, RT-11, TSX; **WANG VS; DATA GENERAL**-AOS/VS, RDOS, etc.; **HEWLETT PACKARD** 3000/1000; PRIME/PRIMOS, **UNIX/XENIX:** Sun, AT&T, etc.

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economical ARCNET connection for scientific, industrial, and commercial systems using MicroVAX II, MicroPDP, and LSI-11 architectures.

The Q-ARC-01 board functions as an intelligent slave, interfacing the SMC 9026 VLSI controller chip to 16, 18, and 22 bit versions of the Q-bus. It has 2K bytes of dual ported onboard RAM to provide four packet buffers of 512 bytes each, in any combination of sends and receives. The Q-ARC-01's pipelined architecture maximizes the speed of bus data transfers. The network buffer base address can be located on any 2048 byte boundary within the Q-bus addressing range (64K, 256K, or 2M), included within the I/O range.

Single piece price is $1,795.

For more information, contact C & C Marketing, P.O. Box 280, Batavia, IL 60510; (312) 879-2074.

Enter 925 on reader card

OTC Printer Has Networking Capabilities

Output Technology Corporation (OTC) announces the TriMatrix 850 PrintNet, their latest in a series of new record breaking 850 cps printers. It is the first dot matrix printer to feature built-in networking capabilities.

Up to five networking users can connect directly to the 850 PrintNet through resident serial ports. The 850 PrintNet is not only a printing station for multiple users, but also a powerful network communication controller and memory storage unit. Any device capable of serial communication, such as computers, printers, and modems, can be connected to the 850 PrintNet, and exchange data in RS-232C or RS-422 formats, at speeds up to 19.2K baud.

The 850 PrintNet is available for $2,995. For more information, contact Output Technology Corporation, East 9922 Montgomery, Ste. 6, Spokane WA 99206; (509) 926- 3855. Telex: 152-269 OUTPUT SPOK. FAX (509) 922-4742.

Enter 943 on reader card

Control Data To Maintain MasterDisk

American Digital Systems and Control Data Corporation have announced an agreement whereby Control Data will provide maintenance services for MasterDisk, disk storage systems from American Digital Systems. These services initially will be available in approximately 75 locations nationwide.

The MasterDisk system combines high capacity with the highest possible disk storage performance available for use with MicroVAX and Q-bus PDP-11 computer systems.

American Digital Systems is a national manufacturer of high-speed, high-performance mass storage products in the DEC market. Control Data is a national supplier of maintenance services for hardware systems manufactured by DEC, IBM and Control Data.

For more information contact American Digital Systems Inc., 75 Union Avenue, Sudbury, MA 01776; (617) 443-7711.

Enter 953 on reader card

CATS Provides Control Of DP Assets

Data Center Software announced the Computer Asset Tracking System (CATS) for

VAXmate and IBM PC/Compatibles. CATS provides complete control of all data processing assets (hardware, software, contracts, telephone equipment, etc.) Items are maintained at the serial number level with associated descriptive, location, and path configuration information. Cost, depreciation, chargeback, and budget/expense can be maintained for accurate financial control.

The problem management system within CATS provides the benefit of recording and tracking all problems related to equipment software of other data processing situations. A change management system provides an effective solution for managing all change request procedures. CATS is an online real-time saving system with easy-to-use menus for data entry and inquiry with extensive reporting.

CATS is available for $995.

For more information, contact Data Center Software, 447 Old Boston Rd., Topsfield, MA 01983; (617) 887-3656.

Enter 926 on reader card

Qualogy Controller Supports Floppy Drives

The Model D4110 controller from Qualogy Inc. is a dual-width Q-bus RX02 emulator that supports up to two 3.5-inch or 5.25-inch floppy drives in any combination, for ½ MB to 1 MB of formatted capacity. The D4110 can handle either single or double density disks. The new controller is compatible with DEC RX02 hardware and software.

The Model D4110 has more capability than any comparable product. It contains its own hardware bootstrap, on-board drive diagnostics (external diagnostic diskette in either 3.5- or 5.25-inch format) write precompensation, diskette formatting ability, diskette write protection and LSI-11 four-level interrupt protocol.

The D4110 is available for $695 in single quantities.

For more information, contact Qualogy Inc., 2241 Lundy Ave., San Jose, CA 95131; (408) 434-5200. Telex: 499-3489.

Enter 935 on reader card

Multi Soft Adds To SUPER-LINK

Multi Soft Inc. announced Version 3.0 of SUPER-LINK, its application development system for building cooperative peer-to-peer applications under CICS, TSO, VM/CMS and IDMS-DC.

This major release adds CPL/I, a PC-based fourth-generation language and BCF, a Background Communications Facility to the SUPER-LINK system. It also provides enhanced features and support for applications connectivity on Digital's VAX computer line running VMS.

The new Background Communication Facility enables PC applications written in C, PASCAL and Assembler to initiate and monitor background transactions on the IBM or DEC Host system, while a foreground PC application continues to process simultaneously.

The Base SUPER-LINK system, comprising File Transfer, Software Distribution and Peer-to-Peer communications is priced at $48,000. The new BCF and CPL/I 4GL options are priced separately at $10,000 each. For the VAX, pricing ranges from $12,000 to $42,000 depending on the CPU model. For more information, contact Multi Soft Inc., 510 Thornall St., Edison, NJ 08837; (201) 549-7722.

Enter 929 on reader card

Touchstone Ported To DEC VAX

Touchstone, the software program for microwave/RF circuit design from EEsof Inc. now is fully implemented on DEC's VAX series of computers. The program provides the full capabilities of the latest Touchstone 1.5 release, including new optimization techniques, linear circuit analysis capabilities, interactive tuning, and Monte Carlo yield prediction.

A new user interface system called the General User Interface, a set of software proprietary to EEsof and built into the program implementation, offers advanced graphics capabilities that include versatile windowing, polar and Smith chart display, and an interactive graphics cursor. These software features now are made available for the computing capabilities and multiterminal configurations of the VAX.

Users can access Touchstone's circuit design features from multiuser VAX stations, extending the program's capabilites and applications potential by allowing engineers to share files and access concurrent information through the VAX's native-mode operation. Touchstone on the VAX combines the advantages of Touchstone with the operating power of a multiterminal, multiuser environment.

The price for Touchstone on the VAX starts at $13,500.

For further information, contact EEsof Inc., 31194 La Baya Dr., Westlake Village, CA 91362; (818) 991-7530. Telex: 384809.

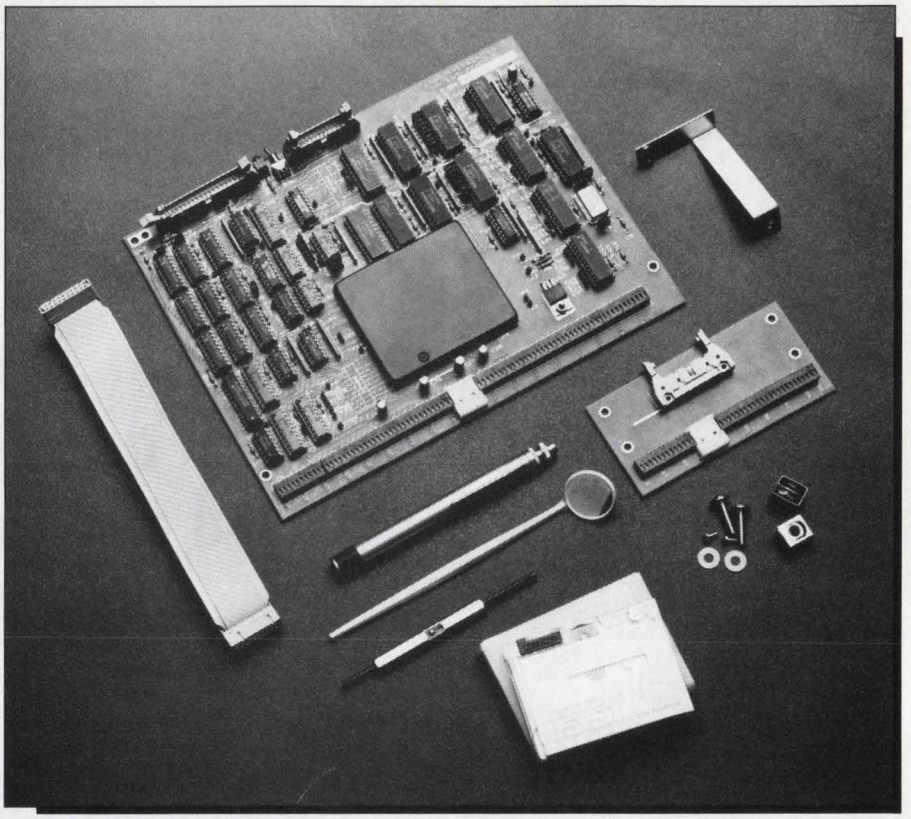
Enter 930 on reader card

The IVAC 750 Enhances The VAX 11/750

Iverson Inc., a DEC systems integrator, has introduced a significant enhancement for the VAX 11/750, the Iverson VAX Accelerator Card, or IVAC 750.

The IVAC 750 speeds up the processor of a VAX 11/750 from 15 to 25 percent, allowing additional users to be added to the system without loss of response time. It improves system speed by providing a new clock which pulses variably, according to the exact time required for each instruction, rather than a fixed pulse (compared to a standard VAX 11/750). The accelerator plugs onto the back of the backplane of an 11/750, conserving valuable space inside the computer. For CPU-intensive applications such as CAD/CAM, hardware and software development, CAE or compiling, the IVAC 750 dramatically increases system performance.

The IVAC 750 is transparent to system and application level software and requires no modifications. It comes ready to install.



The IVAC 750 accelerator board from Iversion Inc.

The accelerator also features and on/off toggle switch for returning the CPU to its standard, slower clock.

IVAC's list price is $9,950.

For further information, contact Iverson Inc., 850 Auburn Court, Fremont, CA 94539; (415) 659-1660.

Enter 938 on reader card

Government Contractors Migrate From PCs To VAX

Deltek Systems Inc. announced the release of its Government Contractors Accounting and Management System for the VAX environment.

The integration within the VAX environment provides larger government contractors with the ability to use the capabilities of the Deltek system. In addition, the VAX version provides a migration path for the Deltek user. A growing company can begin the use of their Deltek system on their PC, then go to a PC network, and then go to a VAX system. Also, the VAX version can provide uniformity to the contractor who wants to use the VAX version at their central location, and PC versions at their off-site divisions or subsidiaries.

The VAX version will operate on any VAX, from the MicroVAX II to the VAX 8800 series as well as within a VAXcluster environment (on VMS Version 4.2 and higher).

For more information, contact Deltek Systems Inc., 8320 Old Courthouse Rd., Ste. 405, Vienna, VA 22180; (703) 734-8606.

Enter 939 on reader card

Softool Releases 3.0 For VAX/VMS

Release 3.0 of Softool Corporation's Change and Configuration Control (CCC) environment now is available for the VAX computer running VMS. With CCC, all components of a given product can be organized, managed, and tracked as a unit.

CCC Release 3.0 provides significant enhancements and optimizations, including support for multiple module levels, the ability to apply changes automatically from one configuration to another, database and journal file integrity checkers, an enhanced Build Facility, a Programmable Interface to CCC, and the ability to communicate between CCC and the database across a network.

The cost of CCC on the VAX/VMS ranges from $10,000 for MicroVAX to $30,000 for the larger systems.

To learn more, contact Softool Corporation, 340 S. Kellogg Ave., Goleta, CA 93117; (805) 683-5777. Telex: 6583343.

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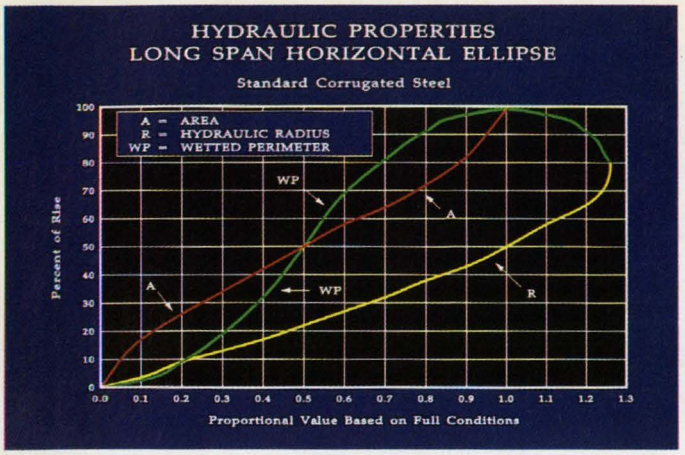
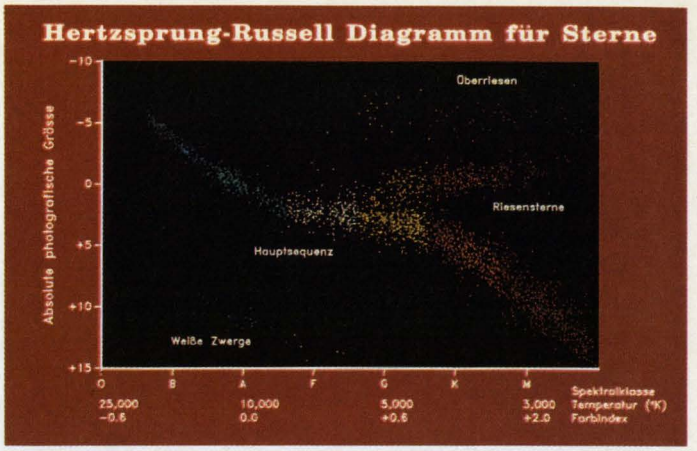
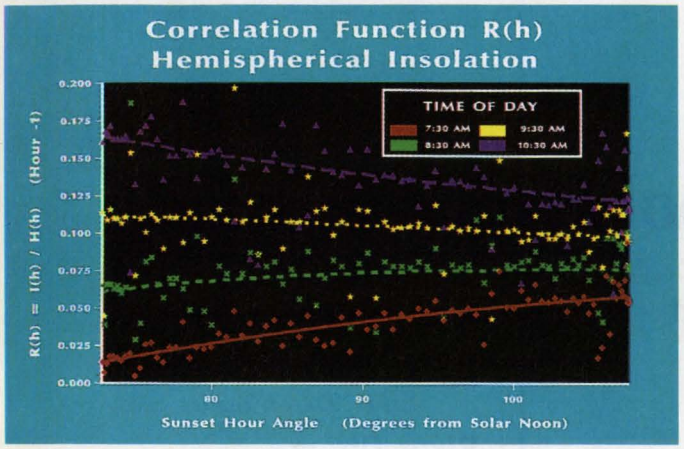


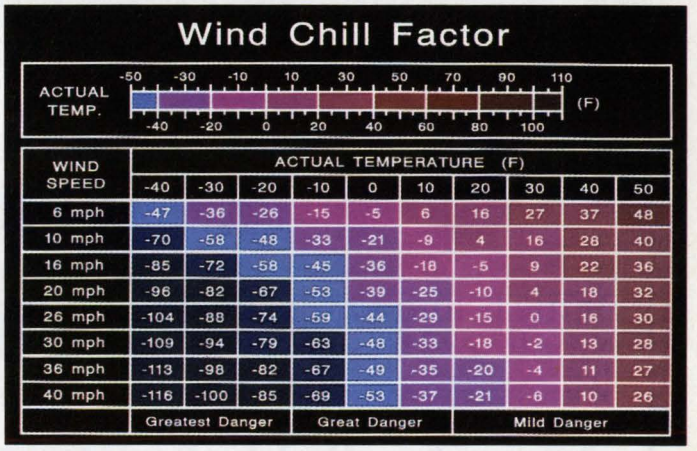
PicSure Plus' curve smoothing clarifies data representation. Shielding adds a professional look.



European text fonts offer a global graphics solution. Multiline annotations aid data interpretation.



Large datafiles can be read directly from disks. User retains complete control over all chart elements.



WIND SPEED	ACTUAL TEMPERATURE (F)									
	-40	-30	-20	-10	0	10	20	30	40	50
6 mph	-47	-36	-26	-15	-5	6	16	27	37	48
10 mph	-70	-58	-48	-33	-21	-9	4	16	28	40
16 mph	-85	-72	-58	-45	-36	-18	-5	9	22	36
20 mph	-96	-82	-67	-53	-39	-25	-10	4	18	32
26 mph	-104	-88	-74	-59	-44	-29	-15	0	16	30
30 mph	-109	-94	-79	-63	-48	-33	-18	-2	13	28
36 mph	-113	-98	-82	-67	-49	-35	-20	-4	11	27
40 mph	-116	-100	-85	-69	-53	-37	-21	-6	10	26
	Greatest Danger			Great Danger			Mild Danger			

PicSure Plus' menus allow easy data entry/editing. Extensive color table control for dynamic graphics.

Precision Visuals' PicSure Plus™

Practical Presentation Graphics for Your VAX

The Need

You need PicSure Plus™ if your work requires: ☐ Producing technical presentations or reviewing data ☐ Supporting a cross section of graphics users, from novice to expert ☐ Building custom user interfaces for specific applications ☐ Accessing and charting information from databases ☐ Pushbutton access to stored charts, datasets, command files, and metafiles ☐ Managing graphics production while maintaining device independence.

The Product

PicSure Plus is an interactive graphics system for producing charts and graphs. Prompting menus guide novice or occasional users in creating line, bar, scatter, pie, text, and table charts. Experienced users can access PicSure Plus features by entering commands, or building tailored menus for specific applications and environments. These user-interface options offer a flexible gateway to the most powerful set of charting functions available today.

The Features

☐ Powerful prompting menu interface speeds chart building for novice and occasional users ☐ Integrated command interface available for more advanced users ☐ Interactive positioning of all chart elements ☐ Directory keeps track of saved charts, datasets, command files, and metafiles—so users don't have to understand the computer's file system ☐ On-line tutorials and instant HELP facility for new users ☐ Easily combine multiple charts into a single image ☐ Draw charts simultaneously on multiple graphics devices for high production chart building ☐ Symbol creation for building flowcharts or illustrations ☐ Merge and annotate images created with other Precision Visuals products ☐ Read up to 10,000 datapoints from system files, or from other software packages ☐ Powerful numeric functions to perform arithmetic and statistical operations on your data ☐ Programmer's interface for accessing custom subroutines, databases, and the operating system ☐ Automatic layout and text sizing for word charts.

The User Interface

Users can move from prompting menu mode to command mode and back again, anytime. PicSure Plus also offers special commands for building prompting menu sessions. These user interface tools help you automate the production of frequently used charts, or design custom interfaces for end users.

The Environment

PicSure Plus runs on the entire VAX family, as well as a wide range of minicomputers and mainframes. Compose graphs on terminals and get hardcopies on laser printers, inkjet printers, pen plotters, and film recorders.

The Offer

PicSure Plus is the only graphics software solution with the range of features for even your most sophisticated charts, combined with user interfaces for the first-time user, occasional users, and experts. If you need functionality and ease-of-use in your graphics software, get the full story on PicSure Plus, and let us arrange a test drive.

Call Chris Logan at:

303/530-9000.

PrecisionVisuals®

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IOCS Unveiled Voice Response Module

Adding to its voice response product line, VOICE-NET, IOCS unveiled a voice response module that can interface directly with DEC's PDP-11, VAX, MicroVAX and MicroVAX 2000 computer lines. The VOICE-NET module can be plugged into an existing computer system and be functional immediately, using VOICE-NET's proprietary software and an audio response unit.

The VOICE-NET module allows users to access a database from any touch-tone telephone. Like a computer terminal's keyboard, the phone's key pad can be used to ask questions, respond to prompts and input information. The system converses with the caller through a digitized human voice.

The VOICE-NET module is an enhancement to VARs offering end user systems in the banking, government, health and transportation industries. VOICE-NET also can be configured as a fully integrated system.

To learn more, contact IOCS, 400 Totten Pond Rd., Waltham, MA 02254; (617) 890-2299.

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Pixar Offers Two Interfaces

Pixar has announced new interfaces between the Pixar Image Computer and both the Silicon Graphics 3100 series and the MicroVAX II computer systems. These systems join Sun Microsystems' Sun-3 and Symbolic Inc.'s 3600 family as hosts for the Pixar Image Computer, a programmable computer that is optimized for both advanced image processing and computer graphics.

The Pixar Image Computer's new interfaces give the large installed base of Silicon Graphics 3100 users in product design, broadcast, simulation and three-dimensional visualization, and MicroVAX II ULTRIX users in the scientific community, access to advanced image processing and computer graphics capabilities in one system.

The Pixar Image Computer's four-way, parallel-processor architecture, integrated with a large picture memory, processes high-resolution digital data at 40 million instructions per second (MIPS) using one-channel processor (Chap), and up to 120 MIPS with three Chaps.

The Pixar Image Computer is available for $79,000.

For additional information, contact Pixar, P.O. Box 13719, San Rafael, CA 94913; (415) 499-3600.

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Orion Announces ORGANON

ORGANON, a low-cost word processing system, designed exclusively for the VAX and MicroVAX, has been announced by Orion Information Systems (OIS). ORGANON is an easy to learn and use system with features that include menu and command drivers, "what-you-see-is-what-you-get" display, together with detailed online help and documentation.

The basic ORGANON package is priced at $1,500 for the MicroVAX and $2,500 for the VAX.

For more information, contact OIS-Orion Information Systems, 13741 Foothill Blvd., Ste. 260, Sylmar, CA 91342; (818) 364-1692.

Enter 937 on reader card

PC-To-VAX Connectivity With CommUnity-DOS/UB

IBM PC/XT/AT and a variety of PC compatible users now can access the power of the VAX from their personal computers without adding any additional hardware or software to the VAX itself. CommUnity-DOS/UB, a software package from Technology Concepts Inc., operating with an Ungermann-Bass Personal-NIU intelligent Ethernet controller, allows personal computers to become nodes in a DECnet Phase IV network. Functions include task-to-task communications, file transfer, remote directory, virtual terminal and network management. PCs already connected on an Ungermann-Bass Net/One Network using the NIU board need only purchase the CommUnity software component. These users can switch between Net/One and DECnet operation.

The single quantity price for the software for each PC is $600 and the Personal-NIU intelligent controller single quantity price is $895.

Contact Technology Concepts Inc. for the PC software at (617) 443-7311, or Ungermann-Bass, 3900 Freedom Circle, Santa Clara, CA 95052-8030; (408) 496-0111 for the Personal-NIU.

Enter 940 on reader card

Gray Technologies Releases DayTracker V2

Gray Technologies has announced the second release of DayTracker, a simplified time-management software tool designed to replace your appointment and resource scheduling books.

It is an advanced appointment scheduler that administers, locates and displays personal and corporate commitments. DayTrack also can be used to maintain and profile daily

expense reports and help you budget and manage your time more efficiently.

DayTracker, developed by SecondHand software Inc., is supported on all VAXs, running V 4.0 of VMS. Enhancements include Softkey functionality to facilitate the scheduling of group meetings; twenty item tickler file that allows you prioritizing and reminder capabilities; calendar cross referencing capabilities allow flexible scheduling of attendees to a meeting by automatically checking their calendars for availability; and the ability to schedule repetitive meetings.

DayTracker for the MicroVAX and VAX is priced at $1,500. For a clustered system, it is priced at $2,000.

To learn more, contact Gray Technologies, 111 Brigham St., Ste. 3D, Hudson, MA 01749; (617) 562-4393.

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TRIPS Is Trilogic's New Retail Software

Trilogic Systems Group, division of Trilogic Corporation, announced a new software product, Trilogic Retail Integrated Point-of-Sale (TRIPS). Written in DIBOL, Digital's business oriented language, the package is designed for the retailer who needs up-to-the-moment information at the cash register and back office accounting. TRIPS is available under the VMS operating system.

List price for TRIPS is $15,000, and product availability is immediate.

For further information, contact Trilogic Systems Group, Old Route 519, Canonsburg, PA 15317; (412) 745-0200.

Enter 951 on reader card

Productivity Products Announces Updates

Productivity Products International Inc. has introduced Release 3.3 of Objective-C and Release 1.3 of Vici for the UNIX operating system.

Objective-C is the object-oriented precompiler that enables C language developers to build software with reusable software components, using small amounts of new code to attach the parts. Release 3.3 is faster and includes new functionality and enhanced documentation.

Vici, the Objective-C and C interpreter, is a prototyping and debugging tool that lets software engineers build and test C and Objective-C applications. Vici 1.3 includes new facilities, improved functionality and new documentation.

For additional information, contact Productivity Products International Inc., 27 Glen Road, Sandy Hook, CT 06482; (203) 426-1875; Telex: 506127.

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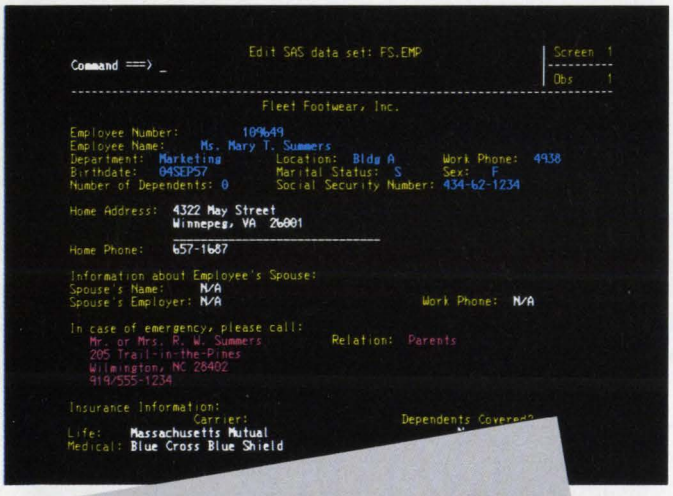

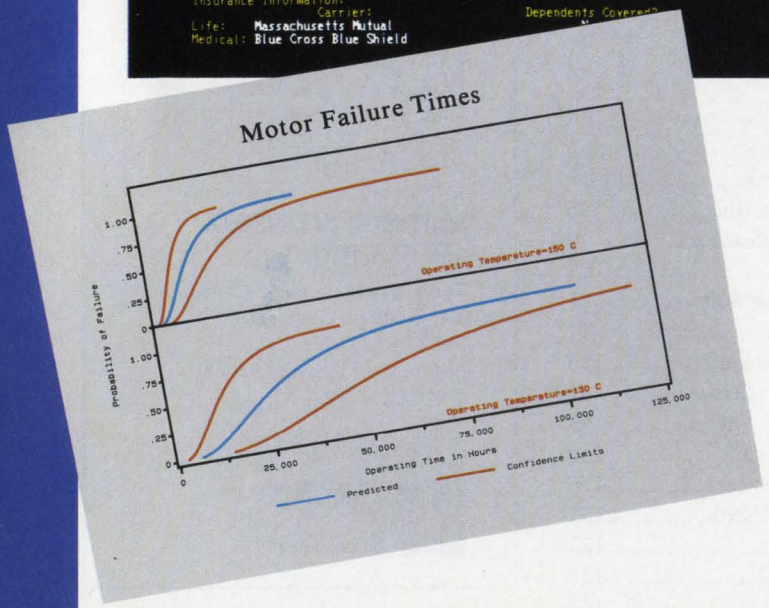

Above: Full-screen editing tools help you keep records and track information.

Below: You can graph results from the Version 5 survival analysis procedures for easy comparison.

Superior Statistical Tools. The SAS System includes everything from simple descriptive statistics to advanced regression, analysis of variance, discriminant analysis, clustering, and scoring. Version 5 includes new survival analysis techniques. We package these tools in ready-to-use procedures, so you don't have to be a statistician to produce the analysis you need.

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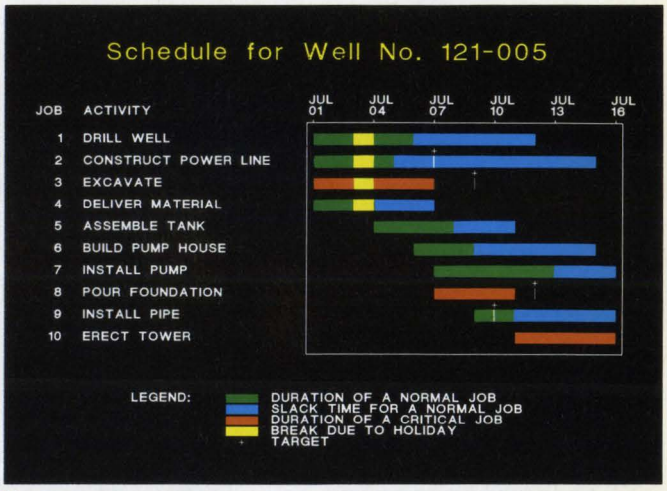

A new procedure for producing Gantt charts includes options for both line printer and color graphics output.

Easy Report Generator. Once you perform your analysis, you can present the results in easy-to-understand graphics. The SAS System has procedures for routine lists, tables, reports, charts, plots, and maps. New tools let you annotate your displays and put multiple graphs on the same page.

The SAS System runs on these minicomputers: Digital Equipment Corp. VAX™ 8600 and 11/7xx series under VMS;™ Prime Computer, Inc. Prime 50 series under PRIMOS;® and Data General Corp. ECLIPSE® MV series under AOS/VS. The SAS System also runs on IBM 370/30xx/43xx and compatible machines under OS, TSO, CMS, DOS/VSE, SSX, and ICCF; IBM XT/370 and AT/370 under VM/PC, and IBM PC XT and PC AT under PC DOS. Note: Not all products are available for all operating systems.

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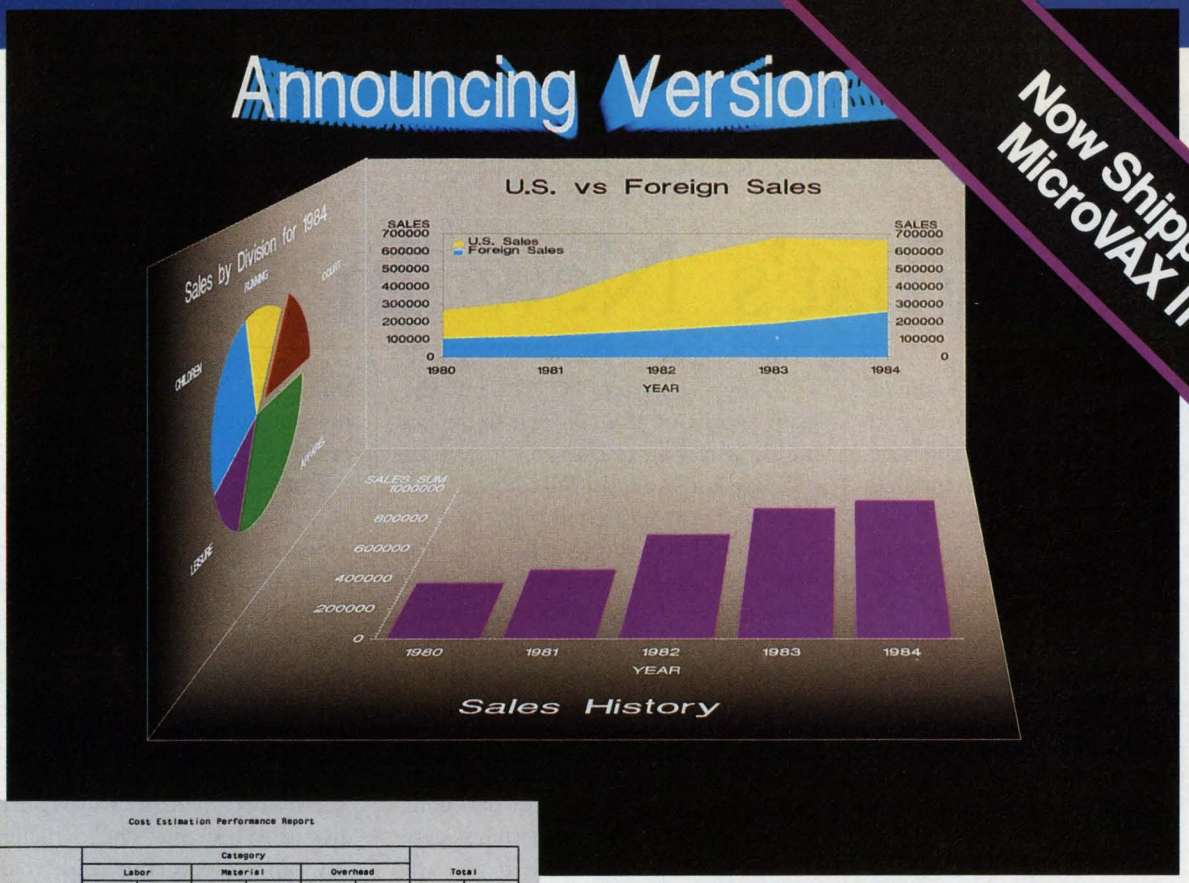

Above: New facilities in Version 5 let you customize your graphics presentations.
Below: Version 5 handles your quality control applications too.

Cost Estimation Performance Report

		Category						Total	
		Labor		Material		Overhead			
		Estimate	Cost	Estimate	Cost	Estimate	Cost	Estimate	Cost
		in $1,000s	in $1,000s	in $1,000s	in $1,000s	in $1,000s	in $1,000s	in $1,000s	in $1,000s
Estimator	Job								
Barbour	2618	549	538	715	763	101	103	1,365	1,404
	2635	619	624	312	298	82	81	1,013	1,003
	2645	589	581	425	423	86	85	1,100	1,089
	2695	119	124	98	103	18	19	235	246
	All Jobs	1,876	1,867	1,550	1,587	287	288	3,713	3,742
Murphy	Job								
	2647	149	144	267	254	32	30	448	428
	2651	748	727	538	523	109	106	1,395	1,356
	2665	836	794	345	353	106	102	1,287	1,249
	All Jobs	1,733	1,665	1,150	1,130	247	238	3,130	3,033
Richards	Job								
	2620	459	483	635	663	87	91	1,181	1,237
	2630	272	246	547	536	62	59	881	841
	2640	632	601	741	698	111	105	1,484	1,404
	2670	239	227	394	347	49	45	682	619
	2680	317	322	296	201	50	45	663	568
	All Jobs	1,919	1,879	2,613	2,445	359	345	4,891	4,669
All Estimators		5,528	5,411	5,313	5,162	893	871	11,734	11,444

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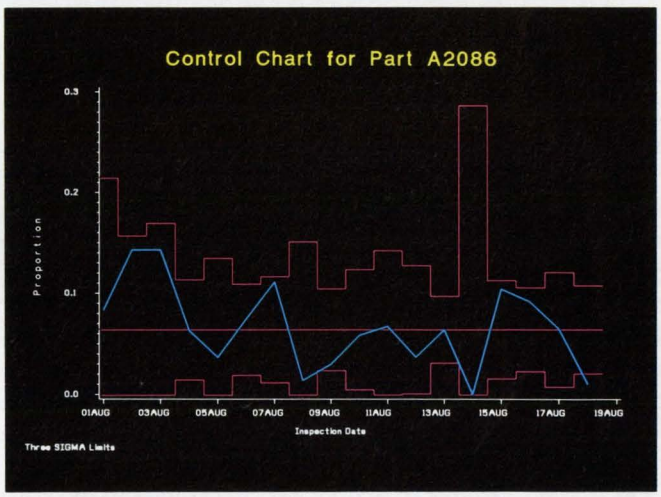

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BACK END

John C. Dvorak

What's New In PCs?

What Kind of PC should you buy? I still have to be reminded that this is a concern of many mainframers and minicomputer users. I assume everyone in the world already owns a PC of some sort. Wrong.

The only personal computers worth considering are computers made by IBM, Apple, major clone and compatible manufacturers (such as Tandy and Compaq) and Atari. Sorry, there are no more. DEC is out to lunch when it comes to PCs. Unless you want a personal MICROVAX II for home (an expensive proposition), then forget it. Wang is out and so is NCR. I'm not impressed with their stuff and neither is anyone else.

There simply aren't that many players anymore. It has long since boiled down to a few big boys and some copycats.

If you want a whiz-bang show-off machine, then buy an Apple Macintosh. While not sporting the educational fare of the Apple II series, the Mac still is *the* state-of-the-art personal computer. Combined with a hard disk and a LaserWriter printer (an expensive proposition) this is the classiest system you can own. I recommend the Macintosh SE with a LaserWriter Plus. It's an incredible duo. The drawback: figure on spending $7,000 or more.

The cheaper Mac combos, such as the 512K Mac Plus and Imagewriter, are the computers of choice for today's college kids. The company makes the machines available for half-price at many college bookstores. The alternative preferred by college students either is a PC clone or one of the inexpensive Tandy machines, such as the Model 1000.

Now we have to fall back into the grim world of IBM. Forget about an IBM if you want to buy an educational machine for the kids. Sure, there were a few packages written in hopes that the PCjr would fly; there's still hope that IBM will gain a foothold in the educational market. Forget these pipe dreams; IBM blew it.

So what about the IBM? Well, it's still the machine of preference for the harried executive who uses a PC at work mostly as an ersatz (and expensive) terminal. He can take some of his work home and do spreadsheeting in his spare time — a dubious practice, if you ask me. The IBM as a personal computer will thrive on desks at the office, but falls prey to lowballers and cloners when it comes to the machine at home.

If your company pays for your home machine, then I'd be a fool not to recommend the IBM. It's well made and the new Personal System/2 machines are engineering gems, no doubt about it. But if you have any sense of responsibility regarding your wallet, then you have to pick a clone. If you want to go very cheap, then find a local, out-of-the-garage vendor to whom you personally can return a defective machine. Avoid one-shot swap meet dealers whom you'll never see again. The big time cloners such as PCs Limited now have national service networks to fix the machine in your home if it breaks. Other clones such as Compaq and Tandon can be found at most local dealers. Check them out if you can't find a local garage vendor who puts together the hot little machine for the lowball price. Remember, if these machines run for a month, they'll probably run forever.

While a PC XT-class clone may be had for as little at $600 (loaded), I still think the PC AT or the 80386-based machine also should be considered for purchase. They compute rings around the XT and its clones. Unfortunately, you have to pay for performance. The Taiwanese AT clones cost $1,200 and up, while the 80386 clone costs approximately $2,700. Not cheap. If you buy an AT, look for the so-called "turbo" XTs. They use a faster version of the 8088 microprocessor. The performance is typically 75 percent greater than that of a stock XT.

If you can in any way afford a hard disk, then buy one. The lowballers usually can get you some old technology for nearly nothing. Some of the old 5 MB hard disks were selling for something like $50, believe it or not. Figure on paying $400 or so for a 20 MB drive and controller. Of course, anyone buying into this technology should join a local users group.

This brings me to the next bunch of machines: the Atari line. This 68000-based equipment is considered by many to be the price-performance leader. If you want raw power for the buck, then this is the machine for you, specifically the 1040 ST. Everyone agrees that you get the most processing power per dollar from these machines. There's also a substantial amount of software available for the 1040 ST. It tends to be less expensive and as powerful as the stuff sold for the IBM family. A users group is highly recommended, though, if you want to go this route. The dealer support network is minimal and you have to have friends if something goes wrong.

Those are the basics. Now it's up to you.

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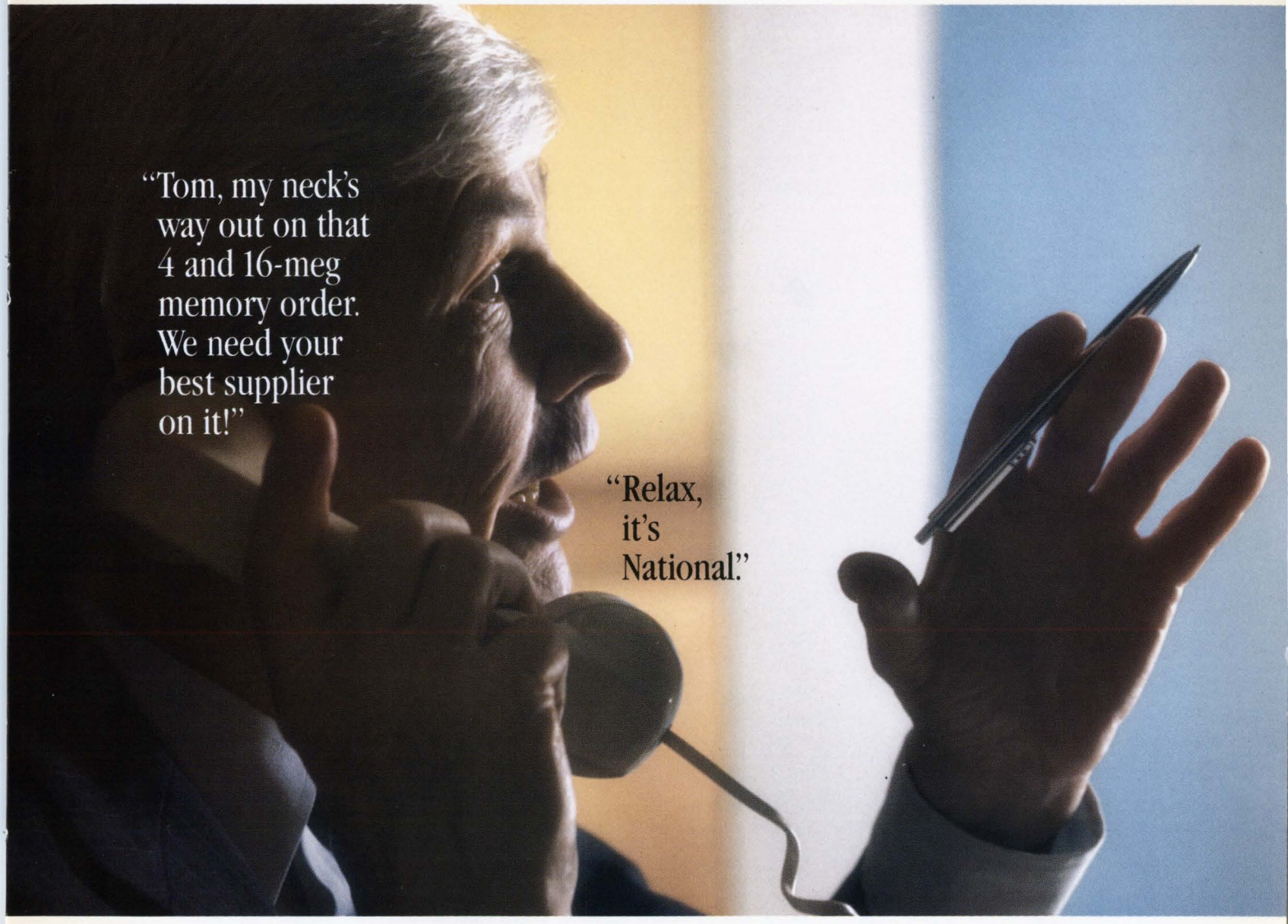

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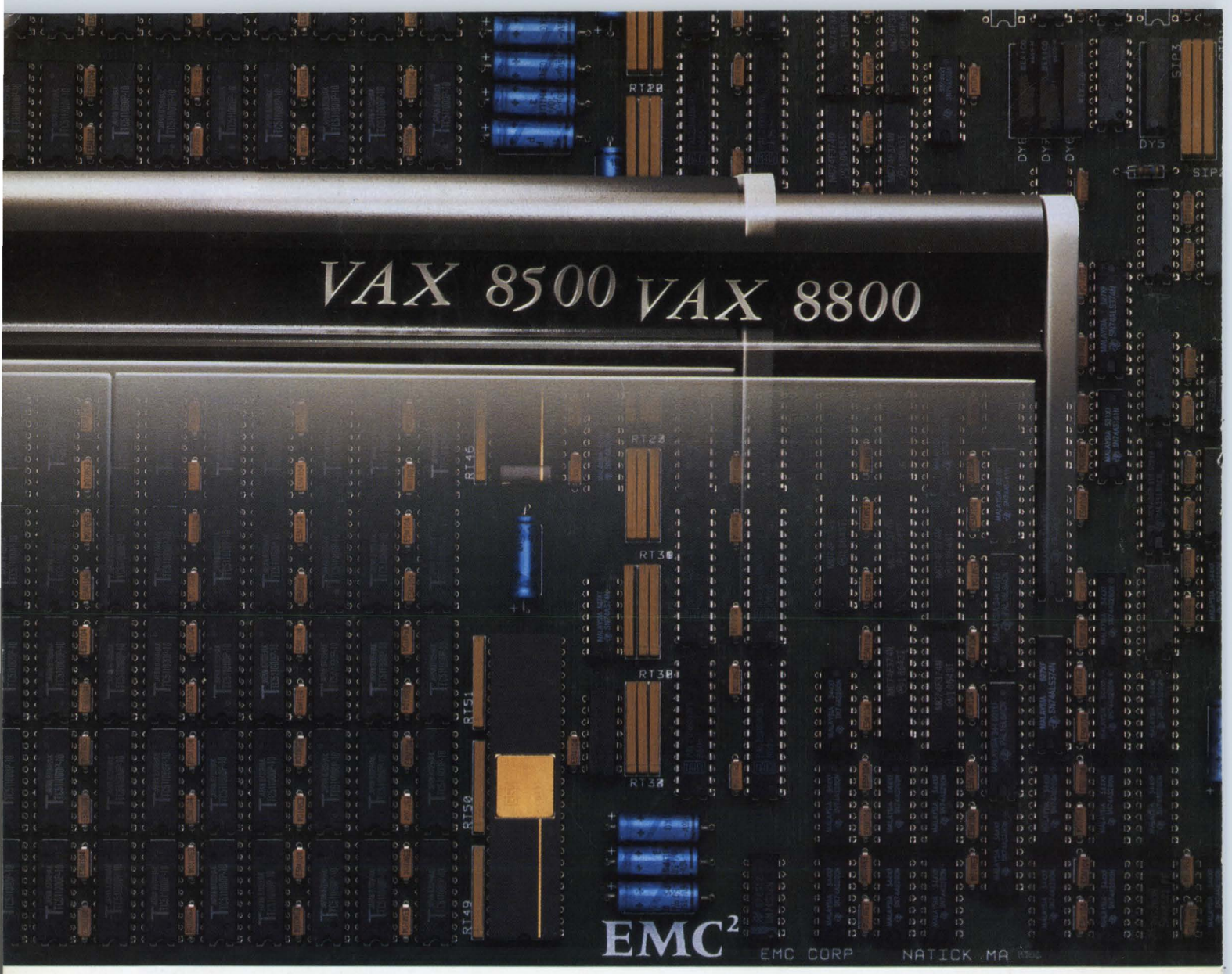

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