

**The VAX Story
Continues.
Just ask any user.**

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To say that the VAX™ computer system is a success is to understate the obvious. Even in its first year, the VAX-11/780 was established as a leading 32-bit machine. And its popularity has been growing ever since.

Needless to say, we're pleased. But not surprised.

Because VAX is one of the first computers designed from the ground up by both hardware *and* software engineers. The result is an unprecedented level of performance and program capacity for computers in its class.

And from the very beginning, VAX software has offered an unusual degree of maturity for a new machine.

One user said, "It was very clear that someone gave a lot of thought to the architecture. VAX is easy to program, easy to write compilers for, easy to code for — and it has the kind of software we'll need as more advanced technology comes along."

The fact is, VAX was designed to be enhanced and built upon for years to come. And now more major software enhancements are here.

We've improved the already remarkable FORTRAN of VAX, making it faster to compile and faster than ever in execu-

tion. We've also added several new languages, including COBOL and BASIC. Made I/O drivers easier to write. Added several major communications protocols. Simplified memory management. Enhanced real-time capabilities. And much more.

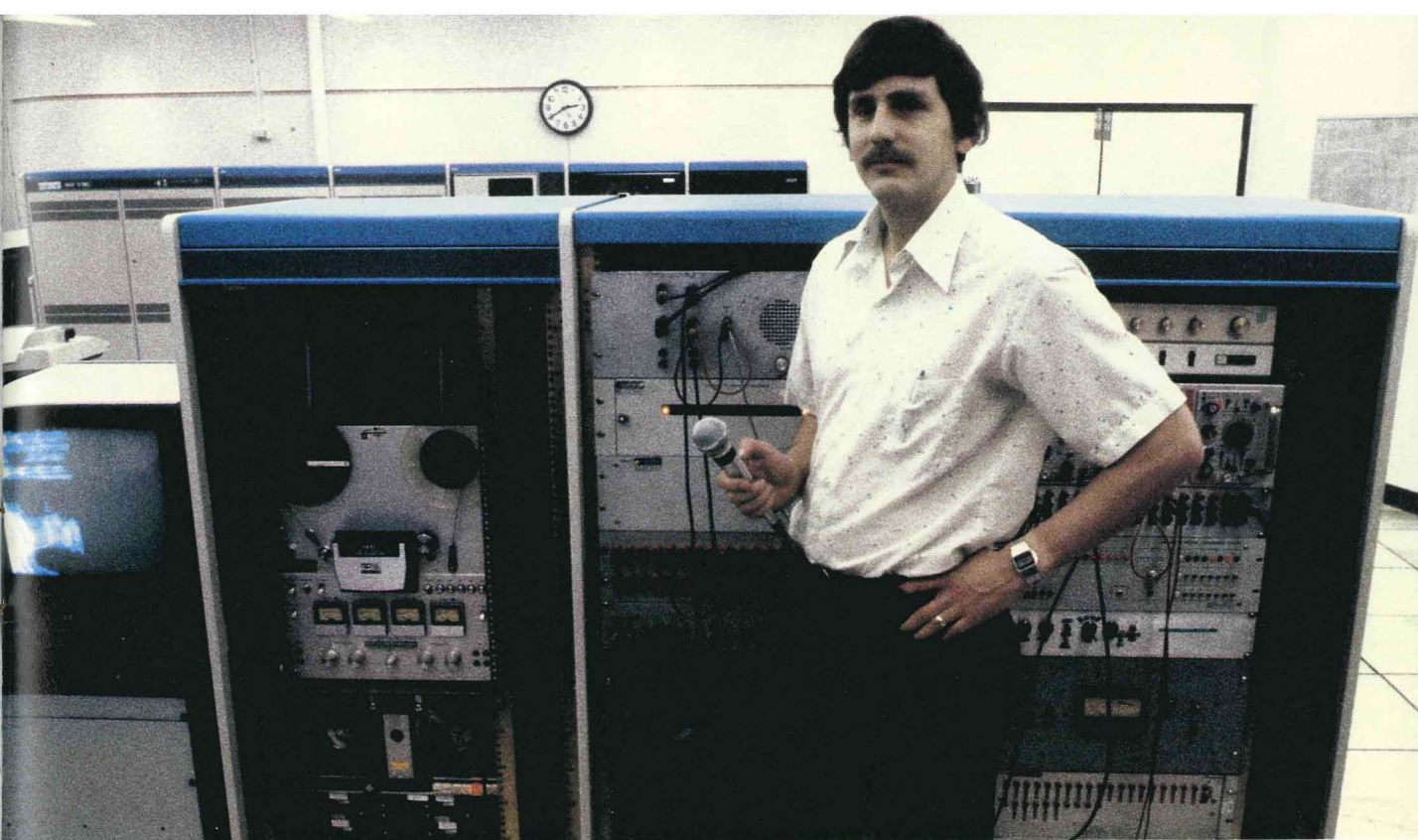
As VAX continues to advance, it will undoubtedly find its way into more and more applications. The following stories highlight just a few of the ways VAX is being used today. Some users talk about VAX's real-time performance. Others like its huge virtual memory. Still others are pleased with VAX's distributed processing capabilities.

But it really doesn't matter what your application is. If you want state-of-the-art technology and mature software in a 32-bit computer, then you want VAX.

Especially when you consider the support behind the computer — extensive system documentation, complete customer training, advanced diagnostic capabilities, and a service staff of more than 13,000 people in some 400 locations worldwide.

But don't just take our word for it. As one of our customers said: "VAX has a wide open future, and I'm looking forward to it."

**Real-Time on VAX.
Ask any user.**



Scientists at the Information Sciences Laboratory at Rockwell International Electronics Research Center are developing computer applications such as target-spotting identification and tracking, image enhancement, and speech processing.

For such state-of-the-art research they needed a state-of-the-art computer. They chose Digital's VAX-11/780.

According to Dr. Jim Larson, member of the technical staff at Rockwell International, "VAX gives us great real-time response. With our old mainframe computer, we had to suspend all of our other user processes during real-time digitization. But VAX's FORTRAN is a lot more powerful. On VAX you never even know when something is being digitized."

The fact that VAX is able to handle real-time and interactive analysis simultaneously is a feature that's especially attractive to Rockwell. Says Larson, "Our people only have to learn and use one computer."

"VAX's real-time capabilities are even better than we expected."

*Dr. Jim Larson, Technical Staff
Electronics Research Center
Rockwell International
Anaheim, California*

The Institute for Nuclear Medicine at the German Cancer Research Center uses gamma cameras, ultrasonic scanners and X-ray computer tomography for the detection of tumors. These processed medical images are also used as input

“With our intensive real-time demands, VAX is clearly the machine for the job.”

*Willfried Muller
VAX System Manager
Institute of Nuclear Medicine
German Cancer Research Center
Heidelberg, Germany*

data for surgery and radiation therapy treatment planning.

Willfried Muller, VAX System Manager, tells why they decided on Digital's VAX-11/780: "We needed a machine that would not only process images quickly, but also help us develop new programs for our applications. In both areas, VAX seemed to be ideal."

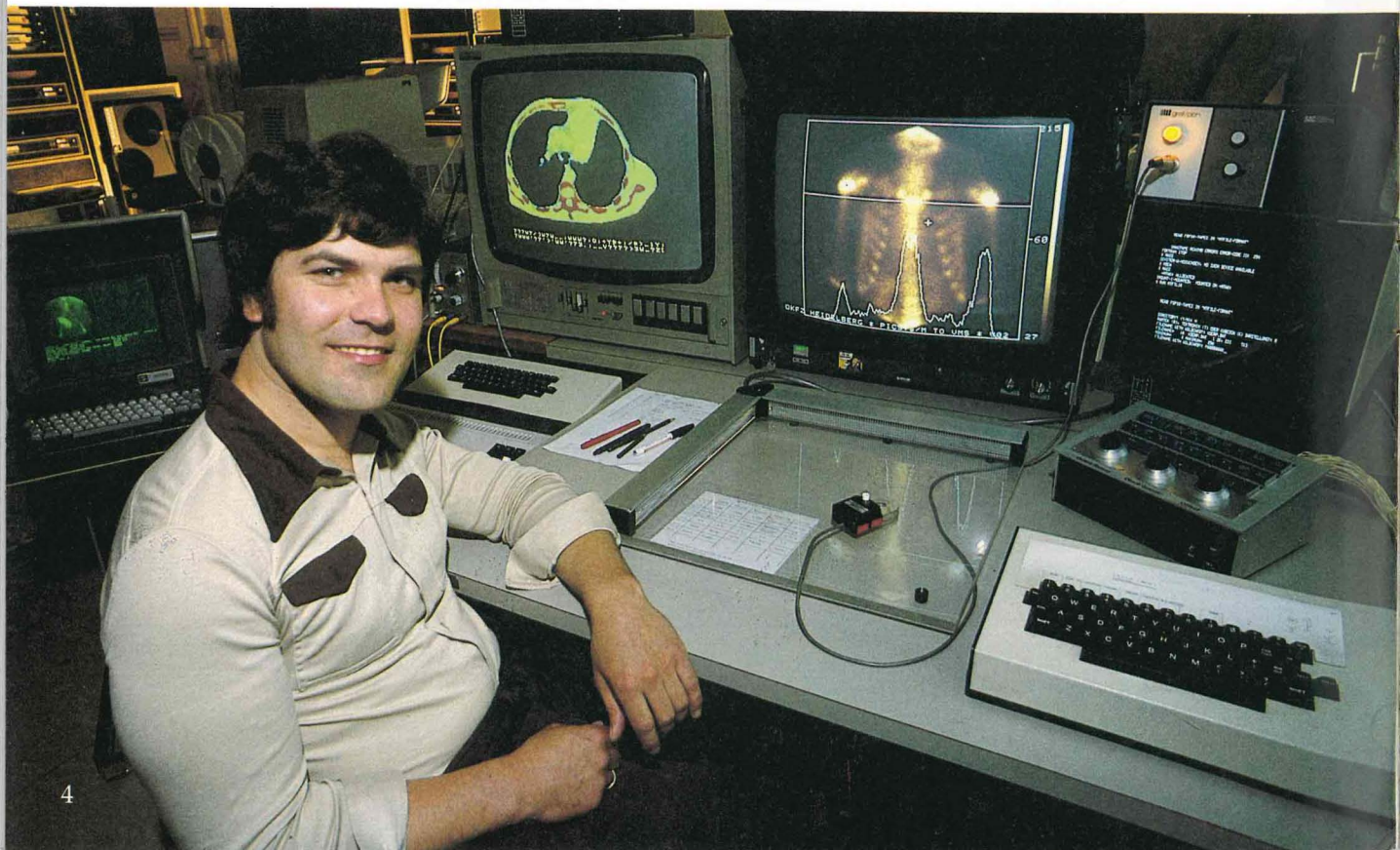
VAX's accessibility was also critical: "Our user community includes many different types of people. The fact that VAX is interactive and easy to use is very important to us.

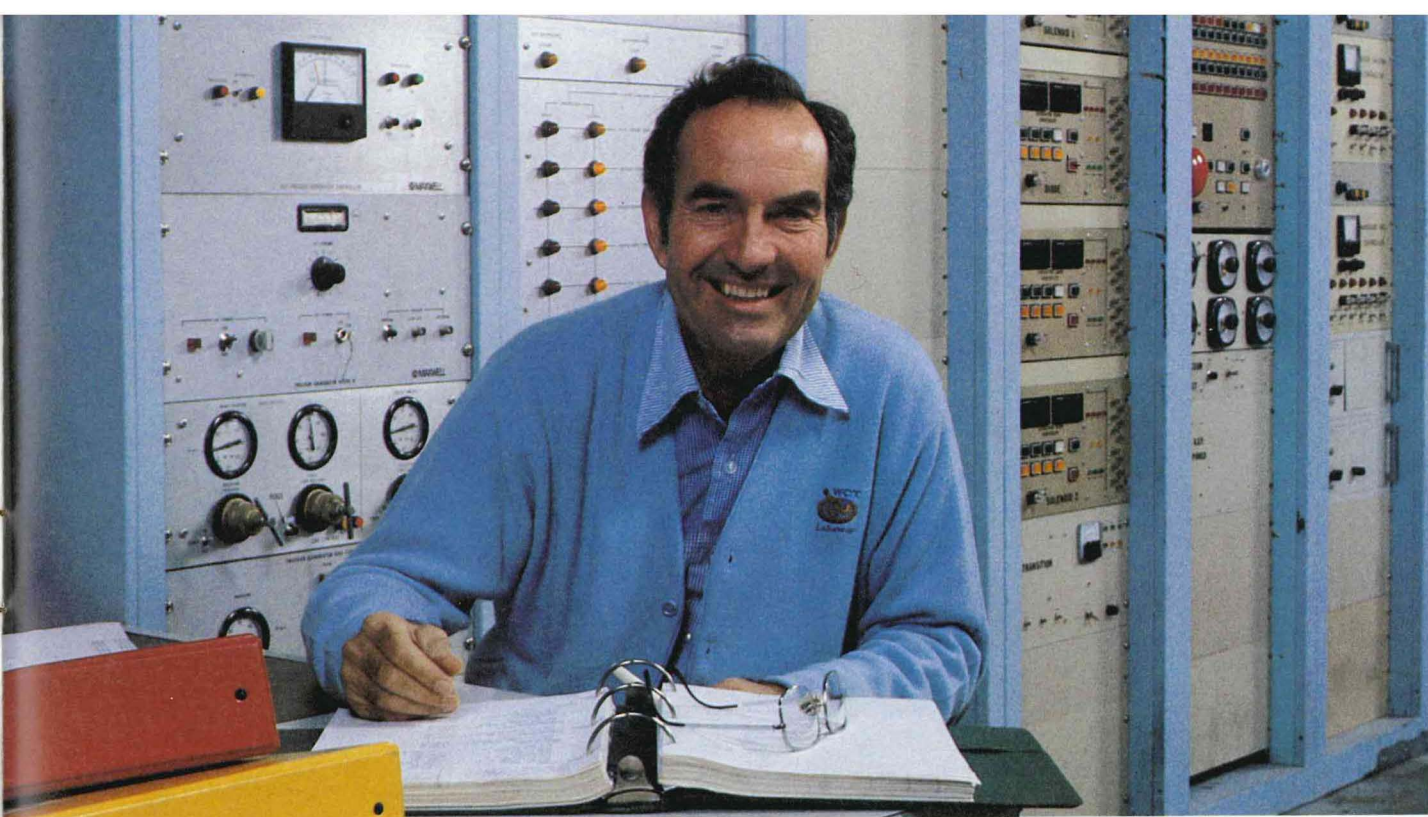
"Also," Muller continues, "our image processing work made VAX's large program capacity very attractive. It can hold several big matrices simultaneously. Equally important, VAX can be expanded to meet our requirements for years to come."

On ease of program conversion, Muller says, "We're finding it as simple as Digital promised."

And according to Muller, VAX's price/performance ratio has proved "very favorable."

Concludes Muller, "We don't know of another machine anywhere that could handle the job as well as VAX."





"VAX's large address capacity makes it a powerful real-time machine."

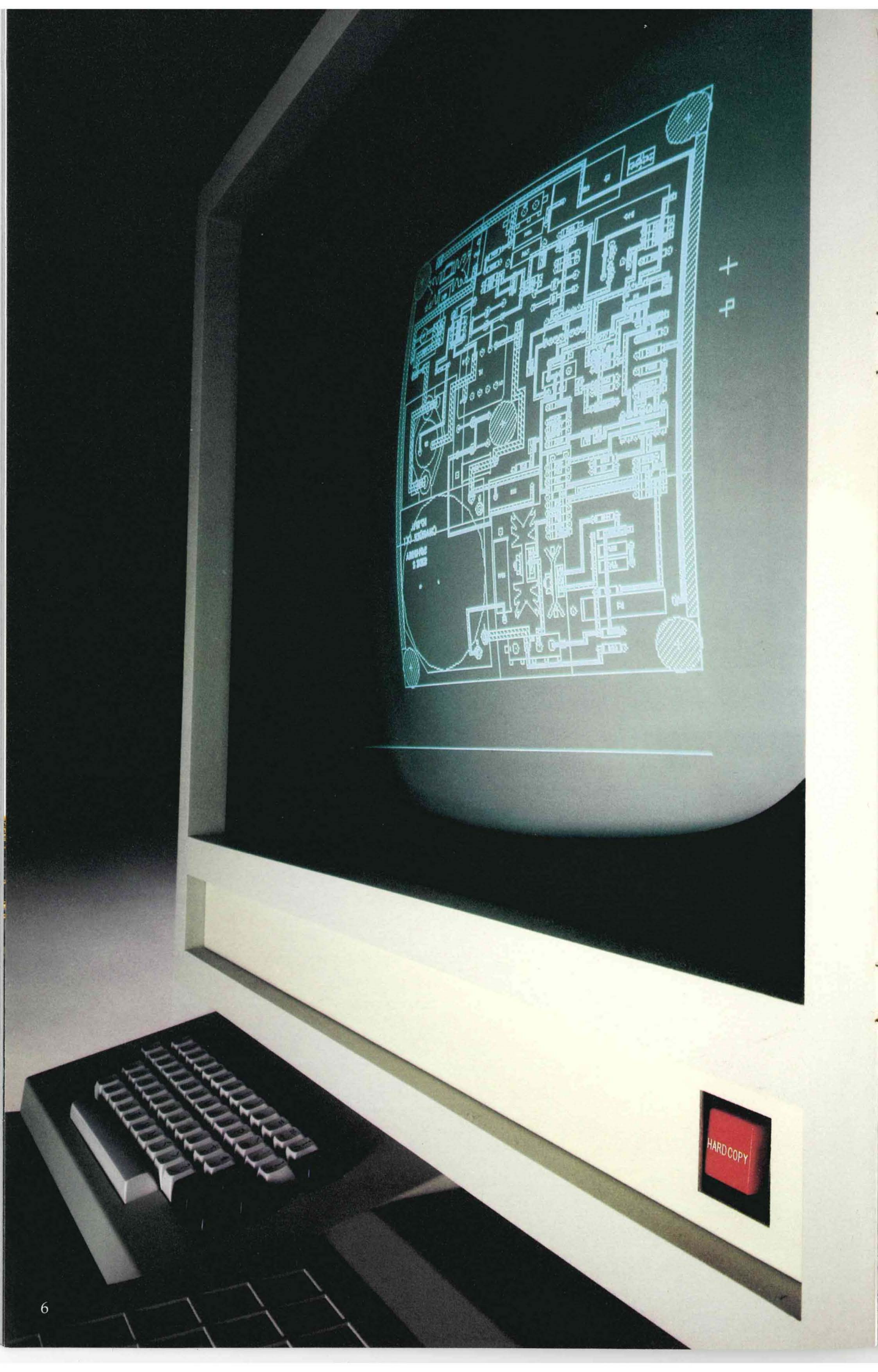
*Dr. William E. Drummond, Chairman
Austin Research Associates
Austin, Texas*

At Austin Research Associates in Austin, Texas, plasma physicists are using VAX to conduct far-ranging scientific research on the collective acceleration of sub-atomic particles.

"We chose VAX because it provided the ability to directly address very large data arrays. And that is crucial to each of our applications," explains Dr. Drummond, Chairman at Austin Research.

"VAX has the capacity to acquire data simultaneously from 15 different experimental sensors, digitize it, and immediately present results to our researchers. And furthermore," Drummond adds, "VAX gives us a perspective we never had before by rapidly providing data comparisons with thousands of earlier test results.

"In addition, while VAX is supporting several interactive users it can also handle our large number-crunching simulation programs, allowing us to off-load a CDC mainframe," says Drummond.



The VAX Real-Time Story.

When it comes to performance, the real test is real-time. And when it comes to real-time, a lot of users count on the VAX-11/780.

The key to VAX performance lies in the concept behind its design: The total integration of system software with system hardware.

For instance, VAX features a micro-coded instruction set. Along with an optimized FORTRAN IV-PLUS compiler, it provides incredibly efficient program execution. Polynomial approximations are done in one instruction. Instead of 17 instructions. Context loading is done in one instruction. And priority interrupts are processed in just microseconds. So you can get a lot done, without taking up a lot of space. Or a lot of time.

But if VAX software is efficient by design, VAX hardware is even more so. It features parallel data paths that let the CPU perform integer arithmetic, floating-point calculations and shifting simultaneously. A 32-bit Synchronous Backplane Interconnect that's pipelined to deliver 13.3 megabyte/second throughput. And an 8K byte high-speed cache and main memory combination that gives you an effective access time of just 280 nanoseconds. If you need even faster performance, you can add a writeable control store that has room for 12K bytes of user-defined micro-code. And a floating-point accelerator that increases the speed of one of the industry's fastest FORTRANs.

Yet there's more to VAX than record-setting performance. There's record-setting flexibility. VAX was designed for the world of real-time. Of its 32 priority-driven scheduling levels, the top 16 are dedicated for real-time applications. What's more, all the real-time programs are separated from the rest of the system. That means low-level users can't interfere with high-level tasks. In addition, the operating system is built around a number of functional layers and based on a highly efficient real-time executive. Depending on your application, you can

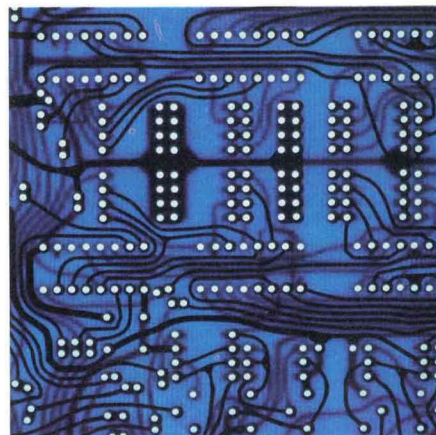
interface directly at the I/O level. Or you can use our efficient file management system to set up your choice of sequential, random or multikey ISAM files.

And since VAX supports the PDP-11™ UNIBUS™ databus, you can interface with a spectacular array of I/O equipment for faster throughput in every application. The VAX I/O offering includes array processors, A-D converters and a whole host of graphic subsystems.

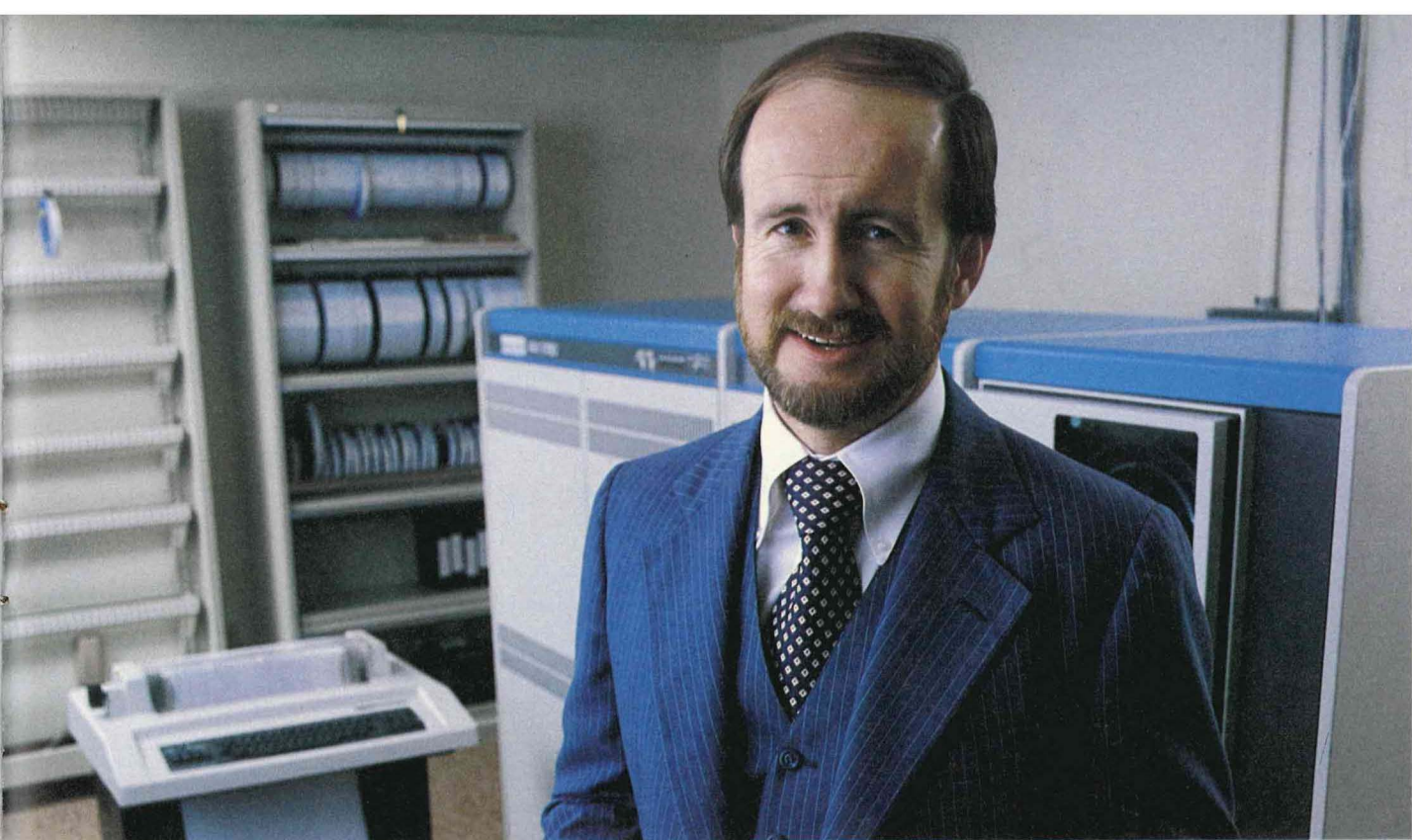
Finally, VAX gives you the one thing you need most with real-time. And that's reliability. In fact, every part of a VAX system is designed for uptime. Large powerful fans eliminate trouble-causing heat pockets. Built-in sensors check for the least bit of trouble. And if there is a problem, Digital's on-board, on-line diagnostic system can help you take care of it in a big hurry. And if for some reason it can't help you isolate the fault, Digital's remote diagnostic facility can. With a response time of just 15 minutes in the United States and Europe.

VAX also provides impressive data reliability. An Error Correction Code automatically corrects all single-bit errors and detects all double-bit errors in memory. A special error-logging system records mistakes on a special file. Automatic parity checking is performed on the Synchronous Backplane Interconnect, as well as most hardware components. And a write/verify operation can make sure the disk space is error-free when you deposit valuable data.

All these features (and more) add up to a totally new level of performance and reliability. So if you've been waiting for a 32-bit real-time system, you'll be happy to know your time has come.



**VAX Virtual Memory.
Ask any user.**



“With VAX’s virtual memory, there isn’t a PC board around that’s too large for LASAR to handle.”

*Fred Grant
LASAR Product Manager
Teradyne, Inc.
Boston, Massachusetts*

Teradyne, Inc. makes a wide range of automatic test equipment including computer-based systems for testing printed circuit boards. To help their customers program the most complex of these PC board test systems, Teradyne developed a sophisticated software package called LASAR™.

But until Teradyne looked at Digital’s VAX-11/780, LASAR was only available to customers through a timesharing service on a large batch-oriented mainframe. The software package was just too big for anything less.

Now with LASAR running on VAX, Teradyne will have the program capacity they need, in a system their customers can afford to purchase.

“When you reach the limit of main memory, VAX automatically puts the program into virtual memory,” Grant says. “That’s a key factor in our LASAR development work. Test programmers can develop more complete programs without being limited by memory size.”

Has Teradyne sacrificed performance by switching from the mainframe?

“Definitely not,” says Grant. “In our benchmarks, VAX matched up one-to-one with the mainframe. That really impressed us.”

And VAX’s interactive capability should be a big plus for Teradyne’s customers: “Several people can program on VAX simultaneously, and they can monitor the progress of their programs as they work.

“There’s more programmer involvement with VAX, and more efficiency too.”

"Without Digital's VAX, our specialized design work just wouldn't be as cost effective."

*Stephen Tritter, Senior Principal Engineer
Engineering Computer Facilities
E-Systems Inc., ECI-Division
St. Petersburg, Florida*

The ECI Division of E-Systems, Inc., designs high-technology electronics and communications equipment for the U.S. Government. And that requires huge computer programming space.

So virtual memory capability was an important factor in the E-System decision to buy a VAX.

"We're doing a lot of work now that we couldn't have done without Digital's VAX," says Steve Tritter, Senior Principal Engineer.

"For example, we use the VAX to help us design our own LSI integrated circuit chips. That means keeping track of thousands of points, each with several different characteristics. It's a big job.

"And while that analysis is running, other people are performing high-frequency radio propagation studies using as many as 210,000 memory locations, or running Fast Fourier Transforms with up to 8,000 points."

Tritter says that ECI regularly has 10 to 12 engineers working interactively on VAX at a given time.

"We're very happy with VAX system performance," he adds. "We expect to add more memory, and eventually service 50 to 60 simultaneous users."





“VAX gave our students both up-to-date technology and freedom from computer memory limitations.”

*Charles Wall
Computer Center Director
Austin Peay University
Clarksville, Tennessee*

Last spring, administrators at Austin Peay University decided to introduce a Computer Science degree program in their curriculum.

“We needed a large capacity computer to support the 50 to 60 interactive terminals we plan to have here within the next couple of years,” explains Charles Wall, Director of Austin Peay’s Computer Center. “We also wanted our graduates to be at home with the high-technology machines that will confront them out in the job market.

“Digital’s VAX-11/780, with its virtual memory and 32-bit address space, offered exactly what we needed — at a very attractive price.”

Now students at 24 terminals around campus are learning COBOL, MACRO, BASIC and FORTRAN on VAX, with other popular languages soon to be added.

According to Wall, VAX has more than lived up to expectations, “Even at peak times no one, not even myself, can tell when users are swapped in virtual memory.

“And the architecture of VAX is so good,” he continues, “that our faculty members who come from other universities say that SPSS — a statistical program designed to run on many different kinds of mainframes — runs faster on VAX than on other machines they’ve used.

“With power like this,” Wall concludes, “it’s obvious that we haven’t even come close to taxing the capabilities of VAX.”

digital VAX 11/780

The VAX Virtual Memory Story.

Now you can get virtually all the memory you'll ever need. With the virtual memory system of the VAX-11/780.

VAX is the first totally integrated 32-bit system. Its hardware was specifically designed to make the software more efficient. While its software was designed to take full advantage of the hardware. The result is a virtual memory system that outperforms every other machine in its class.

And one reason is that it offers more capacity. VAX starts with 512K bytes of MOS memory. From there, you can grow up to eight million bytes of main memory. And up to four billion bytes of virtual memory any time you choose. That means your programmers can write a lot of small programs, or a few larger programs. Some of our customers have run 176 megabyte programs, and the architecture even allows for programs as large as two gigabytes.

To go with this unprecedented capacity, VAX gives you unprecedented performance. The VAX/VMS™ operating system uses advanced memory mapping techniques like "page clustering" to give you maximum execution speeds with minimum overhead.

Yet the real beauty of the VAX/VMS operating system isn't its sophistication of design, but its simplicity of execution. Everything is totally transparent. Your people can write programs without ever worrying about complex overlays or space limitations. Because as soon as VAX main memory ends, VAX virtual memory begins. Automatically.

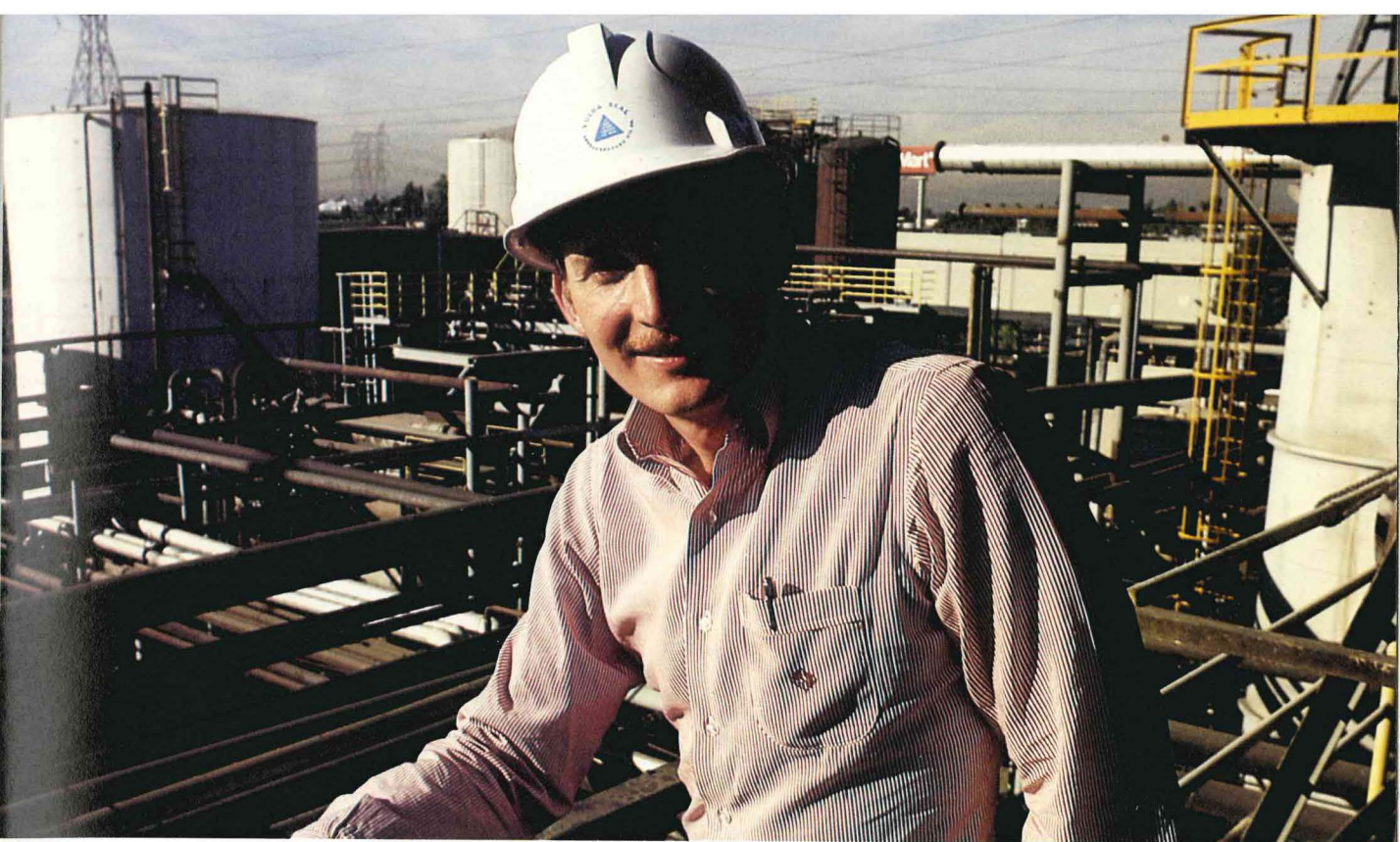
And if there are times when you don't really want to use virtual memory, you don't have to. Instead, you can lock critical programs and subroutines into your main memory. So, in effect, you can

make one of the fastest 32-bit machines on the market even faster.

All in all, the VAX-11/780 is so well balanced, you can get the capacity, performance and control you've always wanted plus a lot more, including communications, PDP-11 compatibility and worldwide Digital support, for a lot less than the cost of a mainframe. In fact, when you compare the cost/capacity ratio of VAX to mainframes and other super-minis, you'll see what VAX users already know. There's no comparison.



**Distributed
Processing
on VAX.
Ask any user.**



**"Data transfer
can take hours.
With VAX and
DECnet, it takes
seconds."**

*Carl Service
Sr. Research Analyst
Lunday Thagard Oil Company
Irvine, California*

Thagard Research Corporation, a subsidiary of Lunday Thagard Oil Company, recently began using a VAX-11/780 in a computer network to help with development of a new high-temperature reactor. Here's how the system works:

Data is first gathered at remote sites by several PDP-11/03 computers from Digital. Then it's transferred through DECnet to a VAX at Thagard headquarters for data reduction, and print and graphics analysis.

Carl Service, Senior Research Analyst responsible for Thagard's data processing, admits, "When we first started out we were literally doing things by hand. Data from remote sites was re-

corded onto a cartridge which was hand-carried to our computers here at Irvine. It took 2½ hours just to get the data from the cartridge into the computer."

VAX's distributed data processing capabilities have saved Thagard a lot of time. Says Service, "With DECnet™, communications software data from other sites is transferred to VAX almost instantaneously."

Both Service and his users have been able to increase their productivity with their new distributed system. "It gives us immediate turnaround," he explains. "Now we can return completely reduced data to our customers while the experiment is still fresh in their minds."

Service is also impressed with the compatibility of Digital's computers: "The command languages of all Digital's operating systems are very similar. So someone who has worked with one of Digital's computers is already familiar with the others. That brings our training curve down and our production up."

Scientists at the NASA Ames Research Center are working in the fields of aeronautics, space science, life science, and fluid mechanics. They use more than a dozen specialized facilities located throughout the Center. An extensive

“VAX was the only supermini to offer the address space and networking capability we needed.”

*Jim Hart
Chief of Systems Development Branch
NASA Ames Research Center
Moffett Field, California*

DECnet system allows their large central mainframes to interact easily with Digital's PDP-11s located in each lab.

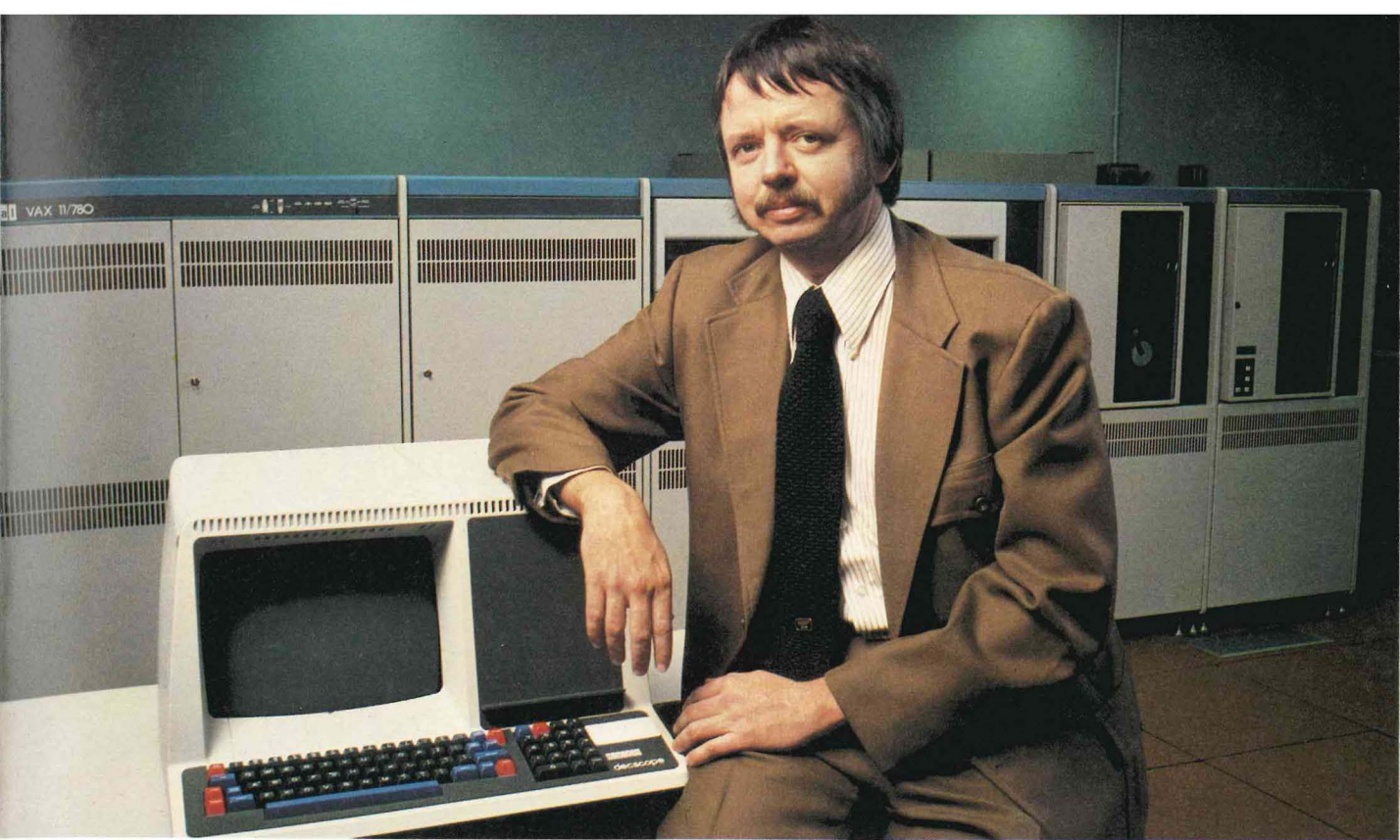
But according to Jim Hart, Chief of the Center's Systems Development Branch, "Our PDP-11 users were constantly generating new requirements for greater capacity. So we decided to extend our central facility."

Says Hart, "A supermini like VAX was the natural choice. It has the large address space we need, and the communications capability to fit right into our existing network."

Now VAX works with both Ames' PDP-11s and mainframes with the help of DECnet. "For example," explains Hart, "scientists studying fluid dynamics prepare jobs on local PDP-11s which are sent to the central Illiac IV super computer or a CDC 7600. After the heavy number-crunching is completed, the data is shipped to VAX for postprocessing. Final results are then transferred, via DECnet, back to the PDP-11s in the labs for either graphics display or additional interactive work."

Hart concludes, "VAX's computing and distributed data processing capabilities have helped us get the maximum use out of all our computers."





“With a distributed system built around VAX, we’re getting information to our users in near real-time.”

*Roger Vossler, Section Manager
and Systems Engineer,
TRW Defense and Space Systems Group,
Redondo Beach, California*

Sensor data processing and distributed processing systems in support of real-time embedded applications are among the specialties of TRW’s Defense and Space Systems Group.

TRW uses four PDP-11 computers from Digital supporting a wide range of peripherals, all controlled by a VAX-11/70.

Roger Vossler, Section Manager and Systems Engineer, explains: “Around

our VAX, we’ve built a distributed file manager for manipulating shared data bases and controlling data flows in a distributed cluster. This helps us reduce floods of data into useful information in near real-time.”

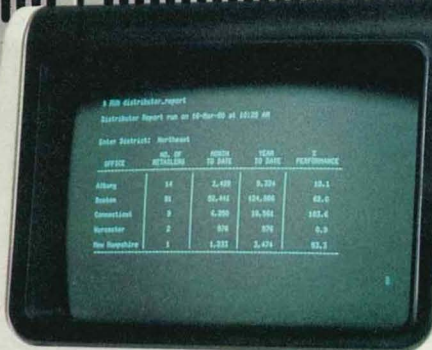
Vossler continues, “VAX’s I/O bandwidth capabilities are extremely important for effectively moving large quantities of real-time data at very high rates.”

In addition to their own processing work, TRW is using the VAX-based network for general research into distributed systems. According to Vossler, “VAX provides a flexible testbed for hands-on, real-time experiments with distributed processing concepts. We’re also designing and verifying higher order languages such as concurrent and distributed PASCAL.”

Vossler sums up VAX this way: “It’s one of the best implementations we’ve ever seen allowing successful integration between hardware and software systems.”

digital VAX 11/780

POWER OFF RESET TESTS RUN PROTECT SERVICE



digital VT100

A VT100 terminal displaying a letter. The text on the screen is:

18 March 1980

Mr. John Simpson
P.O. Box 228
Amherst, MA 01004

Dear John:

You will be very pleased to hear that we have decided to accept your proposal for the development of our new operating system.

Our legal team will contact you to set up a time to sign all the contracts. We anticipate a long and fruitful relationship between our companies. Thank you for all your cooperation.

Sincerely,
James S. Hastings



digital VT100

A VT100 terminal displaying system status information. The text on the screen is:

Line 1.06

RAM, scope and module as to 'TESTMARK'

001 11ms 6 +40

14ms relative PC absolute PC

0 00000000 00000000

2 00000010 00000010

CITS IS .154420E+00

-NORMAL, normal successful completion'

digital VT100

The VAX Distributed Processing Story.

If there ever was a system made for distributed data processing, it's the VAX-11/780. Because VAX offers all the power and flexibility you need to make DDP work. Any way you want it to work.

For example, VAX has all the makings of the perfect host computer. A four billion byte virtual memory for handling huge data bases. State-of-the-art data communications and networking tools that can be tied in with many existing mainframe protocols such as 3780 and MUX/200. And 32 priority-driven interrupt levels that can monitor and control traffic from a whole host of terminals and/or computers.

In addition to host-system applications, VAX also has the makings of the perfect distributed system. It offers you real-time performance with capacity that compares with some mainframes. At a price that can't compare. It also offers you an easy to use, interactive operating system that can handle dozens of different jobs from dozens of different users simultaneously.

The fact is VAX — and only VAX — combines the power and capability you need in a host system with the real-time, interactive performance you need down line.

What's more, only VAX comes with all the resources of Digital Equipment Corporation behind it. These resources include an advanced networking protocol called DECnet. It lets you interconnect PDP-11 micro-based systems, small PDP-11 minicomputers, large PDP-11 superminis and other VAX systems. It even lets you tie together DECsystem-10™ and DECSYSTEM-20™ large scale computers. This gives you the ability to precisely match the size of the computer to the size of the application, for every application in your network. And since all our computers are part of the Digital family, you can be sure they'll be compatible from one system to the next. So your network won't become obsolete once you start

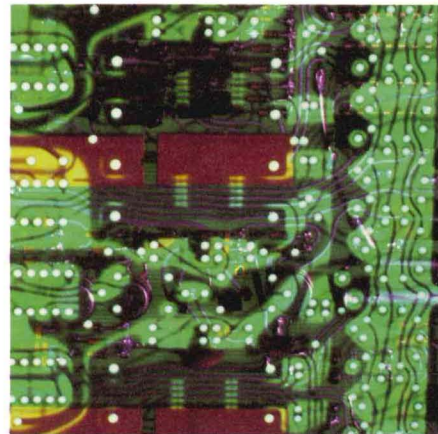
adding new equipment. It also means your network can grow and change, as you needs grow.

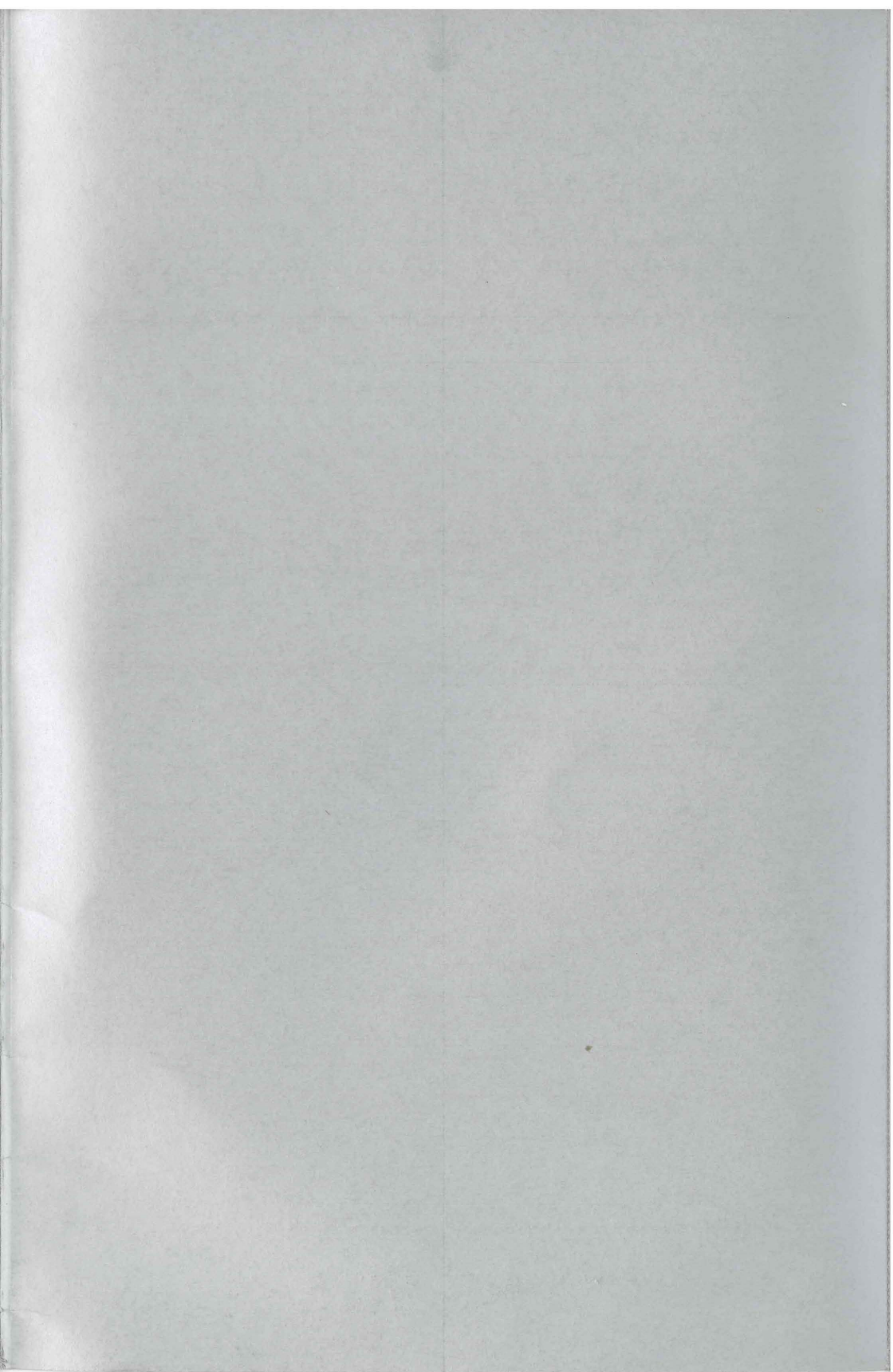
There are other advantages that come from using VAX and Digital equipment. Learn how to use one PDP-11 or VAX, and you're well on your way to learning them all. Because they all offer Digital's easy-to-use Command Language. That means you won't have to spend a lot of time and money rewriting your programs. Because the applications you've developed for one PDP-11 will run on practically all of them. They'll even run on VAX in compatibility mode.

Finally, every piece of Digital equipment is backed by a worldwide service and support organization that includes 13,000

service people in some 400 locations. This organization is designed to make sure your Digital computers run the way you expect them to. No matter what kind of application they're doing. No matter where in the world they might be. And you can tailor Digital's service to your specific needs, selecting anything from our per-call service as needed, to our comprehensive on-site coverage seven days a week.

When you put the capability of VAX together with the capability of Digital, you begin to see why, for a lot of users, distributed data processing only makes sense with one computer company. And that's Digital.





digital

DIGITAL EQUIPMENT CORPORATION, MARLBORO, MA 01752

EA 19101 111/80

Please send additional information on VAX.

Please contact me.

My application is: Education Medical Laboratory

Engineering Government Resale Other

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Company _____

Address _____

City _____ State _____ Zip _____

Telephone _____

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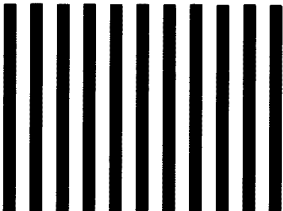
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