KENNEDY

SERIES 5300 DISK DRIVES

Series 5300 drives are fixed media high-performance units utilizing advanced Winchester disk technology.

Available in one, two, or three-platter versions, the unformatted data capacity can be as high as 70M bytes—all in 7" of track space.

Track density of 500 lpi is made possible by prewritten servo tracks utilizing one disk surface, thus assuring accurate read alignment under all circumstances. High data density results from use of advanced media and reconditioned MFM recording.

Maximum seek time is 70 msec., rotational speed, 8000 rpm, and data rate = 1.0 MB/sec.

The tightly sealed disk compartment allows Series 5300 drives to be used in environments unsuitable for conventional drives.

Other Series 5300 features include NRZ-MFM data encoder/decoder circuits, daisy chaining of up to 4 drives, address mark detection, built-in power supply, small, easily replaceable circuit cards, and a standard interface.

Series 5300 is sophisticated in concept, yet like all Kennedy products, is simple in design for greater reliability, improved performance, and lower cost.

KENNEDY
Subsidiary: Microwave Systems, Inc.
1500 Sherman Ave., Monrovia, CA 91016
(213) 357-8881 FAX: 410-535-5248

CIRCLE 1 ON READER CARD
It's a reality. In Cromemco's new Model Z-2H you get all of the above and even more. With Cromemco you get it all.

In this new Model Z-2H you get not only a large-storage Winchester hard disk drive but also two floppy disk drives. In the hard disk drive you get unprecedented storage capacity at this price—11 megabytes unformatted.

You get speed—both in the 4 MHz Z80A microprocessor and in the fast 64K RAM which has a chip access time of only 150 nanoseconds. You get speed in the computer minimum instruction execution time of 1 microsecond. You get speed in the hard disk transfer rate of 5.6 megabits/sec.

EXPANDABILITY

You get expandability, too. The high-speed RAM can be expanded to 512 kilobytes if you wish.

And the computer has a full 12-slot card cage you can use for additional RAM and interface cards.

BROADEST SOFTWARE SUPPORT

With the Z-2H you also get the broadest software support in the microcomputer field. Software Cromemco is known for. Software like this:

- Extended BASIC
- FORTRAN IV
- RATFOR (RATIONAL FORTRAN)
- COBOL
- Z80 Macro Assembler
- Word Processing System
- Data Base Management

with more coming all the time.

SMALL, RUGGED, RELIABLE

With all its features the new Z-2H, including its hard disk drive, is still housed in just one small cabinet.

Included in that cabinet, too, is Cromemco ruggedness and reliability. Cromemco is time-proved. Our equipment is a survey winner for reliability. Of course, there's Cromemco's all-metal cabinet. Rugged, solid. And, there's the heavy-duty power supply (30A @ 8V, 15A @ +18V, and 15A @ -18V) for circuitry you'll sooner or later want to plug into those free card slots.

CALL NOW

With its high performance and low price you KNOW this new Z-2H is going to be a smash. Look into it right now. Contact your Cromemco computer store and get our sales literature. Find out when you can see it. Many dealers will be showing the Z-2H soon—and you'll want to be there when they do.

PRESENT CROMEMCO USERS

We've kept you in mind, too. Ask about the new Model HDD Disk Drive which can combine with your present Cromemco computer to give you up to 22 megabytes of disk storage.
ORGANIZING FOR SUCCESSFUL SOFTWARE DEVELOPMENT
Edmund B. Daly
Software managers want to establish an environment in which high quality software can be developed with minimal resources. The author offers guidelines to achieve this objective.

GRASSROOTS, MICROS, AND PAPAL VISITS
Sarah Rolph
Scores of amateurs in Des Moines took to computing to cope with the crush of clerical work involved in Pope John Paul II's visit to Des Moines.

THE WORLD'S TOP 50 COMPUTER IMPORT MARKETS
Bohdan O. Szuprowicz
Four countries imported more than $1 billion in computers and office equipment in 1977. Western Europe continues to be the largest trading area in the world.

PLANNING FOR GROWTH
Lawrence H. Cooke Jr.
A New Jersey bank steered between too much expensive computer power and too little to take care of its customers by using performance measurement and capacity planning.

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Data General and DEC Systems Live Longer

With Okidata Disc Drives

Data General and DEC users have a big investment in software. Okidata 3300 Series disc drives protect and extend that investment by growing with system requirements—all the way to 80 megabytes.

Six 3300 models, from 13 to 80 megabytes, all use the same set of systems programs and all fit in the same 7" of rack space, including the power supply—Twenty-five percent more capacity than IBM’s Piccolo in half the space. Plus—up to 2.4 megabytes of fast access fixed head storage in the same 7" package.

Okidata disc drives live longer, with a field proven reliability record approaching that of their all solid state host processors. Winchester heads and discs and Okidata’s unique low mass rotary positioner are protected from the environment and the operator by the finest air filtration system in the industry.

You’ve probably read about Okidata “bumping out” those big name disc suppliers. The reason is, when you compare reliability, performance, price, OEM support and ease of growth, Okidata disc drives live longer.
Today. Tomorrow. Data base management with SYSTEM 2000 makes it possible for you to do more without spending more. We call it centsible—so do our customers.

For example, Texas State Comptroller Bob Bullock’s office is using SYSTEM 2000 to assist in recovering hundreds of thousands of dollars in delinquent taxes. (They very cleverly tied together their tax administration and statewide accounting systems with a SYSTEM 2000 data base.)

Some forward-thinking people at a leading manufacturer of nuclear pumps used SYSTEM 2000 to attack problems in inventory, purchasing, and quality control. As a result, they helped management increase the company’s return on investment by increasing the turn on inventory. They solved in six weeks the purchasing problem that the company had been trying to solve with traditional methods for two years. They implemented a very thorough quality control program and a lot of other outstanding, cost-effective applications to make the company more efficient. More importantly, SYSTEM 2000 gave them the ability to expand these applications into their worldwide operations with only a very small increase in staff at the central site. And as for those central site staff members, their productivity—when compared to traditional methods—increased three to four fold! That’s centsible.

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Seven years ago, Ford Motor Company’s Ford Parts and Service Division installed SYSTEM 2000 to track packaging specs and bill of materials information for over 200,000 different types of parts. (These parts are stored in the Ford Parts Redistribution Center which has over 3,000,000 sq. ft. of warehouse space and in 21 Ford Parts Distribution Centers which have 6,100,000 sq. ft. and are strategically located throughout the United States.)

Imagine how incredibly costly and inefficient this would have been under the old paper file method! These are just a few of our centsible customers. We’d like to tell you about the others and what SYSTEM 2000 can do for you. Just send in the coupon—we’ll be right back with a penny for our thoughts.

Yes, tell me about being centsible with SYSTEM 2000.

☐ Send literature. ☐ I’m in a hurry—have someone call me.

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CIRCLE 7 ON READER CARD
From the Graphics Leader

DEVICE INDEPENDENT
CPU INDEPENDENT
HIGH QUALITY TEXT
3-D GRAPHICS
Graphic results can be reproduced in gray scale on our video copier or plotted in color on our digital plotters.

Our 4027 color graphics terminal incorporates sharp detail, powerful firmware functions and software support that sets the industry standard.

It's a combination of high performance and flexibility that could come only from Tektronix.

Display any 8 colors from a palette of 64, with precise control over hue, lightness and saturation. Firmware capabilities include concave and convex polygon fill; 120 user definable patterns; virtual bit mapping for unique scrolling of color displays and full-screen crosshair cursor that returns color information as well as x-y coordinates back to the host.

Our PLOT 10 software provides the tools for both graphing and graphics applications.

Our PLOT 10 Interactive Graphics Library contains the building blocks for basic, two-dimensional graphics, plus 3-D, high-quality text and color commands. It provides device and CPU independence: move from color raster displays to monochrome, DVST or pen plotters, without modifying code. Order the modules you need now, link up new capability in the future.

Written in ANSI FORTRAN IV, IGL is designed to keep pace with advancing computer power.

For quick turnaround from concept to finished graph, PLOT 10 Easy Graphing is the answer.

A few conversational, English-like commands produce full-color line graphs, bar charts, log and pie charts, quickly reproducible on our 4660 Series plotters.

4027 options include up to 192K of graphics memory, and a variety of peripheral interfaces from hard copy to video output.

Find out more about how the graphics leader makes color graphics easy. Call, toll free, 1-800-547-1512 (in Oregon, call 644-9051 collect), or contact your local Tektronix office.

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Information Display Division
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CICS/MM™

A whole new approach to CICS programming.

Saves Time
Display formats are designed interactively. “Mapping” is eliminated.

Reduces Costs
Actual lines of code are reduced 30 to 50%. Programming is easier.

Improves Performance
Programs are smaller, more efficient, and use fewer resources.

And More
• Automatic data editing
• Simplified maintenance
• Self-documenting

CICS/MM is a new software product that can have a dramatic impact on your on-line development efforts.

Contact us today.
We’d like to show you how.

CIRCLE 9 ON READER CARD

NOVEMBER/DECEMBER 1959
Fiber optics may still be in its adolescence, but the technology was born at least 20 years ago, as shown in our 1959 article on the subject. Several circumstances were cited in which fiber optics was of greater value than ordinary photographic techniques in recording data: (1) when very little light is available—which often happens when high speeds are used—(2) when there is a great amount to be recorded, and costs would drop as volume increased, and (3) when compact configuration is important, i.e., common photography methods usually mean much empty space is never utilized.

There was no commercial production of fiber optics at the time, although limited quantities of experimental fiber optics materials were available from American Optical Co. for users interested in researching the area for possible development. Even with the great interest in this technique, however, the fiber optics field in data recording has still not been explored to its full potential.

At the same time, companies in computer-related industries were virtually combing the country to recruit qualified personnel. GE, IBM, NCR, Litton Industries, Chrysler, Ford, Raytheon, Lockheed, T&T, and Sperry Rand, among others, placed classified ads seeking dp analysts, programmers, digital computer R&D teams, inertial guidance experts, engineers in numerous categories, logical designers, specialists in transistor circuits, magnetics, electron and physical optics, etc. Much of the work was of a military nature, as indicated in one ad by Raytheon for its Missile Systems Div. and another by GE for its Heavy Military Electronics Dept. One company, now defunct, placed an ad stating, “Wanted: War Game Players” in a search for mathematicians, statisticians, programmers, and operations research analysts. The ad continues, “Very large-scale air-battle digital computer simulations are now going on at ——” Research on sensitivity of certain model computers to input changes was the bottom line on its requirements. IBM ran a full-pager that read, “You can become an IBM Applied Scientist, if….” and went on to discuss educational and practical experience backgrounds necessary to join its ranks in the dp division.

DECEMBER 1969
And now, excerpts from a poem in computerese by Edmund Conti, which appeared in the December 1969 issue:

The Song of I/O-What-The
...From the wells of honey (Waltham)
From the IBM empty spaces
From the land of Univacuums
From the land of controlled data
From the burrows of Paoli
Where the coder, called programmer,
Feeds among the reeds (and writeouts)
I repeat them as I heard them
Memories from Glitchie-Kludgee
Father of all new computers
Also grand and great-grandfather
(Depending on their generations)...

...Glitchie-Kludgee, not realizing
That his thoughts are being printed
In the subroutine of someone
(Probably a sub-programmer)
Said programmer can’t debug them
Sends them in to Datamation
Thus depots our I/O-what-the
Not to mention Glitchie-Kludgee
In the back of Datamation
Back among the tempting want ads
With the agencies employing
With the agencies imploring
Back with advertisers’ index
And the bore-urn of the Forum.

Ask me once more what the point is
Ask me once more if you care to
Even if you couldn’t care less
I should tell you: I should tell you.
Printers for every job. Terminals for every line.  

NEC Spinwriter™ character printers and terminals can be configured in as many varieties as there are jobs to do. They start as basic 55-cps printer mechanisms for some OEM buyers who want to add their own value. Then they grow and change to fit your precise letter-quality output needs. Each of our 10 models is surrounded with features and options that make customizing easy. Eight industry-standard interfaces, serial and parallel, let you add Spinwriter printers quickly to your current system. Ten form-feed options—most operator changeable—provide unparalleled document handling flexibility. Dozens of 10 or 12 pitch and Proportional Space thimbles—with up to 128 characters—solve your technical and language output requirements. That's not all. Spinwriter printers and terminals lead the industry in reliability, with a more than 2000-hour MTBF. And in serviceability, with a 30-minute MTTR.

When you want hard-working printers that are tailored to your individual needs, call the NEC Spinwriter regional representative nearest you. He'll assure a perfect fit.  

NEC. Going after the perfect printer.

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Home Office and Eastern Region: 5 Militia Drive, Lexington, MA 02173, (617) 862-3121  
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Western Region: 8349 S Sepulveda Blvd, Los Angeles, CA 90045, (213) 670-7341  
Southern Region: 2965 Flowers Rd, South, Atlanta, GA 30341, (404) 458-7016  

CIRCLE 10 ON READER CARD
Remote processing from Northern Telecom: there’s not a single ingredient we can’t deliver.
DDP Data Entry, Remote Job Entry, On-Line. For every remote processing function, there's a state-of-the-art solution from Northern Telecom Systems Corporation.

DDP
We make DDP systems that grow to fit each of the different sizes you're going to be. Systems that add new capabilities for each new task — without adding idle capacity.

Data Entry
Northern Telecom builds both source Data Entry and volume Data Entry equipment. All with concurrent communications.

Because, if you don't have concurrent communications, your high-speed Data Entry system could spend a lot of time standing still.

Remote Job Entry
Our basic, low-cost Remote Job Entry system is a best seller. But we also deliver large-scale RJE equipment to handle massive throughput and all kinds of sophisticated needs.

On-Line
On-Line hardware from Northern Telecom is plug-compatible with IBM 3270's. But what makes our system unique is the Sprinter" printer. It makes a hard copy that's easy to read. It switches in minutes from continuous-roll paper to cut forms. And It adjusts with push buttons where others use wrenches.

Why our bigger choice makes us a better buy.
It's hard to keep all the components in your system working together when service people from each supplier work alone.

When you deal with Northern Telecom, one service team can take responsibility for every part of your remote processing operation. More than 1200 Northern Telecom field engineers are ready to go to work for you today.

And because Northern Telecom can meet all your remote processing needs, we can often meet them for less.

But the best reason to talk to us today — is tomorrow.
Northern Telecom is combining data processing expertise with telecommunications expertise—a mix no other company can match.

Today, it means better access to all the processing power you pay for. Tomorrow, it means a smoother transition to the single system that will meet all your processing and communications needs.

Talk to Northern Telecom Systems Corporation. Where computers and communications meet.

For the office nearest you, call our Marketing Services Department at 1-800-328-6760. In Minnesota call (612) 932-8202. Or write Northern Telecom Systems Corporation, Box 1222, Minneapolis, MN 55440

Northern Telecom Systems Corporation

CIRCLE 14 ON READER CARD
HP presents a computer
Start today.

At Hewlett-Packard, we've participated in the growth of networking for distributed systems right from the start. So we've had time to iron out a lot of the problems that go with it.

One problem was how to implement a distributed network today without limiting the growth needs of your company tomorrow. The answer: HP's Distributed Systems/1000—an advanced, real-time interactive communications package that you can install today without worrying about what changes the future may bring. DS/1000 gives you full system-to-system communications with the design flexibility to preserve your software investment, as well as accommodate the rapid advancements in computer technologies.

Rings, strings, stars: you name it.

No matter what configuration you need, HP's "layered" software approach lets you structure your network in a way that makes sense for your applications. You can arrange HP 1000 systems in star, ring, or string configurations—or any combination of them. Information passes from one system to another through intervening network nodes on an automatic "store-and-forward" basis without special instructions in your application software. And because you can access any system by simply specifying its node number, you can use the network just as easily from a remote terminal as from a local station.

With DS/1000, you can link workstations within a department as well as connect several departments on the factory floor (incoming inspection, final test, and quality control, for example). Or, you can link local manufacturing divisions to a host IBM mainframe or HP 3000 business system in your corporate EDP center. You can even create a nationwide network to coordinate geographically dispersed information.

All together. Now.

HP has a full range of real-time compatible hardware for implementing distributed computer networks—from terminals and interconnection hardware to sophisticated technical computers. A powerful data base management package with remote
Network for manufacturers.

Expand tomorrow.

Access capabilities will put the information you need right at your fingertips. And the modular software design will assure your orderly growth by allowing you to add to, or reconfigure, your DS/1000 network without affecting your existing programs.

Our long experience as a supplier of distributed systems means that HP's advanced technology is available now. Since 1973, HP computers have been installed in distributed networks around the world, all backed by extensive support systems.

If you'd like to know more about the HP 1000 computer system in distributed networking applications, call your nearest HP office listed in the White Pages and ask for a hands-on demonstration. Or for more information, write Hewlett-Packard, Attn: Roger Ueltzen, Dept. 454, 11000 Wolfe Road, Cupertino, CA 95014.
Want 400-1600 Kbytes? Choose our SA801/851 series. With the SA801 8-inch floppy, you have a choice of 400 or 800 Kbytes in single or double density, on the same drive for the same price. More than 400,000 of these standard-setting drives have been specified by OEM's around the world. They know that they can count on Shugart's proprietary read/write head technology to deliver media life of over 3.5 million passes per track, and head life of more than 15,000 hours. That's headstrong performance. And the double-sided SA851 drive gives you even more capacity. It stores 800 to 1600 Kbytes using single or double density recording. The 851's proprietary Fasflex™ band actuator improves track-to-track access time to a fast 3 ms. There's also a programmable door lock and write protect. The headstrong SA801/851.

Solid performers from the leader in floppy technology.

The head
Choose your

Moving up to 5-29 Mbytes? Check Shugart's SA1000 and SA4000 fixed disk drives with the lowest cost per Mbyte in their capacity range. The new 8-inch SA1000 breaks the $1,000 price barrier and is available in 5 and 10 Mbyte versions. Its dimensions and mounting holes are exactly the same as our floppy drives, and it's electrically compatible, too. The SA4000 offers 14.5 and 29 Mbyte capacity with an optional 144 Kbytes of head-per-track storage. Compact and lightweight, it uses only 5¹⁄₄ inches of panel space and weighs only 35 pounds. All Shugart fixed disk drives use proven Winchester head and media technology to ensure better data integrity and longer trouble-free life. And system integration is easy because both the SA1000 and SA4000 can share a power supply with your floppy drives. Shugart fixed disk drives. The head of the family in capacity and cost/performance.
Need 110-440 Kbytes? The famous Minifloppy™ is the right choice. The Minifloppy stores from 110 to 440 Kbytes in a package about half the size of a standard floppy. We invented the Minifloppy family just two years ago and there are already well over 150,000 installed world wide. Compact size, reliability, and lowest cost per function are the reasons. Minifloppy drives have the same headstrong read/write head technology as their big brothers. The servo-controlled DC drive motor eliminates AC power requirements and the simplified actuator with direct drive spiral cam gives you track-to-track access as fast as 25 ms. The little drives offer the lowest heat dissipation of any floppy drive and feature positive media insertion, write protect, and activity light. Minifloppy. The original, and still the most popular 5¼-inch floppy drive in the world.

strong family. capacity.

The Shugart Family. Headstrong and proud of it. We're headstrong about our commitment to our customers. This means supplying you with a family of highly reliable, low cost disk drives in the quantities you need. And it means providing you with the best technical support and documentation in the industry. But it goes deeper. Like maintaining in-house control over the design and manufacture of 100% of our floppy read/write heads. And the continuing investment of financial and human resources in the development of new products and the most modern high volume manufacturing facilities in the business. This is the commitment that keeps our family growing.

Headstrong? You bet. And proud of it. Shugart Associates Headquarters: 435 Oakmead Parkway, Sunnyvale, California 94086 (408) 733-0100; West Coast Sales/Service: (408) 737-9241; Midwest Sales/Service: (612) 574-9750; East Coast Sales/Service: (617) 893-0560; Europe Sales/Service: Paris (1) 686-00-85; Munich (089) 176006; Shugart products are also available off the shelf from local Hamilton Avnet outlets.
NOW,
A FULLY-INTEGRATED,
MULTI-USER,
INTERACTIVE
COMPUTER SYSTEM
FOR JUST
$29,950*

The 5000/ES: BTI's new Entry System to
the 5000 product line. It's a fully-integrated
system specifically designed for a multi-user
environment, featuring:
- MULTUS multi-user timesharing
  executive.
- Full-scale 16-bit minicomputer with the
  processing power and I/O capacity to support
  multiple concurrent users.
- 10 megabytes of hard disk; expandable to
  over 100 megabytes.
- 4 user ports; expandable to 32 ports.
- 6400 bpi cartridge magnetic tape.
- Unique proprietary account protection for
  application software.
- Optional industry-compatible magnetic
tape; line printers to 900 lpm.
- 24 hours/day, 365 days/year maintenance
  support by BTI, featuring computer-to-
  computer remote diagnostics.
- The BTI 5000/ES is backed by experience
  —over 1000 BTI 5000 systems have been
delivered.

Application software is available for:
accounting, financial modeling; manufacturing;
medical billing; pharmacy management;
school administration; text publishing; mailing
list management; general-purpose data base manage
ment; and more.

Call us for details on the
new BTI 5000/ES.
## IN AND OUT OF RENTALS

In September, Digital Equipment Corp.'s president Ken Olsen sparked hopeful OEM speculation about DEC beginning system rentals when he told NY security analysts that "for a specific product, it might be just the right thing to do." Unofficial DEC comments suggested Olsen was referring only to word processing--where competitors claim DEC already has offered rental terms in unusual cases--and Olsen himself tried to dismiss the rental rumors at the Oct. 30 annual meeting as little more than a passing fancy, far from a market offering.

## WANG'S CHALLENGE TO TI, DATAPoint

Wang Laboratories said it will offer new low end additions to its 2200 product line to challenge Texas Instruments and Datapoint in the small general business system and distributed processing market. The Wang system, priced between $12,000 and $15,000, will be of a design similar to the Wang MVP and fully compatible with existing 2200 systems. To be introduced in March, the little 2200 will have dual double density disks and Winchester drives.

## WHAT'S NEXT FROM DATAPoint?

A graphics capability for its electronic message system (EMS) is in the works at Datapoint Corp., which announced the EMS last month (page 76) with a text-only application. As announced, the system interfaces with the San Antonio company's attached resource computer system, its long distance control system or can be used on a standalone basis to transmit messages for printout anywhere a terminal is located. The next step will involve transmitting multiple copies of messages simply by inputting a visual image or a sheet of paper and ordering the number of copies that should go to a recipient. Then the specified number of copies would be printed at the destinations.

## DRAWING A BEAD ON AT&T

Continuing delays plaguing AT&T in its development of the advanced communications service (ACS) has not gone unnoticed at GTE. Just like Avis, the No. 2 phone company seems determined to try harder when it comes to bringing value added network services to users. Having acquired Telenet Communications Corp. earlier this year, GTE also owns the U.S. rights to the British Viewdata type of service. And now Telenet has purchased Cambridge Telecommunications Corp., a pioneer in packet network software and intelligent processors that allow incompatible IBM terminals to operate on X.25 networks such as Telenet.

While ACS is stalled, GTE will encourage Telenet to introduce electronic mail and other advanced features. Innovative marketing experts have been working at Telenet to develop such services on a top priority basis. Customers who sign up for these services would be firmly entrenched and have to think hard before switching to ACS when it finally gets going, according to the GTE game plan.
...AND THERE IS MORE

Industry experts believe Viewdata type services may only be cost effective in the business sector and not the home. Thus a packet network like Telenet geared to business would make an ideal delivery system for such data base services. GTE is configuring a new operation to spearhead the introduction of advanced value added services. One of the pioneers in packet networks, David Horton, now director of computer communications development at Hawaiian Telephone Co., a GTE affiliate, reportedly will soon accept a post at GTE headquarters at Stamford, Conn. With Horton playing a key role, General Telephone is determined to get a jump on ACS and maybe also Satellite Business Systems and Xerox's XTEN. Having an operational packet net in place, is more than all other value added carriers, except Tymnet, have been able to put together. GTE with its widespread organization and resources would like to corner the market before the others can react.

THE MANY USES OF THE 4331

The capabilities of the 4331 have been highly touted by both IBM and its first users. Its price/performance is considered to have boded ill for many a PCM. But what about terminal manufacturers? Informatics, the software company, was a first taker for the 4331 in its Washington office. "And we can get as many as we want," said executive vice president Frank Wagner. What are they using it for? "As a super-intelligent terminal for a customer who wanted to cut the wire to his hated central dp site."

"WHERE WOULD WE BUILD IT?"

Data General says its 32-bit "Eagle" system, expected by some to be introduced this month, has been delayed by DG's internal squeeze on manufacturing capacity. "Where would we build it?" asked DG exec Bradley Stroup, noting DG's struggle to meet Nova 4 demand and to keep their delivery edge over Digital Equipment Corp.

RUMORS AND RAW RANDOM DATA

IBM's marketing expertise is hard to top. A Los Angeles salesman for the Armonk giant, who peddles automated teller machines (ATM) to southland banks, dressed his eight-year-old daughter up as a walking ATM on trick-or-treat night and sent her to his big bank customers. Except where one normally would deposit cash in most ATM's, this one admonished: "Deposit candy." Reports are she got a lot of both. And maybe some goodwill for IBM... The so-called office of the future has gotten official recognition from the Assn. for Computing Machinery (ACM). ACM has formed a new special interest group -- SIGOA (for Office Automation) -- or, as some wags put it, Sig--Olay.

RICHARD O. BAILY

Veteran computer industry executive Richard O. Baily, the president and CEO of Lexitron, died Nov. 9 in Los Angeles after a short illness. Mr. Baily, 55, joined Burroughs Corp. in 1947 and left the company in 1971 to become president of Singer's Friden Business Machines Division. He became president of Lexitron, a word processing manufacturer, in 1976.
A Major Enhancement

Release 8 Is The New MARK IV.

Now you can choose a major new product that can dramatically reduce the cost of programming your business applications. It's called MARK IV® Release 8. It offers major new improvements in throughput, graphics capabilities, on-line support, and multi-dimensional arrays.

(MARK IV is the most successful application implementation software product ever sold. Today it's in use at more than 1,400 computer sites in 44 countries.)

Release 8 has been configured to deliver optimal price/performance for your operating system, database, and virtual memory needs, and DOS-level systems at attractive prices.

Enhancement By Committee.

Many of the advantages available to you in Release 8 are the direct result of the experience of actual MARK IV users: the System Evaluation Committee of the MARK IV User Group.

The number one priority of this experienced group was array processing.

So now the new array definition capability of Release 8 lets you process multi-dimensional arrays to quickly produce aging reports, cross-foot financial reports, and statistical summaries.

Enhanced Throughput.

You achieve it through major architectural changes in Release 8 software.

You get single-step processing capability.

This simplifies execution procedures and reduces I/O channel activity for report sorting.

And since Release 8 uses sophisticated compilation techniques, execution speed is comparable to equivalent COBOL jobs.

Enhanced Data Display.

Graphics is another new feature of Release 8. You can produce vertical or horizontal bar graphs. Scatter diagrams. Absolute or relative bar graphs. And recap summary reports.

All of this display flexibility can be extremely useful in graphic management reports, forecasting, and mathematical or trend analysis.

Enhanced On-Line Support.

Release 8 now makes the MARK IV data inquiry language available for CICS and INTERCOMM environments—together with several query language extensions and enhanced IMS/DC support.

And Release 8 now provides a compatible query language for use with all of these operating systems and monitors:

OS, OS/VS, DOS, DOS/VS, IMS/DC, CICS, INTERCOMM, TSO, and CMS—among others.

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MARK IV Release 8 is a new Implementation System from Informatics. It is a working tool. A system specifically designed to expand the problem-solving power of the human mind.

Discover all of the ways it can help you realize the maximum potential of your programming staff.

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Mr. Ron Mullenaux, Informatics Inc.
21050 Vanowen Street, Canoga Park,
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The new, high-performance 990/12 CPU provides the throughput you need. In many applications, the Models 20 and 30 can handle 20 or more different jobs at speeds up to three times faster than the proven mid-range members of the DS990 computer family. And the compatibility of the DS990 computer family enables you to upgrade your existing hardware and software to the more powerful Models 20 and 30 easily, at minimal expense.

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Until now, the weakest link in IBM 370 and 303X systems has been the slow response of electromechanical disk drives. Today Intel delivers FAST-3805, the solid-state paging device with access speeds ten times faster than even the best performing disk.

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Beyond the inherent reliability of solid state circuitry over electromechanical devices, FAST-3805 gives you unparalleled lines of defense against uncorrectable errors—all on-board. Double-bit error checking and correction (ECC) provides "self-healing" capabilities equal to those specified in the military’s highest reliability systems. Additionally, a powerful iSBC 86™ single board computer performs continuous sweeping error detection and relocation of data to spare storage, if necessary. The entire FAST-3805 system is supported by motor generator sets to ensure data integrity in case of power fluctuations.

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We’re delivering FAST-3805 now. For more information on how it can increase virtual paging throughput in your system, contact Intel Commercial Systems, P.O. Box 35900, Phoenix, Arizona 85069. Or call (800) 528-0590.

**PERFORMANCE COMPARISON**

<table>
<thead>
<tr>
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<th>INTEL</th>
<th>3350F</th>
<th>2305-2</th>
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<td>1.2</td>
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<tr>
<td>Capacity (Mb/s)</td>
<td>12-72</td>
<td>1</td>
<td>11.2</td>
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Sixth Semiannual ATE Seminar/Exhibit, January 8-10, Pasadena, Calif. Features a comprehensive program of workshops, technical papers, and courses. Contact Sheila Goggin, ATE, 1050 Commonwealth Ave., Boston, MA 02215, (617) 232-5470.


WINCON '80, January 29-31, Los Angeles. Scientists and engineers from government, military, and industry will attend to probe new technology and developments in electronics and aerospace. Contact Richard L. Harmon, (714) 557-4700.

Data '80, February 12-14, Toronto. The program will feature panel sessions, audiovisual presentations, workshops, and technical sessions related to the field of data communications. Contact Laurie Whitson, 2 Bloor St. West, Suite 2504, Toronto, Ontario M4W 3E2, (416) 967-6200.


NEPCON West '80, February 26-28, Anaheim, Calif. This will be the largest conference program in its history, consisting of 63 technical sessions, numerous workshops, professional advancement courses, and open forums. Contact Industrial and Scientific Conference Management, Inc., 222 West Adams St., Chicago, Ill. 60606, (312) 263-4866.

CALENDAR

NCC Office Automation Conference, March 3-5, Atlanta. Sponsored by AFIPS in cooperation with its member societies—the Association for Computer Machinery, the Data Processing Management Association, the IEEE Computer Society, and the Society for Computer Simulation. Contact Jerry Chiffriller, c/o AFIPS, 1815 N. Lynn St., Arlington, VA 92209, (703) 243-4100.

Conference on Application Development Systems, March 9-11, Santa Clara, Calif. Contact Mitch Zolliker, IBM Research, San Jose, CA 95121, (408) 256-7582.


The Middle East Business Equipment Show, March 16-20, Bahrain. First international event of this kind held in the Persian Gulf. Will contain a comprehensive and modern range of products and services from the entire spectrum of the business equipment industry. Contact Stephen Powell, Arabian Exhibition Manager, 11 Manchester Square, London, W1M 5AB, 01-486-1951.


Federal DP Expo, April 28-30, Washington, D.C. Update on trends, applications, and stage of the art of all facets of ADP. Contact Sheldon Adelson, Conference Director, 160 Spen St., Framingham, MA 01701, (617) 879-4502.

The Seventh International Symposium on Computer Architecture, May 6-8, La Baule, France. Contact Jacques Andre, Campus de Beaulieu, Avenue du General leclerc, 35042-Rennes, Cedex, France (99) 36 48 15.

NCC, May 19-22, Anaheim, Calif. Will cover the broad areas of management, applications, science and technology, and social implications. Contact AFIPS, 1815 North Lynn St., Arlington, VA 22209, (703) 243-4100.

CECON, May 20-22, Cleveland. The exhibits will display new products related to instruments, components, and systems. Contact Cleveland Electronics Conference, Inc., 2728 Euclid Ave., 5th floor, Cleveland, OH 44115, (216) 241-5515.

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Since its introduction in August, 1977, the Challenger III has become one of the most successful microcomputer systems in small business, educational and industrial development applications. Tens of thousands of Challenger III’s have been delivered and today hundreds of demonstrator units are set up at systems dealers around the country.

The Challenger III systems offer features which make their performance comparable with today’s most powerful mini-based systems. Some of these features are:

**Three processors today, more tomorrow.**

The Challenger III Series is the only computer system with the three most popular processors — the 6502A, 68000 and Z-80. This allows you to take maximum advantage of the Ohio Scientific software library and programs offered by independent suppliers and publishers. And all Challenger III’s have provisions for the next generation of 16 bit micros via their 16 bit data BUS, 20 address bits, and unused processor select codes. This means you’ll be able to plug a CPU expander card with two or more 16 bit micros right into your existing Challenger III computer.

**Systems Software for three processors.**

Five DOS options including development, end user, and virtual data file single user systems, real time, time share, and networkable multi-user systems.

The three most popular computer languages including three types of BASIC plus FORTRAN and COBOL with more languages available from independent suppliers. And, of course, complete assembler, editor, debugger and run time packages for each of the system’s microprocessors.

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Ready made factory supported small business software including Accounts Receivable, Payables, Cash Receipts, Disbursements, General Ledger, Balance Sheet, P & L Statements, Payroll, Personnel Files, Inventory and Order Entry as stand alone packages or integrated systems. A complete word processor system with full editing and output formatting including justification, proportional spacing and hyphenation.

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The “GT” option yields sub-microsecond microcomputing.

Ohio Scientific offers the 6502C microprocessor with 150 nanosecond main memory as the GT option on all Challenger III Series products. The system performs an average of 1.5 million instructions per second executing typical end user applications software (and that’s a mix of 8, 16 and 24 bit instructions!).

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**Networking and Distributed Processing**

OS-65U level 3 now provides networking capabilities as well as time sharing ability allowing Challenger III based systems to be expanded to meet the most demanding business applications.

**Prices you have to take seriously.**

The Challenger III systems have phenomenal performance-to-cost ratios. The C3-S1 with 48K static RAM, dual 8" floppy's, RS-232 port, BASIC and DOS has a suggested retail price of under $4000. 80 megabyte disk based systems start at under $13,000. Our OS-CP/M software package with BASIC, FORTRAN and COBOL is only $600, and other options are comparably priced.

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For more information, write to us at Sperry Univac Mini-Computer Operations, 2722 Michelson Drive, Irvine, California 92713. Or call (714) 833-2400, Marketing Communications.


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A Job Recovery Management System that makes restarts and reruns simple (UCC-15). Circle 156
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The ARCPAC shown here, for example, can handle 1.85 million instructions per second (mips). Add on another 60K processor and the system's capacity increases to 2.10 mips. A second 60K processor added on brings it up to 2.35 mips. And on and on, almost without limit.

No systemwide failures

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The ARCPAC Package

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DECEMBER 1979 35
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- 20-45% in Elapsed Time;
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- 20-50% in Disk Space Utilization;
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PROGRAMMER DIVIDENDS. 1.3 introduces a number of new features designed to reduce the effort that goes into applications programming:

- A new facility that prints sort output with page and column titles. When used with other features like INCLUDE/OMIT, SUM and OUTREC, this one can often eliminate a lot of time-consuming coding, compiling and debugging.
- COPY—copies one file onto another while bypassing the sorting process. A powerful file-edit utility when used with the three features above.

SYSTEMS DIVIDENDS. The new release is smart enough to sense your overall system requirements and then make adjustments to keep sorts from interfering with non-vops.

- Storage Auto Option—a new concept that manages your system's real storage in accordance with your overall system priorities.
- PARM-EXIT—dynamically modifies sort parameters.
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But the best way to find out what SyncSort can do is simply to try it. Benchmark it against your present sort on identical files and make your own judgement.

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Hudson, New Hampshire 03051,
(603) 883-0111.
RACER'S EDGE
Re: "From Nags to Riches" (Sept., p. 207): The system not merely purportedly overcomes the traditional 17% edge at the California racetracks, but does give the player a 28% advantage on selected winning wagers. Wow! I must say the supporting statistics from 102 races at Hollywood Park do look impressive.

Ah, if such an edge is true, player feedback (not to mention action by the track handicappers who weight the horses) will soon kill it off. And much more quickly than happened with blackjack in the Nevada casinos.

In 1960, I was the first computing professional, using a venerable IBM 650, to analyze the game with a stratified sampling model and correct sampling without replacement. My result: the single deck game played according to Las Vegas Strip rules and with correct basic strategy was dead even. Hence, use of card counting to improve one's odds definitely to a positive expectation. Wide circulation of these facts led to various countermeasures by the casinos, such as the introduction of four-deck shoes (inherently less favorable than one deck). Adroit players who maintain a low profile can, of course, sustainably even on four decks, but the feedback has made it a much tougher act.

Those wishing to exploit the bonanza at the tracks before it disappears should pay heed to this advice. To maximize the rate of win (with virtually zero risk of ultimate wipeout), use the optimal betting principle. Betting the right fraction of current bankroll is the key. Using round numbers to simplify an example, 36% winners yielding a 26% return would on average correspond to a payback of 2.5:1 on win. Solve for X in .36(X) - .64(1) = .26 to get that. The proper fraction of bankroll to bet is .26/2.5 = .104 or about 10%. In 100 wagers, the expected factor of multiplication of bankroll is

\[(1 + .26)^{100} (1-.104)^{100} = 3.6\]

Professor Thorp (University of California at Irvine) has further refined the concept, with published research in the journals. And more to the point, he has used it very successfully in multimillion dollar investments in stock/warrant and stock/option hedging!

ALLAN N. WILSON
La Jolla, California

Although Mr. Barber presented an interesting and excellent evaluation of the Racetrack Computer distributed by the Starshine Group of Santa Barbara, he appears to have made a misstatement concerning the algorithm used by the device.

The Starshine Group is now selling a supposed improved Racetrack Computer II which requires only slightly different data than the model examined by Mr. Barber. As with the original model, the new unit requires four pieces of data. The fact that the device needs the first piece of data (the median speed rating of the past three races) to be entered twice is an indication that the unit is not a special purpose device.

After manipulating the numbers from two problems entered into the device at a local calculator shop, I managed to uncover the amazingly simple algorithm. The method requires not "three additions, one subtraction, a square, and a divide function" as Mr. Barber states; rather, it requires only one each of the four basic functions (divide, multiply, subtract, and add, in that order.)

While the device used by Mr. Barber is a prior model, everything he stated in his article, together with the fact that the new model requires essentially the same data, seems to indicate that the hardware and algorithm are the same.

Although the algorithm may be used on virtually any calculator with the same number of keystrokes as the Racetrack Computer, the Starshine Group should be complimented for their ability to develop such a surprisingly simple system with the excellent predictive capabilities outlined in Mr. Barber's article.

DAVID GUIDO
Data Processing Manager
Larry's Food Products, Inc.
Gardenia, California

PERSONALITY PLUS
Re: "Time to Retire the Telephone?" (Aug., p. 185): Our world is rapidly becoming reduced to binary exchanges between data processing managers with all hope of human personality being lost in the transmissions. I disagree with the desire to eliminate all extraneous personal conversation that prefacse and suffices an exchange of necessary information. Are we all going to reduce ourselves to faceless robots?

Part of my job is to read out of the voices coming through my telephone whether or not the caller is someone I wish to hire, terminate, cultivate, or place. By intense listening I can detect whether my requests will be followed, at least heard and understood, or dropped by the wayside. How does Mr. Marill know if his automated action advisories are received, much less correctly understood? Printed words mean different things to different people. A flavorless, impersonal paper message is all too often totally misinterpreted—what you say is not as important as how you say it.

If I could afford it, I'd have the Bell System's long-awaited videophone on my desk. I need to see the expression on my caller's face to fully understand how well received my message is. I know a prominent manager who has 8 X 10 photos of all his field personnel pasted on the wall opposite his desk. When he calls any one of them he can look at the appropriate photo and associate a personality with the voice he is hearing. Electronic mail, which Mr. Marill suggests we use, would reduce each of us to a totally impersonal page of print.

Is time so terribly important that we have to do business in an atmosphere empty of all human feeling? Okay, then let's program the computers to compare notes, make their own decisions, and go to staff meetings in our places. I'll use a video cassette for all my presentations, have a tape recorder take notes, a voice response unit answer my questions, and a facsimile machine transmit the action items back to the plant computer for processing. But don't look for me—I'll be at the zoo, listening to what may be the last conversational exchanges ever to be heard on earth.

JERROLD ASHER
National Sales Manager
Bishop Graphics, Inc.
Westlake Village, California

CORRECTION
Re: "Estimating Software Costs" (Oct., p. 171): Those who actually worked out the equations may have been disgruntled at the results. The equation describing the relationship between number of source statements and the effort, development time, and state of technology applied to the project should have read

\[S = C_0 (K + t)^{1/2}\]

the final superscript was left out).

*
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The easy-to-use HP 2621 interactive terminals have typewriter-like keyboards with control keys labeled right on the screen for self-test, configuration, display and editing. And with just a keystroke, the 2621P's built-in thermal printer will deliver a printout from the screen in seconds.

Impact Printers
Hard copy is easy with our microprocessor-controlled HP 2635 Printing Terminal and 2631 Printer. The easy-to-read 7x9 dot matrix meets the 128-character ASCII Standard, allows true underlining and descenders, and prints six-part forms. The 2631G model even prints graphics output from HP 2647/48 terminals. Both the 2635 and 2631 zip along at 180 cps in both directions. The microprocessor determines the optimum print path, and a high-speed slew speeds up printing columnar data.
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The HP 3077A time Reporting terminal has a built-in clock/display and punched badge reader for time and attendance applications.

Graphics Plotter
The HP 7225A offers a cost-effective approach to professional hard copy graphics. By changing a plug-in module, the 7225A will provide the appropriate interface, language, and graphics capabilities for a variety of computer and instrument systems.

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The desktop HP 7245A uses a thin-film head to produce quality graphics, clean printing and flexible labeling. There are two printing speeds (19 and 38 cps) in four orthogonal directions, and drawn characters may be programmed for size, slant, direction and placement.

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The microprocessor-based HP 9872A plotter produces high-quality, multicolored graphic plots on charts up to 280x432 mm. It has five built-in character sets, with labeling, point digitizing, character sizing and window plotting capabilities.

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The San Francisco Bay Area is first up on the Tour, March 19-21, 1980, at the San Mateo Fairgrounds. Tickets are $10 at the door ($5 with the coupon below), entitling you to the full complement of Expo activities. The rest of the schedule includes L.A. (March 25-27), Dallas (April 1-3), New York (April 22-24), Baltimore (April 28-30), Boston (May 6-8), Detroit (June 3-5), Chicago (June 10-12), and Cincinnati (June 17-19). Be sure to mark your calendar now for the show in your area.

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Communication Gets FERST Priority at Burlington Northern

"Three programmers implemented our nationwide online message-switching system in 3 months, using FERST/VS," says Timothy L. Cherney, director of data processing for Burlington Northern Air Freight, Inc.

The Freight and Equipment Reporting System for Transportation/Virtual Storage (FERST/VS) is an IBM program product. To support its air freight operations, the Burlington Northern, Inc. subsidiary adopted one module of FERST/VS, called Message Switching, installing it in an IBM System/370 Model 148.

To speed shipments to customers, the Newport Beach, California-based company transmits a steady stream of administrative information around the world among its 86 offices. Today, the computer serves as a switch through which all this traffic flows. It queues the messages, stores them, and then forwards each as the destination terminal becomes available.

When an inquiry is not immediately resolved, the system automatically keeps track of it and periodically transmits reminders to the responsible station. A copy of each message is retained in memory and can be recalled at any time within 120 hours, or all traffic for that five-day interval can be reproduced. And, Cherney says, there has been a significant gain in speed of communication because of the computer's fast transmission rates and the efficiency of SDLC.

"The tracing function," Cherney adds, "which allows an operator at a terminal to ask the system for the present location of any shipment, was developed during our first year. By the time the system is two years old we will have total airbill entry, dramatically reducing the amount of paper required to move freight."

Burlington Northern's worldwide network was built using IBM's System Network Architecture (SNA). "With SNA," Cherney points out, "we are able to put the most appropriate device at each location without incurring additional line costs or rewriting our software. SNA gives us the flexibility to respond rapidly to technological advancements that fit the business needs of our company."
Four programmer-analysts created the online customer order processing system at Hills Bros. Coffee, Incorporated, in 15 months from the inception of the project to startup of the system nationally.

"It permitted us to cut the time between receipt of an order and mailing the invoice by 14 days, taking $3 million out of our receivables float," says Frank Pinkela, manager of the Information Systems Department for Hills Bros. The San Francisco-based company is one of the oldest and largest purveyors of coffee in the United States.

Pinkela is describing a new transaction-oriented system which supports a nationwide network of terminals. "We tightened inventory from a four or five week supply down to 3 to 4 weeks," he notes. "At the same time we raised the customer service level from 96 to 99 percent," says Allen Weitzel, corporate distribution manager.

"We previously had a card-oriented batch system," adds Pinkela. "So we had to write online programs from scratch, including support for our terminal network. We could not have done it in so brief a time without DL/I and CICS."

Data Language/1 (DL/I) is an IBM data base manager that organizes and stores the data for any number of application programs. The Customer Information Control System/Virtual Storage (CICS/VS), also an IBM program product, complements DL/I by handling the details of transaction processing and terminal support.

Programmers at Hills Bros. worked at IBM 3277 Visual Display Stations to develop the system, using Source Program Maintenance Online (SPMOL). This IBM program product provides for writing and editing of a program directly at a terminal, and submitting it to the batch stream for compilation and execution.

"SPMOL increased our programmer productivity by 50 percent," Pinkela says. "They get faster turnaround on compilations, immediate diagnostics, and management of source code for test and production." 

"Now that the system is up and running, we are adding to the data base for future applications such as a forecasting model and an online inquiry capability. In two years we've covered a lot of ground; today the information systems function at Hills Bros. is prepared to grow as the business grows."

At Hills Bros., experts sample coffee, then proportion the blend. In 15 months, the company implemented an online order-processing system supporting a nationwide network of terminals.
A Trane Company technician measures the sound level of a central air-conditioning system. For order entry and other applications, Trane's nationwide data network supports several types of terminal under SNA. As little as one day is required to add a new site to the network.

SNA Helps Trane Keep Its COOL

"We have 180 IBM 3767 Communication Terminals across the country for online order entry. Using SNA, we were able to put another 100 devices of different types on the same network, for other applications: remote job entry terminals, visual display stations, and the like."

Gordon Searle is describing the use of Systems Network Architecture (SNA) as the basis for the Computerized Order On Line (COOL) system at The Trane Company. Searle is director of corporate data processing for Trane, a major manufacturer of central air-conditioning systems.

"Today a customer order is accepted and forwarded to manufacturing or shipping in minutes, not days or weeks. As a result, we're retaining business we would have lost—particularly for service parts."

An order for the Commercial Division, keyed into any terminal in the network, is processed on an IBM System/370 Model 158 at Trane's Residential Division plant in Clarksville, Tennessee.

"And SNA has saved us money during implementation. Among other benefits, it relieves the programmers of many of the communications concerns that complicate an online development. Phase one of the project was completed on time and within budget."

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A growth organization consistently seeking growth-oriented people.
Confusion. That’s the word we’d choose to characterize the computer industry in 1979.

Although many things contributed to the muddle, one series of events stands out. With the announcement of the 4300, IBM triggered a chain reaction that created both opportunity and disaster. At the same time they opened a window that could bring one of their most feared competitors into the U.S. marketplace.

It all began last January, when, after much rumor and speculation, the E Series, or 4300, was announced. Price/performance levels were stunning, far better than anyone had anticipated.

Gritting their teeth, IBM’s competitors came up with a flurry of new announcements, and watched their profit margins plummet.

Itel, already faltering, was cut off neatly at the knees. The leasing industry suffered a bloodbath. Residual values on 370s nose-dived, and the redoubtable Lloyds of London, who had made the costly mistake of insuring a number of leasing companies, learned what it means to get into the same ring with the Gray Giant and lose.

Even IBM was caught in the backwash of its own announcement. Users, reasoning that the high-end H Series, reportedly due next year, would offer the same attractive price/performance as the 4300, began leasing instead of buying, or substituting used mainframes for new ones. IBM’s cash flow faltered. Sales of the 8100 and the 303X slowed.

Uncertain as to how the 4300, 8100, and S/38 fit into their capacity planning strategies, users flocked to the order queues, knowing they could cancel later. The order picture became inflated and confused, muddying the waters for IBM and its competitors as well.

A window has been opened. With the users confused, with the competition in disarray, with IBM’s new low-end machines yet to be delivered and its high-end machine yet to be announced, there is an opportunity for those ready to seize it.

IBM has its domestic competitors fairly well under control. But the invasions from overseas are becoming more frequent and more effective. And to the east, Japan is massing its forces once more.

Three Japanese firms are positioned to move into the window. Fujitsu recently concluded a joint venture agreement with TRW; Japanese executives are touring TRW facilities to see how the two might work together. Hitachi, left dangling after Itel’s demise, has the machines if not the marketing. Nippon Electric (NEC) is already here with components and small business machines; their ACOS series of general purpose mainframes, not presently marketed here, is available.

So, at the very least, we have three strong Japanese companies that could join the other foreign and domestic companies in taking advantage of the present window.

But although the window is open, our guess is that the Japanese won’t climb through. Judging by past performance, they will take a careful look around before moving into a new market.

They do not yet have the maintenance capability to support a major sales thrust in this country. The language difference mitigates against them as does the lack of good software, especially applications software, which must reflect the idiosyncrasies of U.S. business, a world and a culture apart from Japanese corporate practices.

But these are not insurmountable problems. A joint venture such as the one between Fujitsu and TRW can take the sting out of maintenance and marketing.

And because the Japanese user demands extraordinary amounts of reliability, the hardware is of the highest quality, a technological edge that could make a significant difference in future American markets.

Japan may not be coming in the window in 1980. But IBM and the other American computer companies must be fully aware that they will be tromping in the door by 1985.
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ADAPSO raced into the '80s amid silver dollars and worries about Ma Bell.

"I fear Bell to no end, much more than IBM."

This statement was made during a question and answer session at the Association for Data Processing Service Organizations' (ADAPSO) 31st Management Conference in late October in Colorado Springs. Topic of the session was the impact of recent IBM announcements or as one speaker, David E. Gold, Saratoga, Calif., consultant, paraphrased it, "Ode to Itel."

ADAPSO's concern with AT&T came up in other sessions. During a business meeting, Bruce Coleman of Informatics, the association's vice president for software issues, noted that ADAPSO had filed a protest with the Justice Dept. asking it to move against Western Electric Co.'s sale of computer software packages, contending that it is "in blatant violation" of the AT&T/Justice Dept. 1956 consent decree, which limits Bell to the provision of communications-related products and services.

And the first question asked of an ADAPSO conference key speaker, Archie McGill, AT&T's vice president, business marketing, posed by ADAPSO president John Imlay, was: "Do you intend to be the world's largest producer of software?"

McGill's answer, as were many of his remarks that day, was designed to reassure. "We do not intend to sell packages. We will make systems program sales only where they support sales of our services."

He allowed as how "we are advertising and selling standalone program systems and this is dominated by the sale of Unix. Unix is a time-sharing operating system for Digital Equipment Corp. PDP-11S which was developed at Bell Laboratories in the early '70s. Bell originally gave the system away but demand forced the company to charge for it." "We could not withdraw unilaterally," said McGill. But, he added, "this (sale of software) is not our game. We're not interested. We don't want to be there and we're not adding products. If I have any control, we will not." This earned him a round of applause.

McGill said AT&T was having "serious programming problems" internally and didn't need the extra problems of developing software for sale. He could have been referring to programming problems which have set back the phone company's ambitious Advanced Communications System (ACS). AT&T has withdrawn its application to the FCC to operate the service which once was to have started last October.

McGill predicted for his ADAPSO audience that software "will become the backbone of the communications process by the mid '80s. We need you to explore the marketplace. We are unable to do it ourselves."

He said customer expenditures on communications, which were $200 billion in 1978, will reach $500 billion per year by the late '80s.

Theme of the conference was "Racing Into the '80s" and ADAPSO had its own racehorse, Cricket, ever present on the grounds of Colorado Springs' plush Broadmoor Hotel. The crystal-ball ing was generally optimistic.

This was true even in the session on the impact of the IBM announcements. Gold, noting that "there are no problems in life, only opportunities," said IBM is "just as locked into 370 compatibility as anyone else," and that others, particularly the plug-compatible manufacturers, can offer better solutions and better delivery schedules and "there's no reason you can't have plug-compatible software."

Gold said he doesn't think the so-called H-Series will be announced until 1981 and that its price performance improvement won't be nearly as dramatic as that of the 4300. He sees it as two or three
times the price performance of the 303X family. His rationale for saying '81 instead of the more oft-quoted early '80 timeframe: "There's no reason to eat your own children."

The most comprehensive picture of the '80s drawn at the ADAPSO conference was by Richard W. Anderson, general manager, Data Systems Div., Hewlett-Packard. "Computers in the '80s," said Anderson, "are going to be dominated by a dramatic larger scale movement toward distributed processing and distributed networks." He used water supply as an analogy. Once, he said, everyone went to a central well for water. Now we're used to having the water supply at our disposal at home.

He predicted that distributed systems will dominate systems technology and systems considerations and that public packet switching will come into its own.

He looks for a single chip processor, "a true microcomputer as opposed to microprocessors which take multiple chips," to show up in the early '80s.

"Charge coupled devices won't make it. They'll lose out to bubbles in the early '80s."

The thrust will shift to more performance, usability or friendliness. "By the mid-'80s, he predicted, "minis will achieve the performance of today's mainframes at today's mini prices."

Anderson doesn't believe charge coupled devices (ccd's) are going to make it. "They'll lose out to bubbles in the early '80s." He foresees two million transistors per lsi chip by the end of the decade.

And as for programming, "We'll no longer be programming to try to conserve memory." He feels there will be more stress on computer vendors for parameterization of software, for software to be used for applications generation. He also looks for "a fairly extensive appearance of computer software in public

The year 1978 was a good one for the computer services industry in the U.S. and 1979 looks just as good.

These conclusions can be culled from the 13th Annual Survey of The Computer Services Industry produced for the Association of Data Processing Services Organizations (ADAPSO) by Input, Palo Alto, Calif.

The survey shows available U.S. computer services revenues in 1978 to have been approximately $7.5 billion. It estimates revenue growth for 1978 versus 1977 at 19%, the same growth rate achieved in 1977 over 1976. However, it indicates 22 major publicly owned computer services companies surveyed actually achieved a 26% growth increase.

Input's forecast of continued computer services industry growth is for an average rate of 16% through 1983. Applying this study says revenues in 1983 should reach $15.8 billion.

Respondents to the 1979 survey expect to install mini/micro computers at customer sites at an increasing rate, the Input study reports. "The rate of installation will increase by 129% in 1979 over 1978, compared to an 85% increase expected by 1978 respondents in the same time period."

The study showed that computer services companies are marketing mini/micro computers in two ways: as part of an integrated offering including extensive software, a communications network and access to the vendor's computers; and as basically standalone systems, often including applications software.

Input reported that impact of mini/micro computers being marketed by hardware manufacturers is being felt most severely by small processing services vendors. It predicts, "The impact will continue as the monthly cost of hardware drops to less than $500 per month. General business applications are more vulnerable than industry specialized applications. On average, services vendors feel that 25% of their business is vulnerable to replacement by mini/micro computers."

Software products companies, the report says, largely see mini/micro computers as an area of opportunity for applications and systems software.

Input estimates that "the current heavy activity" in the industry (it said 100 acquisitions will take place in 1979) will increase rather than decline. "Forty-four percent of respondents to the 1979 survey expected to have acquisitions as part of their 1980 plan, up from 32% who had them as part of their 1979 plan."

The research firm said it believes companies acquired in the computer services industry between now and 1983 will total approximately 700 and will be equivalent to $3.5 billion in revenue at their points of acquisition.

The company said acquisition activity is experiencing strong growth because it offers the acquiring company a reduced failure rate compared to starting up a new activity from ground zero; an immediate addition of competent staff and expertise; immediate broadening of product offerings; accelerated corporate growth; and expanded geographic coverage.

The ADAPSO sponsored study showed that overseas revenues for service companies were the fastest growing category. It said "processing services dominated revenues and professional services dominated Canadian revenue growth. European revenues were particularly important to software product companies, accounting for more than 10% of 1978 respondent revenues after a 1977-78 growth of 61%.

In its breakdown of the kinds of companies surveyed for ADAPSO, Input characterized "processing services companies" as making up 74% of its 1979 respondent total. It defined these companies as "companies whose revenues were derived primarily from remote computing, batch, and facilities management services."

The study said acquisitions were "extremely important to the 1977-78 growth of these companies, with 20% of the incremental growth being due each to 1977 acquisitions and 1978 acquisitions."

It noted that the "dominant type of service is general business, those processing services for applications which are common to users across industry categories."

Companies whose revenues were derived primarily from the sale of software products, Input said, made up 5% of the total revenues of all companies responding to its survey.

Sale of software products by these firms, the study showed, were characterized by a concentration of 64% of sales in three industry sectors: discrete manufacturing, banking and finance and insurance.

Companies whose revenues were derived primarily from the sale of professional services had revenues representing 22% of total reported for respondents to the survey. "Inflation," the 1979 ADAPSO study said, "is felt to have the greatest impact on the computer services companies."

In the processing services category, the Input survey had 101 responses with 22 in the over $25 million class, seven in the $10 to $25 million category, 30 doing from $2 million to $10 million and 42 under $2 million. In software products there were seven over $10 million, seven in the $2 million to $10 million bracket and eleven under $2 million. For professional services the totals were 10 over $10 million, eight from $2 million to $10 million and 13 under $2 million.
of negotiating with the attorney general of Colorado” but he managed to run six pseudo horse races with the participants named suspiciously like members of the ADAPSO staff and board. But, in accordance with Imlay’s agreement with the Colorado lawyer, only silver dollars were accepted as bets. Each conferee received ten of these with a registration package.

How many returned home with more than 10, probably only Cricket knows.

—Edith Myers

**PRICING**

**SHORTAGE OF CHIPS**

As a result, equipment makers will be hard put to keep from increasing prices.

A serious shortage of semiconductor components, especially advanced products like the 16K RAM memory chip and logic circuits called low-power Schottky TTL’s, has hit computer and peripherals manufacturers. And it now appears possible that equipment makers will be hard put to keep from increasing their prices.

In the past, due largely to advances in the semiconductor technology, manufacturers have managed to increase computer performance by an average of 20% to 30% a year, or to drop their prices by much while maintaining the same performance. As Richard W. Anderson of Hewlett-Packard Co. says, computer equipment prices have been “going against the grain of inflation” and this has made it possible for vendors to take the computer technology to a much larger base of users.

“That may be harder to achieve now in the coming year,” says the general manager of HP’s Data Systems Div.

Ramtek Corp., the Santa Clara, Calif., computer display manufacturer, delayed in filling orders for the model 9400 graphics system that was introduced last March because of the components shortage. In the past, according to a spokeswoman, they were able to go out to a so-called spot market, pay a little more, and get the necessary circuits. But there is no longer a spot market—not unless you want to pay 10 times as much.”

All this is occurring at a time when industry shipments of IC’s is up about 40% over last year, and that’s about as fast as the industry can build up its capacity, explains Terry Jones, vice president for marketing at Advanced Micro Devices Inc. “The demand is much higher than anybody expected.”

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**ADAPSO**

William Sweet of Zilog, Inc., Cupertino, Calif., had a similar message to offer in a session on “Microcomputer Directions.” At this point, he said, “we’re pretty blind on applications. All we’re going to do in Silicon Valley is make the bricks. You make the mortar.”

John Roach, executive vice-president of Radio Shack, told the ADAPSO conferees that “innovative service organizations will use micros to their advantage.”

Roach began his presentation by saying, “I don’t know what I’m doing here,” and ended it by saying, “I still don’t know what I’m doing here.” In between he told his audience that Radio Shack is the 47th largest computer producer and that it will continue to develop new products, “new computers to address specific market segments.” He said he believes a true “home appliance computer” will evolve during the ’80s.

In response to a question, Roach said Radio Shack generates some of its own software and buys some outside. “Our posture as to protection of software is to forget it. You can’t do what can’t be done.”

Which isn’t exactly the ADAPSO line. The association currently is involved in studying ways in which software products can be protected.

It also is taking a harder look at international business. A session at the Colorado Springs conference to determine the need for an international relations committee was well attended by conferees who seemed mainly to want how-to-do-it information. Jack Lotz, cars, Inc., Birmingham, Ala. computer-based automotive service firm, wondered

“We shipped some product and probably broke a half dozen international laws in the process, but we got our money.”

about “vendor relations internationally. We buy Data General equipment,” he said, “but we wonder about buying DG in the U.S. and shipping it to Australia. We’re afraid we won’t get maintenance in Australia if we don’t buy in Australia and pay 30% more than we would in the States.”

Another attendee told of an ad his firm had run which elicited inquiries from outside the U.S. “We didn’t know how to handle them. We shipped some product and probably broke a half dozen international laws in the process, but we got our money.”

All attendees seemed to view ADAPSO as a potential international information clearing house.

Whatever it is, ADAPSO is growing. It was announced at the conference “there are 75 new members here today.” The event drew 370 executives from more than 250 companies.

And it was indeed a race into the ’80s. Outgoing president John Imlay, chairman of Management Science America, Atlanta, said it took him “two weeks
NEWS IN PERSPECTIVE

In the last recessionary period, during the oil crisis of 1974, semiconductor companies rushed to reduce inventories and cut back their productive capacity. But they found that when demand for IC's reappeared, it did so with such an intensity that the industry could not fill the supply pipeline fast enough. Companies that had curtailed capital expenditures in the past were the ones that lost market share to those that hadn't retrenched as much.

Thus, despite all the talk this year about an impending recession, which continues to appear to IC makers to be just around the corner, expansion at a deliberate and often uneasy pace is the name of the game. No one wants to expand too fast, but then neither does anyone want to be caught again facing a booming market without the ability to ship enough products.

Just recently, for example, National Semiconductor Corp. announced plans for a new wafer fabrication plant in Vancouver, Wash., a 200,000-square-foot facility to be operational by 1981 and to employ some 2,000 people by 1984. The company, which employs more than 33,000 people worldwide, has wafer fabrication facilities in Utah, Connecticut, California, and in Scotland.

But only a few manufacturers seem to be experiencing any shipment delays stemming from the shortage of critical IC's. A spokesman for Storage Technology Corp., the tape and disk drive manufacturer, says they're experiencing no problems. The same applies to Hewlett-Packard, although everyone admits they're having to work harder in production scheduling, parts procurement, inventory control, and in projecting lead times.

A spokesman for HP says they're having to go to other semiconductor suppliers and having to qualify new suppliers, which increases costs somewhat. "We are buying in whatever quantity we can from whatever sources we can get, which means we're not getting the quantity discounts we're accustomed to getting." Suppliers are not increasing prices, it is being said, although there is a little of that going on. Prices of the very fastest memory chips, the premium parts, are going up, contrary to the pattern of the past.

"We're not really being held up in shipments because of shortages," says Tom Whitney, executive vice president for engineering at Apple Computer Inc., the personal computer maker. But it's had to make some selective substitutions of parts. And in the past, says Whitney, Apple paid more for certain parts. "In other words, there are parts around if you're willing to pay the price for them," he adds. In some cases they are parts being resold by an equipment manufacturer who found he had more than he needed and is making a few dollars by unloading them now.

A number of factors are contributing to the components shortage. Terry Jones of AMD explains that computer and peripherals makers have been approximately doubling their consumption of RAM's each year. This is said to reflect partly the fact that users have found that with lower prices for memory it's cheaper to write more inefficient code that occupies more memory space. And during this time, the per-bit prices of RAM's have been dropping at the traditional 30%-per-year rate.

This consumption pattern, contributing to the enormous demand for memory chips, is being aided and abetted by new consumer products that also require RAM chips—computer games for the home, arcade games, and the personal computer. "They're a new industry that never consumed any semiconductors a few years ago," Jones explains.

"Computer," he adds, "is going to consume more 16K RAM's next year than Intel produced last year." It is a statement not refuted by Apple's Tom Whitney, although Intel Corp. is the world's largest maker of semiconductor memory chips. "So that's playing hell with the supply and demand situation," continues Jones. There are just a lot of new users in the marketplace.

At the same time, of course, semiconductor makers are looking at the huge automotive industry, which has begun to apply microcomputers to the engine control function in expensive models. But in 1981, because of the fuel consumption and pollution emission requirements of the federal government, even average-price cars are expected to be using micros to control certain engine operations. And that's another industry that will consume gobs of IC's, primarily microprocessors.

Indeed, the market for microprocessors by 1983, a mere 10 years after it became a commercial product, will exceed 100 million units, according to the research firm of Creative Strategies International. From its initial use in calculators, the microprocessor has found wide application in industrial, commercial, and consumer markets.

csi says that between now and 1983 the terminals and peripherals business will account for the largest increase in microprocessor sales volume, growing at a compound annual rate of 23%. The consumer product segment will gobble up micros at a 22% compound annual growth rate, and the automotive industry at a 34% annual rate.

This surge in demand for IC's confronts an industry that finds it takes about two years to get a new factory into production, double what it had been only a few years ago. It costs more to build the plant, much more to equip it, and is expensive and time-consuming to train the staff to run it. And to top it off, the semiconductor industry historically has not been able to generate sufficient cash to allow expansion at the rate required by market demand for its products. The business is becoming more capital-intensive. And this is leading to the adoption by the industry of a new pricing philosophy.

Securities analyst Benjamin M. Rosen, a close observer of the semiconductor industry, makes note of the new pricing tack being taken by the leader, Texas Instruments. Instead of regularly lowering its prices by an average of 40% a year, come hell or high water, TI is said to be pricing with an eye to the supply and demand situation. And if this is the new pricing policy at the world's largest semiconductor company, can other IC makers be far behind?

Writing in his Morgan Stanley Electronics Letter, Rosen observes that in these times of need, a user of these IC chips is less concerned with its price than with its availability. "A production line halted for want of a 146 gate is far more costly to an equipment manufacturer than is any 3¢ price increase in that gate."

And TI's return to traditional supply/demand economics, he adds, should be welcome news to its competitors. "Industry profitability will be enhanced somewhat, a not unwelcome development for an industry that historically has rewarded its customers far more than it has itself.

---Edward K. Yasaki

COMMUNICATIONS

PROMISES WEREN'T FEASIBLE

SBS and AT&T explain delays in network offerings but say the outlook is good.

As the decade rapidly draws to a close, the network services promised for the 1980s seem more and more to be falling prey to implementation problems of the 1970s.

The two networks that probably have more visibility than other contenders are the satellite service to be inaugurated by Satellite Business Systems and the Advanced Communications Service of AT&T.
HALL OF SBS—He'll compete first on a pure voice basis.

It now seems clear that both services have dropped back from their initial projections to more manageable abbreviated versions. Just how serious these entrenched positions are will be debated by industry experts during the coming months. But recent statements made by key SBS and AT&T officials, together with views from knowledgeable outside sources, indicate that both network providers promised more than it will be feasible to deliver in the early 1980s.

SBS has clearly been the more tight-lipped of the network purveyors. In the past the fledgling satellite service company has made few statements that were not couched in vague generalities.

But things are changing at SBS. And the architect of that change is Robert C. Hall, the new president and chief executive officer. The 47-year-old Hall comes to SBS from his previous post as executive vice president at the New York Stock Exchange. As a dper who formerly headed up the Securities Industry Automation Corp. (SIAC) which handles the dp and communications for Wall Street, and an executive at Control Data Corp., Hall knows the importance of playing it straight with potential customers.

Hall admitted in an interview, that some of the services that SBS has been aiming at users do not yet have an acceptable market. The four key elements in the SBS service, as Hall sees them, are voice, data, teleconferencing, and bulk document distribution. All of these have been pitched to key Fortune 500 prospects as part of an integrated service offering.

While his company still believes in the integrated service concept as an ultimate implementation goal, Hall revealed, "we will be out competing on a pure voice basis in a highly competitive industry." Using a voice network to establish an operational base with SBS, customers would then see the other key elements as lower cost add-ons that can be integrated as needed, he said.

"Will the image of a voice carrier invoke a reaction from Bell? Hall nods and says a competitive response is expected from the phone company but SBS is confident it can provide equal features at lower cost. Hall speaks of a 10% to 20% savings in both the voice and data areas compared to competing services.

While Hall places data in second place after voice, he said some users would turn up their SBS service with data-only applications. Further down on the priority list are teleconferencing and bulk document delivery, although Hall said a few potential customers are looking at these as the primary application.

For a company like SBS that has emphasized a total spectrum of service since its inception, the admission that selected service offerings will attract the first users is more realistic than radical.

Hall said the SBS timetable is still fixed at early 1981 to begin service. The first satellite is now scheduled for launch in October 1980. Originally set for last July, part of this delay was caused by setbacks in the Space Shuttle and SBS will now use the more expensive Delta launch vehicle, he said.

SMITH OF AT&T—A greater delay than anticipated.

While stressing that SBS is not "trying to be secretive," Hall said 10 to 12 earth stations would be installed in 1980. These earth stations will service the first three networks that will be established in early 1981 when SBS becomes operational. The early customers will be made known in 1980.

Just how far along is SBS toward operating its system? Significant testing has been done at 4gHz and 6gHz, but questions still remain to be answered about satellite transmissions at 12gHz and 14gHz, he said.

"We need to demonstrate the error quality rate at the higher frequencies where attenuation from heavy rain is a potential problem," he said. SBS plans to conduct operational tests next year on one of Canada's Anik satellites which operates at the higher frequencies.

Hall said much of the testing that remains to be done is simply "to get the bugs out" but, he admitted, "We are not all the way home yet on this."

While SBS has no plans for resale or sharing of its facilities, some expanded capabilities are being explored. Since many large SBS users will also be multinational network operators, a gateway interface to overseas networks seems likely. Hall said the X.75 gateway standard would probably form the basis for such interconnections but no final decision has been made. For backup, some terrestrial links will be necessary, especially for voice users. And voice interfaces will be provided with the established telephone network wherever SBS users need such service—even though SBS will provide total end-to-end digitized voice facilities.

While some of these plans may seem different for SBS, Hall said he was still confident that his firm had a "unique and exciting service." Citing some of the different ways in which SBS will handle information, the SBS chief talked about the time division multiplexing combined with demand assignment. He also mentioned the satellite communications controller and the way in which software would be handled as important parts of the SBS service.

And how much will it all cost? Hall smiled and said, "We will file our rates after mid-year 1980." For a company that has already spent more than $500 million put up by three partners—IBM, Aetna, and Comsat General—it did not seem like much. But it was probably more than had been said by any SBS spokesmen since the company was founded.

While SBS was opening the door a crack, AT&T seemed intent on slamming the ACS door shut. What seemed at first like a fatalistic admission of defeat, was characterized more as an unavoidable delay by William Smith, director of inter­premises development at AT&T. In a
classic statement that sounded like some-thing out of a State Dept. briefing, Smith said, "It's not that we decided to delay; rather we discovered that we have to have a greater delay than we had anticipated."

While SBS was opening the door a crack, AT&T seemed intent on slamming the ACS door shut.

But Smith said ACS development was continuing at Bell Labs, primarily in software. The ACS plan had called for "purchased hardware" and extensive use of it, Smith said, and he confirmed that AT&T had originally chosen the Digital Equipment Corp. PDP-11 processors for the network service.

Although he said "we reserve the right to change our mind," Smith indicated many of the considerations that led to DEC in the first place "are still there." Asked if the reported ACS hardware upgrade meant DEC VAX machines would be used, the ACS spokesman said VAX would be a likely choice at this point.

And what about reports that AT&T wanted the Bell-developed Unix operating system for ACS. Would Unix run on VAX processors? Smith said, "VAX supports Unix. And Unix is one of the active software candidates. But if VAX is a final (hardware) candidate, then VMS (virtual memory system) will also have to be considered."

Asked if DEC was working on ACS software, Smith said, "I don't know of any software development that DEC is doing specifically for ACS." He added that DEC had been very cooperative in "helping us run Unix on DEC equipment."

Despite Smith's statement, industry sources said DEC had attached high priority status to upgrades of its decnet architecture—especially in the development of an X.25 capability for decnet. An X.25 support feature for decnet would be potentially important if DEC follows through with its plans to make ACS an X.25 network, these sources said.

Although Smith would not speculate on how long the ACS delay would be, he did comment on what the first service offering would include. "I would expect a message capability to be one of the early features," he said.

A message service would be one of the more clearly defined communications services based on past regulatory history. But the addition of editing support to the message service could lead to a return to the type of discussions that took place with the DataSpeed 40 terminal, he said. The addition of enhanced message preparation features would eventually lead to a crossing of the boundary between communications and dp service although no one can define exactly where that boundary is, he said.

During the period of delay, AT&T will continue to study the needs of potential users, but it will not discuss price, performance, or availability. Such research should not be classified as ACS marketing efforts, Smith implied.

Newer implementations of ACS hardware and software make sense, Smith said. But how long it will take to put those implementations in place was the key question. Outside sources said a delay of at least 12 to 18 months seemed inevitable.

—Ronald A. Frank

OFFICE AUTOMATION

DATAPoint IN THE OFFICE

Enhancements to its ARC system will take the delays out of office procedures.

As its salesmen clamped two years ago for larger machines to match the offerings of competitors, Datapoint Corp.'s product planners had other thoughts.

Why not stay with the same size of computers, but give them the ability to be hooked up into networks where users shared a common data base and could build these networks as large as they needed to? And also allow the networks to communicate with IBM mainframes?

That was the thinking that lead to what the 10-year-old San Antonio computer company called attached resource computers (or ARC) systems. And ARC systems have had a major role in more than doubling the company's revenues in two years—from about $100 million in 1977 to $232 million in the last fiscal year, ended July 31. Datapoint moved up in that time to the prestigious top 1,000 industrial companies and its number of employees passed the 5,000 mark (compared with 1,000 employees five years ago).

The attached resource computer idea represented a marketing coup as well as a technical one. Although Datapoint had to modify its operating system software to fit the ARC environment, it is transparent to users and allows them to add only the exact amount of processing and storage capacity that is needed. According to the company, any of its more than 12,000 installations could convert existing equipment to an ARC system simply by adding ARC communications components that are relatively inexpensive.

Therefore, Datapoint, whose lease revenues last year of $88.7 million accounted for more than half of all revenues, doesn't have to face the problem of obsoleting its lease base with new equipment; it merely offers new hardware and software enhancements to what already is being used.

"I'm absolutely amazed," says Victor D. Poor, a senior vice president in charge of the company's research and development, "that in the two years we've had ARC on the market, we have yet to have a competitor come out and say, 'Look, we've got the same thing or even better.'" He adds: "Maybe the competition doesn't recognize the market as we see it. Or maybe we're wrong. I don't know."

VICTOR D. POOR—Taking the delays out of office communications.

It's improbable that Poor is wrong. Even though he admits that ARC right now "is still very primitive," it's become the heart of the company's very successful product line. Last month at Datapoint's annual meeting, stockholders were given a glimpse of future products the company will add to the ARC system for the so-called office of the future or, as the company's president Harold O'Kelley likes to call it, "the integrated electronic office."

Dispersed processing is in the offices where people are trying to make money.

"Dispersed (distributed) data processing is not in chemical plants or in controllers' offices, it's in offices where people are trying to make money," says Gerry Cullen, vice president of product marketing in the company's data processing division. "If we can show (offices) how to
Dataram’s S33 interfaces Digital Equipment Corporation’s (DEC®’s) PDP-11 series to a wide selection of SMD (storage module drive) and Winchester type disk drives. The S33 emulates DEC’s RM02 and is fully software compatible with RM02 diagnostics and RM02-supporting operating systems. Up to four drives per S33 controller, almost 300 MB of disk storage. The microprocessor-based S33 controller has 2 KB of data buffering, multiple sector transfers, and built-in self-test capability. And media compatibility with DEC’s RM02 drive. All this and amazingly packaged on one DEC hex board...the only controller to make this claim!

One-board means you need only one hex SPC slot. One-board means easy insertion and optimum air flow.

One-board with its attendant features of minimized interconnections and low component count means lower power, complete accessibility, higher reliability...and best of all, lower cost.

If you’re interested in one of our one-board S33 controllers, or a whole bunch of them, we’d like to hear from you. If you operate in the LSI-11® world, still contact us. Our LSI-11 cousin of the S33 is on the way.
make money, our business should grow. The direction we're taking is the integrated electronic office.

The heart of a "future office" product line is a word processing product, which Datapoint will be offering along with a new line of printers, hard disks, and electronic message service, improved communications devices for its ARC system and an innovative way, called Associative Index Method (or AIM), to keep track of where everything is.

Poor says the electronic message service is the most interesting of Datapoint's new offerings from an economic point of view because, in effect, it doesn't cost anything to operate. It's an extension of Infoswitch, a long distance control system the company introduced two years ago to control the telephone expenditures of companies with monthly telephone bills of $5,000 or more.

Infoswitch is used, along with the cost accounting features, to control intolerably long queuing delays that result when more than 60% of a company's telephone capacity is in use. That leaves 40% of capacity idle and EMS would use that 40% for data communications functions.

"So, except in the situation where the user is demanding instant response, which primarily is in an interactive environment, the incremental cost of EMS as far as external communications is concerned, is zero," says Poor. That means the company can offer EMS at no increase in cost over what's already being paid for telephone service.

"It makes the competitive data services that are coming on the market a little less interesting," Poor says, "because when you have to compete with zero cost, it's pretty tough to operate."

The EMS offering, coupled with the company's word processing systems, would enable every internal or external piece of correspondence to be stored digitally within a company and the EMS software would be used to ensure that such things as memos on price changes would be directed electronically to those who need the information, and in the right form. (Does the recipient have a terminal or should the message be typed out on a printer and then mailed if he doesn't?)

Also, using the associative index method (AIM)—which is a searching algorithm for which the company won't apply for a patent because it's so innovative—an office worker can search for documents that have been created at some point in the system and get them back in a few seconds without giving a thought to the procedure.

That means that every electronic message will be filed and indexed. "There will be a copy of it somewhere," explains Poor. "If it goes to archives, that'll be known too. But probably a year's worth of documents will stay in the system. It's up to the user to determine how much he wants to spend for storage."

And the AIM system can be adapted to search the existing files of new customers who "very simply" take data from a raw source and put it into the Datapoint document structure and do AIM indexes on the data. "There are some rough guidelines you have to follow," says Poor, "but they are nowhere near as rigorous as a typical data base management system."

Tying all of these offerings together is a new rooftop infrared communications link between processors in Datapoint's ARC system. The company already has one in place in San Antonio where Datapoint is one of the largest users of ARC with more than 100 processors linked to a common data base and to 29 buildings it occupies in the city. Up to now, the company linked the ARC system by underground cable, but, says Cullen, "We had to practically go to the Pope to get permission to cut up the street and lay those cables." So the company developed the wideband interbuilding link using infrared, or what it calls "light link."

It was developed around laser diodes—spontaneous emissions that, unlike coherent light, are not subject to federal regulations, a problem Datapoint didn't
feel its customers should have to face. In fact, Poor says that the use of noncoherent lines, which require larger collectors and lenses than would laser technology, improved the reliability of the system because the core of light that passed between the transmitter and receiver was several inches in diameter, compared to the very tiny light beam of a laser. As a result, the scintillation in the atmosphere was averaged out and the amount of distortion that appeared at the receiver was a lot less than through a laser.

In clear air, the light link can transmit data up to 40 miles, but initially the company is recommending it for distances of two miles because 85% of Datapoint’s customers have only a two mile requirement.

“And within two miles, you can build a pretty damned reliable infrared link that approaches microwave reliability,” Poor says.

Productivity in the office, Poor says, always has been related to the speed of communications. And productivity could be a lot higher than it is today. “The amount of time you spend trying to establish contact with someone, getting a ruling or a reading or an answer to something, has a lot to do with how fast or how slow decisions get made.”

He thinks that the system Datapoint is evolving eventually will be able to take the intrinsic delays out of office communications. “Then the delays will be entirely that of the decision-making process itself—how long somebody wants to think about something before they answer it or react to it. But the system is no longer responsible for them.”

Adds Poor: “It’s Datapoint’s long range goal to automate everything that can be automated in a typical business office.”

The company seems to be well on its way toward that goal. —Tom McCusker

MAINFRAMERS

FIRE SALE OR WHAT?

Is IBM getting ready for H-Series announcement?

Somewhere within IBM’s facilities there must be a door marked “Other.” Behind this door is a closet full of unmatched shoes, for, as veteran IBM-watchers know, everyone always seems to be waiting for the other wing-tip to drop.

Last Nov. 1, IBM again whetted the appetites of the apprehensive: it announced the 3033N, a stripped-down 3033 with less performance (less cache) and a lower price than existing 3033s. At the same time, the firm cut purchase prices roughly 20% on the 3031 and 3032, and about 15% on the extant 3033s. Memory prices also fell the knife, pared from $75,000 to $50,000 per megabyte. System/370 prices were cut by roughly a third, as were those on two communications controllers (3704 and 3705).

But mainframe lease rates remain the same.

Many speculate that this latest move serves to announce a fire sale on large mainframes before the debut of a more powerful, more attractive series.

The announcement will stimulate purchases, according to many watchers including Robert Fertig, president of the technology analysis group at Advanced Computer Techniques Corp. (ACT). For existing lease customers, the combination of investment tax credit, purchase credits accrued, and need make purchasing attractive. Coupled with the traditionally long time between the announcement of a major new series and the time customers finally get delivery, many users may find themselves without any choice.

IBM should benefit from increased sales. Increased leasing, spurred by the uncertainty implicit in the E-Series announcement earlier this year, have slowed

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NEWS IN PERSPECTIVE

the company’s revenue growth. A good increase in sales in the fourth quarter will help improve year-end results.

"A fire sale typically precedes a big announcement," noted one observer. The long-rumored H-Series is expected to be just such a big announcement. Frederick G. Withington, computer industry analyst at Arthur D. Little, expects an evolutionary introduction of bits and pieces spread over the 1980 to 1982 time frame. He feels it won’t be a single big bang, but rather the staged introduction of various functional units that all work together.

ACT’s Fertig expects the tip of the H-Series iceberg to bear a machine two to three times the power of a 3033 come the summer of next year, with deliveries yet another year off. ACT, which will publish its H-Series forecast this month, predicts the second H-Series machine will be a less powerful model impacting the 3033s; the firm expects an announcement in the last quarter of next year, with deliveries coming as late as 1982.

The announcement of the 3033N didn’t seem to catch the industry by surprise. Quotes for used 303X machines, gathered Oct. 31 by the New York-based Computer and Communications Buyer newsletter, have 3031 and 3033W reselling at approximately 60% of list and retailing at 80%. But the 3032 came in at 60% wholesale and 70% retail.

Amdahl Corp. seemed ready for the announcement: four days after the IBM announcement, it announced a new machine, the 470V/7B, and price reductions on existing processors and memory. The V/7B is said to have 60% to 65% the performance of a V/7. In its minimum configuration with 4MB and eight channels, the V/7B sells for $1,450,000. Memory prices dropped from $70,000 per megabyte to $50,000.

IBM specs its 3033N at 1.3 to 1.8 times the performance of a 3032. Offered in either four or eight megabyte versions, the 3033N sells for $1,800,000 (4MB, six channels) or $2,365,000 (8MB, 12 channels); both prices include 3036 console and 3037 power/cooling units. Four-year lease rates are $55,000 per month and $75,690 per month respectively. Deliveries are to begin next quarter.

—Bill Musgrave

COMPANIES

STABILITY IS THE THING

Microdata chairman sees his company's acquisition by McDonnell Douglas as a chance to plan without worry.

“We now have the financial stability to make longer term plans,” said Don Fuller, chairman and chief executive officer of Microdata Corp., Irvine, Calif. small business systems producer, of his firm’s acquisition by McDonnell Douglas Corp. (November, p. 76).

Fuller said Microdata has been experiencing a “51% compounded growth rate over the last five years,” and allowed as how it would be hard to sustain that rate but he believes “McDonnell Douglas bought a growth company with a strong management team, a core company under whose umbrella they could bring in other compatible acquisitions.”

When the last of Microdata’s un-tendered stock is purchased by McDonnell Douglas (approximately 7% of 1,630,707 shares outstanding) at $32 per share, the St. Louis-based conglomerate, will have paid some $73 million for the

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**NEWS IN PERSPECTIVE**

Orange County company.

Fuller, together with members of his family, was the largest among some 2,200 shareholders. He estimated his share holdings at about 100,000.

He said Microdata will be run as an autonomous operation reporting to a board of directors consisting of himself, Don Graham, Microdata president, and four people from McDonnell Douglas: John McDonnell; Bill Orthwein, president of McDonnell Douglas Automation Co. (MCAUTO); Jerry Brown, treasurer of McDonnell Douglas; and Leo Merrowitz, vice president, McDonnell Douglas for corporate development.

Fuller said the acquisition would not change Microdata's direction but will "allow us to plan ahead without worrying about unexpected economic bubbles changing our plans." He believes most minicomputer companies of Microdata's size will have to merge if they want to grow. "There's no other way to get capital."

He feels there will be a "slow but inevitable meshing" of Microdata's operation with those of MCAUTO (a services operation), consistent with a trend among services companies to combine their offerings with on-site hardware offerings. "It won't happen right away because most of MCAUTO's customer base is made up of large companies who need to be served by large machines." He said MCAUTO is big in health services and sees that area as a prospect for Microdata's Reality small business systems.

He doesn't see Microdata getting into the microprocessor-based small business systems field. "Those are going to have to be sold on a retail basis. All systems under $30,000 are eventually going to have to be sold retail."

Fuller doesn't want to get Microdata in the retail business. He hopes to keep their system at the $30,000 range and "move price performance down a lot."

He said Microdata will continue to sell Reality systems through a dealer network now made up of 22, although he admits the company has had problems in this area. "They (the dealers) are chronically undercapitalized." He said Microdata was forced to take over a New Jersey dealership and turn it into a direct sales office because "they owed us more than $3 million what with accounts payable and a $500,000 note and there was no way they could pay it back."

"All systems under $30,000 are eventually going to have to be sold retail."

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**CAN'T TAKE MOHAMMED**

For Control Data shareholders who can't attend annual meetings, the company takes meetings to them.

Many large companies move their annual shareholders meetings around the country to reach shareholders in different regions.

Control Data Corp. doesn't. Its annual meetings are always held in Minneapolis. It reaches shareholders in other regions in another way, a way which many CDC shareholders think is better.

Control Data holds regional shareholder meetings and they're not just meetings. Each one begins with a reception which includes cocktails, hors d'oeuvres, displays of Control Data equipment and strategically placed TV sets showing slide presentations about the company.

Then comes a sit-down dinner. At one in Los Angeles this featured a strolling violinist, playing requests. The piece de resistance, after dinner, is a presentation by a locally based member of the CDC board of directors and Benjamin Kilgore, vice president of investor relations.

Last come the questions. Not everyone stays for this part but there are...
COULD WINK DINOSAUR AT New Year's Day, take a close look at the Cal Poly float from the Cal touches to microcomputer-based Rose Parade. If you join the 125 million viewers for the Tournament of Roses Parade on New Year's Day, take a close look at the float from the Cal Poly universities of Pomona and San Luis Obispo, Calif.

Against a prehistoric volcano background, you'll see a 30 foot dinosaur, five caveman and numerous other figures all operating under microcomputer control. The cavemen play musical instruments while the dinosaur taps its foot, moves its head and wags its tail in tempo. A butterfly flaps its wings, birds open their beaks and a baby dino emerges periodically from its shell.

The Cal Poly float, one of the most highly animated in the parade, was designed, constructed and financed by the Cal Poly students, supported by equipment donations from corporations in the U.S. Beneath the flowering exterior resides a sophisticated control system with operators' panels that strongly resemble a "Star Wars" creation. The microcomputer is a Rockwell System 65 with 256K bytes of memory. For system design and development, the cpu is supported by a M-200 matrix printer donated by Data-products Corp. and dual 96K byte floppy disks from Pertec. During the parade, the animation programs reside in programmable read-only memory and also in bubble memory.

The float is huge—55 feet long, 16 feet high, 18 feet wide and weighs 19 tons. Structural elements range from 10-inch "I" beams to 0.25-inch rods for the fig-

EXPLANATION FOR SHAREHOLDERS—
Benjamin Kilgore, vice president of investor relations (left) explains Control Data's Plato education system to shareholders Nannette Jacobson and Bob J. Reyer during a shareholders meeting at the Hyatt Regency, Los Angeles.

always questions.
Seven regional shareholders meetings have been held this year, in Miami, Baltimore, Washington, D.C., Pittsburgh, Lima, O., San Diego and Los Angeles.
The director who participated in the Los Angeles meeting was Joseph Walsh, executive vice president of Rohr Industries.

Questions in Los Angeles ran the gamut, from the age of CDC president William Norris (answer, 67) to the effects of IBM's 4300 announcement on the company. Kilgore's answer to the latter was: "There have been some effects on selected parts of our product line, but by and large, none."

One shareholder complained about the lack of photographs in the annual report and was thanked for his input.

Everyone left if not happy, at least well fed.

—E.M.

MICROCOMPUTERS

DINOSAUR COULD WINK AT YOU

Cal Poly students put finishing touches to microcomputer-based Rose Parade float.

If you join the 125 million viewers for the 1980 Tournament of Roses Parade on New Year’s Day, take a close look at the float from the Cal Poly universities of Pomona and San Luis Obispo, Calif.

Against a prehistoric volcano background, you'll see a 30 foot dinosaur, five caveman and numerous other figures all operating under microcomputer control. The cavemen play musical instruments while the dinosaur taps its foot, moves its head and wags its tail in tempo. A butterfly flaps its wings, birds open their beaks and a baby dino emerges periodically from its shell.

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The float is huge—55 feet long, 16 feet high, 18 feet wide and weighs 19 tons. Structural elements range from 10-inch "I" beams to 0.25-inch rods for the fig-

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syncopation.

"We then plot the movements and place them on cards so we can riffle through them and see the action," he continued. "The programs are large, requiring about 36K words of RAM and 32K words of PROM. During program debugging, the system defaults to the printer when errors occur and it lists them and their location."

When school reconvenes in the fall, actual float construction begins and continues through the Christmas holidays. As the float takes shape, the computer system is installed along with six control panels designed and built by the student committees. The panels give the status of microcomputer systems, visual verification of controlled animation actions, analog indication of major figure movements as well as operation of hydraulic and electrical power systems.

During an extensive checkout procedure, each subroutine is loaded from diskette, verified visually from figure actions and printed or plotted on the M-200.

Microcomputer is the Rockwell System 65 with 256K bytes of memory.

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Upon checkout completion, the routines are installed in bubble memory, RAM or PROM. The animation programs may run either from bubble memory or PROM's for redundancy. "We don't want to take a chance on failure during the judging and parade," Wong says. "There is also manual backup operation."

During the final stages, the float is covered by spraying on a plastic latex material which is painted to match the flower colors. "The flowers are picked from Dec. 23 through Dec. 26 and attached with high nutrient glue," explains Wong. "With some watering, the flowers will stay fresh for up to two weeks."

Late on New Year's Eve the float is moved to the parade line-up area — where a final checkout is made and the printer and floppy drive are removed to protect
them from vibration damage. A final judging takes place in the early morning hours of Jan. 1. “We plan to have a flower in the dinosaur’s mouth so he can present it to the judges when they come by,” Wong smiles.

During the parade, five students operate the float—a driver, an assistant driver, the computer operator, the electronic systems operator and one observer. The other Cal Poly students who have been working on the float join about three million others along the Colorado Blvd. parade route.

So on New Year’s Day watch for the Cal Poly float. The dinosaur may wink at you as he goes by. —T.M.

ACQUIRED

But Not Invisible

Under Xerox, Century Data Systems regained its original name, new employees and new products.

Century Data Systems was launched as a company in 1968 in Anaheim, Calif. It put California Computer Products Corp. into the IBM plug-compatible tape and disk memories market when it was acquired by CalComp in 1973 (August, p. 56). Now it’s part of Xerox Corp. And as such it has been growing.

What Xerox bought from CalComp in late 1978 was its Oem Products Div., which the copier giant promptly renamed Century Data Systems. The acquired CalComp Div. had 750 people. Xerox’s Century Data Systems has more than 1,000.

It has introduced four new products with more on the drawing boards and is particularly happy with reception of its Intelligent Marksman disk subsystem which it says is based on the company’s Marksman disk drive and a storage system interface. The company claims it “makes it easy to put Winchester technology on-line, easily and fast.”

And the Century operation has taken on new responsibilities as a result of the Xerox acquisition which has put it firmly in the Xerox family. Last month Xerox announced it had transferred marketing responsibility for disk memory products manufactured in northern California by its Diablo Systems, Inc., from Diablo to Century.

John V. Titsworth, Xerox corporate group vice president and president of the Information Products Group, said the transfer “will give both Diablo and Century Data Systems customers a single source for disk products that meet their full range of requirements, from small business systems up to large information processing systems. The change also will allow Diablo, which introduced the daisywheel printer, to concentrate on development of printing products.”

Jim Conway, who became Century Data Systems president in late summer, said the combination was a natural fit.
NEWS IN PERSPECTIVE

one. "We're calling on the same customers. We'll be taking over sales, service and marketing for their (Diablo's) disk drive operation and will be coordinating forecasting volumes." He said a natural upward evolution for users of Diablo disk products would be to Century products.

Xerox said the combined product line now offered by Century Data will provide disk storage capacities from 2.5 million to more than 600 million bytes of information and includes fixed disk drives, drives for cartridge disks and multiple disk packs which are removable, and combination units.

Conway, who joined Century as president to replace James Y. Payton who had been vice president and general manager of the operation when it was a CalComp division, is a longtime Xerox employee and has himself experienced being acquired. He joined Scientific Data Systems in 1965 and was acquired with it by Xerox in 1969. His most recent job at Xerox was vice president, development, Xerox Business Systems.

Before joining sds, Conway was with General Precision's Librascope unit in the systems area and with Bunker Ramo. He feels an asset he brings to Century Data is "I've been on the other side of the table. I know how to give a hard time in the oem buying business (Century is in the oem selling business)." He believes he brings to the business "a systems approach which is what the user needs."

His and his co-workers' belief in the Intelligent Marksman were echoed by at least two users last month.

The drive plus interface was introduced by Century last June. "Data integrity in the new disk subsystem," its announcement read, "is assured by utilizing Winchester style heads and media, a sealed contamination controlled disk chamber and crc error control on all data. The storage system interface is a straightforward byte parallel, tti connection that significantly reduces the cost of the cpu interface adapter."

Bob Reese, Intelligent Business Machines, a Fresno, Calif. oem customer of Century, has had evaluation units for from four to six weeks. He said they were able to get the units on-line and running smoothly within a couple of weeks. "I expected more than that. I think when you take delivery of raw hardware and get it running right in less than a month, it's great. And we didn't give this a major priority so it could have taken less time."

Ken Allen, president of Micro V, an Irvine, Calif., small business systems firm, said getting the Intelligent Marksman units his firm is using up and going "took very little effort," and was accomplished "in a day or so." His firm took delivery of its first unit last spring and "we've had no disk transfer error yet."

Allen's decision to go with the Intelligent Marksman may bode well for the

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**CIRCLE 56 ON READER CARD**
NEWS IN PERSPECTIVE

Xerox acquisition of Century Data. He said he liked the hardware compared to alternative decisions but a factor in going with it was "the Xerox name."

But then he isn't buying general purpose computers. —Edith Myers

VOICE RECOGNITION

EARS FOR THE OEM MARKET

Interstate Electronics introduces low cost voice recognition module; others see voice response as a here and now technology.

"We're putting ears on computers," pro-claimed Interstate Electronics Corp. last month in announcing an oem plug-in voice recognition module it plans to sell for less than $1,500 in oem quantities.

They're not the only ones trying to do this. The field is crowding and the vendors are all striving for things like speaker independence, greater vocabulary recog-
nition, continuous speech and lower cost.

Interstate may have come through with the lowest cost to date. The company said in mid-November it would be filling oem orders "in 60 days" for its single-board voice recognition module.

It described the device as a micro-
processor-based module for adding voice input technology to intelligent terminals, small business systems, machine control- lers and other computer products.

All the logic and input-output in-
terfacing necessary to convert the spoken words into computer codes are contained on a single circuit board, the company said.

It is a discrete word, speaker de-
pendent device which provides accuracies of better than 99% "regardless of dialect, accent or language." Its communications protocol is compatible with high-level software languages including FORTRAN, BASIC and Pascal.

Supporting the module, which it calls VRM (voice recognition module), Interstate introduced an emulator pack-

when it hired a speech recognition re-
search group from McDonnell Douglas and combined it with a product developed by and acquired from a small Reston, Va., firm, Scope Inc.

At the Los Angeles introduction, Don Kirsch, Interstate's vice president of marketing, said market expectations are
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unmeasurable "because there are so many applications that are not obvious right now."

At a November meeting of the Los Angeles chapter of the Association for Computing Machinery (ACM), George Glaser, president of Centigram Corp., Sunnyvale, Calif., producer of a microprocessor-based voice recognition system called MIKE, talked about applications both existing and potential.

"There are so many applications that are not obvious right now."

He listed applications in office automation; banking for funds transfer, pay by phone and credit authorization; manufacturing for quality control, process control and numerically controlled machine tools; warehousing/distribution in order entry, inventory control, shipping/receiving and package sorting; and medical in clinical labs.

A bit down the road, because "costs are too high as yet," Glaser sees applications for consumers in toys, automotive equipment, environmental controls, entertainment supplies and dialless telephones.

At the Interstate introduction, a company spokesman responding to a question on consumer applications noted that Interstate's demonstrations were conducted using an Apple computer. "Computers like the Apple and Radio Shack's TRS-80 are being sold to consumers. If they want to buy our oem board and use it in applications, well . . ."

For the short term future in voice recognition Glaser looks for larger vocabularies and input via telephone. For the long term he sees speaker independence becoming more general along with ability to recognize continuous speech and, some 20 years away, speech understanding including grammar and syntax.

Glaser said pauses between words required today is typically 10 seconds. He said much work is being done in laboratories but the only commercial device he's seen that can recognize continuous speech is a device made by Nippon Electric.

Kirsch of Interstate noted that Japan has been a receptive market for voice recognition systems because of their large alphabet which makes necessary cumbersome keyboards.

Interstate opened its Los Angeles introduction of its VRM with a recording of the theme from Star Wars. Its intent; to show that while many see the notion of people talking to computers as futuristic, Interstate likes to think it's for here and now.

And so do others—companies like Glaser's Centigram, Logicon of Hawthorne, Calif.; Threshold Technology, Delran, N.J.; Exxon's Dialog Systems, Inc., Belmont, Mass. and, of course, Nippon Electric.

—Edith Myers

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BECAUSE MANAGING DATA MEANS MANAGING CHANGE

Computer Corporation of America
**FEDERAL DP ROLE RAPPED**

But 8,500 who turned out for federal dp conference packed the sessions anyway.

Federal data processing officials were chastised for the way they practice data processing in conference sessions at the second Federal Computer Conference this fall in Washington. But the 8,500 who attended were warmly courted on the exhibit floor.

The turnout demonstrated a strong vote of confidence for a show whose debut last year attracted a bigger-than-expected crowd of 6,000.

"The few of us who travel to such events as the National Computer Conference each year do so with full knowledge that much of the expense is out-of-pocket," commented one government attendee. "Not only is this show affordable for all of us, but also every single session is specifically geared to our needs. Let's hope it's here to stay."

Vendors have that same hope.

More than 100 exhibitors were on hand to display their wares, and there was seldom a minute when the exhibit aisles were empty. What's more, session rooms were packed, as federal dpers filed in to hear some 90 speakers espouse the ills of federal dp activities and to offer some possible remedies in "Preparing for the 1980s," the theme of the three-day conference.

The tone of the conference was set by Pete Jensen, who was responsible for producing the final report of the President's Reorganization Project on Federal CDP. He said, "Over 100 federal agencies that have been audited by General Accounting Office are said to be 'mishandling' their computers."

Jensen added, though, that, "There are some instances of effective dp use in the government, but they are the exception rather than the rule."

"It's no secret that, over the past 15 years, the federal government has fallen behind the private sector in the effective use of information processing," added John F. Akers, vice president and group executive of ibm's Data Processing Marketing Group. In a keynote luncheon address, Akers said one area that is particularly problem-proned is the process of acquisition.

The ibm executive said there are three main problems with the federal acquisition system. First, even with the need for public accountability, decision-making within today's system is often diffuse and imprecise. "There are too many control and review points," he contended. That system alone, Akers claimed, makes it difficult for the government to keep pace with rapidly improving technology.

The second drawback to the acquisition process, Akers said, is that the "focus on acquisition cost tends to result in the government requesting, and industry providing, the lowest common denominator solution, rather than the optimum solution." He urged federal dpers to evaluate total life cycle costs and benefits rather than mere acquisition cost-savings over the short-term.

As the third woe in the process Akers cited certain constraints imposed on the government that the private sector is not bound by, among them the continual effort to reduce the federal deficit, stringent laws and regulations governing such areas as privacy and security, and a commitment to promoting competition in

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the acquisition process.

Despite the constraints and compromises inherent in the federal dp environment, Akers said, the simple truth remains: "The government must be able to take timely advantage of the best industry has to offer. And that's just not happening often enough."

Another speaker from the private sector, this one a user rather than a vendor, pointed out that there are no models in private industry that could serve as a roadmap for federal dpers. In a session on organizational structures, John L. Jones, vice president of management information services at Southern Railway Co., stated, "Every organization is unique; as for the federal government, there is no other organization that even closely resembles it." Because there are "no pat solutions, even in one company," Jones contended, computer technology must be embraced on a trial-and-error basis. The major hindrance in federal dp use, he added, is the government's fear of trying.

Another reason the government cannot simulate successful dp operations in the private sector, Jones said, is its competition mandate. "Once we (at Southern Railway) decided on Data General as a supplier of minicomputers, I decided any mini was great as long as it was from Data General," he explained. "In the government, such a practice is a 'no-no' known as 'sole-sourcing.' Unlike you, I'm not measured on how fair and honest I am (to the suppliers), but on how effective I am."

"Perhaps the biggest problem in the government," Jones ventured, "is the fact that top-level officials do not look at the computer as a tool they use or need. Without high-level understanding and support of the dp missions, the government cannot hope to improve its computer use in the '80s, he added. "If the government doesn't take positive actions toward that end now," he warned, "it will lose total control."

In an issues and answers session, John LeGates, president of Harvard's Center for Information Policy Research, told federal employees that the very issues our country considers most critical today can be alleviated if the government gets its act together on managing information technology. "It is possible for data processing to substitute for some of our natural resources, such as capital goods and energy," LeGates claimed. "If we better manage our natural resources with the use of dp tools, we may need to build fewer new plants and buildings, we may need less raw energy, we may become a self-sufficient society."

The Harvard man added that stepped up use of information technology will not put people out of jobs. "Our experience shows that the more dp is used, the more people are needed to manage it." While the government still has a long way to go in better managing its technological resources, LeGates reminded federal dpers, "Without information, all is chaos. And with increased use of dp, our information can be better managed."

The challenge to the federal dp community was well summed up by Jack Biddle, president of the Computer & Communications Industry Association: "You people have a great awareness of the issues; you have the intelligence to sort out the options and arrive at reasonable decisions on what should be done. But you don't make your views known." According to Biddle, that deficiency results in decision-making by fiat.

To illustrate, the ccia president pointed to the nine-year-old debate over adoption of a federal i/o channel level interface standard. "The federal government is ambiguous about standards. The mainframers say a bundled system is the solution, and they are now in litigation to abolish the fips (Federal Information Processing Standards) program altogether. And still, the user community hasn't been heard from," Biddle blasted.

Calling on federal users to become more assertive, more vocal, Biddle added, "Whatever your opinion, it's a useless opinion if it's not heard." —Becky Barna
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The Compact compiler runs on 32K byte microcomputer systems. It offers a powerful subset of ANSI COBOL facilities, including full support for random, indexed, and sequential files. In addition, it gives you all the CIS COBOL features for conversational working, screen control, interactive debugging, and special peripheral support.

**Standard Compiler**

The Standard CIS COBOL compiler requires a minimum 48K configuration. It is a super-set of the Compact compiler and implements ANSI 1974 COBOL to full Level 1 standard. Among its advanced features are program segmentation and interprogram communication which make it ideal for implementing or converting large systems using modular programming.

The same CIS COBOL extensions are available as in the Compact compiler and can be optionally flagged at compile-time so that the compiler then only accepts strict ANSI COBOL.

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And because CIS COBOL conforms fully to the standard, programs written with it are portable — so if you move up to a mini or mainframe, you will be able to take your software with you.

Equally, CIS COBOL can enable mainframe COBOL programs and programming tasks to be offloaded to less expensive microcomputers. Mainframe programmers love the ease of use of CIS COBOL and they achieve results fast running it on a desk-top micro.

**Forms**

The FORMS utility lets you build a screen layout online at the CRT. Then it automatically generates complete COBOL record descriptions for inclusion in your program — saving you time and leaving you free to concentrate on processing.

**Forms-2**

The FORMS-2 program generator — an extension of FORMS — completely eliminates the need to write simple data entry and enquiry programs. Using it, an entire CIS COBOL source program can be generated automatically from screen definitions — and it works, first time.

**Environment**

CIS COBOL products run on the 8080 or Z80 microprocessors under the CP/M* operating system, and on the LSI-11 or PDP-11 processors under RT-11. They are distributed in a variety of disk formats, and have a CONFIG utility supplied as standard, enabling you to drive many different types of CRT. All are themselves written in CIS COBOL, and are therefore self-compiling and readily transferable to different operating environments — including new operating systems and new microprocessors. All of which makes CIS COBOL a very attractive proposition for OEMs as well as end-users.

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OEM, dealer, and distributor terms are available on application to MICRO FOCUS.

Inquiries on iCIS-COBOL should be directed to Intel Corp.
CUTBACK AT NORTHERN TELECOM:
Northern Telecom Systems Corp. terminated 60 people at its Business Communications group following the shift of that group's end-user PBX activities from Northern Telecom, Inc., Nashville, Tenn. to its Systems Corp. subsidiary in Minneapolis, made up of former Data 100 and Sycor personnel. As part of the reorganization, the company is moving the operations of Northern Telecom Systems Corp. to Dallas. The cutback reportedly was prompted by a soft profit picture for end-user PBX operators.

ITEL LOSSES: ITEL Corp. last month was predicting third quarter losses of $175 million and was looking for a buyer for its plug-compatible computer business in South America, Japan, and Australia, something National Semiconductor reportedly did not want. When National took over the bulk of ITEL's plug-compatible operation, ITEL said it would continue the South America-Japan-Australia business, but now the firm said it is "talking to anyone interested in buying the rest of the computer business." The firm said its third quarter losses will include asset write-downs and loss reserves of about $150 million. The company lost $60.2 million in this year's second quarter.

IT'S TRIUMPH FOR PERTEC: Pertec Computer Corp. has agreed to be acquired by Triumph-Adler, West German computer and office machine manufacturer partially owned by Volkswagen. Ryal Poppa, Pertec president, said his company's management considered the Triumph-Adler offer, valued at some $117 million, "more favorable to the company and its stockholders than the previously announced agreement with North American Philips Corp. (September, p. 116). Philips had agreed to acquire 45% of Pertec's common stock for about $56.1 million. Triumph-Adler has agreed to pay $16.50 for each outstanding share of Pertec common in an acquisition which will be accomplished through a cash tender offer by a U.S. subsidiary of Triumph-Adler, to be followed by a cash merger. The merger is expected to be completed in January.

REJECTIONS BY MEMOREX: Memorex Corp. last month had rejected merger proposals from both Amdahl Corp. (September, p. 86) and Storage Technology Corp. but had resumed negotiation with Amdahl with Memorex working for a better offer from the PCM manufacturer. Amdahl had proposed an exchange of 1.2 shares of its stock for each share of Memorex. That proposed deal was valued at $234 million. Storage Technology said it would make no further offers to Memorex. SRC had first proposed an exchange of 1.6 shares of SRC for each Memorex share, then came up to 1.75 shares, the latest offer rejected by Memorex.

TANDY AND DATAPoint: Tandy Corp., Fort Worth, Texas, and Datapoint Corp., San Antonio, have agreed in principle to form a joint venture firm to manufacture 8 and 5 1/4 in. floppy disks. Tandy's Radio Shack Div. uses 5 1/4 in. floppy for its Trs-80 personal computer and 8 in. drives for its Trs-80 Model I small business computer. Current floppy sources for Radio Shack are Shugart Associates, Control Data and Tandon Magnetics. Datapoint, which uses 8 in. floppy on its dispersed processing and small business systems, has been manufacturing its own under license to Shugart. Location of the joint venture facility is undetermined but it has been decided it will be in Texas.

HARRIS ACQUISITION: Harris Corp., Melbourne, Fla., has agreed to acquire Farinon Corp., San Mateo producer of telecommunications installation and transmission equipment, in a stock exchange valued at $125 million. Under a preliminary agreement, Harris would issue eight-tenths of a share for each of the five million Farinon shares outstanding. Farinon's major product lines involve microwave radios and multiplexors but the firm also has competed against Harris in the receive-only earth station marketplace.

FOUR FROM SANDERS: Four representatives of Sanders Associates have taken seats as directors of California Computer Products, Inc. (CalComp) despite legal efforts of former CalComp president Lester Kilpatrick to stop them. Kilpatrick filed suit in Los Angeles Superior Court last Oct. 19 to stop the naming of the new directors and to enjoin the issuance to Sanders of 500,000 shares of CalComp preferred stock. The court denied Kilpatrick's suit on Oct. 30. Nov. 1, CalComp said it, with Sanders, had signed a definitive merger agreement and that Sanders had purchased the newly issued stock for $6,350,000 in cash and the cancellation of a $7,650,000 subordinated note sold by CalComp to Sanders earlier this year. CalComp directors who re-signed Nov. 10 were Walter F. Bauer, president, Informatics, Inc.; Dr. George W. Brown, a university professor; Richard V. King, president of Delfi American Corp., and James W. Lewis, vice president, Paine, Weber, Jackson & Curtis, Inc. Remaining are George M. Canova, CalComp president; Harry G. Bowles, retired senior vice president, who also is a Sanders director; Albert G. Handschumacher, chairman emeritus, Aerocna, Inc.; Stuart A. Krieger, business consultant and Kilpatrick. From Sanders have come Jack L. Bowers, Sanders president; Henry F. Argento, a Sanders director and Sanders vice presidents Joel Kosheff and Albert B. Wight.

INTERFACE STANDARDS OPPOSED: Honeywell, Control Data, Burroughs and Sperry Univac filed simultaneous motions asking a federal court for a summary judgment to block implementation of federal I/O interface standards which they describe as arbitrary and capricious. The companies charge that the standards, if incorporated into the Federal Property Management Regulations, would cost the industry millions of dollars in both hardware and software modifications. If not blocked by a court order, the standards were to go into effect Dec. 13.

MICROS DOCUMENTARY: A documentary television special report on the use of microcomputers for elementary classroom instruction will be broadcast over the PBS network Jan. 6 at 6 p.m. Titled "Don't Bother Me, I'm Learning," the broadcast documents the growth of microcomputer use in schools and demonstrates from a child's perspective the far-reaching implications this has on society. It includes interviews with teachers, parents, consultants, university experts and computer research spokesmen. Major funding for the broadcast was provided by the Bell & Howell Corp. Local PBS affiliate listings can be checked for exact times.

SOFTWARE FOR SMALL BUSINESS: "The independent packaged software market for small business computers, running at a $241 million-a-year level currently, will increase to $700 million in 1988," said the New York market research firm, Frost & Sullivan, Inc. In a market report, "The U.S. Software Package Market Outlook in Small Business Computers," the company says software "is becoming the most essential part of a small business computer system and the only way to differentiate among similar hardware." It projects that more than one million software packages will be sold over the next ten years and that unit sales will increase from 60,000 packages this year to 65,000 in 1980 and 185,000 in 1988.
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<thead>
<tr>
<th>Consolidated Summary of Earnings</th>
<th>1978</th>
<th>1977</th>
<th>1976</th>
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<tbody>
<tr>
<td><strong>Operating Revenues</strong></td>
<td>$1,918,988</td>
<td>$1,686,696</td>
<td>$1,383,442</td>
</tr>
<tr>
<td><strong>Other Income, net</strong></td>
<td>10,873</td>
<td>16,810</td>
<td>20,787</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$1,929,861</td>
<td>$1,703,506</td>
<td>$1,404,229</td>
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</tbody>
</table>

...to a 132 column statistical tabulation on the same standard narrow 8¾” paper like this:

<table>
<thead>
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<tr>
<td><strong>Operating Revenues</strong></td>
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<td><strong>Other Income, net</strong></td>
<td>10,873</td>
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<td>20,787</td>
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<td>12,956</td>
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<td>$1,929,861</td>
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<td>$1,404,229</td>
<td>$1,017,699</td>
<td>$1,026,313</td>
</tr>
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</table>

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<th>ORDER HERE</th>
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<th>DESCRIPTION</th>
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<th>DISCOUNTED PRICE</th>
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<td>5 or 10MB cartridge disc subsystem with single board controller for the LSI-11</td>
<td>$7,810</td>
<td>$6,250</td>
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<tr>
<td>0 PM-DSV11/C</td>
<td>RKV11D+3 RK05J</td>
<td>5 or 10MB cartridge disc subsystem with 4 board controller for the PDP-11</td>
<td>$8,410</td>
<td>$6,130</td>
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<td>3.32 or 6.64MW cartridge disc subsystem with 3 board controller for the PDP8</td>
<td>$8,085</td>
<td>$6,470</td>
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<td>RKV11D+3 RK05J</td>
<td>62.4MB disc pack storage for the PDP-11, with controller. Emulates DEC's RP11.</td>
<td>$15,550</td>
<td>$12,440</td>
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<tr>
<td>0 PM-DS11/300C</td>
<td>RJP04,06,06</td>
<td>254MB disc pack storage for the PDP-11, with controller. Emulates DEC's RH11.</td>
<td>$25,180</td>
<td>$20,145</td>
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<td>0 PM-DSW11/300</td>
<td>RWP04,06,06</td>
<td>254MB disc pack storage for the PDP-11/70, with controller. Emulates DEC's RH70.</td>
<td>$33,875</td>
<td>$27,100</td>
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<td>RX11-B</td>
<td>152KB dual floppy subsystem with 1 board controller for the PDP-11.</td>
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<td>RKV11</td>
<td>Single board disc controller for the LSI-11. Supports up to 20MB.</td>
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<td>$1,385</td>
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<td>RK11</td>
<td>Disc controller for the PDP-11 for 10MB, 5MB, or 2.5MB drives.</td>
<td>$2,500</td>
<td>$1,925</td>
</tr>
<tr>
<td>0 PM-DC8</td>
<td>RK8E</td>
<td>Disc controller for the PDP-8 for 1.66MW, 3.32MW, or 6.64MW drives.</td>
<td>$2,125</td>
<td>$1,675</td>
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<td>0 PM-DC11/300C</td>
<td>RH11+RJP04</td>
<td>Mass storage disc controller for the PDP-11. Operates up to 8 254MB drives. Emulates DEC's RH11.</td>
<td>$8,955</td>
<td>$7,164</td>
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<td>RH70</td>
<td>Mass storage disc controller and coupler for the PDP-11/70. Emulates DEC's RH70.</td>
<td>$17,650</td>
<td>$13,590</td>
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<td>0 PM-XC11</td>
<td>XCV11</td>
<td>Single density floppy disc controller for the PDP-11. Allows diskette formatting.</td>
<td>$1,800</td>
<td>$1,370</td>
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The fact that the user community has invested close to $300 billion in software and systems guarantees this.

So, if you take stock in IBM's direction, our position has been reinforced. We feel the industry will continue and thrive as long as we keep delivering compatible computers and peripherals that work better and cost less than IBM's.

At National we've made our commitment. As of October 1, 1979 the compatible computer industry is here to stay.


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National Advanced Systems is a subsidiary of National Semiconductor.
HP1000: Crunching matrices and slicing time

HP3000: Compact power for business systems and networks
The matrix machine

The Vector Instruction Set (VIS) gives the HP1000 F-Series computer a capability unique in the minicomputer industry: efficient and fast operation on matrices of data in a 16-bit computer.

VIS, a set of microcoded CPU instructions, fits the F-Series for applications that require manipulation of large, multi-dimensional arrays of data such as statistical analysis, 3D graphics rotation, structural analysis, image processing, and electronic circuit simulation. Such applications frequently require that a company purchase time on a mainframe, or buy a large computer, even when most of its applications do not justify such an expense.

With VIS, the HP1000 Model 45 becomes the Matrix Machine, the optimized system for scientific and engineering computation. This

F-Series model comes with the RTE-IVB real-time executive operating system, which can manage up to 2 million bytes of main memory. The base system includes the 2648A graphics terminal, GRAPHICS/1000 software package, and the high-performance HP7906 20-megabyte disc drive.

- The HP1000 F-Series with VIS will provide the fastest minicomputer solution to many matrix operations.
- It can avoid the "overkill" of buying an expensive computer for a few speed-critical operations.
- And it provides room for expansion by speeding up present operations and freeing the CPU for other jobs.

Vector arithmetic

VIS expands the computational power of the F-Series processor by speeding matrix computations.

In most small computers, matrix operations are executed in FORTRAN DO loops, in which a single pair of numbers is brought from memory and combined according to the specific instruction, then the next pair brought, etc. The overhead associated with these fetch operations eats up CPU time.

VIS acts directly on whole groups of numbers, called vectors, improving execution speed by an order of magnitude.

The basic element of a vector, called a scalar, has a single distinct value. A vector is a set of scalars that share some common attribute; they may be X-axis coordinates, for example, in a 3D graphics problem.

Pipelined processing

The F-Series computer performs vector arithmetic; that is, a single VIS instruction tells the CPU that the operation is to be performed on all scalars in a given vector.

With such an instruction, the CPU can pipeline the HP1000 floating point processor so as to achieve parallel processing of several elements in the vector. While the floating point processor is operating on two scalars, the CPU fetches the next pair from memory. Without VIS, the CPU would have to return to the DO loop for a new instruction each time it completed an operation, and then go search for the next pair of scalars.

Managing DO loops and chasing scalars can account for 90 percent...
of matrix computation time. Here's an example:

**Rotating an image**

A 3D image may be rotated a specified amount by multiplying its present XYZ coordinate matrix by a rotation matrix. In FORTRAN, this operation must be carried out by multiplying each element in each rotation matrix column by each element in each coordinate matrix row. It takes nine multiplications and nine additions to establish a single point.

The FORTRAN instructions for rotating a 1000-point image look like this:

```
DO 10 I=1,3
    DO 10 J=1,1000
      B(I,J)=0.0
    DO 10 L=1,3
      10 B(I,J)=B(I,J)+R(I,L)*A(L,J)
```

The execution time is 920 msec.

With VIS, the HP1000 can simplify the operation. Instead of a series of separate multiplications, VIS multiplies each rotational coordinate by an entire column of the coordinate matrix. The instructions look like this:

```
DO 10 I=1,3
    CALL VSMY (R(I,1), A(1,1),3, B(I,1),3,N
    CALL VPIV(R(I,2),A(2,1),3, B(I,1),3,B(I,1),3,N
    10 CALL VPIV(R(I,3),A(3,1),3, B(I,1),3,B(I,1),3,N
```

The execution time using VIS is 90 msec.

**Mainframe capability**

Working with large matrices efficiently requires fast access to large blocks of data, larger than normally available in 16 bit computers. A 400 x 400 matrix of floating point numbers, for example, requires a single block of 640,000 bytes of main memory.

The HP1000 computer systems have a unique feature called Extended Memory Area (EMA), that allows single blocks of data (matrices) as large as almost two million bytes to be specified without the need for special segmentation schemes. For a look at how EMA operates, see page 5.

Since vectors are arranged in memory in an orderly manner, the Vector Instruction Set can provide high speed access to matrices in the Extended Memory Area. The combination of VIS and EMA makes for a powerful matrix processing machine.

The chart on this page shows that the HP1000 F-Series with VIS can invert a 400 x 400 matrix of floating point numbers in 11 1/2 minutes. That's mainframe performance—at a fraction of the cost. The HP1000 F-Series is priced as low as $13,750.

To learn more about matrix operations on the HP1000 F-Series, check A on the reply card.  

---

**32-BIT PERFORMANCE IN A 16-BIT MACHINE**

Very large matrices will normally overflow the addressing capabilities of a computer that uses a 16-bit word, so that the machine either cannot perform the application or has to resort to disc memory, drastically slowing the performance.

The HP1000 with EMA and VIS overcomes this limitation on small machines at a fraction of the cost of a large mainframe. We ran a matrix comparison test between the 16-bit HP1000 F-Series computer with VIS and one of the fastest 32-bit computers on the market. Here are the results:

<table>
<thead>
<tr>
<th>Matrix Size</th>
<th>F +VIS</th>
<th>32-bit computer</th>
</tr>
</thead>
<tbody>
<tr>
<td>50x50</td>
<td>1.8 sec</td>
<td>1.5 sec</td>
</tr>
<tr>
<td>100x100</td>
<td>12.3 sec</td>
<td>11.7 sec</td>
</tr>
<tr>
<td>200x200*</td>
<td>105.0 sec</td>
<td>92.0 sec</td>
</tr>
<tr>
<td>400x400*</td>
<td>690.0 sec</td>
<td>720.0 sec</td>
</tr>
</tbody>
</table>

*EMA used
The Session Monitor for the HP1000 computer series, part of the RTE-IVB operating system, allocates and protects system resources when the computer is accessed by many users for both real-time and session activity.

Functionally, the monitor is a layer of software above the operating system. Following criteria set by the system manager, the monitor:

- Controls and coordinates access to work-station instruments and system peripherals such as discs and line printers.
- Assigns CPU time according to predetermined program priorities.

### Time for everything

With the Session Monitor, the HP1000 can support program development, data entry, data base query and similar jobs that are not time-critical, and at the same time be used to monitor real-time processes and respond to them.

Session Monitor allocates CPU time to different classes of users according to a priority schedule set up by the system manager. Session activities, which are not time-critical, can be carried out concurrently with real-time data capture and control functions, with no danger that the background sessions will interfere with time-critical functions. Session monitor is now included in RTE-IVB software package for the HP1000 computers.

Every 10-millisecond clock tick, and on device interrupts, the monitor scans the program list to make sure that the highest priority program is running. Real-time activities, such as data capture, time-critical controls, or external alarms, are handled by an absolute priority. The tasks are carried out to completion unless preempted by an activity with an even higher priority.

Session activities are time-sliced; they are placed in a queue that is logically circular, with one queue for each priority level. The “fence” between real-time and ses-
This diagram shows how Session Monitor slices time both vertically and horizontally. Above a “fence” level selected by the system manager, programs execute strictly according to priority. Below the fence, programs share time as it becomes available. If six programs with equal priority are running, they each get a sixth of the CPU time alloted to that level.

Schematically, the time-sliced layers resemble an inverted cone. The lower a program's priority, the lower its representation on the cone. Since the cone widens toward its base, low-priority programs get longer time slices when they are allocated CPU time! The slope of the cone's edge may be varied by the system manager.

**Low overhead**

By pre-setting priority levels, the system manager can load-balance the system without incurring the CPU overhead that accompanies heuristic algorithms. The RTE-IVB operating system explicitly recognizes that the user knows more about system workload than a sophisticated algorithm can.

User devices are assigned according to a list attached to the log-on IC. The system keeps track of what instruments are being monitored at which stations, and keeps records of connect time and CPU time for each user. I/O and data storage devices may be designated by the system manager for particular users or groups of users, protecting files against unauthorized or accidental alteration by other users.

**Tailor-made terminals**

The monitor tailors an individual terminal to the needs of the person using it. A technician, for instance, may need no more than the ability to load data. A supervisor needs access to certain files to compile reports. A programmer can store new programs without worrying about their being changed or lost. The system manager can access the whole system and change it as needed.

RTE-IVB also provides spooling capability so that users can have access to peripheral devices, such as printers, without having to wait for the printing to be finished before continuing with other work.

In this way, the system ensures that the full capability of the HP1000 will be optimally distributed for the individual user's job mix.

Check B for literature on HP's RTE-IVB Session Monitor.

---

**EMA: Virtual memory in the central processor**

Through the use of the Extended Memory Area (EMA), the RTE-IVB operating system can put the entire two million-byte physical memory of the HP1000's central processing unit, less only space for the operating system and the user code, at the service of a single program.

EMA looks to the user very much like disc storage. Its data is not directly addressable, but must first be brought into the 32K-byte logical address space of the program. To do this, part of the EMA is used for a Memory Window Segment (MSEG) to map the location of desired data.

EMA is user-transparent, and is called through simple FORTRAN statements.

When an element located in EMA is called by a program, the segment containing the element is mapped into the logical address space. Because this mapping requires no disc swaps, EMA provides fast retrieval of random access data.

With a Vector Instruction Set (see pp. 2-3), the retrieval of elements of arrays and matrices can be faster, since a single mapping locates all desired data.

EMA can be made to run faster for specific applications by writing memory management routines. Many separate operations may be performed on the same EMA when a segmented program is used. One segment can read in data, a second can process it, and a third can store the result. Actual execution speeds depend on how much memory management the user wants to do.
Hewlett-Packard's proprietary silicon-on-sapphire technology has made it possible to introduce a new compact computer system that makes the HP3000 the right business computer family for an even wider range of users and applications.

The newest member of the family is the HP3000 Series 30, an SOS-based processor that performs all the functions of the larger Series 33 and Series III systems, including concurrent transaction processing, batch processing, data communications and program development. It's packaged in a small cabinet measuring only 24" by 36" by 18", accompanied by a separately packaged system/maintenance console and a system disc. Yet it costs under $50,000.

**SOS: An HP innovation**

HP alone among computer manufacturers has developed SOS to the point where it can be used in commercially available products. For the user, SOS technology translates into small size, low power requirements, and high reliability in a general purpose machine.

The central processor unit (CPU) is designed around three SOS microprocessor chips containing the equivalent of 20,000 MOSFET transistors on one square inch of circuitry. Since devices on an SOS chip are dielectrically isolated, parasitic capacitance is dramatically reduced; the devices may be driven at relatively high speed—typically 2 nanosecond gate delays—on low power.

Putting most of the processor logic on three chips means that fewer integrated circuit packages and fewer printed circuit boards are required for the system. Reducing the number of components directly improves system reliability.

**Easy to install**

Because of modest power requirements, the Series 30 does not require the classic raised-floor air-conditioned data center. When configured with the standard 20-megabyte disc drive, the Series 30 produces about 4,650 BTUs per hour—about the same amount of heat as a medium-sized copying machine.

**I/O flexibility**

SOS technology is also implemented in the input/output (I/O) circuitry of the Series 30, allowing for broad expansion of peripherals from a single card cage. Up to 32 asynchronous terminals may be attached, with four magnetic tape drives, eight disc drives (with a maximum of 960 megabytes disc storage), two line printers, and one flexible disc drive.

The Series 30 can now be networked with other members of the HP3000 family through HP's Distributed Systems Network (HP-DSN) architecture. With two communication lines, the Series 30 can configure 24 terminals, 4 magnetic tape drives, 8 disc drives, 2 line printers and 1 flexible disc.

**"Hard” and “Soft” MPE**

The Series 30 processor maintains compatibility with the proven HP3000 MPE III (Multiprogram-
Where the need for immediate access to information is high but must be provided very economically, the entry level Series 30 is ideal. It can operate as a stand-alone system or as a station in a distributed processing network performing on-line order entry, batch inventory update, new application development and communications.
One of our newest SOS products is a front-end Intelligent Network Processor (INP) tailored for communications. Most of the data communications protocol handling is carried out by the INP; thus this load is removed from the CPU.

A data network manager wants programmers or analysts to be able to access remote data quickly, without degrading terminal response time for the rest of the on-line users. INP helps attain this goal by directing the flow of data.

Software off-loaded
The heart of the INP is a silicon-on-sapphire microprocessor, which generates BISYNC protocols from operating system software downloaded from the CPU when the communications line is opened. The protocols are stored in the INP's own 32K bytes of fast RAM, which is also used for data buffering. This memory, with automatic error detection, is made up of the same chips used in the HP3000's main memory.

Faster response time
When operating, the INP will interrupt the CPU only to report when a block of data has been transferred or received. The chart on this page shows how the INP can reduce CPU overhead; on a system that is heavily CPU-bound, this will result in faster response times at the terminal.

Other factors — I/O activity, amount of memory, number of users, and especially the nature of the particular application — will also affect response time. However, our tests show that on a system with a load of 30 sessions, the INP can reduce the effect of DS/3000 lines on response time by 80 percent.

The INP will also improve the throughput of low-priority background batch jobs.

The fact that the protocol driver software is downloaded from the CPU means that different communications protocols and subsystems may be accommodated in the future without adding new hardware.

The INP will support data transfer rates to 19,200 bits per second using modems, or up to 56,000 bits/second hardwired or with a CCITT V.35 standard interface. In general, maximum data rates depend on the communications subsystem used and the hardware to which the INP is linked.

INP is the preferred data interface for new users of the HP3000 computers. It may be a cost-effective replacement for the present HP SSLC (Synchronous Single Line Controller) on existing systems that are CPU-bound.

Check D on the reply card for further details on the Intelligent Network Processor.

Computer Advances is written to inform professionals of the latest technical contributions from Hewlett-Packard. You are invited to receive issues at your place of business or residence. Write Bob Ingols, Editor, Computer Advances, 19316 Pruneridge Ave, Cupertino, CA 95014.
The new Release 2.0 of our OnLine Query system is a major advance. Fully integrated with IDMS, it needs no application programming and produces immediately after installation. Easy to use, it has a powerful set of English commands to give both management and user departments on-line access to selected information via interactive terminals."  

—James M. Hudson, Project Leader, OnLine Query.

By installing OnLine Query-2 in the IDMS environment, reports that normally take two months can be done directly by user departments in less than an hour.

Programmers can test suspect records on-line, cutting bug finding and bug-killing to minutes, rather than hours. New features for release 2.0 include:

**Multiple Record Retrieval**, where a single GET command lets users retrieve multiple records of a specified type in one operation, with the user receiving only the data in which he is interested.

**QFILE Storage**, where special programs may be constructed and stored in the data dictionary for reuse by program-
129 reasons why your transaction processing system needs Perkin-Elmer's new 3220 supermini.

You can build an ultra-high-performance, 128-terminal system on Perkin-Elmer's powerful new 32-bit Model 3220. That's 128 good reasons right there.

The 129th reason is our RELIANCE software—the transaction processing package that makes it all possible. The instantaneous terminal response. The ability to handle a variety of complex operations all at once. The unmatched throughput for a massive number of transactions. Even with all this power, a RELIANCE system is easy to operate.

RELIANCE integrates COBOL, data management, and transaction processing software. It's explicitly designed to deliver the reliability, integrity, and security so critical to applications requiring large amounts of on-line file processing. And RELIANCE protects your commercial data base from media faults and system failures.

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City State Zip
Digital introduces
DEC Datasystem 540.
A powerful new business computer running the industry's most highly developed distributed processing software.

Our DEC Datasystem 540 brings a new level of power to mid-range distributed processing systems.

Built around our hot new PDP-11/44 processor, the D540 gives you an extra large memory (a million bytes) to support more terminals. Handle more processing more efficiently. And give you plenty of room to expand your application.

It also offers a Commercial Instruction Set and a new enhanced COBOL compiler that deliver powerful performance for your business programs.

And to make sure you get all the benefits of this increased capability, we've also increased the uptime with plenty of reliability features. Like a microprocessor-controlled ASCII console. Plus facilities for optional remote diagnosis for 24-hour-a-day, 7-day-a-week service with an average response time of less than 15 minutes.

But what really sets the DEC Datasystem 540 apart from ordinary computers is the distributed processing software that comes with it:

Digital's proven CTS-500 operating system.

And now we're introducing major new enhancements to CTS-500. Combined with the performance improvements of the D540, it means you get response times 50% better than with comparable systems.

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It's part of the broadest range of COBOL-compatible interactive systems.

The DEC Datasystem 500 family now offers the widest choice of COBOL-compatible systems in the industry. From the economical D530, through the D540, all the way to the high-end D570.

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A-12-9
Software development requires competent technologists, competent managers and an effective organization structure. The synergistic effect of these three elements differentiates successful development organizations from those forced to operate in a chaotic environment. A good organization structure is meaningless without a well-defined design methodology and without effective management practices. The organization structure brings together technologists and management, but the structure must work within the culture of the organization.

An organization can be described by the way it handles information flow, or by its hierarchical structure—the way it looks on an organization chart. In either case, one must first consider an organization as a group of managers and technologists and then attempt to decompose these personnel in a manner best fitting the projects to be developed. Organization structures must be dynamic and must be modified to accommodate the project (or work activity) environment.

An interesting analogy can be established between concepts employed in organizational decomposition and concepts employed in software decomposition. In fact, if one employs the same decomposition rules for both the job to be performed and the people who are to perform the job, a very effective organizational decomposition can be achieved. The common decomposition rules are:

**Software:** Each software segment should be small so that it can be easily understood (20 source lines).

**Organization:** Each software team should be assigned a unit of work which allows for minimal coupling among software teams.

**Software:** Each software segment should be loosely coupled from other software segments.

**Organization:** Each software team should be assigned a unit of work which allows for minimal coupling among software teams.

**Software:** Each software segment should enjoy high cohesion (performs one function).

**Organization:** Each software team should be assigned a work unit that is highly cohesive. (One team should not design diagnostic software and supporting software, such as compilers.)

**Software:** The scope of effect of a software segment should be a subset of scope of control.

**Organization:** Software teams should be grouped together (reporting to one manager) in such a manner so that the decisions made within the manager group have minimal effect on the work of other managerial groups.

**Software:** As software is decomposed into a hierarchy of segments, higher level segments perform decision-making and lower level segments do the actual work.

**Organization:** In an organization structure the managerial hierarchy performs decision-making (more abstract and longer range decisions at higher level of management) and the lower organization levels perform the actual work.

**Software:** Pathological connections should be avoided, or if not, at least fully documented. A pathological connection is a communication link not following the hierarchical software structure.

**Organization:** Pathological connections should be avoided among programmers in an organizational structure.

Fig. 1 illustrates the similarity between a software hierarchy and an organizational hierarchy when one applies the same rules to the decomposition of both work and people. This hierarchy is a basic entity in GTE's software development methodology.

The correlation depicted in Fig. 1 shows that interfaces between modules within a subprogram are controlled by the chief programmer, who is assigned the responsibility for developing one or more subprograms. Interfaces between subprograms within a class are controlled by the first line manager (or an appointee), who is responsible for the development of a software class. Note that in a matrix organization structure (which will be described in detail later), the technical coordination among subprograms will be performed by the project manager.

Let us assume the new development organization is required to develop two projects: Project A and Project B. Each project has three major functions to perform: real-time software development (operating systems), support software development (compilers), and hardware development (computers).

Fig. 2 shows six separate organizational entities, one entity for each technology for each project. The lower levels of the hierarchies shown in Fig. 1 can be viewed as existing within each box in Fig. 2. Now the manner in which we combine these separate organizations will give us a project organization structure (Fig. 3), a functional organization structure (Fig. 4), or a matrix organization structure (Fig. 5).

**FACTORS IN SELECTING STRUCTURES**

A combination of both matrix and project structures (where small project teams are created within the environment of a larger matrix superstructure) is the most advanta-
The matrix organization has the capability of exhibiting concern both for people and for projects.

genous for organizations responsible for developing both large and small projects. In most practical situations, the organizational structure selected is dependent on the following factors:

1. Size of each software development. Number of programmers/engineers whose output must be combined to make up one working system.

2. Number of projects. Few larger projects (above 30 people) or many small projects (under 10 people).

3. Scope of development. Types of work activity being performed at any one time. Are all programmers involved in active development? Are some involved in planning for new projects, some involved in new design, and some involved in software maintenance?

4. Environment. A laboratory organization structure must recognize and be able to cope with the corporate culture and structure in which it exists. There is no such entity as a "project organization" in a development environment when the project organization controls only 30% of the resources needed to complete the project and the external environment is functionally structured and controls the remaining 70%.

5. Physical limitations. Is the project being developed in one location or in many locations, possibly in different countries?

6. Organizational culture. What style of manager exists within the organization? And more importantly, what organization structure does the organization's chief officer feel comfortable with? Project Organization. This structure can be most effectively employed when an organization has many small projects to develop and when each project is developed at one location. The project structure requires that at least 70% of the resources needed to bring a project to completion is under the direct control of one line manager. This one person performs both the functions of project manager (technical) and line manager (administrative).

The advantages of the project organization are:

- Project and administrative decisions are made at the lowest possible organizational level thus allowing quicker decisions and better project control.
- Since full authority for the project is under the control of one person, interfaces are minimized and project responsibility is strictly defined (in case something goes wrong).
- This structure tends to mold system generalists and management personnel who are not assigned to functional specialties.

- Motivation is high during the active development period—programmers tend to identify with the project.

The disadvantages are:

- Projects must be kept small.
- Higher level management often loses track of project progress since their immediate involvement is not required.
- Economics of scale for critical resources can not be achieved. It is difficult to assign one "compiler" expert to three different projects. At least the project structure does not help cope with this problem.
- Training is costly since experts in all phases of development are required on each project. As an example, if one system software load must be generated for a given project, a member of the project organization must be trained in the techniques of generating a load. He may only utilize this training for a few weeks.
- Movement of programmers, especially gone from one project to another is difficult.
- Attrition is low during the active project development but often becomes excessive when the project is completed. Either programmers feel a loss of identity or alternative positions on other projects are not attractive.

- Probably the most serious flaw in this structure is that it inhibits both commonality among projects and generation of good software development standards and methodologies.

**Functional Organization.** This, the oldest form of organizational structure, is seldom used in medium to large development organizations. The concepts associated with a functional organizational structure are important only in so far as they serve as a base behind the more complex matrix structure. The basic problem is that all decisions that cross functional boundaries are made by one individual—the administrative and technical head of the functional organization. Very few managers are able to deal effectively with this much authority and in bottlenecks result, such as schedule slippages, project overruns, and poor quality. Also, the superhuman manager on top of the functional organization often gets bogged down in today's problems, leaving the organization's future to chance.

The advantages of a functional organization are:

- For a strong manager (hopefully free from megalomania) this organization sets a stage for very tight, centralized control.
- Since all the people associated with one specialty are centralized under a functional manager (e.g., one functional manager controls all real-time software development for all projects), commonality among projects can be effectively controlled. Also, selected personnel can be set aside to establish standards and advanced development methodologies, and ensure that industry-wide technological advancements are effectively included in the functional manager's internal operation.
- People establish affinity to a profession or to an organization rather than to a project, thus eliminating the attrition many development organizations face when the project technologists are assigned to nears completion.
- Adapts effectively to the long-range aspects—acquiring advanced technologies, and training and retaining personnel. This structure is capable of concentrating on the individual rather than the project.

The disadvantages of this form of organization are:

- Resolution of interface problems are made by one manager for all projects.
- Limits the creation of system generalists since all technologists are assigned to one functional specialization.
- Exhibits poor project control in terms of meeting development costs, schedules, and quality.

**Matrix Organization.** The project structure and the functional structure attempt to optimize one organizational constraint. Project structures tend to force organizational structures to concentrate on short-term project goals such as schedule, cost, and project quality. Functional structures tend to force concentration on long-term goals such as commonality among projects, technological advancement, improved standards of operation, and critical skills economies of scale.

The matrix operation is a complex organizational structure that attempts to optimize two or more organizational constraints simultaneously. Some matrix structures have been grown in an attempt to optimize multiple organizational constraints. Dow Corning, for example, has instituted a four-dimensional structure aimed at simultaneously optimizing project, function, territory, and strategy. Simple matrix structures are two-dimensional (Fig. 6). Here we see a structure that attempts the advantages of the two simpler structures, project and functional. The project side of the matrix concentrates on short term project objectives. The functional side of the matrix concentrates on longer term organizational objectives.

Probably the major disadvantage
Fig. 1 shows that there is a similarity between the software and organizational hierarchies when the same rules are applied to the decomposition of work and people. The lower levels of the hierarchies in Fig. 1 can be viewed as existing within each box in Fig. 2.

Fig. 1 illustrates that there is no single person responsible for the success of each project; the responsibility is truly shared between the functional line managers and the project managers. In the matrix philosophy, the functional manager decides how to do the job. He supplies all resources for development to take place. The project manager decides what to do. He controls the dollars. Dollars are allocated to the functional manager as part of a contractual agreement to perform work.

I have found that not all managers can work effectively in a matrix organization; many managers do not like the division of project responsibility. Unlike project organizations, the matrix does not have, and cannot tolerate, either a bureaucratic manager (must follow the rules) nor an autocratic manager (must...
do it my way).

In the face of conflict, the method of management operation in a matrix structure is for the project side and functional side to:
• Trust each other.
• Put all the facts on the table.
• Agree to a resolution. If this cannot be accomplished, both sides should compromise. As a last resort (admitting defeat) the problem should be brought to the "boss" who presides over both sides.

An often discussed disadvantage of the matrix is that it is a "two-boss system," meaning that a certain number of people in the organization have two bosses. However, I believe that if authority is properly defined and projects properly planned, the "two-boss" problem can be beneficial rather than detrimental.

**MATRiX**

If a development group decides to implement a matrix organization, top management must first define, in detail, the responsibility and authority of both the functional and project sides of the matrix. This is often done. What is overlooked in many situations is projects must be planned differently in a matrix environment. The matrix is a very powerful structure. Unlike either a project or functional structure, the matrix has an inherent capability to properly control "single project" development taking place in diversely located facilities or multiple companies. In a matrix environment, all work is effectively subcontracted rather than passed down through multiple levels of management.

For software design to take place properly within a matrix structure, one must ensure that project planning allows for subcontracting. To ensure this, the project group (usually expanded by temporary assignment of functional chief programmers and group leaders) will decompose the total project (using work breakdown structure techniques if necessary) into small subprojects. In software, a small project would be one subprogram (3,000 source lines). Each subproject is then fully defined by the project group prior to subcontracting. The resulting package is called a "cost account," and it is this package which will be subcontracted to the functional software development line organization.

Sitting on the functional side of the fence, the functional manager sees his responsibility as one of developing many small projects (cost accounts). The functional software group will be contracting for these cost accounts with many different project groups. The important con-
Too little attention has been given to the effects an organization has on software development rates.

The major advantages of the matrix organization structure are:
- The matrix structure enjoys the intrinsic capability to optimize two or more organizational objectives simultaneously: project, functional, geographical strategic objectives.
- The functional dimension of the matrix structure allows for project commonality, advancement in technology and standards, sharing of critical resources among projects. Simultaneously, the project dimension allows for stringent schedule, quality and cost control.
- The matrix structure enables technologists to be matured in either a technological speciality via the functional dimension or as system generalists via the project dimension.
- Due to the power of the matrix structure, it allows for effective coordination and control of large software development performed in diversely located organizations.

Disadvantages are:
- The matrix is a complex structure and as such requires mature management capable of working without excessive autocratic or bureaucratic tendencies. For this reason, matrix organizations must be introduced gradually rather than installed.
- Functional and project authority is divided in the matrix structure. This requires that approximately 15% of the development staff (the chief programmers) must work for two bosses. Often this two boss system imposes conflicting demands on Chief Programmers.
- A matrix structure requires more formal project planning and control techniques than does a project structure. This is true because of the "subcontracting" philosophy utilized in matrix organizations.
- Small developments and some medium-sized developments cannot be effectively managed utilizing the matrix due to overhead costs and division of responsibility. Thus, in most development environments utilizing the matrix, a Project organization philosophy should be employed as a substructure. As a general rule, those projects requiring less than 10 programmers should not be placed into a matrix unless there is excessive commonality with other projects being...
Software management's objective: an environment in which high quality software can be developed with minimal resources.

The Management Grid. A popular tool for measuring management style is based on a concept developed by R. R. Blake and J. S. Mouton. This tool is referred to as the management grid. The grid, shown in Fig. 7, represents a two-dimensional analysis of managerial behavior: concern for production and concern for people. A manager who demonstrates extensive concern for people will score high on the vertical axis. A manager who demonstrates extensive concern for production will score high on the horizontal scale. An ideal manager will exhibit behavior characteristics which place him high on both scales, thereby approaching 9.9 on the managerial grid. I have found that the management grid applies to management styles exhibited by organizations as well as by individual managers.

By applying the management grid to organization theory we can see that the characteristics of a project structure tend to force the management style exhibited by the total organization into the lower right-hand quadrant of the grid since this structure stresses project objectives. On the other hand, a functional organization structure tends to force the exhibited management style into the top left-hand quadrant since this structure stresses people rather than projects.

The matrix organization, properly implemented, can now be shown to have a very powerful advantage over either of the two simpler structures (project or functional) since it has the capability of exhibiting concern for people via its functional dimension and concern for projects via its project dimension.

It is extremely rare to find an organization where all the managers fall in the 9.9 quadrant of the management grid. It is, however, easier to find managers who exhibit personality characteristics which place them in the 1.9 quadrant. It is also not too difficult to find managers who fall within the 9.1 quadrant.

By placing the 9.1 type managers in the project side of the matrix structure and the 1.9 type managers in the functional side, a synergistic effect occurs whereby the organization, as a whole, can be seen as exhibiting 9.9 quadrant management.

**Organizational and Software Productivity**

We have looked at various heuristics that can be used to decompose a software organization into manageable parts and have shown that these parts can then be put together in one of three basic structures: functional, project or matrix. Now let us analyze a third facet, organizational efficiency. Organizational efficiency is the intrinsic ability of an organization to generate quality software in minimal time with minimal resources. Once the efficiency of an organization has been determined, we can begin to solve a problem that plagues all software management: how to accurately estimate software development effort.

Software development rates are normally measured in "executable source lines generated per programmer hour." The major factors which influence software development rates are the complexity of the software being designed (see Table 1 for a condensed complexity model which has been shown to be effective for our developments); the capability of the programming staff hired to perform the development; the activities required to generate and support commercial software (Table 2); and the efficiency of the organization within which the development is performed.

Experience we have gained in GTE has indicated that the effort required to develop a commercial software package (measured in executable source lines developed per hour) can vary by 6 to 1 depending on the software complexity (see Table 1); by 2 to 1 depending on programmer capability (this ratio is lower than that experienced by other organizations, because all programmers must follow a well-defined methodology for software development and, more importantly, the talented programmers have been assigned the more complex software tasks); by 12 to 1 depending on the management and technological methodologies utilized within the organization structure.

Although a significant amount of literature is available describing software complexity models and the effect of programmer capability on software productivity, too little attention has been given to the effects that an organization (along with its engrained methodologies) has on software development rates.

Organizations affect software productivity in three ways: first, the structure used to organize programmers; second, the systems used to plan and control the software development; and third, the management/technical methodologies employed.

Organizations manage these factors with different levels of effectiveness. The most effective organizations can develop high quality commercial software at rates approaching 12 to 1 better than organizations that do not contain the necessary talent to properly manage software development activities.

---

![Management Grid](image-url)

**Table 1:**

<table>
<thead>
<tr>
<th>Factor</th>
<th>Value (Ratio)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software Complexity</td>
<td>6 to 1</td>
</tr>
<tr>
<td>Programmer Capability</td>
<td>2 to 1</td>
</tr>
</tbody>
</table>

**Table 2:**

<table>
<thead>
<tr>
<th>Factor</th>
<th>Value (Ratio)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management/Technical Methodologies</td>
<td>12 to 1</td>
</tr>
</tbody>
</table>

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*Fig. 7.*
You can buy financial software from a company that pretends to speak your language...

Most financial systems are designed by data processing people who don't really understand accounting. Things are different at McCormack & Dodge. Our software packages are designed by teams of financial and data processing experts. We're fluent in Generally Accepted Accounting Principles as well as ANSI Cobol. So you get efficient, well-designed systems with all the comprehensive features and capabilities you need.

We start with a complete determination of the needs of financial people... by financial people. Experts who are familiar with complex accounting requirements and understand the meaning of financial planning and control. They make sure you get the reports you need, in the form you need them.

Then our data processing experts go to work to give you software that's flexible and easy to use. Streamlined, efficient systems incorporating state-of-the-art technology.

Our software packages have been audited by the "big eight" accounting firms. Given top ratings in the 1978 Datapro Users' Survey. Selected by some of the world's most critical financial executives. And installed in over 850 companies, including dozens of the Fortune 500. In fact, 7 out of 10 companies we talk to end up doing business with us.

That's why you should talk to us about: General Ledger/Financial Analysis, Accounts Payable, Fixed Asset Accounting, Capital Project Accounting, Purchasing Management.

or you can talk to McCormack & Dodge.
Based on this dichotomy of management styles, we can segregate software development organizations into one of three categories: dated software organizations, modern software organizations, and state-of-the-art software organizations.

**Dated Software Organization.** We have found that development groups using dated organizational techniques have a low software productivity rate. These organizations do not employ composite design techniques nor do they follow a rigid methodology for software implementation. If documentation standards exist at all, they are poor, not formally defined, and poorly planned. Attribution is usually high and the feeling of software professionalism is not a significant aspect of the programming environment. The first four systems in Table 3 illustrate development rates of systems utilizing these concepts.

**Modern Software Organization.** As a software development organization matures, it establishes stricter controls over the development process. These organizations have enjoyed an improvement in software development rates of 300% over organizations using ineffective techniques for the same type of software. Listed above, System E in Table 3 illustrates the development rate of a large software system utilizing these more advanced design and management techniques.

Some of the techniques employed by these more efficient organizations:

1. Organizational structures are optimized around the projects being developed. Project structure and matrix structure are both used.
2. Organization hierarchy includes both chief programmers and feature chiefs, as well as a thoroughly documented and enforced design methodology.
3. Standard techniques are employed for decomposing software into functional entities. Techniques employed are transaction analysis, transform analysis, pseudo code, Jackson technique.
4. Strict software documentation standards are established and rigorously enforced. These standards are established to meet the following objectives: documentation is completely computer generated; documentation is a direct output of the design process and is the entity which undergoes design and code reviews; documentation defines software function, inputs and outputs; documentation is structured and accompanied by a hierarchy chart.

**COMPLEXITY MODEL**

Raw Software Design Hours (RDH) equals the product of (E) which represents organizational efficiency; (B) which represents program specific variables and (N) which represents number of executable instructions. Thus

\[ RDH = E \cdot B \cdot N \]

The complexity model is employed to estimate the variable (B) where B is the product of \( B_1 \), \( B_2 \), ..., \( B_n \).

\[
\begin{align*}
B_1 &= 0.8 \quad \text{If the project development is aided by a set of interactive support tools. Else } B_1 = 1.0 \\
B_2 &= 0.95 \quad \text{If the program is developed by one programmer.} \\
B_3 &= 1.15 \quad \text{If the program is developed by more than 15 programmers.} \\
B_4 &= 1.0 \quad \text{If the number of independent module inputs and output items is less than five.} \\
B_5 &= 1.1 \quad \text{If greater than five.} \\
B_6 &= 1.2 \quad \text{If greater than ten.} \\
B_7 &= 1.25 \quad \text{If this module has been specified as real-time critical.} \\
B_8 &= 1.5 \quad \text{If the module contains a very complex algorithm or has a significant hardware interface.} \\
B_9 &= 0.7 \quad \text{If the module is purely data-manipulative.} \\
B_{10} &= 1.2 \quad \text{If the module algorithm is not similar to previous work.} \\
B_{11} &= 1.0 \quad \text{If the algorithm is similar.} \\
B_{12} &= 1.5 \quad \text{If the module is modified from an existing module and only new or changed instructions are included in the instruction count.} \\
B_{13} &= 1.0 \quad \text{If the program is developed by more than 15 programmers.} \\
B_{14} &= 1.25 \quad \text{If the module is entirely new.} \\
B_{15} &= 1.1 \quad \text{If batch is employed and turnaround is greater than four hours.} \\
\end{align*}
\]

Table 1.

**SUPPORT REQUIREMENTS**

**Raw Software Design Hours (RDH)**

\[
S = \frac{1}{\text{Total development hours up to one year after turnover to customer}}
\]

Based on 3,000,000 Hours of Historical Statistics

<table>
<thead>
<tr>
<th>Software Design Hours — Project Size —</th>
<th>Value of &quot;S&quot; Type of Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>400,000 Hours</td>
<td>1.9 New design—no existing base</td>
</tr>
<tr>
<td>100,000 Hours</td>
<td>2.0</td>
</tr>
<tr>
<td>200,000 Hours</td>
<td>1.7</td>
</tr>
<tr>
<td>200,000 Hours</td>
<td>2.1 Modified design using existing base</td>
</tr>
<tr>
<td>20,000 Hours</td>
<td>2.2</td>
</tr>
<tr>
<td>50,000 Hours</td>
<td>1.5 Design maintenance after first year</td>
</tr>
<tr>
<td>10,000 Hours</td>
<td>1.9</td>
</tr>
</tbody>
</table>

*Includes only software design hours required to decompose predefined subprograms into modules and segments, code, unit test, string test, integration test and all design documentation.

**DEVELOPMENT STATISTICS**

<table>
<thead>
<tr>
<th>System</th>
<th>Commericially Available to Customer</th>
<th>Size of Program (New Instructions)</th>
<th>Development Rate Instructions Per Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1972</td>
<td>160,000</td>
<td>.33*</td>
</tr>
<tr>
<td>B</td>
<td>1973</td>
<td>117,000</td>
<td>.43</td>
</tr>
<tr>
<td>C</td>
<td>1974</td>
<td>111,000</td>
<td>.53*</td>
</tr>
<tr>
<td>D</td>
<td>1977</td>
<td>220,000</td>
<td>.52*</td>
</tr>
<tr>
<td>E</td>
<td>1979</td>
<td>131,000</td>
<td>1.2*</td>
</tr>
</tbody>
</table>

*Executable object

Table 3.
TI's small business computers. Solutions for OEMs and their customers alike.

Solve problems for your customers and solve a few of your own at the same time—and at prices starting at under $10,000*!

Your applications programs combined with TI's highly-reliable small business computer systems give your customers the power they need to tackle today's demanding business problems—like payroll, accounting and inventory control.

Both the Model 771 and DS990 Model 1 are powerful, complete, desktop systems. Since they are compatible with our larger business computer systems, helping your customers upgrade as their needs grow is a snap.

Implementing your applications on both these systems is no trouble either. For maximum versatility the DS990 Model 1 operates on a variety of software and programming languages. Among them are BASIC, FORTRAN, Pascal and TPL, TI's unique program for simplified forms generation.

The Model 771 desktop computer uses single-sided, single-density diskette storage for a total of up to 500,000 characters of instantly available on-line data storage. The DS990 Model 1 stores up to 4,600,000 characters using double-sided, double-density diskette storage, making it among the most powerful small business computers available anywhere.

And when you need service, Texas Instruments products are backed by trained specialists worldwide. Service is available wherever TI products are sold or TI will train your service personnel.

Solve your problems reliably and efficiently using small business computers from Texas Instruments, the company appointed the official computer and calculator company of the 1980 Olympic Winter Games. Contact the TI sales office nearest you, or write Texas Instruments Incorporated, P.O. Box 1444, M/S 7784, Houston, Texas 77001. In Europe write Boîte Postale 5, 06270 Villeneuve Loubet, Nice, France.

*Quantity one, U.S. domestic price. Quantity discounts available. Copyright ©1979, Texas Instruments Incorporated
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Little by little, bit by bit, almost without anyone realizing it, a multi-billion dollar industry has been born.
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These PROCESSORS require 415 Hz power! If you have one on order, call us for a delivery schedule on our award-winning, solid state, 415 Hz frequency converters.

Save ENERGY and MONEY. These are the most EFFICIENT 415 Hz power sources available. They have the LOWEST life cycle cost. And they're easily paralleled at no extra cost.

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CAREER INSURANCE

System input materials are as sensitive as they are significant. Temperature of only 150° can damage or destroy them, and even a short, minor fire in your building can generate that much heat. 85% humidity can also ruin your computer input. Ordinary safes and insulated files are not designed to protect against these hazards.

That's why you should protect system input with a Diebold Data Safe. Available for sale or lease with either 1-hour or 4-hour listing from Underwriters' Laboratories, the Diebold Data-Safe can help you be sure you and your system will both have a job tomorrow.

And that should be worth looking into.

DIEBOLD
INCORPORATED
CANTON, OHIO 44711
"We know how to help you"
(216) 469-4047

CIRCLE 42 ON READER CARD

5. Design walkthroughs are held at each level of software decomposition. Preestablished review formats are employed with standard reports generated. Reviews are formally scheduled to ensure programmer time is made available. Only commercial documentation is reviewed at these meetings. Adherence to design standards, documentation standards, and quality, inter cost account interfaces are ensured by these reviews.

6. Walkthroughs are conducted for each feature prior to system testing. During feature review the customer's requirement specification is validated against evaluation test plans and the software functional designs.

7. Structured code is employed, embodied within a medium high level compiler such as PASCAL. Code reviews and code walkthroughs are conducted following a predefined process. The chief programmer and at least one peer programmer read each module of code.

8. Strong management planning and control systems are employed. These systems help plan and control software quality, time, and cost. An ideal system combines PERT networks and the concepts of C/SCSC (a cost/schedule control system developed by the U.S. Department of Defense).

9. All major software interfaces and data structures are defined before detail design begins. Data structures and software interfaces form a contract which is monitored and controlled throughout design and testing.

10. Management attempts to hire and retain the correct mix of software personnel: 30% with more than six years' experience, 40% with between three and six years' experience, and 30% with college degrees and less than three years' experience.

State-of-Art Software Organization. Organizations which are at the state of art in software development should enjoy productivity of from 200% to 400% over modern software organizations. The higher percentage prevails in larger, very complex software developments. These organizations employ all the techniques described above and in addition utilize advanced concepts of a "software factory." This concept is a consolidated set of powerful development tools which allow software managers and programmers to perform the innovative aspects of software development and automate most of the more rudimentary tasks. Projects which have used this consolidated set of supporting tools have experienced significant improvement in developing rates.

The types of tools which have been shown to be most promising in improving development efficiency are described below:

1. A program which accepts rough software documentation as input and performs the following four processes: checks that all data variables have been defined and inserts a definition of
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Sanders' Graphic 7 provides the whole picture by drawing bright, crisp vectors and symbols so rapidly that you see all the data you want. Benchmark tests with actual time measurements have proven Graphic 7 to be the fastest cost-performance leader. This performance spells results for your application.

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INDEX: 228-1894.
What you hear from your favorite minicomputer hardware salesman is about one-half of what you should know. Get some straight answers about their Operating System before you buy; and look out for those...

PROMISES...PROMISES

"Sure we’ve got Software Support"... but, we’ll take care of that later.

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"Sure we’ve got communications."... if you don’t mind being off-line.

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Tape cleaners and testers... Why you should buy from Kybe:

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Find out for yourself. The best equipment, competitively priced... from Kybe.

EDMUND B. DALY

Mr. Daly was recently appointed executive director-electronic switching of GTE Automatic Electric Laboratories, where during the past 10 years he has held the positions of assistant to the executive director, director-Advanced Development Laboratory, and director-EAX Operations Laboratory. He holds a BSEE and MSEE from the University of Illinois, Urbana, and a BA and MBA from the University of Chicago.
SAS is a powerful software system that can increase your productivity. In the programming task shown here, 4 SAS statements produced the same chart as 400 COBOL statements. That's a typical example of how SAS can help you produce results faster.

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919/834-4381.
The differences are enormous. The system is entirely transparent.

It began with the Tandem NonStop System. First of its kind. The one multiple processor system in the world capable of continuous operation—even during the failure of a processor I/O channel, disc controller or disc. Without loss or duplication of any transaction, even those in process. And with maximum protection for the data base—at a level unprecedented in the industry. Plus phenomenal flexibility: expandable in low cost increments from a basic two processor system all the way to sixteen processors with the ability to support thousands of terminals per system. File capacity of up to four billion bytes per file, and no limit on the number of files. Extraordinary it is, all by itself, and now as many as 255 Tandem NonStop Systems can be economically interconnected in a powerful, complete and amazingly simplified network. Read on.

**Announcing the 4000 processor network.**

Here's how to tie together 4000 processors: Easy. Interconnected in the most beautifully simple way. Per the diagram. Point-to-point connections can be made between all centers of overlapping activities, but are not required. We can in fact tie the network together with a single continuous line. And there is no user involvement for pass-through. To get from “A” to “F,” no user housekeeping penalties from “B,” “C,” “D,” & “E.”

It looks exactly as if all messages were being transmitted only next door. And X25 protocol is available as well.

**Introducing the distributed/centralized data base.**

Totally transparent. With a split of geography completely invisible to the user. Not the separate interconnected data bases found in other networks but a unified data base completely and transparently accessible throughout the network. No user, and no application program, has or requires any awareness whatsoever as to the actual location of any segment of the data base in the Tandem network. With a Tandem NonStop Computer System, your data may be in Ypsilanti, but it looks for all the world like it’s residing right in your own local system.

**To get rid of a host of problems, get rid of the host.**

Having a host system in a network is traditional. Unfortunately, it is also the traditional point of concentrated difficulties. For when the host goes down, so does the whole network. And even if the host is only suffering an intermittent difficulty, the integrity of the data base is up for grabs, not only in the host, but throughout the remote data bases as well. With Tandem’s GUARDIAN/EXPAND Network, a local failure has no impact whatsoever on the rest of the network.

Conventional fixed network is difficult and expensive to expand and modify as needs grow. And they always do. Communication and utilization of data base records from twice removed nodes is prohibitively expensive in applications programming, so more lines are the only viable solution. And that is expensive, too.

Tandem pass-through packet switching enables “A” to communicate with “E” at no penalty in system overhead. And you can add direct lines, per “B” to “E” or “L” to “G” whenever traffic warrants without disrupting system performance or efficiency. Note that nodes can be of variable sizes, all using Tandem NonStop Systems as the common element. Efficient, powerful and extremely low cost.
A unique and unified operating system— free of geographic limits.

Whereas most network operating systems are created "on top" of prior operating systems, at significant penalty, Tandem's Guardian Operating System was created from day one for the multiple processor environment. It treats all resources within the system as files, both hardware and software, and accordingly achieves complete geographic independence, both for the user and for the user's programs. This is beautiful at any time, and it is a lifesaver when increased work loads call for an expanded system, more processors and peripherals, and perhaps a new configuration of resources. This is unique: no reprogramming is required, not even recompilation.

The long and the short of it— keeping costs down and performance up.

No one can do that like Tandem. For the differing needs at each node can be met by the expandable Tandem NonStop System in varying configurations. Single system programming works over the entire network and will continue to work regardless of growth and complexity of the system. And because this is after all a mini-based system, the costs are low to begin with and add-ons come in low-cost increments. Without one cent of penalty on the original investment.

Comprehensive software— transparent and segmented.

Under the overall supervision of GUARDIAN/EXPAND, the Network Operating System, each individual system maintains its own Guardian Operating System plus all of the multiple processor and control communications systems and a host of applications languages including industry standard ANSI '78 FORTRAN and ANSI '74 COBOL. With T/TAL, EDITOR, SORT/MERGE, DEBUG, TGAL, ENFORM Query/Report Writer, and complete remote diagnostic capabilities, the software package of the Tandem NonStop Operating Network is truly impressive. Best of all, it never requires one iota of modification as systems, nodes and the entire network expand and are modified to suit changing requirements. And any Tandem GUARDIAN/EXPAND node can communicate with IBM or any other mainframe using industry standard protocols. We've made it possible and practical to go from any industry standard system to a low cost, comprehensive and flexible network without sacrificing your original installation.

If you're from Missouri, too.

Call or write for complete information about the Tandem NonStop Operating Network. We'll be happy to demonstrate both how and why this system will cost you less to begin with, less to expand, and less to operate than any other network on the market today. And most likely for years to come.

Tandem Computers, Inc.
19333 Valco Parkway, Cupertino, CA 95014.
Toll Free 800-538-9360 or (408) 996-6000 in California.
Global computer and office equipment trade grew 11% in 1977.

THE WORLD’S TOP 50 COMPUTER IMPORT MARKETS

by Bohdan O. Szuprowicz

The preliminary international trade statistics released by the United Nations in September 1979 provide comparative trade data for 113 countries. These statistics, compiled for specific commodities, are useful in assessing the size and growth of import markets.

Computers, peripherals, spare parts, and office equipment are accounted for under the Standard International Trade Code (SITC) 714. Under this code, about 85% of all equipment traded consists of computers, dp equipment, and parts, but does not include any software.

Although dp hardware production is one of the largest industries in the world, international trade in computer and office equipment is not one of the largest commodity groups traded in world markets. In 1977, total computer and office equipment trade was almost $11.6 billion, or 1.4% of the total trade in all commodities. This ranks computers and office equipment 16th in volume, comparable to paper and paper products, and only slightly larger than television, radio, and phonographs.

Interestingly, telecommunications (SITC 724) equipment trade is about 50% larger than that in computers and office equipment. Japan and West Germany are already larger exporters of telecommunications apparatus than the U.S.; Japan exports almost three times more telecommunications equipment than the U.S.

However, in the export of computers and office equipment the U.S. remains in the lead at 31.2%, followed by West Germany and Japan with 15.6% and 9.7%, respectively.

The top five countries exporting computer and office equipment command a collective market share of 74.5%. The top 10 exporting countries supply 93.3%.

Because the contribution of computer hardware exports to balance of payments is relatively small compared with trade in other commodities, governments are tempted to use such trade for political purposes. While individual manufacturers are frustrated by such attitudes, when they object vociferously about government-imposed export controls, they become even more valuable as “bargaining chips” to the politicians. Export licenses for advanced (or even state-of-the-art) computer systems are often a political pawn in the hands of government negotiators.

Western Europe continues to be the largest trading area in the world and is a net importer of computers and office equipment. While much of Western Europe’s trade is strictly regional (and a certain portion that consists of shipments across countries), the region still imports over $1 billion more than it exports. Nevertheless, total Western European exports are now almost $6 billion, $2 billion more than the exports of the U.S. and Canada. However, much European trade consists of dp hardware manufactured by subsidiaries of American companies such as IBM and DEC.

Whereas imports in Europe increased by 17.7% in 1977, it is not the fastest growth area. Once again, that honor belongs to the 20 Arab countries in Africa and the Middle East which, as a group, have an imports growth of almost 26%.

Among the top 50 importing countries, four were over $1 billion markets in 1977; new to the group is the United Kingdom. The U.K. is also one of the four $1 billion-plus exporters (U.S., Japan, West Germany). France, which reached $995.8 million in 1977, is almost certainly a $1 billion exporter by now.

The fifth largest import market in 1977 was Canada, with imports at $669.5 in 1977. Canada is also the eighth largest exporter, with about $400 million shipped outside its borders in 1977. A large importer of Canadian-built equipment is the U.S., in many cases, buying from subsidiaries of American dp manufacturers.

The significant change in the top 10 importing countries was the dropout of the U.S.S.R., which showed a drastic decline as an import market for computers and office equipment in 1977, ending in 18th place among such countries as Brazil and Norway.

In market size among the fastest growing importing countries, Ireland leads with “77 imports of $156.8 million, an increase of 66% over ’76. Since becoming a member of the Common Market, Ireland is a preferred assembly location for American, Japanese, and European manufacturers, who take advantage of Ireland’s low labor costs and its proximity to the huge Western European markets. Ireland’s exports were $213 million in 1977; it is one of the few countries in the world showing a surplus, far ahead of such traditional “off-shore” suppliers as Brazil, Singapore, Mexico, South Korea, or Hong Kong.
Among the Arab States, Saudi Arabia is the leader; Saudi imports grew 51.2% in 1977. Because the Soviet economy has a limited capacity to absorb high technology products without simultaneous training, installation, and operational assistance, these are additional dp markets; purveyors of software, services and supplies are in a position to get dp projects installed and operating until Soviet personnel are trained to take over.

Following Saudi Arabia, the largest dp import markets in the Arab world are Algeria, Kuwait, Egypt, Iraq, and Morocco. Lebanon, if political stability continues for the next few years, will probably outpace most Arab states as a large importer of dp products because of its extensive banking and trading industries. In addition, Lebanon's longer range potential is enhanced by its high literacy rate; it is in a position to absorb high technology faster than many of its neighbors.

Four countries import considerably more than they export, resulting in an unfavorable balance of trade in the SITC 714 category. Traditionally, such countries are prime prospects for development of domestic dp manufacturing in an attempt to correct trade imbalances. Leading among these countries is Australia which imported $282 million of computer and office equipment products in 1977, an import-to-export ratio of 14:1.

The dramatic collapse of the import markets in the Soviet Bloc countries was perhaps the greatest surprise in 1977 because many Western manufacturers had high hopes for selling plug-compatible peripherals for use with COMECO-designed RIAD computer systems (designed around IBM/360 and 370 operating software). However, there is some question whether the decline of the Soviet Bloc computer trade has been as large as the United Nations trade statistics lead us to believe.

One reason for this is that Soviet Bloc countries are increasingly reluctant to provide commodity trade statistics pertaining to import and export of engineering products at detailed product levels. For 1977, Bulgaria, East Germany, Hungary, Poland, and Rumania did not provide full SITC 714 code statistics. East Germany withheld its export trade data at this level for the first time in 1977, and because its trade in computers and office equipment is the largest in the Soviet Bloc, this would immediately influence trade statistics of other COMECO countries who import 90% of East German exports in this category.

An analysis of Soviet trade statistics shows the Soviet Union imported $240 million of SITC 714 products in 1977, twice the amount reported by the U.N. statistics.

There are also differences in valuation of imports and exports that are troublesome to the compilers of comparative international trade statistics. In the case of the Soviet Union, for example, U.N. statistics based on U.S. Customs export data indicate $5.9 million of equipment left the U.S. in 1977 destined for the Soviet Union. For the same year, Soviet statistics published in Moscow indicate dp equipment imports from the U.S. valued at over $11 million. Soviet valuation, customs duties, and freight charges create differences, but if the discrepancies are unreasonably large, there is always the suspicion that Soviet imports reflect equipment shipments that may have been originally exported from the U.S. to other destinations in order to obtain export licenses, and later illegally diverted to the Soviet Union or some Eastern European countries for which export licenses could not be issued. Withholding trade statistics by COMECO countries would help in preventing the discovery of such trade inconsistencies.

There could be several reasons for the decline of Soviet Bloc imports markets, but the most plausible are an increasing shortage of hard currencies, a growing indebtedness to the West, and the development of significant domestic dp hardware manufacturing capabilities within each COMECO country (including Cuba's minicomputer production).

### Table 1

**Significance of Computers Among Other Commodities**

<table>
<thead>
<tr>
<th>Rank</th>
<th>Category</th>
<th>Imports in millions of U.S.</th>
<th>Percent of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fuels</td>
<td>170,590</td>
<td>22.0</td>
</tr>
<tr>
<td>2</td>
<td>Agricultural products</td>
<td>104,314</td>
<td>13.0</td>
</tr>
<tr>
<td>3</td>
<td>Motor vehicles &amp; parts</td>
<td>68,056</td>
<td>9.0</td>
</tr>
<tr>
<td>4</td>
<td>Raw materials</td>
<td>56,638</td>
<td>7.5</td>
</tr>
<tr>
<td>5</td>
<td>Chemicals</td>
<td>53,633</td>
<td>6.8</td>
</tr>
<tr>
<td>6</td>
<td>Industrial machinery</td>
<td>42,586</td>
<td>5.4</td>
</tr>
<tr>
<td>7</td>
<td>Electrical machinery</td>
<td>34,917</td>
<td>4.5</td>
</tr>
<tr>
<td>8</td>
<td>Iron and steel</td>
<td>26,122</td>
<td>3.3</td>
</tr>
<tr>
<td>9</td>
<td>Textile fabric and yarn</td>
<td>22,284</td>
<td>2.8</td>
</tr>
<tr>
<td>10</td>
<td>Clothing</td>
<td>20,241</td>
<td>2.6</td>
</tr>
<tr>
<td>11</td>
<td>Nonferrous metals</td>
<td>19,727</td>
<td>2.5</td>
</tr>
<tr>
<td>12</td>
<td>Telecommunications</td>
<td>18,604</td>
<td>2.4</td>
</tr>
<tr>
<td>13</td>
<td>Scientific instruments</td>
<td>14,506</td>
<td>1.8</td>
</tr>
<tr>
<td>14</td>
<td>Metal manufacturers</td>
<td>14,009</td>
<td>1.7</td>
</tr>
<tr>
<td>15</td>
<td>Paper</td>
<td>12,214</td>
<td>1.5</td>
</tr>
<tr>
<td>16</td>
<td>Computers &amp; office expl.</td>
<td>11,683</td>
<td>1.4</td>
</tr>
<tr>
<td>17</td>
<td>TV, radios, phonographs</td>
<td>11,330</td>
<td>1.4</td>
</tr>
<tr>
<td>18</td>
<td>Diamonds</td>
<td>9,333</td>
<td>1.2</td>
</tr>
<tr>
<td>19</td>
<td>Aircraft</td>
<td>6,883</td>
<td>0.9</td>
</tr>
<tr>
<td>20</td>
<td>Agricultural machines</td>
<td>5,920</td>
<td>0.7</td>
</tr>
</tbody>
</table>


### Table 2


<table>
<thead>
<tr>
<th>Region</th>
<th>Total Imports in 1977</th>
<th>Total Imports in 1976</th>
<th>Percent change 1976-1977</th>
</tr>
</thead>
<tbody>
<tr>
<td>World Total</td>
<td>11,683.9</td>
<td>10,520.8</td>
<td>+11.0</td>
</tr>
<tr>
<td>Western Europe</td>
<td>7,019.5</td>
<td>5,989.8</td>
<td>+17.2</td>
</tr>
<tr>
<td>North America</td>
<td>2,041.2</td>
<td>1,790.4</td>
<td>+14.0</td>
</tr>
<tr>
<td>Asia (including Far East)</td>
<td>882.2</td>
<td>768.7</td>
<td>+14.7</td>
</tr>
<tr>
<td>Latin America</td>
<td>566.9</td>
<td>520.8</td>
<td>+8.8</td>
</tr>
<tr>
<td>Soviet Bloc</td>
<td>386.5</td>
<td>377.5</td>
<td>-4.9</td>
</tr>
<tr>
<td>Oceania</td>
<td>330.8</td>
<td>279.2</td>
<td>+18.5</td>
</tr>
<tr>
<td>Africa</td>
<td>263.6</td>
<td>235.0</td>
<td>+12.0</td>
</tr>
<tr>
<td>Middle East</td>
<td>189.9</td>
<td>161.5</td>
<td>+17.6</td>
</tr>
<tr>
<td>Arab States only</td>
<td>169.4</td>
<td>134.5</td>
<td>+25.9</td>
</tr>
</tbody>
</table>


*Arab States are a grouping of 20 Arab countries located in Africa or the Middle East. The totals for Africa and Middle East also include the constituent Arab countries in these statistics. These figures are developed for comparative purposes by region and do not add up to the world total as some duplication and overlap will occur.
### TOP 50 COMPUTER AND OFFICE EQUIPMENT IMPORT MARKETS

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
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<tbody>
<tr>
<td>World Total</td>
<td>11,683.9</td>
<td>10,520.8</td>
<td>+ 11.0</td>
<td>+ 10.95</td>
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<tr>
<td>West Germany</td>
<td>1,382.9</td>
<td>1,171.9</td>
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<tr>
<td>United States</td>
<td>1,368.6</td>
<td>1,181.1</td>
<td>+ 15.9</td>
<td>+ 26.7</td>
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<tr>
<td>France</td>
<td>1,135.4</td>
<td>1,018.9</td>
<td>+ 11.3</td>
<td>+ 17.1</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>1,159.8</td>
<td>977.9</td>
<td>+ 18.6</td>
<td>+ 18.1</td>
</tr>
<tr>
<td>Canada</td>
<td>669.5</td>
<td>607.1</td>
<td>+ 10.2</td>
<td>+ 19.8</td>
</tr>
<tr>
<td>Italy</td>
<td>620.0</td>
<td>579.5</td>
<td>+ 7.7</td>
<td>+ 13.2</td>
</tr>
<tr>
<td>Japan</td>
<td>499.6</td>
<td>432.8</td>
<td>+ 15.4</td>
<td>+ 6.2</td>
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<tr>
<td>Netherlands</td>
<td>483.3</td>
<td>410.4</td>
<td>+ 17.8</td>
<td>+ 15.2</td>
</tr>
<tr>
<td>Belgium/Luxembourg</td>
<td>341.7</td>
<td>283.7</td>
<td>+ 29.6</td>
<td>+ 14.3</td>
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<tr>
<td>Sweden</td>
<td>302.7</td>
<td>262.8</td>
<td>+ 15.2</td>
<td>+ 23.6</td>
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<tr>
<td>Australia</td>
<td>281.7</td>
<td>231.5</td>
<td>+ 21.7</td>
<td>+ 4.8</td>
</tr>
<tr>
<td>Spain</td>
<td>273.9</td>
<td>253.9</td>
<td>+ 7.8</td>
<td>+ 5.9</td>
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<tr>
<td>Switzerland</td>
<td>261.4</td>
<td>224.8</td>
<td>+ 16.3</td>
<td>+ 16.3</td>
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<tr>
<td>Denmark</td>
<td>173.6</td>
<td>129.3</td>
<td>+ 32.3</td>
<td>+ 8.6</td>
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<tr>
<td>Austria</td>
<td>169.0</td>
<td>140.5</td>
<td>+ 20.3</td>
<td>+ 18.4</td>
</tr>
<tr>
<td>Ireland</td>
<td>156.8</td>
<td>94.4</td>
<td>+ 66.1</td>
<td>+ 103.4</td>
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<tr>
<td>Brazil</td>
<td>155.2</td>
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<td>+ 0.9</td>
<td>- 31.4</td>
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<tr>
<td>Soviet Union</td>
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<td>Norway</td>
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<td>100.7</td>
<td>+ 10.6</td>
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<tr>
<td>Mexico</td>
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<td>- 4.7</td>
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<td>Venezuela</td>
<td>89.3</td>
<td>69.4</td>
<td>+ 28.6</td>
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<tr>
<td>Finland</td>
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<td>84.4</td>
<td>+ 4.9</td>
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<tr>
<td>Czechoslovakia</td>
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<td>120.5</td>
<td>- 27.4</td>
<td>- 30.7</td>
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<td>Argentina</td>
<td>81.0</td>
<td>39.1</td>
<td>+ 107.1</td>
<td>+ 12.9</td>
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<tr>
<td>Yugoslavia</td>
<td>76.2</td>
<td>46.9</td>
<td>+ 62.5</td>
<td>- 14.6</td>
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<td>South Korea</td>
<td>64.6</td>
<td>45.7</td>
<td>+ 41.3</td>
<td>+ 55.4</td>
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<tr>
<td>Poland</td>
<td>53.0</td>
<td>140.7</td>
<td>- 62.3</td>
<td>+ 9.2</td>
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<tr>
<td>Singapore</td>
<td>49.9</td>
<td>40.0</td>
<td>+ 24.7</td>
<td>- 8.5</td>
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<td>49.1</td>
<td>42.8</td>
<td>+ 14.7</td>
<td>- 21.8</td>
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<td>Hungary</td>
<td>48.9</td>
<td>78.0</td>
<td>- 37.3</td>
<td>- 12.1</td>
</tr>
<tr>
<td>Iran</td>
<td>44.2</td>
<td>45.6</td>
<td>- 2.8</td>
<td>- 29.6</td>
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<tr>
<td>New Zealand</td>
<td>42.2</td>
<td>42.6</td>
<td>- 0.7</td>
<td>- 12.6</td>
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<tr>
<td>Israel</td>
<td>41.6</td>
<td>42.3</td>
<td>- 1.6</td>
<td>+ 2.4</td>
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<tr>
<td>Saudi Arabia</td>
<td>39.0</td>
<td>25.8</td>
<td>+ 51.2</td>
<td>+ 56.4</td>
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<td>Portugal</td>
<td>35.9</td>
<td>25.2</td>
<td>+ 42.5</td>
<td>+ 8.2</td>
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<tr>
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<td>+ 38.9</td>
<td>+ 37.6</td>
</tr>
<tr>
<td>Philippines</td>
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<td>30.7</td>
<td>+ 0.6</td>
<td>+ 15.4</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>32.4</td>
<td>44.1</td>
<td>- 31.2</td>
<td>- 13.2</td>
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<tr>
<td>Panama (inc. Canal Zone)</td>
<td>22.4</td>
<td>17.8</td>
<td>+ 27.3</td>
<td>+ 74.0</td>
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<tr>
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<td>21.0</td>
<td>19.5</td>
<td>+ 7.7</td>
<td>+ 31.8</td>
</tr>
<tr>
<td>Greece</td>
<td>20.7</td>
<td>16.8</td>
<td>+ 23.2</td>
<td>+ 14.3</td>
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<td>19.9</td>
<td>14.6</td>
<td>+ 36.3</td>
<td>+ 22.3</td>
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<td>11.8</td>
<td>+ 65.3</td>
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<td>16.8</td>
<td>+ 71.4</td>
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<tr>
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<td>16.5</td>
<td>27.8</td>
<td>- 40.2</td>
<td>- 21.1</td>
</tr>
<tr>
<td>Kuwait</td>
<td>16.1</td>
<td>9.9</td>
<td>+ 62.6</td>
<td>NA</td>
</tr>
<tr>
<td>Egypt</td>
<td>15.7</td>
<td>12.8</td>
<td>+ 22.6</td>
<td>+ 31.1</td>
</tr>
<tr>
<td>Iraq</td>
<td>14.7</td>
<td>9.3</td>
<td>+ 58.1</td>
<td>NA</td>
</tr>
</tbody>
</table>

Table 3.

### FASTEST GROWING IMPORT MARKETS IN 1977

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<tbody>
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<td>1</td>
<td>71</td>
<td>Lebanon</td>
<td>158.8</td>
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<tr>
<td>2</td>
<td>26</td>
<td>Argentina</td>
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<td>81.0</td>
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<td>3</td>
<td>46</td>
<td>Colombia</td>
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<td>4</td>
<td>16</td>
<td>Ireland</td>
<td>66.1</td>
<td>156.8</td>
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<td>5</td>
<td>45</td>
<td>Chile</td>
<td>65.3</td>
<td>19.5</td>
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<tr>
<td>6</td>
<td>48</td>
<td>Kuwait</td>
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<td>16.1</td>
</tr>
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<td>7</td>
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<td>72.6</td>
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<td>50</td>
<td>Iraq</td>
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<td>14.7</td>
</tr>
<tr>
<td>9</td>
<td>36</td>
<td>Saudi Arabia</td>
<td>51.2</td>
<td>39.0</td>
</tr>
<tr>
<td>10</td>
<td>59</td>
<td>El Salvador</td>
<td>48.3</td>
<td>8.9</td>
</tr>
</tbody>
</table>

Table 4.

There is little question that since the early 1970s, when COMECON RIAD unified computer hardware, considerable progress has been made in the development of domestic production. (During the summer of 1979, the RIAD 2 series of computers, reportedly compatible with the IBM/370, was introduced to COMECON end users.) The magnitude of COMECON’s dp manufacturing capabilities was outlined in August 1979 by the Central Intelligence Agency in its annual volume on basic international statistics. According to the CIA report, the Soviet Union’s production of computers and peripherals reached 3.3 billion rubles in 1978 ($4.8 billion).

The CIA report also indicates that East German dp production was on the order of $700 million, while Poland and Hungary manufactured about $500 million and $121 million, respectively. Not counting Bulgaria, Rumania, and Cuba, which all manufacture computers, mini-computers, or peripherals, this suggests an output of dp equipment and peripherals valued at about $6 billion or 40% the size of dp shipments in the U.S. in 1978. Asia, Japan, China, and India are the three countries with their own domestic computer hardware manufacturing industries, but only Japan is a factor in international trade. The second largest end user in the world, Japan is the seventh largest import market, and the third largest exporter. However, unlike the U.S., Japan’s exports include a large proportion of office equipment products rather than computers.

Although progressive liberalization of the Japanese import markets has been widely publicized, the sluggish growth of Japanese import markets in recent years suggests that trade restrictions continue to have a decisive effect in protecting the Japanese dp markets for domestic manufacturers. The Japanese hardware production level by 1978 was estimated to have reached about $3 billion. This means that the U.S.S.R. is already a larger dp manufacturer than Japan. The reason for this is the huge military market which both the Soviets and the U.S. prefer to supply from domestic production.

Mr. Szuprowicz is president of 21st Century Research, an international market research firm specializing in strategic materials and high technology trade. His past experience includes engineering and management posts at Boeing, General Dynamics, IBM, CER-Control Data, and High Technology West.
The one-chip computer: offspring of the transistor

The MAC-4 one-chip computer, developed for a variety of telecommunications applications, is compared to a standard-sized paper clip. The chip’s numerous functional areas are labeled.
The latest descendant is the Bell System's 30,000-element MAC-4 "computer-on-a-chip." It's another in a long line of microelectronic developments that have come from Bell Laboratories.

The MAC-4 is so efficient that a program written on it takes 25 percent less storage space than required by most other microcomputers. Its assembler language, C, also developed at Bell Labs, has features that make MAC-4 easier to program, debug and maintain. And the MAC-4 can handle anything from nibbles to bytes to words with its 4-, 8-, 12-, and 16-bit operations capacity.

Like other one-chip computers, the MAC-4 has sufficient memory to support its varied tasks—3000 nibbles of read-only memory and 200 nibbles of random access memory coupled to 34 input/output ports.

Fabricated with the latest CMOS technology, the MAC-4 needs little power. Thus it is well matched to a variety of telecommunications applications.

It started with the transistor

MAC-4 is just one current example of the many microelectronic devices to come from Bell Labs since we started the solid-state revolution with the invention of the transistor in 1947. Over the past three decades, our advances in materials, processing, and devices have been vital to solid-state technology. These include:

- The Junction Transistor
- Crystal Pulling
- Zone Refining
- Field-Effect Transistor
- Diffusion
- Solar Cell
- Oxide Masking
- Thermocompression Bonding
- Photolithography
- Epitaxial Film Process
- Magnetic Bubble Memory
- Charge-Coupled Device
- Semiconductor Heterostructure
- Laser Used in Lightwave Communications
- Electron-Beam Exposure System

Today and tomorrow

Today, we continue to make important contributions to solid-state technology. For example, we've developed a rugged 65,536-bit RAM that can tolerate processing faults. Corrections can be made on the chip itself, so we can get more usable chips out of each manufacturing batch—and thus lower unit costs.

In materials processing, we've developed a technique for precisely controlling the growth of successive atomic layers of single crystal materials. This "molecular beam epitaxy" process is finding increasing use within Bell Labs and elsewhere in the electronics industry. We've used it to fabricate a device that permits us to double the speed of electrons by channeling them into crystal layers where they meet less resistance.

Other advances, in X-ray lithography and new resist materials, for example, promise to help place more elements on microelectronic devices and thus enhance their ability to perform important tasks.

As the solid-state revolution continues, these and other developments from Bell Labs will play an important part in it. What's important to us is the promise these advances offer for new telecommunications products and services. Like the transistor, MAC-4 and its solid-state relatives will find more and more applications in the nationwide telecommunications network.

For further information, or to inquire about employment opportunities, write: Bell Laboratories, Room 3C-303, 600 Mountain Avenue, Murray Hill, N.J. 07974.
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The environment, development process, people, and dp shop management all determine the productivity of an organization.

by Robert L. Patrick

"By Invitation Only"—that's how the 150 representatives of IBM's larger customers came to attend the Applications Development Symposium held Oct. 15-17, in Monterey, Calif. They were joined by about 50 IBMers, in an event IBM cosponsored with SHARE and GUIDE.

The 20 papers ran the gamut from the prosaic through state-of-the-art practical situations to the fringe of emerging research. Unfortunately, the sequence of presentations was confusing and the quality of the papers was spotty. In an attempt to spare the reader some of the sorting and cataloging the attendees had to do, a pause for an organizing principle is now in order.

There are four parts to the productivity problem. The parts are so fundamental they dictate the solution. First comes the environment. The physical facilities provided for your development people, the policies that guide your salary administration (overtime, bonus, compensatory time, or other incentives), and the basic value system of the organization control the relative values of people and machines (current expense versus capital outlay) in your organization. Every organization is different. The differences in these environments are significant since they determine how you motivate your staff and how they are rewarded for positive attitudes.

The second facet of the productivity problem is the process itself. Most shops have some formal developmental system that breaks up activities into phases. However, here shops start to differ greatly. Some plan and track development activities carefully and have rigorous milestones and lists of deliverable items which must be present for the phase to exist. Other shops have processes which are much less well structured. The process discipline and the developmental standards also change from shop to shop depending on the management goals and how tight a ship you run. Into this milieu we inject programming languages, support systems, special methodologies like structured programming, and a variety of tools and techniques designed to make specific activities within the process more efficient.

The third constituent is the people. How you select them, the education you insist upon, the entry level skills you demand, the refresher training and skills enhancement you provide, and the attitude you tolerate all form the whole being that carries out your development activities. The employees' home life can interfere with his productivity if he allows it to get out of kilter.

PRODUCTIVITY  Finally the management of the dp shop has a direct effect on productivity of a development team. How many administrative distractions impact the developers? Do their previous systems, now in production, compete for their time, effort, and mental faculties? Are they given work assignments so they grow and learn and are prepared for new responsibilities? How are project planning, estimating, tracking, reviewing, and inspecting conducted?

All four of these facets interplay in a complex manner to determine the productivity of your development shop.

THE PRODUCTIVITY GAP

The symposium was billed as a comprehensive look at the state of the art, the environmental facets were not mentioned at all. The people problems were only alluded to, and only one or two speakers even mentioned the oft-quoted numbers—that the difference in productivity between a clod and a top-notch programmer can be as much as 10 to 1 on almost any scale you wish to measure by.

Also, as you might expect, a great number of the papers concentrated on the process. Half of these presented new tools for improving the efficiency of specific developmental activities, e.g., a paper on the use of a program specification language to improve requirements analysis; and another paper which described an experimental programmer's workbench that allowed data to be gathered, stored, and organized during the design process so it could be easily transformed into a data dictionary load to improve the programming process.

The other half of the process papers tried to change the process itself. There was the usual cry for getting the users involved so we could off-load some of the more mundane design responsibilities on the user, but these were complemented by calls for user-friendly specification systems so the users could be prompted to tell what they knew and help when they could.

And then there were several papers that tried to meet the productivity problem head-on through direct management action. These tried to innovate within the corporate environment by establishing measures for productivity, installing tools and techniques to support those measures, and then managing the data processing center to achieve these stated short-term goals.

The cocktail party discussions recognized that the size of the installation, the size and complexity of the systems being developed, and the pace of development within the shop acted as modifiers to the environment. Big jobs naturally suffered from more overhead and needed more support tools just to put them within the grasp of the typical development team.

Undercurrents running through the sessions and the informal conversations were concerns over the shortage of people, a scarcity of good people, the distraction caused by the constant flow of new products from the vendors (amplified by the vendors' software changes), and the squeeze caused by the growing backlog of old code that demands ongoing maintenance and attention to run productively. The audience didn't wince when one speaker noted that it was not unusual for a mature programming shop to expend 60% to 80% of its current labor force in changing and maintaining old code.

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While we made good progress in the past, we still have a problem: the demand is outstripping the supply.

while only 10% to 15% of the workers were building new systems. With the growth of the shops and the legacy of old code, it will take years for process changes to be assimilated in some of the larger shops (even when an integrated set of tools and techniques becomes available).

Several of the outstanding papers dealt with real-world situations. T. A. DiMartino, who works for the State of Connecticut, reported on a success story involving the use of the standard IBM DMS/VS (Development Management System, a fill-in-the-blanks programming technique for use with a class of on-line data base systems) to set up a Medicaid accounting and expense approval system. Evidently his application fit the DMS/VS design point exactly, because he took a crew of five young programmers and in less than a year designed, implemented, and put into production a major social service data base system. Furthermore, he had some estimates on what it would have taken to program the system using routine techniques running in CICS, and he beat those estimates by 5 to 1.

F. A. Comper of the Bank of Montreal characterized his environment as follows: 1,204 branches, 4,400 terminals on a network, and a sustained on-line load of 75 transactions a second. The bank has 2,500 changes outstanding at any one time, and they manage the 20,000 source modules in their production library with a formal change management procedure backed by airtight software library controls. Several years ago they launched a study and concluded they had to get rid of their assembly code and their personalized programming techniques. They went for a package of modern techniques that included structured design, PL/1, and walkthroughs. They completely renovated the programming environment and now have increased the statements per day per programmer by 43%. Comper hastened to add that he had installed quality controls at the same time so the increased productivity was matched by quality improvements.

A. J. Albrecht of IBM, White Plains, also reported success in improving the productivity of 450 contract programmers. He has a well-defined development process that all projects must follow rigorously, gets good labor distribution information as his people work, and collects all of this into a data base that he uses for estimating. He has prepared an estimating algorithm that seems to fit his work in his environment, and now he can track the estimates he starts with and the performance he achieves. He has been at this long enough that he can compare programmer productivity improvements over time for three separate programming languages: COBOL, PL/1, and DMS/VS. The results are impressive: he apparently has set up a management system that allows him to know what he gets whenever he innovates.

**STAMPING OUT WASTE**

R. G. Lanergan of Raytheon did a study and found that many projects wasted many labor hours redoing modules of code that had been done before. He got $250,000 out of his management and assigned six top-notch people to stamp out that waste. They conceived and built a support system that encourages the use of reusable modules of code. He now has a library of subroutines, similar to the mathematical libraries long used by scientific installations, which contains the commonly called business programming functions (edit input statements, prepare report, update a record, etc.). Some of these are complete modules ready to be called and inserted in compiled code, whereas others are logical skeletons that require some coding by the user.

So far that's not a breakthrough, but he went on to produce a library support system that describes and indexes these modules so programmers can easily find out if what they need is already available, and a set of software that maintains an audit trail of which modules were used by whom and in what programs, so corrections and improvements can be properly promulgated throughout the production libraries. In five major applications consisting of over 250 programs, he has realized more than 60% reusable code. This means a substantial saving in time, development cost, and errors avoided.

W. E. Winters of AT&T Long Lines started back in 1973 to attack the analysis problem. He found that the Problem Statement Language (PSL, University of Michigan, Techroew, et al.) showed promise in improving the quality of his systems analysis, which then made programming and documentation easier. He evaluated PSL on a pilot project, sold it for prototype use, and now six long years later has it installed in several locations for use by the 300 people he has trained. He is proud to report that 87 of their current development efforts have now voluntarily chosen to use PSL. They found to date that PSL does not have a deleterious effect on the analysis step, and has a positive benefit on programming and maintenance.

J. B. Menard of Exxon followed with a similar success story on the use of Michael Jackson's technique for data-driven design. She and her colleagues evaluated it, extended it, built the necessary support software, and now have it installed in several of Exxon's worldwide locations to enhance development productivity. Both Winters and Menard reported on future plans that include extensions to these automated techniques to further improve the productivity of the development process.

In addition to those success stories dealing with improvements in the process, three papers concentrated on the management of development. T. C. Jones of IBM, San Jose, continued his string of excellent analyses of the programming process; in this case he addressed programming productivity and identified the factors that affect productivity while classifying the techniques to improve productivity. J. R. Ehrman of Stanford gave us a very lucid presentation of the complexity we have added to the programming process through the use of incompatible and illogical languages throughout the programming process itself. He identified 12 languages (enough for the tower of Babel) that a programmer needs to know to get an algorithm coded, compiled, tested, and documented. W. R. Bradshaw, of IBM-Corporate, enumerated a series of indirect productivity measures that have been designed by his staff function to cause the managers of IBM's internal data processing shops to keep the user's productivity foremost in their minds while controlling the proliferation of underutilized equipment.

As the seminar closed, it was pretty clear that some individual tools were available from IBM and other vendors and that some packages existed, but we had nothing that looked like an integrated set of tools and techniques to support the development process.

About the time we were feeling pretty glum because we had only pinpoint solutions to a broad-based pervasive problem, one of the audience tried to end the conference on a positive note by getting us to look back at all the progress we had made in the last 20 years. While we made good progress in the past, we still have a problem: the demand is outstripping the supply. With the price of hardware continuing to go down and the price of personnel continuing to go up, the pressure is building. We had better do some sincere work on the productivity problem because it is going to persist for a long while. *

Mr. Patrick has been an independent computer consultant for 20 years and has served on the DATAMATION editorial board for the same period.
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CIRCLE 88 ON READER CARD
SOFTWARE PACKAGES: BEST BUY TODAY

by Martin A. Goetz

The software products industry is approaching $2 billion in annual revenues, and software product growth has been predicted to be 27% per year for the next five years. A variety of competitive software packages are available to users, and, as the DATAMATION/DATAPRO survey shows, there is overall user satisfaction with the packages rated.

Competition in the software industry has improved the general quality, the specific features, and the price of software products. Today, with the increasing cost of custom programming and the corresponding shortage of qualified programmers, the software package is a bargain. A user can buy a package that has been fully tested and is operational, and he can also receive full maintenance against errors. Also the user can begin using the package in a few days, and, additionally receives enhancements over the years.

Software packages have brought psychological as well as productivity benefits to the user. Studies show programmers are more productive and morale is higher when state-of-the-art software
packages are introduced in a company. Finally, many software packages increase both the effective throughput of the computer and the reliability of operational user programs. Today's packages have undergone years of testing, and the code, although perhaps not bug-free, represents the most stable software available. Also, since software packages are built in a competitive environment, they tend to be more efficient than custom programs.

PACKAGES IN THE THOUSANDS At last count, software packages numbered in the thousands. There is no doubt the catalyst for this rapid growth has been the promulgation of software unbundling since 1970. While unbundling did increase the opportunity for software product success, there are still thousands of unsuccessful—or marginally profitable—software packages that have been built both by hardware manufacturers and by independent software suppliers. On the average, the actual chance for success of a package is only 1 in 10. Because of this, many questions continue to linger regarding the elements of a successful software product.

The answer to these questions depends largely on the size of the software company, its history, its user base, and its management people. A user in the marketplace would be wise to consider several technical factors that are keys to a successful package.

Advanced technology. Today's users are knowledgeable enough to objectively compare competitive products. Successful packages are usually the most technically advanced. The day of buying pig-in-a-poke software is gone forever.

Ongoing enhancements. Users' requirements and operating environments are rapidly changing. Products that are continuously enhanced are viable to the user for many years, and help the software company stay ahead of competition.

Expertise. Most successful software products have been built by companies with personnel who have strong, concentrated experiences in the specific subjects addressed by each product.

Good engineering disciplines. In an environment where most products are targeted for long lives, a soundly designed and constructed product will help to ensure success.

Ease of use. In a world where programming management faces training problems, shortage of personnel, and inexperienced users, "easy to use" should be one of the primary technical goals for any product.

The last few years have dramatically demonstrated the benefits of successful software products in both the systems and applications categories. Successful systems software has significantly improved the productivity and discipline of program development while simultaneously reducing the costs of getting applications operational. Applications software has reduced the total number of applications companies must develop from scratch. The cost benefits are obvious.

As these benefits continue to accrue to the users of packages, off-the-shelf software will become as commonplace as off-the-shelf hardware.

Martin A. Goetz is senior vice president of Applied Data Research, Inc., Princeton, N.J. He was recently appointed contributing editor for DATAMATION.
More than 5,000 users of proprietary software packages rated 335 products in this year's survey.

THE SOFTWARE SCENE

USERS' RATINGS OF SOFTWARE PACKAGES

by Elizabeth F. Severino
Editorial Director,
Datapro Research Corp.

This is the fifth annual Datapro/DATAMATION survey of proprietary software users. As in the past, the survey was based on questionnaires mailed to approximately 35,000 DATAMATION readers identified from the subscriber list as the dp manager or "leading dp person" at an installation.

As the survey has grown in popularity, criticism from software industry associations has been increasingly directed at its methods and the validity of the resulting ratings. Datapro and DATAMATION acknowledge that the survey does not employ statistical sampling methods. Due to small sample sizes, individual ratings may lack the statistical validity to aid a user in making a buying decision and may further have categorized a product in a level that a larger statistical sampling may have otherwise categorized. Datapro and DATAMATION are taking steps to improve the sampling techniques which will be used in future surveys.

The aims of the 1979 survey are to poll the largest number of software users and then report their attitudes towards packages implemented at their facilities. No attempt is made to contact a statistical sampling of all the users of all the software packages marketed. Results are reported in an easy-to-understand manner for the general reader, making no attempt to interpret the data. The survey serves to report on user comments, not to determine the value or worth of each package. Results should not be regarded as complete criteria for the selection of a software package or vendor. Hopefully, the survey will be useful as a guide to a number of packages that could be considered for closer scrutiny and evaluation by more rigorous techniques.

Each questionnaire allowed the user to rate up to three different packages. However, the recipient was encouraged to reproduce the form as many times as necessary in order to rate the program products employed or evaluated. Also, a second copy of the form was enclosed in the set as a pass-along copy for a user department within the installation.

Each recipient was requested to rate any software package that was installed, that was acquired but no longer in use, or that was rejected after thorough testing.

Seven rating categories were specified on the questionnaire: overall satisfaction, job throughput/efficiency, ease of installation, ease of use, documentation, vendor technical support, and training (if applicable). Overall satisfaction is the only category reported in this article. All ratings forwarded for a particular package were then collected, verified, recorded, and averaged using a weighting scale of from 1.0 to 4.0 (poor to excellent).

This year we have used the following categories of reporting user ratings: 1.5-2.0 = Fair (F); 2.1-2.4 = Good (G); 2.5-3.4 = Excellent (E); 3.5-4.0 = Honor Roll (HR) or Honorable Mention (HM).

The criteria employed by Datapro for inclusion in the Software Honor Roll were: (1) a package must be rated by no fewer than 10 individual users; (2) the package must receive a weighted average rating of 3.5 or better in the overall satisfaction category; and (3) the package must also receive a weighted average rating of 2.8 or better in all other categories except training (eliminated because there are program products being implemented on a self-taught basis with no formal training procedures.)

Those packages that met the Honor Roll rating criteria of 3.5 or better in the overall satisfaction category and 2.8 or better in all other categories but received ratings from only five to nine users were listed as Honorable Mention.

Datapro processed responses from 5,683 users, a return of over 15% from the DATAMATION mailings. The responses involved 8,861 ratings on 2,141 individual software packages.

The list that follows summarizes the survey results on the 335 proprietary software packages rated by five or more users. The information in this report can be informative if used with discretion and with the understanding there are many factors involved in selecting the right software package to meet a particular need. There are also many software packages that do not appear in the survey that may possibly warrant evaluation. The results of this survey should be considered as one step in a meaningful evaluation cycle.
1979 HONOR ROLL
(Listed Alphabetically by Number of Years Appearing)

SEVENTH YEAR

ALLTAX
Management Science America, Inc.

DISK UTILITY SYSTEM
Westinghouse Electric Corp.

EPAT
SDI

THE LIBRARIAN
Applied Data Research, Inc.

PANVALET
Pansophic Systems, Inc.

FIFTH YEAR

DYL-260
Dylakor Software Systems, Inc.

1130/ FORTRAN
DNA Systems, Inc.

RPG-II (360/370)
IBM Corp., DPD

WEST I
Westinghouse Electric Corp.

FOURTH YEAR

CA-SORT
Computer Associates, Inc.

IDMS
Cullinan Corp.

SAS
SAS Institute, Inc.

SLICK
NCI

1130/SORT
DNA Systems, Inc.

THIRD YEAR

ADABAS
Software AG of N.A., Inc.

EDOS, EDOS/VS
The Computer Software Co.

FLEE/FLIM
Goal Systems Corp.

IMAGE/3000
Hewlett-Packard Co.

ROSCOE
Applied Data Research, Inc.

SOFTWARE 1040
SAB, Inc.

SECOND YEAR

BEM
Sperry Univac

DOCS
CFS, Inc.

FAQS
Goal Systems Corp.

SHADOW-II
Altergo Software, Inc.

SORT (S/3)
IBM Corp., GSD

TLMS
Capex Corp.

INTEREST
On-Line Software Int'l

MINICOMM
Informatics, Inc. (now marketed by SDA Products, Inc.)

MPE-II
Hewlett-Packard Co.

ON-LINE FILE DISPLAY
IBM Corp., GSD

PASCAL-1
Oregon Minicomputer Software, Inc.

PAYROLL
Information Associates, Inc.

ACCOUNTS PAYABLE
Bancroft Computer Services

AUTOFLOW II
Applied Data Research, Inc.

COMMERCIAL LOAN
Florida Software Services

DOS/RS
Dearborn Computer Co. (now marketed by The Computer Software Co.)

DOSSIER
Computer Concepts, Inc.

FATS/FATAR
Innovation Data Processing

FINANCIAL MANAGEMENT SYSTEM
Florida Software Services

FORESIGHT
United Computing Systems

ANTHEM
Unilevel Software, Inc.

SCEPTER
Westinghouse Electric Corp.

SPACE/ MANAGER
Altergo Software, Inc.

SRI/EDIT
Systems Research, Inc.

VOLLIE
Applied Data Research, Inc.

1979 HONORABLE MENTION

ACCOUNTS PAYABLE
Bancroft Computer Services

AUTOFLOW II
Applied Data Research, Inc.

COMMERCIAL LOAN
Florida Software Services

DOS/RS
Dearborn Computer Co. (now marketed by The Computer Software Co.)

DOSSIER
Computer Concepts, Inc.

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Oregon Minicomputer Software, Inc.

PAYROLL
Information Associates, Inc.

USERS’ RATINGS

Categories: 1.5 – 2.0 = Fair (F);
2.1 – 2.4 = Good (G);
2.5 – 3.4 = Excellent (E);
3.5 – 4.0 = Honor Roll (HR) or Honororable Mention (HM).

Allinson-Ross Corp.
TIP/30
Offers interactive transaction processing for Univac users.
Users reporting 5
Overall satisfaction E
CIRCLE 400 ON READER CARD

ALTERGO SOFTWARE INC.
QUOTA-II
Source program maintenance support system.
Users reporting 5
Overall satisfaction H M
CIRCLE 401 ON READER CARD

SHADOW-II
A general purpose teleprocessing monitor.
Users reporting 21

AMERICAN VALUATION CONSULTANTS, INC.
BET/FACS
Total fixed assets management system.
Users reporting 11

SPACE/ MANAGER
A disk vs disk space management program.
Users reporting 16
Overall satisfaction HR
CIRCLE 403 ON READER CARD

A TELECOMMUNICATIONS PROCESSOR
For IBM 360/370 and compatibles.
Users reporting 9

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<table>
<thead>
<tr>
<th>USER RATINGS</th>
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<tbody>
<tr>
<td>Overall satisfaction E</td>
</tr>
<tr>
<td>CIRCLE 406 ON READER CARD</td>
</tr>
<tr>
<td>DATACOM/DB</td>
</tr>
<tr>
<td>Database management system for IBM 360/370 and compatibles.</td>
</tr>
<tr>
<td>Users reporting 18</td>
</tr>
<tr>
<td>Overall satisfaction E</td>
</tr>
<tr>
<td>CIRCLE 407 ON READER CARD</td>
</tr>
<tr>
<td>THE LIBRARIAN</td>
</tr>
<tr>
<td>A source program management system; can do batch and on-line retrieval.</td>
</tr>
<tr>
<td>Users reporting 131</td>
</tr>
<tr>
<td>Overall satisfaction HR</td>
</tr>
<tr>
<td>CIRCLE 408 ON READER CARD</td>
</tr>
<tr>
<td>LOOK</td>
</tr>
<tr>
<td>A performance measurement tool.</td>
</tr>
<tr>
<td>Users reporting 10</td>
</tr>
<tr>
<td>Overall satisfaction E</td>
</tr>
<tr>
<td>CIRCLE 409 ON READER CARD</td>
</tr>
<tr>
<td>ROSCOE</td>
</tr>
<tr>
<td>Remote job entry system for OS and OS/VS operating systems.</td>
</tr>
<tr>
<td>Users reporting 30</td>
</tr>
<tr>
<td>Overall satisfaction HR</td>
</tr>
<tr>
<td>CIRCLE 410 ON READER CARD</td>
</tr>
<tr>
<td>DRS</td>
</tr>
<tr>
<td>Self-contained data management system with DBMS capabilities.</td>
</tr>
<tr>
<td>Users reporting 5</td>
</tr>
<tr>
<td>Overall satisfaction E</td>
</tr>
<tr>
<td>CIRCLE 412 ON READER CARD</td>
</tr>
<tr>
<td>Argonaut Information Systems, Inc.</td>
</tr>
<tr>
<td>PAYROLL</td>
</tr>
<tr>
<td>Generalized payroll system.</td>
</tr>
<tr>
<td>Users reporting 11</td>
</tr>
<tr>
<td>Overall satisfaction E</td>
</tr>
<tr>
<td>CIRCLE 413 IN READER CARD</td>
</tr>
<tr>
<td>Aries Information Systems, Inc.</td>
</tr>
<tr>
<td>PERPAS/POBAS</td>
</tr>
<tr>
<td>A personnel/payroll, budget and accounting system.</td>
</tr>
<tr>
<td>Users reporting 8</td>
</tr>
<tr>
<td>Overall satisfaction E</td>
</tr>
<tr>
<td>CIRCLE 414 ON READER CARD</td>
</tr>
<tr>
<td>Arthur Anderson and Company</td>
</tr>
<tr>
<td>MAC-PAC</td>
</tr>
<tr>
<td>A comprehensive manufacturing planning and control system.</td>
</tr>
<tr>
<td>Users reporting 10</td>
</tr>
<tr>
<td>Overall satisfaction E</td>
</tr>
<tr>
<td>CIRCLE 415 ON READER CARD</td>
</tr>
<tr>
<td>Ask Computer Services, Inc.</td>
</tr>
<tr>
<td>MANMAN</td>
</tr>
<tr>
<td>Manufacturing management on-line system for use with HP 1000s.</td>
</tr>
<tr>
<td>Users reporting 8</td>
</tr>
<tr>
<td>Overall satisfaction E</td>
</tr>
<tr>
<td>CIRCLE 425 ON READER CARD</td>
</tr>
<tr>
<td>Users reporting 8</td>
</tr>
<tr>
<td>Overall satisfaction E</td>
</tr>
<tr>
<td>CIRCLE 418 ON READER CARD</td>
</tr>
<tr>
<td>Atlantic Software, Inc.</td>
</tr>
<tr>
<td>PC/70</td>
</tr>
<tr>
<td>Automated project planning and resource measurement system.</td>
</tr>
<tr>
<td>Users reporting 19</td>
</tr>
<tr>
<td>Overall satisfaction E</td>
</tr>
<tr>
<td>CIRCLE 417 ON READER CARD</td>
</tr>
<tr>
<td>Bancroft Computer Systems, Inc.</td>
</tr>
<tr>
<td>ACCOUNTS PAYABLE</td>
</tr>
<tr>
<td>A multi公司 accounts payable system for use with IBM 5/3.</td>
</tr>
<tr>
<td>Users reporting 6</td>
</tr>
<tr>
<td>Overall satisfaction HM</td>
</tr>
<tr>
<td>CIRCLE 410 ON READER CARD</td>
</tr>
<tr>
<td>ACCOUNTS RECEIVABLE</td>
</tr>
<tr>
<td>General-purpose, multi-company accounts receivable system for IBM 5/3.</td>
</tr>
<tr>
<td>Users reporting 5</td>
</tr>
<tr>
<td>Overall satisfaction E</td>
</tr>
<tr>
<td>CIRCLE 419 ON READER CARD</td>
</tr>
<tr>
<td>Boole &amp; Babbage, Inc.</td>
</tr>
<tr>
<td>RESOLVE</td>
</tr>
<tr>
<td>On-line system performance and job monitoring package for IBM 360/370 and compatibles.</td>
</tr>
<tr>
<td>Users reporting 13</td>
</tr>
<tr>
<td>Overall satisfaction E</td>
</tr>
<tr>
<td>CIRCLE 420 ON READER CARD</td>
</tr>
<tr>
<td>SECURE</td>
</tr>
<tr>
<td>An OS and OS/VS security system that guards against illegal access to data.</td>
</tr>
<tr>
<td>Users reporting 7</td>
</tr>
<tr>
<td>Overall satisfaction E</td>
</tr>
<tr>
<td>CIRCLE 421 ON READER CARD</td>
</tr>
<tr>
<td>Burroughs Corp.</td>
</tr>
<tr>
<td>ACCOUNTS PAYABLE</td>
</tr>
<tr>
<td>Accounts payable system for most Burroughs small- to large-scale computers.</td>
</tr>
<tr>
<td>Users reporting 6</td>
</tr>
<tr>
<td>Overall satisfaction G</td>
</tr>
<tr>
<td>CIRCLE 422 ON READER CARD</td>
</tr>
<tr>
<td>BHAS II</td>
</tr>
<tr>
<td>Hospital administration system for use on B 80 through B 4800 series.</td>
</tr>
<tr>
<td>Users reporting 8</td>
</tr>
<tr>
<td>Overall satisfaction G</td>
</tr>
<tr>
<td>CIRCLE 423 ON READER CARD</td>
</tr>
<tr>
<td>CANDE</td>
</tr>
<tr>
<td>Command and edit message control system for Burroughs' large-scale computers.</td>
</tr>
<tr>
<td>Users reporting 20</td>
</tr>
<tr>
<td>Overall satisfaction E</td>
</tr>
<tr>
<td>CIRCLE 424 ON READER CARD</td>
</tr>
<tr>
<td>COBOL</td>
</tr>
<tr>
<td>Standard Burroughs COBOL compiler.</td>
</tr>
<tr>
<td>Users reporting 18</td>
</tr>
<tr>
<td>Overall satisfaction E</td>
</tr>
<tr>
<td>CIRCLE 425 ON READER CARD</td>
</tr>
<tr>
<td>DMS-II</td>
</tr>
<tr>
<td>Burroughs' full-blown data management system.</td>
</tr>
<tr>
<td>Users reporting 34</td>
</tr>
<tr>
<td>Overall satisfaction E</td>
</tr>
<tr>
<td>CIRCLE 426 ON READER CARD</td>
</tr>
<tr>
<td>FORTE II</td>
</tr>
<tr>
<td>Disk file management system for Burroughs B 1700 and up.</td>
</tr>
<tr>
<td>Users reporting 15</td>
</tr>
<tr>
<td>Overall satisfaction E</td>
</tr>
<tr>
<td>CIRCLE 427 ON READER CARD</td>
</tr>
<tr>
<td>GEMCOS</td>
</tr>
<tr>
<td>Generalized message control system for the Burroughs B 1800 series.</td>
</tr>
<tr>
<td>Users reporting 9</td>
</tr>
<tr>
<td>Overall satisfaction E</td>
</tr>
<tr>
<td>CIRCLE 428 ON READER CARD</td>
</tr>
<tr>
<td>GENERAL LEDGER</td>
</tr>
<tr>
<td>Generalized general ledger and accounting system.</td>
</tr>
<tr>
<td>Users reporting 10</td>
</tr>
<tr>
<td>Overall satisfaction E</td>
</tr>
<tr>
<td>CIRCLE 429 ON READER CARD</td>
</tr>
<tr>
<td>MCP</td>
</tr>
<tr>
<td>Operating system for Burroughs computers.</td>
</tr>
<tr>
<td>Users reporting 6</td>
</tr>
<tr>
<td>Overall satisfaction E</td>
</tr>
<tr>
<td>CIRCLE 430 ON READER CARD</td>
</tr>
<tr>
<td>NDL</td>
</tr>
<tr>
<td>Network definition language for use on most B series computers.</td>
</tr>
<tr>
<td>Users reporting 45</td>
</tr>
<tr>
<td>Overall satisfaction E</td>
</tr>
<tr>
<td>CIRCLE 431 ON READER CARD</td>
</tr>
<tr>
<td>ODESY</td>
</tr>
<tr>
<td>On-line data entry system for Burroughs' B 1800 series.</td>
</tr>
<tr>
<td>Users reporting 12</td>
</tr>
<tr>
<td>Overall satisfaction E</td>
</tr>
<tr>
<td>CIRCLE 432 ON READER CARD</td>
</tr>
<tr>
<td>PAYROLL</td>
</tr>
<tr>
<td>A generalized payroll system for use on most Burroughs computers.</td>
</tr>
<tr>
<td>Users reporting 15</td>
</tr>
<tr>
<td>Overall satisfaction E</td>
</tr>
<tr>
<td>CIRCLE 433 ON READER CARD</td>
</tr>
<tr>
<td>PCS-II</td>
</tr>
<tr>
<td>A production control system; runs on most Burroughs computers.</td>
</tr>
<tr>
<td>Users reporting 14</td>
</tr>
<tr>
<td>Overall satisfaction E</td>
</tr>
<tr>
<td>CIRCLE 434 ON READER CARD</td>
</tr>
<tr>
<td>REPORTER</td>
</tr>
<tr>
<td>COBOL source code report preparation system for most Burroughs' large-scale computers.</td>
</tr>
<tr>
<td>Users reporting 20</td>
</tr>
<tr>
<td>Overall satisfaction E</td>
</tr>
<tr>
<td>CIRCLE 435 ON READER CARD</td>
</tr>
<tr>
<td>RPG</td>
</tr>
<tr>
<td>Standard RPG compiler for most Burroughs computers.</td>
</tr>
<tr>
<td>Users reporting 8</td>
</tr>
<tr>
<td>Overall satisfaction E</td>
</tr>
<tr>
<td>CIRCLE 436 ON READER CARD</td>
</tr>
<tr>
<td>TEXT/EDITOR</td>
</tr>
<tr>
<td>Text editing facility for remote programming for B 1700 and up.</td>
</tr>
<tr>
<td>Users reporting 15</td>
</tr>
<tr>
<td>Overall satisfaction E</td>
</tr>
<tr>
<td>CIRCLE 437 ON READER CARD</td>
</tr>
<tr>
<td>THRIFT</td>
</tr>
<tr>
<td>Series of thrift industry programs including time deposits, loans, etc.</td>
</tr>
<tr>
<td>Users reporting 11</td>
</tr>
<tr>
<td>Overall satisfaction E</td>
</tr>
<tr>
<td>CIRCLE 438 ON READER CARD</td>
</tr>
<tr>
<td>Business EDP Services, Inc.</td>
</tr>
<tr>
<td>APRO</td>
</tr>
<tr>
<td>Generalized storage and retrieval system; used with Burroughs' 2500 and up.</td>
</tr>
<tr>
<td>Users reporting 5</td>
</tr>
<tr>
<td>Overall satisfaction E</td>
</tr>
<tr>
<td>CIRCLE 439 ON READER CARD</td>
</tr>
<tr>
<td>CACI</td>
</tr>
<tr>
<td>SIMSCRIPT II.5</td>
</tr>
<tr>
<td>Computer program modeling and simulation language.</td>
</tr>
<tr>
<td>Users reporting 6</td>
</tr>
<tr>
<td>Overall satisfaction E</td>
</tr>
<tr>
<td>CIRCLE 440 ON READER CARD</td>
</tr>
<tr>
<td>California Computer Products, Inc.</td>
</tr>
<tr>
<td>GRAPHIC SOFTWARE</td>
</tr>
<tr>
<td>Library of plotting subroutines; used with host computers and CalComp plotters.</td>
</tr>
<tr>
<td>Users reporting 5</td>
</tr>
<tr>
<td>Overall satisfaction E</td>
</tr>
<tr>
<td>CIRCLE 441 ON READER CARD</td>
</tr>
<tr>
<td>Cambridge Systems Group, Inc.</td>
</tr>
<tr>
<td>ACF</td>
</tr>
<tr>
<td>MVS data access control and security system used on IBM 5/370 and compatibles.</td>
</tr>
<tr>
<td>Users reporting 5</td>
</tr>
<tr>
<td>Overall satisfaction E</td>
</tr>
<tr>
<td>CIRCLE 442 ON READER CARD</td>
</tr>
<tr>
<td>ASM</td>
</tr>
<tr>
<td>Automated disk space management system for use with OS or OS/VS systems.</td>
</tr>
<tr>
<td>Users reporting 7</td>
</tr>
<tr>
<td>Overall satisfaction E</td>
</tr>
<tr>
<td>CIRCLE 443 ON READER CARD</td>
</tr>
<tr>
<td>Candle Corp.</td>
</tr>
<tr>
<td>OMEGAMON</td>
</tr>
<tr>
<td>IBM 3270-oriented display monitoring system used with IBM MVS operating systems.</td>
</tr>
<tr>
<td>Users reporting 16</td>
</tr>
<tr>
<td>Overall satisfaction E</td>
</tr>
<tr>
<td>CIRCLE 444 ON READER CARD</td>
</tr>
<tr>
<td>Capex Corp.</td>
</tr>
<tr>
<td>OPTIMIZER III</td>
</tr>
<tr>
<td>Optimizes object code of IBM 360/370 ANSI COBOL programs under OS and OS/VS systems.</td>
</tr>
<tr>
<td>Users reporting 36</td>
</tr>
<tr>
<td>Overall satisfaction E</td>
</tr>
<tr>
<td>CIRCLE 445 ON READER CARD</td>
</tr>
</tbody>
</table>
Complete Line of FCC Registered DDD Direct Connect Data Modems Designed to Save You Money the Moment You Plug Them In.

- SAVE MONEY — Compare prices . . . the Rixon Alternative is lower!
- YOUR CHOICE — LEASE OR BUY — With Rixon, you can lease with a buy option or buy outright.
- OTHER Rixon ALTERNATIVES include . . . dial-up test center . . . exchange/repair program . . . service contract . . . the latest technology and built-in diagnostics.
- PEACE OF MIND — For more than two decades, Rixon has served data communications needs with quality products and service.
  A satisfied customer is our first consideration.

SEND FOR THE RIXON ALTERNATIVE KIT . . .
with details on our complete line of DDD data modems, a comparison chart on prices, details on our lease and service programs and more.
USER RATINGS

PLAN IV/PLAN IV MVS
A planning and performance control system.
Users reporting 11
Overall satisfaction E
CIRCLE 448 ON READER CARD

TLMS
Tape library management system for IBM 360/370 and compatible systems.
Users reporting 12
Overall satisfaction HR
CIRCLE 447 ON READER CARD

CFS, Inc.
DOSCS
A display operator console support program.
Users reporting 19
Overall satisfaction HR
CIRCLE 448 ON READER CARD

Cincom Systems, Inc.
ENVIRON/1
General purpose data communications monitor.
Users reporting 19
Overall satisfaction E
CIRCLE 440 ON READER CARD

TOTAL
Generalized data base management system for use on a variety of systems.
Users reporting 122
Overall satisfaction E
CIRCLE 450 ON READER CARD

Computer Associates, Inc.
CA-SORT
Replacement sort/merge facility for OS or DOS environments.
Users reporting 122
Overall satisfaction E
CIRCLE 451 ON READER CARD

DYNAM/D
A DOS and DOS/VS disk space and catalog management system.
Users reporting 38
Overall satisfaction E
CIRCLE 452 ON READER CARD

DYNAM/T
A DOS and DOS/VS tape library maintenance system.
Users reporting 39
Overall satisfaction HR
CIRCLE 453 ON READER CARD

JASPER +
Job accounting and performance analysis for IBM 360/370 DOS, OS and VS systems.
Users reporting 12
Overall satisfaction E
CIRCLE 454 ON READER CARD

Computer Concepts, Inc.
DOSSIER
A DOS and DOS/VS documentation and standards tool.
Users reporting 8
Overall satisfaction HM
CIRCLE 455 ON READER CARD

The Computer Software Co.
EDOS, EDOS/VS
Replacement for DOS and DOS/VS operating systems.
Users reporting 43
Overall satisfaction HR
CIRCLE 456 ON READER CARD

Conservate Corp.
AMAPS-MPS
Master production schedule development system for use with IBM 360/370s and 3030s.
Users reporting 5
Overall satisfaction E
CIRCLE 457 ON READER CARD

Cullinan Corp.
CARS/3
IBM System 3 auditing and information retrieval system.
Users reporting 7
Overall satisfaction E
CIRCLE 458 ON READER CARD

CULPRIT
Output processor and report creation system for IBM 360/370s and compatibles.
Users reporting 13
Overall satisfaction E
CIRCLE 459 ON READER CARD

IDMS
Data base management system for IBM 360/370 and compatible OS and OS/VS modes.
Users reporting 46
Overall satisfaction HR
CIRCLE 460 ON READER CARD

INTERACT
Text editing and documentation preparation system for OS or OS/VS modes.
Users reporting 8
Overall satisfaction E
CIRCLE 461 ON READER CARD

Cyborg Systems, Inc.
PAYROLL
General payroll and personnel system for systems supporting ANS COBOL.
Users reporting 6
Overall satisfaction E
CIRCLE 462 ON READER CARD

Data Design Associates, Inc.
FIXED ASSETS
Specialized accounting system for IBM 360/370 and Burroughs 7100 and up.
Users reporting 7
Overall satisfaction E
CIRCLE 463 ON READER CARD

Data General Corp.
AOS
Operating system for Data General Eclipse Series minicomputers.
Users reporting 9
Overall satisfaction E
CIRCLE 464 ON READER CARD

COBOL
Standard Data General COBOL compiler.
Users reporting 8
Overall satisfaction E
CIRCLE 465 ON READER CARD

FORTRAN
Standard Data General FORTRAN compiler.
Users reporting 8
Overall satisfaction E
CIRCLE 466 ON READER CARD

IDEA
Interactive data entry and access system for the Data General Eclipse Series.
Users reporting 6
Overall satisfaction E
CIRCLE 467 ON READER CARD

INFOS
File access method for the Data General Eclipse Series.
Users reporting 9
Overall satisfaction E
CIRCLE 468 ON READER CARD

RDOS
Real-time disk operating system for Nova and Eclipse minicomputers.
Users reporting 8
Overall satisfaction E
CIRCLE 469 ON READER CARD

SORT/MERGE
Standard sort/merge program for use on Nova and Eclipse minicomputers.
Users reporting 6
Overall satisfaction E
CIRCLE 470 ON READER CARD

INTERACT
Text editing and documentation preparation system for OS or OS/VS modes.
Users reporting 8
Overall satisfaction E
CIRCLE 460 ON READER CARD

DATA PROCESSING DESIGN, INC.
SAVER
Direct replacement for the standard PDP-11 RSTS/E BACKUP utility program.
Users reporting 6
Overall satisfaction E
CIRCLE 471 ON READER CARD

WORD-11
Multiterminal word processing system for use with the DEC PDP-11/34-70.
Users reporting 7
Overall satisfaction E
CIRCLE 472 ON READER CARD

Dearborn Computer Co.
DOS/RS (now marketed by the Computer Software Co.)
A replacement operating system for IBM DOS users.
Users reporting 9
Overall satisfaction HM
CIRCLE 473 ON READER CARD

Digital Equipment Corp. (DEC)
BASIC
Various versions to complement DEC operating systems.
Users reporting 16
Overall satisfaction E
CIRCLE 474 ON READER CARD

COBOL
Several versions to complement DEC operating systems.

RFTON
Available in various versions to support DEC computers.
Users reporting 36
Overall satisfaction E
CIRCLE 475 ON READER CARD

IAMS
Multifunction, multilingual operating system for the PDP-11. Users reporting 7
Overall satisfaction E
CIRCLE 480 ON READER CARD

OS/8
TAPE or disk operating system for batch or interactive PDP-8 systems.
Users reporting 5
Overall satisfaction E
CIRCLE 481 ON READER CARD

RJ2780 (Emulator)
DEC users can communicate directly with systems supporting the IBM 2780 remote terminal.
Users reporting 6
Overall satisfaction E
CIRCLE 482 ON READER CARD

RJE-HASP
Allows DEC systems to appear to the host computer as a HASP remote terminal.
Users reporting 5
Overall satisfaction E
CIRCLE 483 ON READER CARD

RMS-11
File management system for PDP-11s under the RSTS/E operating system.
Users reporting 9
Overall satisfaction E
CIRCLE 484 ON READER CARD

RSTS/E
Resource-sharing/time-sharing operating system for the PDP-11.
Users reporting 26
Overall satisfaction E
CIRCLE 485 ON READER CARD
Benefit from our experience.

Recognized as a leader in our industry, we've installed over 15,000 intelligent systems worldwide. Highly satisfied Ontel users know our reliable, low-cost systems and support have been the solution to their OEM problems and needs. Broad in-depth experience, our unique hardware design and very extensive software are a proven and tested combination for success. We're dedicated to making your OEM purchase live up to your expectations. Buy Ontel. It's a sound business decision.

Contact me today.

Edward J. Heinze
Vice President Marketing
Ontel Corporation
250 Crossways Park Drive
Woodbury, NY 11797
(516) 364-2121
<table>
<thead>
<tr>
<th>Program</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RSX-11M</td>
<td>Subset of the larger RSX-11D advanced operating system for PDP-11s.</td>
</tr>
<tr>
<td>Users reporting</td>
<td>28</td>
</tr>
<tr>
<td>Overall satisfaction</td>
<td>E</td>
</tr>
<tr>
<td>CIRCLE 408 ON READER CARD</td>
<td></td>
</tr>
<tr>
<td>RT-11</td>
<td>Foreground/background real-time disk operating system for the PDP-11.</td>
</tr>
<tr>
<td>Users reporting</td>
<td>23</td>
</tr>
<tr>
<td>Overall satisfaction</td>
<td>E</td>
</tr>
<tr>
<td>CIRCLE 407 ON READER CARD</td>
<td></td>
</tr>
<tr>
<td>SORT</td>
<td>Standard sort for use with most DEC operating systems.</td>
</tr>
<tr>
<td>Users reporting</td>
<td>13</td>
</tr>
<tr>
<td>Overall satisfaction</td>
<td></td>
</tr>
<tr>
<td>CIRCLE 408 ON READER CARD</td>
<td></td>
</tr>
<tr>
<td>TOPS-20</td>
<td>Operating system for the DEC System-20 mainframe.</td>
</tr>
<tr>
<td>Users reporting</td>
<td>5</td>
</tr>
<tr>
<td>Overall satisfaction</td>
<td>E</td>
</tr>
<tr>
<td>CIRCLE 409 ON READER CARD</td>
<td></td>
</tr>
<tr>
<td>WISE</td>
<td>A data management tool primarily intended for college administration.</td>
</tr>
<tr>
<td>Users reporting</td>
<td>9</td>
</tr>
<tr>
<td>Overall satisfaction</td>
<td>E</td>
</tr>
<tr>
<td>CIRCLE 409 ON READER CARD</td>
<td></td>
</tr>
<tr>
<td>Digital Research CP/M</td>
<td>Disk-based operating system for most 8080, 8085 and Z-80-type microcomputers.</td>
</tr>
<tr>
<td>Users reporting</td>
<td>13</td>
</tr>
<tr>
<td>Overall satisfaction</td>
<td>HR</td>
</tr>
<tr>
<td>CIRCLE 401 ON READER CARD</td>
<td></td>
</tr>
<tr>
<td>DNA Systems, Inc. 1130/FORTRAN</td>
<td>For IBM 1130 and compatible systems.</td>
</tr>
<tr>
<td>Users reporting</td>
<td>16</td>
</tr>
<tr>
<td>Overall satisfaction</td>
<td>HR</td>
</tr>
<tr>
<td>CIRCLE 402 ON READER CARD</td>
<td></td>
</tr>
<tr>
<td>1130/SORT</td>
<td>Generalized sort program for IBM 1130 and compatible systems.</td>
</tr>
<tr>
<td>Users reporting</td>
<td>11</td>
</tr>
<tr>
<td>Overall satisfaction</td>
<td>HR</td>
</tr>
<tr>
<td>CIRCLE 403 ON READER CARD</td>
<td></td>
</tr>
<tr>
<td>TSO</td>
<td>Time-sharing operating system for IBM 1130 and compatible systems.</td>
</tr>
<tr>
<td>Users reporting</td>
<td>11</td>
</tr>
<tr>
<td>Overall satisfaction</td>
<td>E</td>
</tr>
<tr>
<td>CIRCLE 404 ON READER CARD</td>
<td></td>
</tr>
<tr>
<td>XBASE</td>
<td>Disk access enhancement for IBM 1130 and compatible computers.</td>
</tr>
<tr>
<td>Users reporting</td>
<td>5</td>
</tr>
<tr>
<td>Overall satisfaction</td>
<td>E</td>
</tr>
<tr>
<td>CIRCLE 406 ON READER CARD</td>
<td></td>
</tr>
<tr>
<td>Duquesne Systems, Inc. QCM</td>
<td>Independent, interrelated programs designed to measure and report computer utilization.</td>
</tr>
<tr>
<td>Users reporting</td>
<td>5</td>
</tr>
<tr>
<td>Overall satisfaction</td>
<td>E</td>
</tr>
<tr>
<td>CIRCLE 497 ON READER CARD</td>
<td></td>
</tr>
<tr>
<td>Dylakor Software Systems, Inc. DYL-250</td>
<td>File maintenance and label printing utility for IBM 360/370 and compatibles.</td>
</tr>
<tr>
<td>Users reporting</td>
<td>14</td>
</tr>
<tr>
<td>Overall satisfaction</td>
<td>E</td>
</tr>
<tr>
<td>CIRCLE 498 ON READER CARD</td>
<td></td>
</tr>
<tr>
<td>DYI-260</td>
<td>Data management and report writing system for IBM 360/370.</td>
</tr>
<tr>
<td>Users reporting</td>
<td>67</td>
</tr>
<tr>
<td>Overall satisfaction</td>
<td>E</td>
</tr>
<tr>
<td>CIRCLE 499 ON READER CARD</td>
<td></td>
</tr>
<tr>
<td>Execom Systems Corp. IFS</td>
<td>Interactive financial planning and simulation system.</td>
</tr>
<tr>
<td>Users reporting</td>
<td>6</td>
</tr>
<tr>
<td>Overall satisfaction</td>
<td>E</td>
</tr>
<tr>
<td>CIRCLE 500 ON READER CARD</td>
<td></td>
</tr>
<tr>
<td>Florida Software Services, Inc. CERTIFICATE OF DEPOSIT</td>
<td>General-purpose system for IBM 360/370, Burroughs and Honeywell systems.</td>
</tr>
<tr>
<td>Users reporting</td>
<td>9</td>
</tr>
<tr>
<td>Overall satisfaction</td>
<td>E</td>
</tr>
<tr>
<td>CIRCLE 501 ON READER CARD</td>
<td></td>
</tr>
<tr>
<td>COMMERCIAL LOAN SYSTEM</td>
<td>Generalized system for IBM 360/370, Burroughs and Honeywell computers.</td>
</tr>
<tr>
<td>Users reporting</td>
<td>8</td>
</tr>
<tr>
<td>Overall satisfaction</td>
<td>HM</td>
</tr>
<tr>
<td>CIRCLE 502 ON READER CARD</td>
<td></td>
</tr>
<tr>
<td>DEMAND DEPOSIT ACCOUNTING</td>
<td>General purpose system for IBM 360/370, Burroughs and Honeywell systems.</td>
</tr>
<tr>
<td>Users reporting</td>
<td>14</td>
</tr>
<tr>
<td>Overall satisfaction</td>
<td>E</td>
</tr>
<tr>
<td>CIRCLE 503 ON READER CARD</td>
<td></td>
</tr>
<tr>
<td>FINANCIAL MANAGEMENT SYSTEM</td>
<td>Generalized financial management reporting system.</td>
</tr>
<tr>
<td>Users reporting</td>
<td>6</td>
</tr>
<tr>
<td>Overall satisfaction</td>
<td>HM</td>
</tr>
<tr>
<td>CIRCLE 504 ON READER CARD</td>
<td></td>
</tr>
<tr>
<td>INSTALLMENT LOAN</td>
<td>General purpose loan system for IBM 360/370, Burroughs, and Honeywell computers.</td>
</tr>
<tr>
<td>Users reporting</td>
<td>7</td>
</tr>
<tr>
<td>Overall satisfaction</td>
<td>E</td>
</tr>
<tr>
<td>CIRCLE 505 ON READER CARD</td>
<td></td>
</tr>
<tr>
<td>MORTGAGE LOAN</td>
<td>Generalized mortgage loan system for IBM 360/370, Burroughs, and Honeywell computers.</td>
</tr>
<tr>
<td>Users reporting</td>
<td>11</td>
</tr>
<tr>
<td>Overall satisfaction</td>
<td>E</td>
</tr>
<tr>
<td>CIRCLE 506 ON READER CARD</td>
<td></td>
</tr>
<tr>
<td>Forth, Inc. MICROFORTH</td>
<td>Microprocessor programming language for most 8080, 6800, Z-80 and 8086.</td>
</tr>
<tr>
<td>Users reporting</td>
<td>5</td>
</tr>
<tr>
<td>Overall satisfaction</td>
<td>E</td>
</tr>
<tr>
<td>CIRCLE 507 ON READER CARD</td>
<td></td>
</tr>
<tr>
<td>Four-Phase Systems, Inc. DATA IV</td>
<td>Multistation key-to-disk data preparation system with remote batch capability.</td>
</tr>
<tr>
<td>Users reporting</td>
<td>5</td>
</tr>
<tr>
<td>Overall satisfaction</td>
<td>E</td>
</tr>
<tr>
<td>CIRCLE 508 ON READER CARD</td>
<td></td>
</tr>
<tr>
<td>DYL-260</td>
<td>Data management and report writing system for IBM 360/370.</td>
</tr>
<tr>
<td>Users reporting</td>
<td>67</td>
</tr>
<tr>
<td>Overall satisfaction</td>
<td>E</td>
</tr>
<tr>
<td>CIRCLE 499 ON READER CARD</td>
<td></td>
</tr>
<tr>
<td>EXECCOM SYSTEMS CORP. IFPS</td>
<td>Interactive financial planning and simulation system.</td>
</tr>
<tr>
<td>Users reporting</td>
<td>6</td>
</tr>
<tr>
<td>Overall satisfaction</td>
<td>E</td>
</tr>
<tr>
<td>CIRCLE 500 ON READER CARD</td>
<td></td>
</tr>
<tr>
<td>Florida Software Services, Inc. CERTIFICATE OF DEPOSIT</td>
<td>General-purpose system for IBM 360/370, Burroughs and Honeywell systems.</td>
</tr>
<tr>
<td>Users reporting</td>
<td>9</td>
</tr>
<tr>
<td>Overall satisfaction</td>
<td>E</td>
</tr>
<tr>
<td>CIRCLE 501 ON READER CARD</td>
<td></td>
</tr>
<tr>
<td>COMMERCIAL LOAN SYSTEM</td>
<td>Generalized system for IBM 360/370, Burroughs and Honeywell computers.</td>
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<tr>
<td>Users reporting</td>
<td>8</td>
</tr>
<tr>
<td>Overall satisfaction</td>
<td>HM</td>
</tr>
<tr>
<td>CIRCLE 502 ON READER CARD</td>
<td></td>
</tr>
<tr>
<td>DEMAND DEPOSIT ACCOUNTING</td>
<td>General purpose system for IBM 360/370, Burroughs and Honeywell systems.</td>
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<tr>
<td>Users reporting</td>
<td>14</td>
</tr>
<tr>
<td>Overall satisfaction</td>
<td>E</td>
</tr>
<tr>
<td>CIRCLE 503 ON READER CARD</td>
<td></td>
</tr>
<tr>
<td>FINANCIAL MANAGEMENT SYSTEM</td>
<td>Generalized financial management reporting system.</td>
</tr>
<tr>
<td>Users reporting</td>
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</tr>
<tr>
<td>Overall satisfaction</td>
<td>HM</td>
</tr>
<tr>
<td>CIRCLE 504 ON READER CARD</td>
<td></td>
</tr>
<tr>
<td>INSTALLMENT LOAN</td>
<td>General purpose loan system for IBM 360/370, Burroughs, and Honeywell computers.</td>
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<td>Users reporting</td>
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</tr>
<tr>
<td>Overall satisfaction</td>
<td>E</td>
</tr>
<tr>
<td>CIRCLE 505 ON READER CARD</td>
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<tr>
<td>MORTGAGE LOAN</td>
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</tr>
<tr>
<td>Overall satisfaction</td>
<td>E</td>
</tr>
<tr>
<td>CIRCLE 506 ON READER CARD</td>
<td></td>
</tr>
</tbody>
</table>
Distributed processing means different things to different people.

To Raytheon, it means delivering the maximum number of capabilities within a user's data communications network at the lowest possible cost.

That was one criterion for designing our PTS/1200 MARK I and MARK II distributed processing systems. Judge for yourself if the capabilities of the MARK I and MARK II meet the standard we set.

**Multiple emulation capabilities.** The system can operate immediately in most existing networks. MARK I and II support 3270 interactive (dumb and intelligent), 2780 and 3780 batch, HASP remote job entry, and a variety of non-IBM protocols, with SDLC batch/interactive in the future. Concurrent interactive and batch operation is supported on some models.

**Intelligent controllers.** You can program as little or as much power as you want into your system. PTS/1200 systems offer up to 128K-byte controllers capable of managing up to 20 peripheral devices.

**Terminal power.** Multiple screen sizes, up to 34 terminals per controller, a variety of keyboard options, programmable function keys, and numerous operator prompting aids are available with every terminal.

**Rapid applications expansion.** Every MARK I and II comes with a feature we call intelligent 3270-type operation. It lets your 3270-type applications add local terminal storage, local printing, direct data base access and updating, and either batch or transaction operations. The MARK I or II applications program decides when to go to the host, so your operators never have to get involved.

**Data base storage.** for local applications processing.

**PTS/1200s** are expandable from 10MB to 252MB of disk storage, with powerful memory management software techniques that assure efficient data base operations.

**Network enhancement.** A distributed processing system with truly enhanced capabilities should allow you to do more with your network than simply transfer data. PTS/1200 systems let you add teleprinters to your terminal lines, or run batch and interactive jobs concurrently, or perform remote program development in any host CPU language, or debug, load and operate downline multipoint lines. Not bad features for a system that is priced starting at $850 a month, including maintenance, for a four-terminal, 10MB disk, 165 CPS printer configuration.

When we decided to call MARK I and II "The Distributed Processing Machines," we wanted to be sure they were worthy of what you want in a modern terminal-based product.

**Raytheon terminals.** 60,000 now, and growing fast.
<table>
<thead>
<tr>
<th>USER RATINGS</th>
</tr>
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<td>and data base management system.</td>
</tr>
<tr>
<td>Users reporting 6 Overall satisfaction E CIRCLE 528 ON READER CARD</td>
</tr>
<tr>
<td>GCOS Generalized operating system for all Honeywell computers.</td>
</tr>
<tr>
<td>Users reporting 10 Overall satisfaction E CIRCLE 526 ON READER CARD</td>
</tr>
<tr>
<td>GENERAL LEDGER Standard general ledger system for Honeywell Series 60, 600, 6000 and Level 6.</td>
</tr>
<tr>
<td>Users reporting 13 Overall satisfaction E CIRCLE 527 ON READER CARD</td>
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<tr>
<td>INVENTORY MANAGEMENT SYSTEM (IMS) An inventory management system for most medium- to large-scale Honeywell computers.</td>
</tr>
<tr>
<td>Users reporting 24 Overall satisfaction E CIRCLE 528 ON READER CARD</td>
</tr>
<tr>
<td>MDQS A self-contained management data query system for Series 60, Levels 66 and 68 computers.</td>
</tr>
<tr>
<td>Users reporting 7 Overall satisfaction G CIRCLE 529 ON READER CARD</td>
</tr>
<tr>
<td>PAYROLL For Honeywell Series 60, 600, 6000 and Level 6 computers.</td>
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<td>Users reporting 12 Overall satisfaction E CIRCLE 530 ON READER CARD</td>
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<tr>
<td>Scribe School attendance and grade reporting system.</td>
</tr>
<tr>
<td>Users reporting 7 Overall satisfaction E CIRCLE 532 ON READER CARD</td>
</tr>
<tr>
<td>SORT/MERGE Standard sort/merge package for Honeywell computers.</td>
</tr>
<tr>
<td>Users reporting 6 Overall satisfaction E CIRCLE 533 ON READER CARD</td>
</tr>
<tr>
<td>TDS A high-volume, transaction-driven processing system.</td>
</tr>
<tr>
<td>Users reporting 12 Overall satisfaction E CIRCLE 534 ON READER CARD</td>
</tr>
<tr>
<td>TRANSACTION PROCESSING SYSTEM (TPS) Level 66 system which controls the loading and execution of application programs.</td>
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<td>Users reporting 6 Overall satisfaction G CIRCLE 535 ON READER CARD</td>
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<tr>
<td>UTILITIES Standard series of utility programs for use with Honeywell computers.</td>
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<tr>
<td>Users reporting 5 Overall satisfaction E CIRCLE 536 ON READER CARD</td>
</tr>
<tr>
<td>IBM Corp. DPD A documentation tool that aids in the development of line art applications.</td>
</tr>
<tr>
<td>Users reporting 9 Overall satisfaction E CIRCLE 537 ON READER CARD</td>
</tr>
<tr>
<td>ADVANCED PROGRAMMING FUNCTIONS A series of IBM/370 DOS/VS programming enhancement features.</td>
</tr>
<tr>
<td>Users reporting 9 Overall satisfaction E CIRCLE 538 ON READER CARD</td>
</tr>
<tr>
<td>ALPHA SEARCH INQUIRY SYSTEM A CICS phonetic search and retrieval system for IBM 360/370 DOS/VS and OS/VS systems.</td>
</tr>
<tr>
<td>Users reporting 6 Overall satisfaction E CIRCLE 539 ON READER CARD</td>
</tr>
<tr>
<td>APL Standard APL language processor for IBM 360/370 computers.</td>
</tr>
<tr>
<td>Users reporting 17 Overall satisfaction E CIRCLE 540 ON READER CARD</td>
</tr>
<tr>
<td>ATMD Word processing system for OS/VS and DOS/VS systems with CICS capabilities.</td>
</tr>
<tr>
<td>Users reporting 10 Overall satisfaction E CIRCLE 541 ON READER CARD</td>
</tr>
<tr>
<td>BACIS Generalized budget accounting information system for use with IBM 360/370 computers.</td>
</tr>
<tr>
<td>Users reporting 5 Overall satisfaction E CIRCLE 542 ON READER CARD</td>
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<tr>
<td>CAPPOSS Capacity planning and operations sequencing system for 360/370 systems.</td>
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<tr>
<td>Users reporting 5 Overall satisfaction E CIRCLE 543 ON READER CARD</td>
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<tr>
<td>CICS Data communications monitor.</td>
</tr>
<tr>
<td>Users reporting 241 Overall satisfaction E CIRCLE 544 ON READER CARD</td>
</tr>
<tr>
<td>CCO II Insurance contract maintenance system for IBM 360/370 DOS or OS systems.</td>
</tr>
<tr>
<td>Users reporting 6 Overall satisfaction E CIRCLE 545 ON READER CARD</td>
</tr>
<tr>
<td>COBOL (360/370) Versions for DOS, OS and VS systems on 360/370 computers.</td>
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<td>Users reporting 123 Overall satisfaction E CIRCLE 546 ON READER CARD</td>
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<tr>
<td>COMPUTER ASSISTED TRAINING A self-teaching, computer-aided instruction course for 360/370 computers.</td>
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<tr>
<td>Users reporting 5 Overall satisfaction E CIRCLE 547 ON READER CARD</td>
</tr>
<tr>
<td>COPICS A total system of packages serving the production and manufacturing industry.</td>
</tr>
<tr>
<td>Users reporting 5 Overall satisfaction E CIRCLE 548 ON READER CARD</td>
</tr>
<tr>
<td>DBOMP (360/370) Data base organization and maintenance processor utility for IBM 360/370.</td>
</tr>
<tr>
<td>Users reporting 30 Overall satisfaction E CIRCLE 549 ON READER CARD</td>
</tr>
<tr>
<td>DITTO (360/370) File copy/file management utility for IBM 360/370.</td>
</tr>
<tr>
<td>Users reporting 25 Overall satisfaction E CIRCLE 550 ON READER CARD</td>
</tr>
<tr>
<td>DL/1 DOS/VS Data base management system for IBM DOS/VS users.</td>
</tr>
<tr>
<td>Users reporting 39 Overall satisfaction E CIRCLE 551 ON READER CARD</td>
</tr>
<tr>
<td>DL/1/ENTRY Data base management system for entry-level DOS users.</td>
</tr>
<tr>
<td>Users reporting 8 Overall satisfaction F CIRCLE 552 ON READER CARD</td>
</tr>
<tr>
<td>DMS (360/370) IBM 3270 display management system for use with IBM 360/370.</td>
</tr>
<tr>
<td>Users reporting 35 Overall satisfaction E CIRCLE 553 ON READER CARD</td>
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<tr>
<td>EPIC SYSTEMS A series of program products for schools.</td>
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<tr>
<td>Users reporting 17 Overall satisfaction E CIRCLE 554 ON READER CARD</td>
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<tr>
<td>ETSS-II DOS/VS entry time-sharing system for IBM 370 users.</td>
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<tr>
<td>Users reporting 34 Overall satisfaction E CIRCLE 555 ON READER CARD</td>
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<tr>
<td>FORTRAN (360/370) Versions for IBM 360/370 DOS, OS, and their VS counterpart systems.</td>
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<td>Users reporting 24 Overall satisfaction E CIRCLE 556 ON READER CARD</td>
</tr>
<tr>
<td>GPSS-V Broad-range, general-purpose simulation system; for use with 360/370 systems.</td>
</tr>
<tr>
<td>Users reporting 5 Overall satisfaction E CIRCLE 557 ON READER CARD</td>
</tr>
<tr>
<td>HEALTH CARE SYSTEM (HCS) A specialized hospital-oriented accounting system for DOS/VS installations.</td>
</tr>
<tr>
<td>Users reporting 6 Overall satisfaction G CIRCLE 558 ON READER CARD</td>
</tr>
<tr>
<td>IMS Data base management system for OS and OS/VS systems.</td>
</tr>
<tr>
<td>Users reporting 49 Overall satisfaction E CIRCLE 559 ON READER CARD</td>
</tr>
<tr>
<td>MTCS Minimum teleprocessing communications systems for use with IBM 360/370.</td>
</tr>
<tr>
<td>Users reporting 5 Overall satisfaction E CIRCLE 560 ON READER CARD</td>
</tr>
<tr>
<td>PANEL A documentation tool that aids in the development of line art applications.</td>
</tr>
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<td>Users reporting 7 Overall satisfaction E CIRCLE 561 ON READER CARD</td>
</tr>
<tr>
<td>PERFORMANCE ANALYZER General system performance analysis and reporting package for 360/370s.</td>
</tr>
<tr>
<td>Users reporting 5 Overall satisfaction E CIRCLE 562 ON READER CARD</td>
</tr>
<tr>
<td>PLancode System for building business planning models on VS systems.</td>
</tr>
<tr>
<td>Users reporting 6 Overall satisfaction E CIRCLE 563 ON READER CARD</td>
</tr>
<tr>
<td>PL/1 OPTIMIZER Automatic optimizing compiler for 360/370 computers.</td>
</tr>
<tr>
<td>Users reporting 30 Overall satisfaction E CIRCLE 564 ON READER CARD</td>
</tr>
<tr>
<td>RMF Resource measurement facility for logging and recording system activity data.</td>
</tr>
<tr>
<td>Users reporting 8 Overall satisfaction E CIRCLE 565 ON READER CARD</td>
</tr>
<tr>
<td>RPG II (360/370) Versions for DOS, OS and their VS counterpart systems.</td>
</tr>
</tbody>
</table>
Pack 10 to 120 megabytes in a unit one-third the size of conventional disk drives.

For OEMs and system builders, the D100 family of compact disk drives offers a surprising list of advantages. Two new models, D140 and D160 add capacity and flexibility to the proven performance of the D120. The D140 includes a 10MB fixed platter in addition to the 10MB removable cartridge as used with the D120. The D160 uses a sealed (non-removable) module which includes low pressure heads and carriage.

Small Size: Occupying approximately one-third the volume of conventional drives, models D120 and D160 measure 5.6" x 12.2" x 21.8". Model D140 is slightly taller at 6.7".

Innovative Cartridge: Both D120 and D140 models use a flat, thin (11" square by .9") self-ventilated cartridge weighing only 2.8 pounds.

Common Interface: The same controller handles D120, D140, D160, or any combination of the three models. One or more D160's in conjunction with a D120 provide a fixed data base with a high-throughput-10MB load-dump yielding twice the operating flexibility at half the size of conventional single-spindle drives.

High Density/Speed: Up to 7300 BPI, 600 TPI; 920 kilobytes/sec transfer rate.

Accuracy: Data-imbedded servo-tracking techniques assure accurate head positioning and full cartridge interchangeability.

Low Power Consumption: From 100 to 130 watts depending on model.

Reliability: Simplified mechanisms rule out any need for preventive maintenance. The spindle-mounted dc motor is brushless. There are no belts or pulleys, no blower, no transducer, no thermal compensation device. And no head alignment is required. MTBF is 5000 hours for models D120 and D140, 8000 hours for the D160.

For more information, send coupon to: Jean-Paul Garodel, Bull Corporation of America, 200 Smith Street (MS 430), Waltham, Massachusetts 02154. Or call, (617) 890-8400, extension 2019.

In Europe, write Alain Kiffer, Cii Honeywell Bull, 6 Avenue des Usines, 90001 Belfort, France. Or call, (84) 228200.
### USER RATINGS

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<tr>
<th>System</th>
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<th>Overall Satisfaction</th>
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<td>COBOL (S/3)</td>
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<td>CIRCLE 568 ON READER CARD</td>
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<td>SALEM</td>
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<td>The Salem School student record</td>
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<td>system.</td>
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<td>CIRCLE 567 ON READER CARD</td>
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<td>SORT (360/370)</td>
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<tr>
<td>Disk-based sort for DOS and their</td>
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<tr>
<td>vs counterpart systems. Users reporting 99</td>
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<td>CIRCLE 568 ON READER CARD</td>
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<tr>
<td>SPF (Structured Programming Facility)</td>
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<td>A programming development tool</td>
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<td>SPM-360/370 (Source Program Maintenance)</td>
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<td>Source program maintenance for COBOL programs.</td>
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<td>IBM OS and OS/VS operating systems.</td>
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<td>55</td>
<td>E</td>
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<td>Crt-oriented on-line data entry system for</td>
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<td>IBM Corp., GSD</td>
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<td>ACCOUNTS PAYABLE (S/3)</td>
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<td>for IBM S/3. Users reporting 49</td>
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<td>BOMP (S/3)</td>
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<td>Bill of material processor for the</td>
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<td>CIRCLE 586 ON READER CARD</td>
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<td>MMS BUSINESS APPLICATIONS</td>
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<td>accounting routines for IBM'S S/32 and 34.</td>
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<td>ON-LINE FILE DISPLAY</td>
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<td>Interactive, on-line query and display</td>
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<td>ON-LINE SCREEN DESIGN FACILITY</td>
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<td>IBM 3270 screen development and</td>
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<td>documentation aid for s/3 computers.</td>
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<td>Users reporting 31</td>
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<td>INFODATA SYSTEMS, INC.</td>
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<td>Users reporting 25</td>
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<td>Overall satisfaction 20</td>
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<tr>
<td>system; versions for IBM OS and OS/VS</td>
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<td>environments. Users reporting 14</td>
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<td>Infodatal Systems, INC.</td>
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<td>system for IBM OS and OS/VS environments.</td>
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<td>GENERAL LEDGER</td>
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<td>Generalized package written in</td>
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<td>ANSI COBOL for most mainframes.</td>
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<td>Multidivision, multicompany accounts</td>
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<td>payable system for use on IBM 360/370,</td>
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<td>Burroughs, Univac, Honeywell, and other</td>
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<td>comparable computers. Users reporting 7</td>
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<tr>
<td>Overall satisfaction 6</td>
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<td>CIRCLE 607 ON READER CARD</td>
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<td>GENERAL LEDGER</td>
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<td>E</td>
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<td>Generalized package written in</td>
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<td>ANSI COBOL for mainframes.</td>
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<td>Users reporting 6</td>
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<td>E</td>
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<td>Overall satisfaction 4</td>
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<td>CIRCLE 608 ON READER CARD</td>
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<td>INFODATA SYSTEMS, INC.</td>
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<tr>
<td>Informatics Inc.</td>
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<td>Accounting IV</td>
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<td>Multidivision, multicompany general ledger/</td>
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<td>financial reporting system for</td>
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<td>use on IBM 360/370, Burroughs,</td>
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<tr>
<td>Univac, Honeywell, and other other</td>
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<td>comparable computers. Users reporting 3</td>
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<td>E</td>
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<tr>
<td>Overall satisfaction 2</td>
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<tr>
<td>CIRCLE 609 ON READER CARD</td>
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</tbody>
</table>
"Up and running at Peugeot in sixty days."

"Peugeot, producing 2.5 million vehicles a year, is now the third largest automobile maker in the world. Domestically, Peugeot needed a comprehensive data base-oriented financial reporting system that could be implemented quickly, with the least amount of impact on data processing and accounting staffs and resources.

"We did not want to 're-invent the wheel', and after a thorough review, we selected Software International's Accounts Payable software package to start. We planned to follow that with their General Ledger a year later, but since Payables went in smoothly in only 60 days, we installed the Ledger six months ahead of schedule.

James F. Miller
Assistant to the President
PEUGEOT MOTORS OF AMERICA, INC.

"There was no need for either accounting or data processing to compromise with either system. Prior to choosing Software International, we surveyed their customers and our 'Big 8' auditors, and were well-satisfied with reliability, field support and system performance.

"Preparing for anticipated growth in the U.S. market, Peugeot recently completely reorganized its field operations. Changing from seven regions to three zones meant realigning our reporting system to the new organization. Within 24 hours, the General Ledger provided us with necessary management reports without skipping a beat."

Bernard F. Steiner
Treasurer
PEUGEOT MOTORS OF AMERICA, INC.

General Ledger and Financial Reporting
Fixed Asset Accounting • Accounts Receivable
Accounts Payable • Payroll/Personnel
Net Change Manufacturing Resource Planning

More than software . . . results.

"We believe, and more than 1500 major corporations around the world back us up, that we offer the most cost-effective, reliable and easy-to-use-financial and manufacturing control systems available.

"But it takes more than great systems for successful implementation. Software International supports all of its products with a worldwide network of local offices staffed with professionals whose wide range of experience covers both data processing and business. Users benefit from this expertise with training, technical support, comprehensive documentation, maintenance and regular enhancements.

Chet Domoracki
Vice President, Small Business System Division
Software International Corporation
<table>
<thead>
<tr>
<th>Company</th>
<th>Software Description</th>
<th>Overall</th>
<th>HR</th>
<th>User Satisfaction</th>
<th>E</th>
<th>HM</th>
<th>Overall</th>
<th>User Satisfaction</th>
<th>E</th>
<th>HM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Information Associates, Inc.</strong></td>
<td><strong>PAYROLL</strong>&lt;br&gt;Specialized institution payroll/personnel system for use with DOS, OS and VS counterpart systems.</td>
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<td><strong>Information Builders, Inc.</strong></td>
<td><strong>FOCUS</strong>&lt;br&gt;Comprehensive report preparation and information analysis system; runs in OS/VS environments on 370 computers.</td>
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<td><strong>Information Sciences, Inc.</strong></td>
<td><strong>INVENTORY</strong>&lt;br&gt;Job accounting and resource measurement for use with IBM OS or OS/VS systems.</td>
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<tr>
<td><strong>MSP, Inc.</strong></td>
<td><strong>DATAMANAGER</strong>&lt;br&gt;Tape surface verification and copy program for use on IBM 360/370 systems.</td>
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<tr>
<td><strong>NCI</strong></td>
<td><strong>DISK-O-TEK</strong>&lt;br&gt;Multiuser operating system and COBOL compiler for Data General and like minis.</td>
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<td><strong>Microsoft, Inc.</strong></td>
<td><strong>BASIC</strong>&lt;br&gt;Standard basic compiler for use with 8080 or Z-80 microprocessor.</td>
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<tr>
<td><strong>MRI</strong></td>
<td><strong>SYSTEM 2000</strong>&lt;br&gt;Data base management system for IBM 360/370 and compatibles, Univac, and CDC computers.</td>
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<tr>
<td><strong>Mathematica Products Group, Inc.</strong></td>
<td><strong>RAMIS II</strong>&lt;br&gt;Data management and retrieval system with many data base management system features.</td>
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<tr>
<td><strong>MCA (Mini-Computer Business Applications, Inc.)</strong></td>
<td><strong>MCBA</strong>&lt;br&gt;Data dictionary system for DBMS or standard file organizations.</td>
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<tr>
<td><strong>MCI</strong></td>
<td><strong>DISK-O-TEK</strong>&lt;br&gt;Tape interface organization and maintenance utility, runs with IBM DOS or DOS/VS systems.</td>
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<tr>
<td><strong>CIRCLE 610 ON READER CARD</strong></td>
<td><strong>ACCOUNTS PAYABLE</strong>&lt;br&gt;In ANSI COBOL for use on various mainframes.</td>
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<tr>
<td><strong>CIRCLE 620 ON READER CARD</strong></td>
<td><strong>ACCOUNTS RECEIVABLE</strong>&lt;br&gt;Generalized system for most mainframes.</td>
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<tr>
<td><strong>CIRCLE 625 ON READER CARD</strong></td>
<td><strong>PAYROLL</strong>&lt;br&gt;Generalized payroll package for use with IBM and Data General minicomputers.</td>
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<tr>
<td><strong>CIRCLE 630 ON READER CARD</strong></td>
<td><strong>FIXED ASSETS</strong>&lt;br&gt;Specialized fixed asset accounting system for most mainframes.</td>
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<tr>
<td><strong>CIRCLE 635 ON READER CARD</strong></td>
<td><strong>INVENTORY CONTROL</strong>&lt;br&gt;Data base management system for any IBM 360/370 or Burroughs 3500 or larger system.</td>
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<td><strong>CIRCLE 636 ON READER CARD</strong></td>
<td><strong>DR. D</strong>&lt;br&gt;Multifunction DOS and DOS/VS</td>
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</table>
A message from John R. Bennett, President, Applied Data Research, to firms considering DB/DC systems.

If you are interested in a DB or DC system that your programmers can learn in days, that will increase responsiveness to your users, reduce the burden of system maintenance and revision, and stabilize your hardware requirements... call Applied Data Research.

Send in coupon or call toll-free 800-527-7572

John R. Bennett, President of Applied Data Research, at ADR's new corporate headquarters in Princeton, N.J. This is one of the world's largest facilities dedicated exclusively to the design, development and marketing of systems software for IBM computers.
<table>
<thead>
<tr>
<th>USER RATINGS</th>
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<tbody>
<tr>
<td>disk dump and restore utility.</td>
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<tr>
<td>Overall satisfaction</td>
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<tr>
<td>N 5500 Project planning and control</td>
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<td>system written in ANSI COBOL.</td>
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<tr>
<td>Users reporting</td>
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<tr>
<td>Overall satisfaction</td>
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<td>CIRCLE 310 ON READER CARD</td>
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<td>CIRCLE 310 ON READER CARD</td>
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<tr>
<td>O.W.L.</td>
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<td>DOS/VS on-line programming</td>
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<td>Users reporting</td>
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<td>Overall satisfaction</td>
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<td>CIRCLE 306 ON READER CARD</td>
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<tr>
<td>SLICK</td>
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<td>Users reporting</td>
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<tr>
<td>Overall satisfaction</td>
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<td>CIRCLE 306 ON READER CARD</td>
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<tr>
<td>NCR Corp.</td>
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<td>Users reporting</td>
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<tr>
<td>Overall satisfaction</td>
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<tr>
<td>CIRCLE 307 ON READER CARD</td>
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<tr>
<td>ACCOUNTS RECEIVABLE</td>
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<td>Users reporting</td>
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<td>Overall satisfaction</td>
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<td>CIRCLE 309 ON READER CARD</td>
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<td>CIRCLE 309 ON READER CARD</td>
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<td>CIF</td>
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<td>Users reporting</td>
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<td>Overall satisfaction</td>
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<td>CIRCLE 309 ON READER CARD</td>
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<td>CIRCLE 309 ON READER CARD</td>
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<td>COBOL</td>
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<td>Users reporting</td>
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<td>Overall satisfaction</td>
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<td>CIRCLE 310 ON READER CARD</td>
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<td>CIRCLE 310 ON READER CARD</td>
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<td>GENERAL LEDGER</td>
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<td>Users reporting</td>
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<td>Overall satisfaction</td>
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<td>CIRCLE 311 ON READER CARD</td>
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<td>CIRCLE 311 ON READER CARD</td>
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<td>I.G.A.S.</td>
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<td>Users reporting</td>
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<td>Overall satisfaction</td>
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<td>CIRCLE 312 ON READER CARD</td>
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<td>CIRCLE 312 ON READER CARD</td>
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<tr>
<td>PAYROLL</td>
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<td>Users reporting</td>
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<td>Overall satisfaction</td>
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<td>CIRCLE 313 ON READER CARD</td>
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<td>CIRCLE 313 ON READER CARD</td>
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<td>SPIRIT</td>
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<td>Users reporting</td>
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<td>Overall satisfaction</td>
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<td>CIRCLE 314 ON READER CARD</td>
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<td>CIRCLE 314 ON READER CARD</td>
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<td>Users reporting</td>
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<td>CIRCLE 316 ON READER CARD</td>
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<td>CIRCLE 316 ON READER CARD</td>
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<td>Sort/merge package for use on DEC PDP-11 computers running under RSTS/E.</td>
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<td>Users reporting</td>
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<td>Overall satisfaction</td>
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<td>CIRCLE 317 ON READER CARD</td>
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<td>CIRCLE 317 ON READER CARD</td>
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<td>On-Line Software International</td>
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<td>Users reporting</td>
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<td>Overall satisfaction</td>
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<td>CIRCLE 318 ON READER CARD</td>
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<td>CIRCLE 318 ON READER CARD</td>
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<tr>
<td>Data management information and retrieval system.</td>
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<tr>
<td>Users reporting</td>
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<td>Overall satisfaction</td>
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<tr>
<td>CIRCLE 319 ON READER CARD</td>
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<td>CIRCLE 319 ON READER CARD</td>
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<tr>
<td>Advanced financial reporting system with planning and budgeting capabilities.</td>
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<td>Users reporting</td>
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<tr>
<td>Overall satisfaction</td>
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<td>CIRCLE 320 ON READER CARD</td>
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<tr>
<td>CIRCLE 320 ON READER CARD</td>
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<tr>
<td>Advanced financial reporting system for use on DEC PDP-11 minicomputers with RSTS/E.</td>
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<tr>
<td>Users reporting</td>
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<td>Overall satisfaction</td>
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<tr>
<td>CIRCLE 321 ON READER CARD</td>
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<tr>
<td>CIRCLE 321 ON READER CARD</td>
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<tr>
<td>Disk operating system for Prime minicomputers.</td>
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<td>Users reporting</td>
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<tr>
<td>Overall satisfaction</td>
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<tr>
<td>CIRCLE 330 ON READER CARD</td>
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<tr>
<td>CIRCLE 330 ON READER CARD</td>
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<tr>
<td>End-user-oriented data base management system for DEC System-10 and 20.</td>
</tr>
<tr>
<td>Users reporting</td>
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<tr>
<td>Overall satisfaction</td>
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<tr>
<td>CIRCLE 340 ON READER CARD</td>
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<tr>
<td>CIRCLE 340 ON READER CARD</td>
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<tr>
<td>General-purpose accounts payable system.</td>
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<td>Users reporting</td>
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<td>Overall satisfaction</td>
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<tr>
<td>CIRCLE 341 ON READER CARD</td>
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<tr>
<td>CIRCLE 341 ON READER CARD</td>
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<tr>
<td>Generalized system for use with most NCR mainframes and minis.</td>
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<td>Users reporting</td>
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<td>Overall satisfaction</td>
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<td>CIRCLE 342 ON READER CARD</td>
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<td>CIRCLE 342 ON READER CARD</td>
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<td>Users reporting</td>
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<td>Overall satisfaction</td>
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<tr>
<td>CIRCLE 334 ON READER CARD</td>
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<td>CIRCLE 334 ON READER CARD</td>
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<tr>
<td>Seibels, Bruce &amp; Co. PMS Property and liability insurance system; runs on any IBM DOS or DOS/VS system.</td>
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<td>Users reporting</td>
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<tr>
<td>Overall satisfaction</td>
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<td>CIRCLE 335 ON READER CARD</td>
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<td>CIRCLE 335 ON READER CARD</td>
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<tr>
<td>Software ag of North America, Inc. AFRS Data base management system for IBM 360/370 and other comparable mainframes.</td>
</tr>
<tr>
<td>Users reporting</td>
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<td>Overall satisfaction</td>
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<td>CIRCLE 336 ON READER CARD</td>
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<td>CIRCLE 336 ON READER CARD</td>
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<tr>
<td>Software ag of North America, Inc. AFRS Data base management system for IBM 360/370 and other comparable mainframes.</td>
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<td>Users reporting</td>
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<td>Overall satisfaction</td>
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<td>CIRCLE 338 ON READER CARD</td>
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<td>CIRCLE 338 ON READER CARD</td>
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<td>Seibels, Bruce &amp; Co. PMS Property and liability insurance system; runs on any IBM DOS or DOS/VS system.</td>
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<td>Users reporting</td>
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<td>Overall satisfaction</td>
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<td>CIRCLE 339 ON READER CARD</td>
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<td>CIRCLE 339 ON READER CARD</td>
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<td>Software ag of North America, Inc. AFRS Data base management system for IBM 360/370 and other comparable mainframes.</td>
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<td>Users reporting</td>
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<td>Overall satisfaction</td>
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<td>CIRCLE 340 ON READER CARD</td>
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<td>Software ag of North America, Inc. AFRS Data base management system for IBM 360/370 and other comparable mainframes.</td>
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<td>CIRCLE 341 ON READER CARD</td>
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是否有办法让您的想法变为现实？

问题的核心在于您是否掌握了一台能够轻松帮助您实现想法的超级计算机系统。各大电脑公司都在尝试将计算机的性能提高一倍或两倍。所以，您需要确保您的计算机系统能够跟上思维的潮流，否则您会发现自己的想法变得越来越容易实现。

不过，您不必担心价格。只需在阅读这篇文章的同时，联系您的当地电脑公司。他们将为您提供最优惠的价格，以确保您能拥有最理想的功能。他们将根据您的需求为您提供最适合的电脑系统。

赶快行动吧，不要错过这难得的机会！
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and STUART E. MADNICK

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in computer security, together with a critical assessment of this research.
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By ROBERT S. BOYER and
J. STRO�ER MOORE

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of the Theory and Two Simple Examples. A
Precise Definition of the Theory. The Correct­
ness of a Tautology Checker. An Overview of
How We Prove Theorems. Using Type Infor­
mation to Simplify Formulas. Using Axioms
and Lemmas as Rewrite Rules. Using Defini­
tions. Rewriting Terms and Simplifying
Clauses. Eliminating Destructors. Using
Equalities. Generalization. Eliminating Irre­
levance. Induction and the Analysis of Recur­
sive Definitions. Formulating an Induction
Scheme for a Conjecture. Illustrations of Our
Techniques via Elementary Number Theory.
The Correctness of a Simple Optimizing Ex­
pression Compiler. The Correctness of a Fast
String Searching Algorithm. The Unique
Prime Factorization Theorem. Appendices.

1979, 276 pp., $18.00 ISBN: 0-12-357650-4

USER RATINGS

| USER RATINGS |
|------------------|------------------|
| DOS/VMT Replacement operating system for IBM DOS users. | Overall satisfaction E |
| Users reporting 10 | CIRCLE 344 ON READER CARD |
| Sperry Univac \[BEM\] A basic editor monitor for interactive programming under the os/3 operating system. | Overall satisfaction HR |
| Users reporting 35 | CIRCLE 345 ON READER CARD |
| GENERAL LEDGER Generalized system for use with most Univac computers. | Overall satisfaction E |
| Users reporting 6 | CIRCLE 346 ON READER CARD |
| ICS/90 Data collection system for use on Series 90. | Overall satisfaction G |
| Users reporting 8 | CIRCLE 347 ON READER CARD |
| PAYROLL General purpose payroll/personnel system for use on most Univac mainframes. | Overall satisfaction |
| Users reporting 6 | CIRCLE 348 ON READER CARD |
| UNIS A bill of material, inventory control, planning, and scheduling system for the Univac Series 90. | Overall satisfaction |
| Users reporting 21 | CIRCLE 349 ON READER CARD |
| SPSS, Inc. SPSS For statistical work in the social sciences. | Overall satisfaction |
| Users reporting 46 | CIRCLE 350 ON READER CARD |
| SPSS/Carleton College SPSS/(PDP-11) A PDP-11 version of the spss package available through this conversion point. | Overall satisfaction G |
| Users reporting 9 | CIRCLE 351 ON READER CARD |
| SPSS/MeCMaster Univ. SPSS (HP 3000) An HP 3000 version of the original spss package available through this conversion point. | Overall satisfaction |
| Users reporting 5 | CIRCLE 352 ON READER CARD |
| SPSS/Northwestern Univ. SPSS (CDC) A CDC 6000 version of spss available through this conversion site. | Overall satisfaction |
| Users reporting 9 | CIRCLE 353 ON READER CARD |
| SPSS/University of Kansas SPSS (HONEYWELL) Honeywell spss package available through this conversion site. | Overall satisfaction |
| Users reporting 5 | CIRCLE 354 ON READER CARD |
| SPSS/University of Pittsburgh SPSS (DEC-20) DEC's spss version available from this conversion point. | Overall satisfaction |
| Users reporting 6 | CIRCLE 355 ON READER CARD |
| Stockholder Systems, Inc. PEP Paperless entry processing for automatic payment through ACI for IBM 360/370 and Burroughs computers. | Overall satisfaction |
| Users reporting 11 | CIRCLE 356 ON READER CARD |
| Systems Research Inc. SRI/EDIT On-line programming text editor and file maintenance system. | Overall satisfaction |
| Users reporting 11 | CIRCLE 357 ON READER CARD |
| Systems Support Software, Inc. QUIKJOB File management and reporting system for any IBM 360/370. | Overall satisfaction |
| Users reporting 39 | CIRCLE 358 ON READER CARD |
| Systems Unique SCREEN DEVELOPMENT SYSTEM (SDMPS) Screen development and message processing system for Univac 90/30 series. | Overall satisfaction |
| Users reporting 5 | CIRCLE 359 ON READER CARD |
| TCC, Inc. LIFE/70 Life insurance company management information system. | Overall satisfaction |
| Users reporting 8 | CIRCLE 360 ON READER CARD |
| Tektronix, Inc. PLOT-10 Versatile graphics support package. | Overall satisfaction |
| Users reporting 12 | CIRCLE 362 ON READER CARD |
**VCI—Years Ahead of IBM**

**In Production Control Software!**

<table>
<thead>
<tr>
<th>VCI</th>
<th>IBM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Data Base</td>
<td>1. Data Base</td>
</tr>
<tr>
<td>2. Long Range Plans</td>
<td>2. Long Range Plans</td>
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<tr>
<td>5. On-Line Job Tracking</td>
<td>5. On-Line Job Tracking</td>
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<tr>
<td>6. Data Base Constructed From SMF</td>
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<td>7. Actual vs. Plan</td>
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<tr>
<td>8. On-Line JCL Editing</td>
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<td>9. On-Line Documentation</td>
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<tr>
<td>10. Multiple Resources Scheduled</td>
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<td>11. Paging Scheduled</td>
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<td>12. Data Sets Scheduled</td>
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<td>13. Job Mix Optimization</td>
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<td>14. Network Tracking</td>
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<tr>
<td>15. DOS/VSE and Non-IBM Systems</td>
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<tr>
<td>16. Purchase Options</td>
<td></td>
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<tr>
<td>17. Over 300 Users</td>
<td></td>
</tr>
<tr>
<td>18. Simulation</td>
<td></td>
</tr>
</tbody>
</table>

Contact us today for information on VCI Production Control Software that can make your data center more efficient and reduce your costs.

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Vice President  
Value Computing Inc.  
300 VCI Building  
West Marlton Pike  
Cherry Hill, NJ 08002  
Toll-Free (800) 257-8242 in NJ (609) 429-4200

**Value Computing Inc.**  
Software Systems  
For More Efficient Data Centers
### USER RATINGS

<table>
<thead>
<tr>
<th>Software Package</th>
<th>Rating</th>
<th>Overall Satisfaction</th>
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<tr>
<td>Texas Instruments, Inc. DX-10</td>
<td>6</td>
<td>E</td>
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<tr>
<td>Time Share Corp. GIS (GUIDANCE INFORMATION SYSTEM)</td>
<td>9</td>
<td>E</td>
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<tr>
<td>Tomark, Inc. ABEND-AID</td>
<td>13</td>
<td>E</td>
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<tr>
<td>Tower Systems DFST &amp; DFST/VS</td>
<td>24</td>
<td>E</td>
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<tr>
<td>Tosc Int. TOSC-IV</td>
<td>5</td>
<td>E</td>
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<tr>
<td>Turnkey Systems, Inc. TASK/MASTER</td>
<td>20</td>
<td>E</td>
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<tr>
<td>United Computing Systems, Inc. FORESIGHT</td>
<td>7</td>
<td>HM</td>
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<tr>
<td>Universal Software, Inc. ADAS</td>
<td>13</td>
<td>E</td>
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<tr>
<td>DOS/ASAP</td>
<td>23</td>
<td>E</td>
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</tbody>
</table>

### Optional Software Packages

**MAC™ MACRO ASSEMBLER:**
- Compatible with new Intel macro standard.
- Complete guide to macro applications.
- Built-in assembler/diastemmer.
- $75-Diskette and Manual.

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- Built-in assembler/diastemmer.
- $75-Diskette and Manual.

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- Use with CP/M

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| 3720 Longview Drive |
| Atlanta, Georgia 30341 |

If you'd like more information about how O-W-L can make me immediately productive:

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
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<table>
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<tr>
<th>City</th>
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<table>
<thead>
<tr>
<th>Telephone</th>
<th>IBM computer/model</th>
</tr>
</thead>
</table>
Unless you have an unlimited budget... an enormous staff... and a hundred years to finish your project... You need Nichols!

Nichols Project Planning and Control Systems enable project leaders and managers to successfully plan and control their projects. These systems dramatically improve planning efficiency, highlight future loads, and quickly indicate potential problem areas.

VENDOR INDEX

To obtain additional information about the software packages rated in the preceding listing, please contact the vendor directly at the address listed below, or circle the appropriate number on the reader service card.

Allinson-Ross Corp.
P.O. Box 185, Station A
Rexdale, Ontario M9W 5L1
(416) 746-3388

Altergo Software Inc.
Four Fancuil Hall
Boston, MA 02109
(617) 227-5100

Detailed results of the survey described in this article are contained in “User Ratings of Proprietary Software,” a DATAPRO 70 report available for $15 from Datapro Research Corp., 1805 Underwood Blvd., Delran, NJ 08075, (609) 764-0100.

USER RATINGS

<table>
<thead>
<tr>
<th>Software Package</th>
<th>Vendor</th>
<th>Description</th>
<th>Overall Rating</th>
<th>Satisfaction</th>
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<tbody>
<tr>
<td>DATAPRO 70</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>WESTI</td>
<td></td>
<td>Teleprocessing interface system for small to medium DOS/VS mainframes.</td>
<td>Overall rating: 10</td>
<td>Satisfaction: HR</td>
<td>CIRCLE 398 ON READER CARD</td>
</tr>
<tr>
<td>Whitlow Computer Systems SYNCSORT</td>
<td></td>
<td>DOS, DOS/VS, OS, or OS/VS disk and tape sorting program replacement.</td>
<td>Users reporting: 167</td>
<td>Overall satisfaction: HR</td>
<td>CIRCLE 399 ON READER CARD</td>
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</table>

CIRCLE 100 ON READER CARD
So you've got to make sure the computer system you select today will be able to handle your data processing needs tomorrow. The best way to make sure is to make the move to Data General ECLIPSE® Data Systems. They're a family of compatible interactive business systems with a very broad range of advanced features and configurations. In short, there's an ECLIPSE Data System for just about every stage of a company's growth, whether it is for stand alone applications or part of a distributed data processing network.

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CIRCLE 102 ON READER CARD

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American Valuation Consultants, Inc.
2200 East Devon Ave.,
Suite 247
Des Plaines, IL 60018
(312) 297-6100

Applied Data Research, Inc.
Route 206 CN-8
Princeton, NJ 08540
(201) 874-9100

A.R.A.P.
P.O. Box 2229
Princeton, NJ 08540
(609) 452-2950

Argonaut Information Systems, Inc.
383 Grand Ave., Suite 6
Oakland, CA 94610
(415) 444-5954

Aries Information Systems, Inc.
7400 Metro Blvd., Suite 370
Minneapolis, MN 55435
(612) 835-2366

Arthur Anderson & Co.
69 West Washington St.
Chicago, IL 60602
(312) 346-6262

ASK Computer Services, Inc.
730 Distel Dr.

Los Altos, CA 94022
(415) 969-4443

Atlantic Software, Inc.
Lafayette Bldg., Suite 910
Fifth & Chestnut Sts.
Philadelphia, PA 19106
(215) 922-7500

Bancroft Computer Systems, Inc.
715 Trenton St., P.O. Box 1533
West Monroe, LA 71291
(318) 388-2236

Boole & Babbage, Inc.
510 Oakmead Pkwy.
Sunnyvale, CA 94086
(408) 735-9950

Burroughs Corp.
Burroughs Pl.
Detroit, MI 48232
(313) 972-8068

Business EDP Services, Inc.
P.O. Box 5445
Tallahassee, FL 32301
(904) 576-7197

CACI
12011 San Vincente Blvd.
Los Angeles, CA 90049
(213) 476-6511

California Computer Products, Inc. (CalComp)
2411 W. La Palma Ave.
Anaheim, CA 92801
(714) 821-2341

Cambridge Systems Group, Inc.
24275 Elise Ct.
Los Altos, CA 94022
(415) 941-4558

Candle Corp.
4676 Admiralty Way,
Suite 401
Marina Del Rey, CA 90291
(213) 821-9202

Capex Corp.
4125 N. 14th St., S.E.
Grand Rapids, MI 49506
(616) 942-1420

CFS, Inc.
1330 Boylston St., Suite 608
Chestnut Hill, MA 02167
(617) 566-0222

Cincom Systems, Inc.
2300 Montana Ave.
Cincinnati, OH 45211
(513) 662-2300

Computer Associates, Inc.
125 Jericho Turnpike
Jericho, NY 11753
(516) 333-6700

Computer Concepts
6443 S.W. Beaverton Hwy.
Portland, OR 97221
(503) 297-4741

The Computer Software Co.
6517 Everglades Dr.
Richmond, VA 23225
(804) 276-9200

Comserv Corporation
3050 Metro Dr., Suite 211
Minneapolis, MN 55420
(612) 854-2020

Cullinan Corp.
20 Williams St.
Wellesley, MA 02181
(617) 237-6600

Cyborg Systems, Inc.
2 N. Riverside Plaza,
Suite 2225
Chicago, IL 60606
(312) 454-1865

Data Design Associates, Inc.
1333 Lawrence Exwy.,
Suite 418
Santa Clara, CA 95051
(408) 985-2570

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Route 9
Southboro, MA 01772
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Able, the computer experts

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**TERMINALS FROM TRANSNET**

**PURCHASE FULL OWNERSHIP AND LEASE PLANS**

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>PURCHASE PRICE</th>
<th>12 MOS.</th>
<th>24 MOS.</th>
<th>36 MOS.</th>
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<tr>
<td>LA36 DECwriter II</td>
<td>$1,595</td>
<td>$153</td>
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<td>$57</td>
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<tr>
<td>LA34 DECwriter IV</td>
<td>$1,295</td>
<td>$124</td>
<td>$69</td>
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<tr>
<td>LA120 DECwriter III KSR</td>
<td>$2,295</td>
<td>$220</td>
<td>$122</td>
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<tr>
<td>VT100 CRT DECscope</td>
<td>$1,895</td>
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<td>VT132 CRT DECscope</td>
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<td>DAT80/1 DATAMEDIA CRT</td>
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<td>TI745 Portable Terminal</td>
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<td>$268</td>
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<tr>
<td>TI810 RC Printer</td>
<td>$1,895</td>
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<tr>
<td>TI820 KSR Printer</td>
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<td>TI825 KSR Printer</td>
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<td>ADM3A CRT Terminal</td>
<td>$875</td>
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<td>QUME Letter Quality KSR</td>
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<tr>
<td>QUME Letter Quality LD</td>
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<td>DataProducts 2320 Printer</td>
<td>$7,900</td>
<td>$757</td>
<td>$421</td>
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<tr>
<td>DATAMATE Mini Floppy</td>
<td>$1,750</td>
<td>$168</td>
<td>$93</td>
<td>$63</td>
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</table>

**FULL OWNERSHIP AFTER 12 OR 24 MONTHS**

10% **PURCHASE OPTION AFTER 36 MONTHS**

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Tel: (401) 333-6200
TWX: 710 384-1911
Export: EMEC, 2350 S. 30th Ave., Hallandale, Florida 33009
A few lines on increasing the productivity of your computer.

You'd find it hard to be productive, too, if you were right in the middle of manipulating important data, and you suddenly received a request for information you hadn't thought about for nanoseconds.

Yet, your very expensive, highly advanced CPU has to put up with interruptions like that all day long.

If your company had a Kodak IMT-150 microimage terminal, however, your computer could spend much more of its valuable time manipulating data. And a lot less time searching for it.

That's because the IMT-150 terminal has its own intelligence—a built-in microprocessor that enables it to perform on-line lookups in seconds. At the touch of a button. Without tying up your mainframe.

The IMT-150 terminal helps your people be more productive, too. They can find needed data quicker and easier, resulting in more lookups per hour/day.

And because source information stored in superdense microimages can be linked to complementary indexes in your on-line data base, you can reduce the cost of keeping non-dynamic information in a dynamic state.

The choice, then, is a simple one.
You can increase the productivity of your computer by buying more expensive and sophisticated data-storage equipment, in order to handle growing information demands.

Or you can buy a Kodak IMT-150 microimage terminal.

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## VENDOR INDEX

<table>
<thead>
<tr>
<th>Vendor Name</th>
<th>Address</th>
<th>Phone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management Science America, Inc. (MSA)</td>
<td>3445 Peachtree Road, N.E., Suite 1300, Atlanta, GA 30326</td>
<td>(404) 262-2376</td>
</tr>
<tr>
<td>Mathematica Products Group, Inc.</td>
<td>P.O. Box 2392, Princeton, NJ 08540</td>
<td>(609) 799-2600</td>
</tr>
<tr>
<td>McCormack &amp; Dodge Corp.</td>
<td>560 Hillside Ave., Needham Heights, MA 02194</td>
<td>(617) 449-4012</td>
</tr>
<tr>
<td>Microsoft</td>
<td>10800 N.E. Eighth, Suite 819, Bellevue, WA 98004</td>
<td>(206) 455-8080</td>
</tr>
<tr>
<td>MRI Systems Corp.</td>
<td>P.O. Box 9968, Austin, TX 78766</td>
<td>(512) 258-5171</td>
</tr>
<tr>
<td>Optipro, Inc.</td>
<td>Box 10, Stock Exchange Tower, Montreal, Quebec H4Z 1A4</td>
<td>(514) 866-5841</td>
</tr>
<tr>
<td>Oregon Minicomputer Software, Inc.</td>
<td>2340 SW Canyon Rd., Portland, OR 97201</td>
<td>(503) 226-7760</td>
</tr>
<tr>
<td>Oxford Software Corp.</td>
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Critical systems can be processed during crises without a duplicate dp configuration.

**VM: A BASIC INGREDIENT IN EMERGENCY PLANNING**

by Matthew Murphy

Much of the logistical nightmare associated with contingency planning can be alleviated by incorporating the virtual machine (VM) as a basic ingredient in a backup plan. With VM it is possible to assure processing of critical systems in emergency situations without a duplicate configuration.

Contingency planning has become more important in light of the numerous crises that could interfere with operations of a data center. Not only are we exposed to fire, floods, and vandalism, but a new list of energy-related disasters appears on the horizon. We are now forced to deal with fuel shortages of both oil and natural gas. Electrical brownouts and blackouts could occur if electrical production is dependent on fossil fuels. Another danger not given much consideration before now is the prospect of forced or voluntary evacuations of data centers in the vicinity of nuclear plants.

The majority of the host control programs now in use are dependent on an explicit hardware configuration. The difficulty experienced by the dp community in finding any configuration, much less a number of candidates, closely resembling the one for which their host control program was generated defeats many a contingency plan before it gets off the ground. Also, most major host control systems (MVS, VSI, DOS/VS, etc.) are intrinsically connected to real peripheral devices (hardwired addresses and device characteristics). This severely limits the number of places to take one's production applications in case of an emergency. It also increases the workload associated with rebuilding a data center.

The limitations that hardware and software requirements placed on contingency planning in the past can be overcome by the implementation of a VM system. With respect to software, all of the following host system programs can run under control of VM: DOS, OS/MFT, OS/MVT, DOS/VS, OS/VS2, S/VS, MVS, and a lower level VM system itself.

VM has been with us for many years now, and has had significant success in the area of testing new applications and new systems. It is widely used in the educational community because of its versatility.

VM as a host control program has been with us for many years now, and has had significant success in the area of testing new applications and new systems. It is widely used in the educational community because of its versatility.

VM is the versatility and flexibility of this host control program that has led us to take a good look at it within the context of contingency planning.

Our data center supports a critical IMS batch application with a 3MB working set. Our host control program is MVS release 3.7H and version of IMS we now use is release 1.1.4. We have an IBM 370/158 model I with 3MB of storage, 3350 and 3330-1 disks, and 3420 tape drives with the dual density feature giving us 1600 and 6400 bpi. We were able to run a text version of this configuration and the IMS application at a separate data center with the following configuration: an IBM 370/148 model I with 2MB of storage, 3330 model IIs, and 3420 tape drives similar to ours.

The two sites were obviously quite dissimilar with regard to physical characteristics; in fact, the addressing schemes were also quite different. In spite of this, we were able to bring up our MVS system and run our critical batch IMS application under VM on the backup 370/148 within an acceptable set of performance criteria and with a minimal amount of effort. The success of this test run should show that this critical application system can be processed under VM in a myriad of data centers nationwide.
Using VM, emergency applications can run concurrently with the regular programs of the backup site.

SMILE—IT'S A FREE PROGRAM

There is another aspect of this approach that should really make you smile. VM is available in most cases as a free host control program. There is, however, some cost involved in training your staff to use VM. This is an important factor, because the more familiar staff members are with VM and its abilities, the easier it is for them to implement a VM system and integrate it with your contingency plan.

Our installation happened to have two individuals trained in VM who had previously worked in environments where VM was the production system. Having moved our data center from New York City to Roanoke, Va., and also having converted from SVS to MVS, we had to revamp our contingency plan operations. In New York we had relied on a considerable number of data centers where we could process critical applications in cases of emergency, but in Roanoke we were much more restricted in the number of backup sites available. The concept of using VM as an integral part of our contingency plan was thus born out of necessity.

One of the major drawbacks of using a production environment in another data center as a backup site is having to wait for time to be available. Using VM is a big improvement since the programs of the backup site and of the corporation that needs emergency processing can run concurrently, thus minimizing the impact on the data center. Different machines will perform with different degrees of efficiency, depending generally on the amount of storage attached. For planning purposes, the memory size presents no configuration problems but is directly related to the performance levels achieved. Only the following device dependencies must be considered when migrating an operational host system to VM:

The off-site location requires only a tape or disk with characteristics similar to the present system. The nice thing about this is that only one device with these characteristics is required. This is basically the only requirement for backing up a batch operation (or an on-line application for which you are able to process the critical portion in batch mode). Those configurations for which on-line applications are necessary require a considerable amount of further planning; however, VM could still be feasible in many instances.

The benefits of VM can best be seen by what the migration does not require.

A host control program is typically generated for a specific set of addresses for disk and tape devices. The system generation is also specifically linked to those device characteristics. The hardwired address and characteristics after a system generation thus become a requirement for the initial program load of that particular host control program. Running under VM, however, this requirement no longer exists. Hardwired addresses and channels can be logically changed by VM to the requirements of the pseudo-host system. If a bank of 3350s are defined to the pseudo-host as addresses 250 through 25F, they can be any set of real addresses when that pseudo-host control program is run under the control of VM. VM can "ATTACH" (a VM command) a real device, such as hardwired "480," to that pseudo-host system. At the same time, VM can ATTACH real device "620" as device 251.

Even disks with unlike characteristics are easily handled—3330-Is can be restored to 3330-IIs (this wastes space, but is operational). As far as hardware is concerned, converting 3350 devices from or to emulation mode is a minor five-minute change. The logical configuration necessary for the mode desired can then be handled by the VM system.

Console configurations can also be logically changed to allow any consoles that are pseudo-host system defined (and some that are not) to become the primary console.

Even tape devices present no problem to the VM system with respect to their hardwired channel and device addresses. Again, the logical addressing scheme is the one of importance to the person seeking a backup site, and VM can logically change the hardwired channel and device addresses to the addresses required by a particular generated host control program. Once again, the ATTACH command can be used to reconfigure real addresses to those that were defined to the pseudo-host system.

Unit record devices can also be logically reflected by VM to be those that were defined to the pseudo-host system. Actually, real devices need not exist. VM can define virtual unit record devices, and this flexibility extends to the point that you can choose a third site for printing or punching cards if that is necessary. In fact, you may hold the output of particular jobs that were processed pending the
Software Aids? You’ve heard it all before. Increased programmer productivity, faster response to user needs, greater flexibility, money saving... all real benefits, and all sometimes rather hard to believe.

So when a Filetab user* says it all again we tend not to get too excited.

* Ronald Walthew GKN

"People ask for urgent, one-off, fairly detailed reports. Filetab gives us the resources to produce them."

But that doesn't happen very often..?

"Over 700 times a year. That's 14 programs a week written with FILETAB."

Well they must be fairly trivial...

"Using FILETAB, yes. They average about half a day of effort each. But if we had to write them in COBOL, that would be a different story—we just wouldn't be able to cope."

Sounds like you're creating work...

"No, we're satisfying a need. Mind you, that was standard FILETAB. We've started using FILETAB LEVEL 6 now and the first job we did with it was develop and implement an on-line Work in Progress system."

With FILETAB? What's wrong with COBOL?

"Our best estimate for implementation using COBOL was two years, but the system was wanted in nine months. Using FILETAB we achieved that—a total of 39 FILETAB modules (say 12,000 lines of source) in 45 weeks. I would think that it's the equivalent of 40,000 lines of COBOL—so you can work out the implications of that for yourself."

OK. It gives you fast development, but you must be paying some run-time penalties.

"Well, we run between 5000 and 8000 programs every week and haven't noticed any drop in efficiency. Remember that FILETAB handles jobs much more economically. And if you look at efficiency in terms of jobs not individual programs, you won't find significant differences between FILETAB and, for example, COBOL."

Expensive, was it?

"FILETAB paid for itself the very first time we used it. And has repaid the initial investment a thousand times since."

FILETAB— that may be one man's view but it's backed by the practical experience of 800 other FILETAB users.
VM provides possibly the best security features of any host control program.

arrival of a suitable unit record device for your particular requirements.

Even teleprocessing devices are reconfigurable with regard to channel and device addressing. Additionally, device emulation readily lends itself to substitution in this category.

Thus these restrictions are lessened considerably if not eliminated by the flexibility of VM.

**PERFORMANCE**

You might be asking yourself now, "If VM is so great, why isn't it used more often?"

The answer is, in a word, performance.

All the logical configuration and address changing involves a considerable amount of overhead. VM intercepts channel programs and translates them into that which has been configured as the logical set of addresses. In a production environment, this overhead would be intolerable, but the performance necessary to support a production and development environment is not necessarily the performance needed in an emergency situation, where the continuation of critical processes is at issue.

Most contingency plans are concerned with providing an ability to run only critical application systems while a new fully equipped data center is built. This implies that the overall throughput requirement would be considerably lessened in times of emergency, suggesting that the performance degradation experienced with VM is tolerable. Also, the typical data center runs 35% to 50% of its time in support of development work, giving considerable room for performance degradation in times of emergency. Convenience reports or management tools can be held in abeyance to further decrease the amount of absolutely necessary work.

In most cases no problem exists in converting from a smaller cpu to a larger one, or in going to a cpu with larger memory. In these cases performance might not even suffer. The problem arises in changes to a smaller cpu, to a less efficient model, to one with a smaller memory, or any combination of these. Even in these cases, however, the difficulties should be no more severe than the lessening of throughput. Given an emergency situation and given the options available using VM, only very large systems would have a limited number of candidates for temporary emergency replacement.

The average dp user will thus find a large number of candidates for an off-site or backup facility. The small dp center will also find a considerable number of candidates for backing up his operation, and the large user will find a number of candidates he never expected, including machines with smaller cpu's.

Once your level of expertise in using VM increases you can use VM in the mode for which it was primarily designed. VM was designed to enable users to test new applications and new systems without the impact they currently have on a single host control program shop. Testing a new version of your host control program usually requires standalone time within the data center. Using VM one can run a test version and production version concurrently. Performance considerations are necessary, of course, but you might find that the benefits of this type of operation far outweigh the performance degradation encountered.

Those organizations providing backup facilities for contingency planning purposes that themselves do not have a production environment may find this concept quite interesting. One of the reasons companies hesitate before enlisting the services of a contingency planning firm is the fear that in case of disaster they would find themselves in competition with another organization. This problem can be alleviated to a great extent by using VM because the programs of two or more companies can run simultaneously.

VM also provides possibly the best security features of any host control program in existence. Each system or user defined to VM and all its data files can be isolated from any other user with a minimum of effort and with considerable integrity.

Maintenance of a VM-based contingency plan is also considerably lessened by virtue of the fact that VM looks at a particular data center in a logical manner. Such changes as additional storage, new disks, or different versions of your operating system are easily handled by VM by simply introducing parameters indicating the changes made.

VM allows the maximum use of the resources at hand. A degree of flexibility heretofore missing from most contingency plans is provided because specific address schemes and specific device characteristics are no longer necessary. This is perhaps the logistical breakthrough necessary to the development of a workable contingency plan. The VM contingency plan should provide hope for those plans that are collecting dust because they have outlived their usefulness and cannot be easily updated, and may be good news to those shops where no contingency plans exist.

**MATTHEW MURPHY**

Mr. Murphy is manager of systems support at The Atlantic Companies, and was previously employed as a program support representative with IBM. He is a graduate of St. John's University with a BS in business. He is not the progenitor of Murphy's Law.

"Rogers, I like your conceptualization, your initialization, your prioritization, and your implementation, but you, I can't stand!"
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We understand how frustrating it can be to try and please all the people all the time. Trying to put in capabilities we think they need, and having to leave out something else. So we got crafty. And gave both our terminals user-programmable behavior modification.

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Who knows? They could even come up with suggestions you never considered.

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And then you'll see why your search for the right smart terminal just ended.
The pressure for constantly increasing utilization of data center resources, both people and equipment, results in conflicting demands on their time. For auditors and financial executives operating in this environment there is now a system to resolve these conflicts. It's called PANAUDIT, the new systems approach to computer auditing.

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GRASSROOTS, MICROS, AND PAPAL VISITS

by Sarah Rolph

When Pope John Paul II decided to include Des Moines on his U.S. tour, the Des Moines diocese was thrilled with the honor, but the possibility of crowds far outnumbering the population of the town was disturbing.

The Living History Farms, a museum and demonstration farm, was chosen as the site for the papal mass. The huge flat open area of the farms was made into a natural amphitheater, and the picturesque home of the state cornhusking championship was a perfect symbolic setting for what was officially known as "A visit to the people of rural America."

The house of Bishop Dingman, head of the Des Moines diocese, was the headquarters of logistics planning. Colonel Thompson of the National Guard and his staff operated out of the Bishop's basement, while the foyer, dining room, living room, sitting room, library, and kitchen were abustle with the activities of multitudes of volunteers. Upstairs in the Bishop's chapel, prayer groups were continual.

Outside, press conferences for the hordes of local reporters were held under the oaks on the Bishop's expansive front lawn. Here, too, gifts for the Pope from the people of Des Moines were assembled for inspection by the press and by religious organizers. A ceramic Polish bride doll, seated on a hope chest with the insignia of the Pope's native Krakow, was the official gift from the governor of Iowa.

The diocese presented a rural scene it had commissioned a local artist to paint, featuring an old farmhouse and a country road, with the church spire rising as the central focus of the town in the background, to represent the church as the heart of the community.

Then there were the gifts from other towns and states—samplings of produce, arrays of seed packets, a metal wall sculpture of a windmill. There were personal gifts and letters, and gifts from community groups, such as a photo of the local basketball team, which had been autographed by every member. Donations supplied by the community included a papal chair fashioned from Iowa oak. Medications and standby ambulances for the first aid tent at the Farms were donated by local hospitals. And at the Bishop's, endless meals and snacks were provided to officials and volunteers.

AN APPLE FOR THE BISHOP

Early on, an active member of the church who works for the state of Iowa as a computer operator had a good idea. In contemplating the crush of volunteer work, much of it clerical—receiving and replying to a mountain of requests for official prayer cards, for example—Patty Croat mused, "It's too bad they don't have a computer." She had heard of Apple computers; her boyfriend, a programmer, has one he plays games on. She went down to the local computer store and asked if these little computers could help out. Paul Miller, marketing manager of the store, lent Patty an Apple, a disk drive, and some software—a mail list package and a new DBMS package. A demonstration was set up for the colonel, the Bishop, and various diocese staff.

"It blew my mind," said the Bishop, who had never seen a computer before.

The group was sold at once on the possibilities and began suggesting applications. Some were impossible, such as keeping track of donations—such a hefty volume of money was expected that a timesharing service was enlisted. Some good potential applications were never arranged—it would have been very helpful to coordinate housing offers, for example, but the idea of using the Apple system to find guests for hospitable community members didn't arise in time.

There were aspects, though, for which the use of the Apple proved invaluable. Transportation and parking arrangements were made much easier—an estimated 36 miles of parking was reserved along local roads for buses, and these checkpoints were coordinated with shuttles and communicated to travelers. A bus crisis arose in and around Iowa, as church groups, many of them from places as far away as St. Louis and Minneapolis, reserved an estimated 900 buses.

The naiveté of the volunteer users was probably a blessing. Certain that the volunteers would be able to handle the project, Ms. Croat began looking for enough equipment to pull the job off. Miller sells Apple micros as well as the Apple. His first impulse was to suggest the Alpha, for it handles larger amounts of information at a time, but the Apple was chosen because of the need to use only volunteer labor and to start at once with as little training as possible (about 20 minutes per person).

Finding the equipment threatened to be a problem. A few people had Apples and were willing to lend them, but data base to be generated—probably the largest amount of information ever processed with Apple machines—would require about a dozen machines. Miller first thought of borrowing some of the machines he had sold to schools, but abandoned that idea when the Iowa Civil Liberties Union filed a lawsuit against the county and the school system for considering the papal visit a holiday (the school suit was dropped, and the county won the right to let workers off; many businesses declared unofficial holidays as well). Miller's store has no stock to speak of, since most Apple dealers rely on one of five regional distributors. Apple headquarters was contacted, but apparently receives many such requests and couldn't help out. Ms. Croat also contacted Radio Shack, and was flatly refused. Her contact claimed their machines would not handle the application.
In the Bishop's living room were long rows of Apples on tables and 15 printers hammering away.

**WORK OF THE HOLY SPIRIT**

In her confusion and distress, recounts Patty, she went home to pray, and emerged that afternoon with the conviction that Paul Miller would be their guide to a successful project. When Miller called her back the next morning with the happy news that 10 Apples and a number of disk drives were on their way to the Bishop's house, Ms. Croat relates, "I knew it had to be the work of the Holy Spirit."

Data entry had already begun on the Apple loaned by George Catanzano, who is one of the few Apple owners in Des Moines with a dual disk drive. George, an enthusiastic Apple user who said he missed the machine while it was at the Bishop's, was one of the programmers who donated countless hours to get the application up and running. No custom programs were written, but the software packages required some modification and some explanation. Three or four programmers were available, as were Miller and a couple of his staffers.

When the Apples arrived, followed by 15 printers loaned by Centronics, the Bishop's living room was almost entirely filled up with equipment. The Apples in long rows on tables and the printers hammering away were an impressive sight. The diskettes on which the valuable programs and data were stored, however, fit conveniently into an ordinary shoe box.

For the next month, the volunteers were kept busy with the logistics support operation. Mailing labels were generated for the plethora of press releases—about 800 a day were mailed—and prayer cards. Keeping track of church members and religious leaders was another application. This information would be used for the post-visit evaluation to be sent to the Vatican.

Another major use of the system was keeping track of press credentials issued, including gathering information for the FBI and Secret Service clearance required for each pass. About 1,300 passes were issued, causing a problem when an alphabetical listing of press passes was needed. A diskette only holds 999 names—at least that was the belief. A programmer from Iowa State spent 12 hours rewriting the program, squashing all the names on one disk so the list could be sorted alphabetically.

While the Holy Spirit may be to thank for the success of the project, the actual distribution was handled by the distributor, High Technology. High Tech, an Oklahoma City company with a main office in St. Louis, was founded by Charles Weddington as a retail computing store in November 1976. In April 1977, the Apple II was unveiled at the First West Coast Computer Faire. Weddington was there, was excited by the product, and arranged to meet Mike Markkula, chairman of Apple.

Weddington was pleased to find that Apple's market plan included a two-step distribution scheme. "It was the classic circumstance," says Weddington, "of being in the right place at the right time." High Tech became Apple's first distributor, and, as far as Weddington knows, "the first company in the world chartered to create a retail dealer network and distribute microcomputers."

The same month High Tech's contract was executed, June 1977, Team Electronics, a nationwide retail chain headquartered in Minneapolis, began selling the Apple with its inventory of home electronics. Team has about as many stores as High Tech has now (close to 200), but High Tech reached that mark by mushrooming almost 500% last year, and expects a 400% growth rate in the year to come.

**EXPLORING OTHER CHANNELS**

While Apple boasts of its distribution-dealer network as the best possible way to provide users with a solution, a number of other distribution channels are being explored. The recent venture with Bell & Howell, wherein a slightly modified Apple is marketed by Bell & Howell strictly to the education market, offers the opportunity to strengthen that stronghold while relieving Apple of the burden of that market segment. Bell & Howell is in a better position than Apple to reach education clients because it has the contacts—"it already sells to schools. B&H is also equipped to deal with the economic workings of educational institutions, which include a bidding system and a three-to-six-month payment delay.

Another new distribution channel for Apple is the "high end" audio dealer. Apple has reportedly been recruiting hi-fi salespeople as Apple dealers in the hope that these sophisticated stores will provide the service Apple knows is essential. As Wil Houde, Apple's director of service operations, points out, when an Apple owner has a problem with a machine he gets truly irate because the personal computer is bought with personal money.

The availability of good software is changing the marketing of small computers. Until recently, software acquisition has been entirely at the discretion of Apple's distributors—some produce it, some seek it out from other sources, and some offer none at all. As more formal distribution channels develop, the nature of the microcomputer salesmen is changing—the market has begun to attract the professional businessperson as micro dealer. Whether this situation will compare to the ranks of dedicated computer dealers who were once hobbyists and who have grown up with the industry, and whether Apple will be able to keep its dealers primed to answer questions about software and applications remain to be seen.

Apple is clearly keeping its eggs in more than one basket—and looking for a big new basket. Markkula explains that Apple's original market plan divided the market into segments to be approached in conjunction with the estimated timing of the marketplace. The hobbyist market fueled the development of the education market through the evolution of software, and the hobby and education segments have given Apple the leverage to launch a similar effort into small business applications. This may well mean a new method of distribution, a route Markkula admits Apple is considering.

The grassroots distribution-dealer network from which Apple has profited is a product of the enthusiasm inherent in the short history of microcomputing. That enthusiasm is now in the hands of a new group of users. While hobbyists paved the way, the success of the papal visit logistics support group in using an unfamiliar technology suggests that the microcomputer has come of age.
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Small Business Systems Surveyed

Microdata Reality Gets Top User Rating

Microdata Corp.'s Reality, Basic/Four Corp.'s Model 400 and the IBM System/3 models 6, 10 and 15 reaped the highest marks in Management Information Corp.'s (MIC) fourth annual small business systems users survey.

To assess how well small business systems are meeting users' needs, MIC polled 568 companies that use 689 small business CPU's. Each respondent was asked to subjectively rate the vendors and their products on performance (whether stated equipment specifications have been realized), reliability (uptime vs. downtime), ease of use (amount of time necessary to train new personnel), service (maintenance) and vendor support (such as advance training and program assistance).

A four-point rating scheme was used (1 = poor, 2 = fair, 3 = good, 4 = excellent). The survey results were given as averages of the ratings assigned to each product in each of the five categories.

The Microdata Reality, Basic/Four 400 and System/3 Model 10 and Model 15 were the only small business systems to receive ratings of 3.0 or higher in all five categories. Taking the average of all five categories, the Microdata Reality topped the field with a score of 3.66 (based on 27 respondents using 55 units). The Reality earned 3.8 in performance, 3.8 in reliability, 4.0 in ease of use, 3.4 in service and 3.3 in support.

Based on nine respondents with nine units, the average for the IBM System/3 Model 15 was 3.6. This system was rated 3.6, 3.8, 3.6, 3.7 and 3.3 in performance, reliability, ease of use, service and support, respectively.

Eight users with 17 Basic/Four 400's gave that system an overall rating of 3.5. In performance, reliability, ease of use, service and support, the system was rated 3.5, 3.4, 3.8, 3.4 and 3.4.

Following this order, the IBM System/3 Model 10 was rated 3.3, 3.5, 3.3, 3.3, and 3.3, respectively, by 34 users with 45 units. The System/3 Model 6 received 3.4, 3.7, 3.7 and 3.1 ratings in performance, reliability, service and support, respectively, by eight users with eight units.

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180 DATAMATION CIRCLE 117 ON READER CARD
Traditionally, a company determines when its computer resources are saturated by the same mechanism some people use to tell when they're drunk—it's when no more fits in and normal functioning collapses. As a way out of this process, dp managers are increasingly turning to capacity planning.

Most dp managers would like to avoid either the underutilization of an expensive resource or the inability to process work due to insufficient capacity. Because of the variety of cpu speeds, memory sizes, number of channels, and types of i/o devices, it is difficult to make comparisons. I faced this problem for nearly two years at Midlantic Bank, West Orange, N.J. As a consequence of our capacity planning study, which I will describe, we upgraded our 370/145/158 to a 158/3031. Performance measurement took place on a Tesdata hardware monitor, a software monitor (vs1/pt), and three accounting packages: Johnson Accounting, Grasp, and Usage.

Performance Measurement. Accurate measurement antecedes any attempt at planning. Unless one can track where one is, planning is impossible. The obvious question, "How full is the computer?" requires further refinement before a meaningful answer emerges.

At the time we began our research, cpu's cost about $1 million, memory cost about $100K a megabyte, and channels cost about $10K. Other components, such as disks, tapes, and printers were spread out in the low end of the price spectrum. (Today's prices are generally lower, but the basic approach is still valid.) Note that at the early stage of analysis, the method of payment—lease vs. purchase—is not particularly relevant. Viewing gross capacity, a new cpu would cost about a megabuck; another channel would cost about 1% of that figure.

Two general principles emerged from the economics. First, any non-cpu alternative (if it were able to handle the workload) would almost certainly be more cost-effective because of the order of magnitude of cpu prices. Secondly, the cpu analysis was so sensitive to price con-
We discovered that no single factor would solve all our economic problems.

<table>
<thead>
<tr>
<th>HARDWARE MONITOR</th>
<th>SOFTWARE MONITOR</th>
<th>ACCOUNTING PACKAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All measured events can be obtained in an unbiased manner</td>
<td>Can pinpoint events to program (region) causing the event</td>
<td>Permits an overview of demand and supply</td>
</tr>
<tr>
<td>Can measure across cpu’s</td>
<td>Can measure queues of events waiting to occur</td>
<td>Provides analysis tools at program and system levels in a “data-reduced” format</td>
</tr>
<tr>
<td>Is independent of operating systems</td>
<td>Provides quick feedback useful for system tuning</td>
<td>Provides several useful reports</td>
</tr>
<tr>
<td>Most vendors provide several useful reports</td>
<td>Low cost or sometimes even free</td>
<td></td>
</tr>
<tr>
<td>CON</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Can't determine which programs are causing events</td>
<td>Is operating system dependent</td>
<td>Can't provide short-interval measurement</td>
</tr>
<tr>
<td>Can't measure queue lengths</td>
<td>Can't bridge cpu’s to determine contention for resources</td>
<td>Provides performance data only in gross aggregates, i.e., cpu- or i/o-bound</td>
</tr>
<tr>
<td>Reasonably expensive to install and train in use and operation</td>
<td>Reporting information is usually weak, requiring considerable time in data reduction and analysis</td>
<td>Requires custom programming on smf data to go beyond package offering</td>
</tr>
<tr>
<td>External cabling and attachments limit flexibility</td>
<td>Can't measure itself or above, causing some information loss</td>
<td>Takes cpu and other system resources (to 5%)</td>
</tr>
<tr>
<td></td>
<td>Takes cpu and other system resources (to 5%)</td>
<td></td>
</tr>
</tbody>
</table>

Table 1.

siderations that it took nearly 90% of our analysis time.

We had on hand or were able to obtain several measurement tools to analyze the basic performance variables. Table 1 identifies the strengths and weaknesses of each one. Each tool helped us to reach an understanding of our operating environment.

Accounting packages fleshed out the picture by showing the ebb and flow of demand across shifts, weeks, and months. In our banking environment, work peaks third shift, by day of week, and at quarter and year-end. Viewing this long-range flow of data, we were able to do some scheduling changes that dampened the peaks somewhat. The basic objective, however, was to get a picture of how performance varied day to day and hour by hour. A rhythm of data flow emerged that could not be flattened further without disrupting the basic mission of the enterprise—that of serving customers by providing needed data in time for the bank to open for business each day.

We quickly found average statistics to be meaningless. Statistics over our busiest eight-hour period were discovered to be the most useful figures to examine. The time period was long enough to net out instantaneous spikes of demand, yet still short enough for us to deliver needed service in that interval. In the banking environment, we are fortunate to have our severest peaks when customers are not physically present waiting for data.

NO SINGLE SOLUTION

We discovered that no single factor would solve all our economic problems.

The cpu power was the constraining variable on the third shift, while main memory was the constraint on the first shift. As a by-product of our measurement activity, we found that a memory increment, with workload rescheduling, deferred an additional cpu requirement for over a year, at about one-tenth the cost of the cpu. Savings of this magnitude, though temporary, were made possible by the measurement process.

One of the initially depressing situations facing the neophyte performance analyzer is the nearly infinite set of events one might measure. We found the key ones to be cpu busy, channel busy, virtual paging, and terminal wait time.

There are too many secondary events to mention them all. However, some are favorable, such as cpu channel overlap; others, such as individual device loading, can help isolate problems inside specific programs. Focusing on the key variables, though, is most helpful to answering the question of how full the computer resource really is.

A significant fact we learned from the measurement process was that 100% utilization was not generally obtainable. Rules of thumb showed that channels clogged at 35% utilization, cpu’s bogged down at 85%, and paging at over 10 frames per second meant generally poor service to interactive users. Further, we found we could no more smooth out workflow than tunnel operators could get commuters to travel only at non-rush hours. The cpu-bound and I/O-bound programs refused to come together in ideal proportions to keep our mix in perfect harmony over extended periods.

This led us away from feeding the computer and back to focusing on optimum service levels to keep our customers reasonably satisfied at moderate costs. With adequate measurements over our environment every 10 seconds, hour, shift, day, month, and longer, we were finally qualified to do adequate planning.

As to what measurement tools you should have, we discovered: as many as you can afford, proportional to potential...
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CIRCLE 118 ON READER CARD
Facing the neophyte performance analyzer is a nearly infinite set of events one might measure.

**CAPACITY MANAGEMENT OVERVIEW**

Data collection & analysis → Management review & control → Planning

- **Workload Components**
  - Scheduling Function
- **Billing & EDP Cost Accounting System**
  - Data Base
- **Data Reduction & Analysis**
- **Workload & Configuration System**
  - Workload: Usage, Trend, Characterization System
- **Performance Control System**
  - Performance & Capacity Usage Improvement Activities
  - On Plan (No Action)

**COMPARISON OF ACTUALS TO PLANNED**

- **Formal Capacity Usage Plan**
- **Formal Performance Plan**

**Management Policies & Decisions**

- New Application Forecasts
- User Forecasts
- Trend Data

**Equipment Planning & Configuration Design Function**

- **Formal Equipment & Configuration Plans**
- **Configuration**
- **Cost**
  - **Rial Setting Function**
  - **Standard Capacity Usage Rates**
  - **Standard Rates**

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**Fig. 1.**

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**POLL THE EXPERTS**

Planning is a business problem, not a computer problem. From the author's experience, the best way to forecast the future is to poll the experts to get their assessment of what's going to happen. In our case, a bank has basic lines of business, each with a different expected rate of growth. This can be affected by new lines of business, acquisitions, divestitures, demographics, and recessions. Forecasting is aided somewhat by netting out where some systems may grow faster than projected. However, it must be stressed that basic business growth is not a computer problem; this input must come from outside the technical realm.

An overview of the planning process is provided in Fig. 1. This procedure, which integrates data collection and analysis, planning, and management review and control was developed by the Institute of Software Engineering. Forces act on the dashed box in the center of the chart. Activity central to capacity issues pops out at the bottom—performance and capacity improvement.

A numerical example may be helpful to illustrate the process in a simplified way. Your present computer is 80% full in some variable—say, cpu power. You expect to grow at 20% per year for the next five years. In years two through six, utilization of capacity will be 96, 115, 138, 166, and 199%, respectively. In short, it will double. Should you replicate your present computer next year, just doubling total power, and be underutilized in years three through five? Unfortunately, there's no simple answer. It's probably not possible to extend cpu power in 20% increments either. Perhaps adding 50% more computing power in year two and again in year five may be the best approach. For example, let us assume the present computer is a 370/148 with a relative performance index of 24. A doubling of power could be achieved, of course, by another 370/148; on the other hand, replacing the present machine with an IBM 3301 would achieve about the same total savings. Any are better than none. If a glaring lack in your measurement arsenal shows up, make an economic case for it.

**CAPACITY planning.** As vital as measurement tools are, they share a common fault: they can only measure what's presented. Predictions of the future can only come from people.

A vital aspect of planning is the service level. We felt it was not cost-effective to expect to provide service regardless of the demand that might arise. A target of the 95th percentile was found to be far less costly; it meant, however, that not all the deadlines would be met all the time. If problems were encountered on super-heavy days and periods, some scheduled work would, of necessity, be delayed. We estimated that we might be late with some work five to 10 days a year. This decision is tied to the firm's service level demand, competition, and so forth. However, it should be pointed out that service level decisions are central to the capacity decision. Measurement only makes sense against a background of what is expected.
NASA shuttles information with TI's 810.

NASA required a printer that was both fast and reliable to handle the heavy workload in their Logistics Management System for inventory control. And they were right on target when they selected TI's OMNI 800* Model 810 Receive-Only Printer. For over a year the field-proven 810 has been working virtually nonstop as an inventory tracking station, printing out information at a speedy 150 characters-per-second.

The 810 RO prints out the status and location of over 470,000 parts and supplies for all Orbiter and Orbiter ground-support components for NASA's space shuttle program. Using TI's 150-million character-life impact printhead, the 810 RO also prints transaction reports, local stock movements, purchase requests, forecast requirements and approved parts lists.

And the 810 RO is proving itself in NASA's simulator capsule used for designing the space shuttle. The 810 RO prints out data on the simulator's specification, design and testing results. It gives NASA scientists and engineers the fast, easy-to-read information they need to design and refine the space shuttle interior.

The 810 RO has also had quite an impact on NASA's accounting operations. Its wide, adjustable carriage easily handles a variety of multi-copy forms for accounting, travel authorizations, balances and fund source reports.

Versatile, reliable and speedy, the 810 has landed assignments in other industries outside aeronautics. Airline, newspaper and real estate industries are using the 810 RO Printer in projects of their own where quick, dependable printing is required.

TI is dedicated to producing quality, innovative products like the OMNI 800 Model 810 Receive-Only Printer. And TI's over 200,000 data terminals shipped worldwide are backed by the technology and reliability that comes from over 30 years of experience in the electronics industry.

Supporting TI's data terminals is the technical expertise of our worldwide organization of factory-trained sales and service representatives. And TI-CARE†, our nationwide automated service dispatching and field service management information system. That's why TI has been appointed the official computer and calculator company of the 1980 Olympic Winter Games.

If you would like more information on the OMNI 800 Model 810 Receive-Only Printer, contact the sales office nearest you, or write Texas Instruments Incorporated, P.O. Box 1444, M/S 7784, Houston, Texas 77001, or phone (713) 937-2016.

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We put computing within everyone's reach.

CIRCLE 185 ON READER CARD
The goal of capacity planning is to manage computer power to avoid waste, yet remain flexible and progressive.

power (an index of 54 versus 48 for the dual 148s). It would do the job with some slack in years two through five.

An incremental procedure would be to either add a 4331 (an index of 11) to the 148, or replace the existing 148 by a 4351 (index of 37). Both these solutions offer approximately 50% more power.

The alternatives could be selected in year two, with the understanding that another 50% jump would be needed in year five or six. The incremental approach would keep total power closer in line with total demand, but would, of course, require computer room changes more frequently.

If the incremental approach is selected, the adding versus replacing has its pros and cons also. An additional computer, the 4331, gives more backup. The replacement approach would probably be cheaper to operate, since it might offer economies of scale and require fewer operators.

The capacity issue quickly brings in additional considerations such as back-up and operational efficiency. Also, the entire picture becomes too diverse and company-related to cover these considerations here.

**BENCHMARKING** One area of common interest, though, is that of benchmarking. We found that as we became more adroit at performance measurement, benchmarking was unnecessary. Predicted rates of speed could be forecast on different configurations to within minutes for long-running and complex job mixes. Linear projections were valid in all but pathological situations (radio trash, channel overloading, etc.).

Benchmarking, however, may be a way to provide a transition to perhaps the most delicate aspect of capacity planning — communication of results to the non-technical management who pay the bills. Benchmarking can provide incontrovertible evidence that theoretical but jargon-filled reports cannot communicate. The try-it-and-see method should be avoided if possible, because of the expense involved in locating a site with exactly the correct laboratory conditions to perform a benchmark, together with the chore of relocating personnel, duplicating data, running test transactions, and so forth. Nonetheless, if the communications gap between technicians and management cannot be bridged, benchmarking may be the convincing proof of capacity needs.

We found that generally linear, commonsense projections of capacity demand worked fine. Twice as many loans took twice the time on the same configuration. The same number of loans on a cpu rated at twice the speed took only about half as long, as we might have expected. (We're simplifying the problem enormously by discussing only one parameter; obviously, an insufficiency in memory, channels, etc., could change the results dramatically.) We encountered no mathematical problems that could not be solved with a handheld calculator.

Communicating those results, though, took great diplomacy. There probably wasn't a single paragraph in the initial draft a ceo could understand. Over the successive versions of the report, as it grew by charts, appendices, references, and so on, we weren't certain whether the decision-makers were won over by the information or whether we had just worn them down.

In summary, capacity planning first requires data and a measurement procedure for the existing environment. Next, business systems planning, to capture trends, must be superimposed onto the existing configuration. Several technical considerations have been covered above, but stripped of the jargon, the process is similar to selecting a different-sized suit. Preliminary exercise with a tape measure can guide one toward the right rack.

Then, standard financial analysis and planning can cover lease vs. purchase and long vs. short financing methods. Lastly, education and familiarity with the process of capacity planning will provide the dp industry with better computer solutions to business problems over time. The goal is to manage computer power to avoid waste, and yet remain flexible and progressive.

**LAWRENCE H. COOKE JR.**

Mr. Cooke is a senior vp at Baybanks data Services, Inc., Waltham, Mass. Prior to that, he was manager of technical support and systems and programming for Midlantic National Bank, West Orange, N. J. He has also worked at IBM, Computer Applications, Inc., and the Federal Reserve Bank of New York.
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Screen graphics courtesy of Control Data.

CIRCLE 120 ON READER CARD

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A Trans Union Company
Should computer use be restricted for privacy?
Two-thirds of the public said yes, but only 8% of computer executives.

THE IMPACT OF COMPUTERS ON PRIVACY

by Alan F. Westin

Now that computers have been used extensively for two decades in the management of personal data files by government and private organizations, just how does the American public view the impact of computer systems on society, especially in terms of computers and privacy? How do these attitudes compare with the views of key business and government leaders (including computer industry executives)? Are there demographic, ideological or other social factors that help explain the shape of public opinion? And, most importantly of all, what does current public and leadership opinion suggest about the environment in which computer uses will be unfolding in the 1980s?

Data for answering these questions is now available from a national survey conducted by Louis Harris & Associates, in a public service project sponsored by Sentry Insurance. The public survey consisted of a representative sample of 1,513 adult Americans interviewed in November and December 1978. The leadership survey was composed of 618 interviews with representatives of 11 selected groups: public sector representatives (Congress members, federal regulatory officials, law enforcement officials, and state insurance commissioners), and leaders from the private sector (business employers, computer industry executives, life insurance executives, credit card company executives, credit industry executives, commercial bank executives, and doctors). The computer industry interviews were with executives from 34 computer hardware or software firms selected from Standard & Poor’s Directory.

First, some of the good news. The Sentry survey found that the public and most leadership groups held some highly positive views about the value of computers to society. Sixty percent of the public feel that “computers have improved the quality of life” in the United States. Demographic groups that scored substantially higher than the public average (5% or more) included younger adults (18 to 29), the college educated, professionals, Easterners, males, those earning over $25,000 annually, and liberals.

Those groups scoring substantially lower than the public in seeing such value to computers were people over 50, those with only eighth grade educations or lower, those earning under $7,000, and women. All the leadership groups, both business and governmental, scored substantially higher than the public’s 60% in seeing computers as improving the quality of life. Not surprisingly, 97% of computer executives believe that computers have had this effect.

The survey also asked whether those interviewed agreed that “because they can use more personal details, computers make possible more individualized service to people.” Almost two of three members of the public (64%) agreed with this statement. This view was especially strong among males, executives, and higher income groups, and was less accepted by the eighth grade educated, lower income earners, proprietors, and political liberals. All the business executives, law enforcement officials, and state insurance commissioners held this view more strongly than the public, while federal regulatory officials, Congress members, and doctors were more skeptical. Again, computer executives supported this view fervently, at 86%.

At the same time, both the public and leadership groups see some clear and present dangers in the way that computers are being used to process personal data. Eighty percent of the public believe that “computers make it easier for someone to obtain confidential information improperly on individuals.” Higher income groups, professionals, and proprietors held such a view even more strongly than the public average, as did all the government leaders and doctors. Though they scored lower than the public, majorities of all business executives and law enforcement officials still registered such a sentiment. And 67% of computer executives saw their own technology as having this effect today.

DO COMPUTERS THREATEN PRIVACY?

Turning from the general tendency to immediate dangers, the survey asked whether respondents “believe the present uses of computers are an actual threat to privacy in the U.S.” Fifty-four percent of the public said yes, a jump from 34% who recorded such a view when the same question was asked in 1976. Somewhat surprisingly, 53% of computer executives—a majority and only a point off the public view—adopted the same judgment. Among other leaders, all government officials believed computers threaten privacy today more strongly than the public did, while all business leaders scored below the public.

A final measure of negative judgment came from the question asking respondents whether they believed privacy was adequately safeguarded today in computer systems. Fifty-two percent of the public replied that they felt it was not, and 53% of computer executives expressed the same view. Government officials and doctors felt much more strongly that safeguards today are not sufficient.

The survey also listed a number of
Judgments about computer impact do not divide along lines of political philosophy.

**WHAT COMPUTER EXECUTIVES SAY**

Computer executives are more concerned about threats to personal privacy than the public or other business executives, but the computer executives are more willing to believe that organizations need the personal data they request.

Here are some of the responses by the WP heads in the survey conducted by Sentry Insurance:

One in four computer executives (to the public's 19%) say they have personally been victims of an invasion of privacy, citing credit bureaus and government as the main intruders.

Computer executives are more willing to accept the need for information collection by organizations than the public is. Some 69% accept the need to supply many personal details for credit, insurance, and employment compared to the public's 46%, and 67% support law enforcement's need for some intrusion compared to the public's 57%.

Where 72% of the public feel most organizations ask for more sensitive information than really necessary, only 44% of computer executives state this view.

On the other hand, computer executives believe more strongly than the public that Americans begin surrendering their privacy the day they open a charge account, apply for credit, or take out a loan (92% to the public's 76%).

Ninety-four percent of computer executives reject the idea that people who complain about their privacy being invaded are engaged in immoral or illegal conduct (to the public's 64%). And, where 41% of the public believe that most organizations collecting personal information today don't have enough checks and safeguards against misuse of personal information, 53% of computer executives hold this view.

Computer executives are consistently ahead of the public majority that believe controversial moral activities should be left up to the individual rather than being regulated or forbidden by law. This is true of smoking marijuana, homosexual relations in private, heterosexual relations between unmarried adults, and a woman's right to elect abortion.

Also, computer executives are much stronger than the public in believing that major private-sector organizations—banks, finance companies, insurance companies, credit card companies, credit bureaus, hospitals, and employers—should be doing more to keep the information they collect confidential. Computer executives were generally below the public in believing that government agencies should be doing more today.

When asked about the need for new organizational policies or laws to protect privacy in the private sector, 73% of computer executives believed new laws were needed; and within this, 31% wanted detailed and comprehensive legislation now, more than any other industry group. Only 6%—the lowest for any industry group—said no new policies or laws were needed.

More particularly, computer executives are far ahead of the public in believing that courts (83%), the people themselves (69%), and Congress (53%) should be the primary instruments for protecting individual privacy. However, where 62% of the public believes it very important to have an independent agency to handle complaints about violations of privacy by organizations, only 28% of computer executives take this view. And 72% of computer executives oppose creation of a national privacy protection agency, to the public's 46% against.

Where the public by 61% or more feel it is important for Congress to pass privacy legislation covering health records, insurance, employment, mailing lists, and credit cards, computer executives were significantly lower in each category in believing legislation is needed.

As for what computer executives say is their own company's philosophy toward installing new privacy protections for their employees, only 11%—the lowest for all industries—say they want to be a pioneer in introducing such measures (25% of industrial employers and 38% of insurance executives say they want to pioneer). Forty percent of computer executives—the highest percentage of all industries—say they want to wait until laws are passed.

The public was less sure whether it was justifiable for the Internal Revenue Service to use computers to compare tax returns with the files of credit card companies. Only 48% of the public felt this was all right, though majorities of most business and government officials supported such a use. Of computer executives, 61% said this was justified. Westerners, political liberals, people living in towns, and the non-college educated were the least accepting of such a computer use.

In a question that tapped people's general feeling about the balance between computer benefits and computer dangers, the survey asked for agreement or disagreement with the statement "If privacy is to be protected, the use of computers must be sharply restricted in the future." Almost two out of three members of the public (63%) expressed their agreement with the statement, a view especially strong among white collar workers and situations in which computers might be used and asked the respondent to indicate whether such uses seemed justified or not. An overwhelming 87% of the public feel it is justifiable to use computers to match employment records with welfare rolls to detect improper welfare payments. Business and government officials were about the same or even higher in expressing support for such practices, and 92% of computer executives held this view. Somewhat surprisingly, 92% of the public who classified themselves as political liberals also said that this use of computer systems was justified. Only Southerners, blacks, and persons with eighth grade educations scored substantially lower than the general public.

By a much smaller majority (53%), the public said that it was justifiable for the insurance industry to maintain a central file on people suspected of making fraudulent claims on any insurance policy. There was not a majority of
ATTITUDES TOWARD CONTEMPORARY SOCIAL PERFORMANCE

<table>
<thead>
<tr>
<th>Question</th>
<th>Percent Agree</th>
<th>Percent Disagree</th>
<th>Percent Not Sure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government can generally be trusted to look after our interests</td>
<td>34</td>
<td>58</td>
<td>8</td>
</tr>
<tr>
<td>The way one votes has no effect on what the government does</td>
<td>38</td>
<td>54</td>
<td>8</td>
</tr>
<tr>
<td>Technology has almost gotten out of control</td>
<td>43</td>
<td>41</td>
<td>16</td>
</tr>
<tr>
<td>In general, business helps us more than it harms us</td>
<td>72</td>
<td>19</td>
<td>10</td>
</tr>
</tbody>
</table>

Table 1.

LEVELS OF PUBLIC ALIENATION

<table>
<thead>
<tr>
<th>Alienation Level</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>21</td>
</tr>
<tr>
<td>Moderate</td>
<td>28</td>
</tr>
<tr>
<td>Low</td>
<td>34</td>
</tr>
<tr>
<td>Not alienated</td>
<td>17</td>
</tr>
</tbody>
</table>

Table 2.

ALIENATION LEVEL AND ATTITUDES TOWARD PRIVACY

<table>
<thead>
<tr>
<th>Question</th>
<th>Percent Public</th>
<th>Percent High</th>
<th>Percent Moderate</th>
<th>Percent Low</th>
<th>Percent Not</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very concerned about threats to personal privacy</td>
<td>31</td>
<td>47</td>
<td>30</td>
<td>27</td>
<td>21</td>
</tr>
<tr>
<td>Very close to a 1984 society or already there</td>
<td>34</td>
<td>55</td>
<td>35</td>
<td>29</td>
<td>13</td>
</tr>
<tr>
<td>Have personally been victim of privacy invasion</td>
<td>19</td>
<td>24</td>
<td>20</td>
<td>17</td>
<td>13</td>
</tr>
<tr>
<td>Most organizations collect too much personal information</td>
<td>72</td>
<td>87</td>
<td>72</td>
<td>68</td>
<td>62</td>
</tr>
<tr>
<td>Congress should pass privacy legislation for insurance</td>
<td>65</td>
<td>72</td>
<td>66</td>
<td>63</td>
<td>61</td>
</tr>
<tr>
<td>Favor a national privacy protection agency</td>
<td>37</td>
<td>45</td>
<td>36</td>
<td>34</td>
<td>32</td>
</tr>
</tbody>
</table>

Table 3.

ALIENATION LEVEL AND ATTITUDES TOWARD COMPUTERS

<table>
<thead>
<tr>
<th>Question</th>
<th>Percent Public</th>
<th>Percent High</th>
<th>Percent Moderate</th>
<th>Percent Low</th>
<th>Percent Not</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present uses of computers threaten privacy</td>
<td>54</td>
<td>74</td>
<td>56</td>
<td>51</td>
<td>36</td>
</tr>
<tr>
<td>Computers make it easier to obtain confidential information improperly</td>
<td>80</td>
<td>89</td>
<td>78</td>
<td>79</td>
<td>74</td>
</tr>
<tr>
<td>Privacy not adequately safeguarded in computers</td>
<td>52</td>
<td>70</td>
<td>56</td>
<td>47</td>
<td>32</td>
</tr>
<tr>
<td>Justifiable for IRS to check tax returns against credit-card records</td>
<td>43</td>
<td>56</td>
<td>44</td>
<td>38</td>
<td>32</td>
</tr>
<tr>
<td>To protect privacy, computers will have to be sharply restricted</td>
<td>63</td>
<td>80</td>
<td>65</td>
<td>59</td>
<td>47</td>
</tr>
</tbody>
</table>

Table 4.

union members.

Not surprisingly, such a position did not sweep the computer executive sample. Only 8% of computer industry officials believed that sharp restrictions on computer use are needed to assure privacy protection in the future. On this issue, business and government leaders were substantially less in agreement that restrictions were needed than the public, though still considerably higher than computer officials.

So much for the bare summary of the questions and responses about computers on the Sentry study. Like most complex and interesting surveys, the results offer some clear readings of public and leadership views but also raise major issues of interpretation and explanation. First, do demographic or social factors help to explain the basis of these public attitudes? The short answer is no, as the mention of groups scoring significantly above or below public sentiment has already indicated. Factors such as income, education, sex, occupation, race, region, age, and community do not provide consistent divisions of attitudes toward computer uses and social values.

Nor do the judgments about computer impact divide along lines of political philosophy. Liberals score higher than the public in believing that computers have improved the quality of life but lower in believing that computers make possible more individualized service. Both liberals and conservatives score higher than the general public in feeling that the present uses of computers are a threat to privacy, and that if privacy is to be preserved, computer use must be sharply restricted in the future.

When the Sentry survey was being planned, we suspected that a more significant factor in shaping people's attitudes toward privacy as well as computer issues was the degree of alienation that the individual felt from the institutions of American society. To test this, we developed four questions that measured people's reaction or acceptance of contemporary social performance. These questions and the public responses are shown in Table 1.

We then divided the national public sample according to the number of "negative" responses, producing the profile of alienation levels in the public shown in Table 2.

When each individual's responses to the entire Sentry survey were correlated with his or her alienation level, there
was a direct relation between the degree of alienation and the individual's concern about current invasions of privacy, desire for strong privacy protection, and fears about the future of privacy. In a majority of the responses, the answers "scaled" along the alienation continuum when compared with the public averages. The sample of privacy questions in Table 3 shows this clearly.

The same is true for most of the questions about computers (see Table 4). As the survey shows, there is a strong relationship between the degree of alienation an individual feels from American institutions and processes and his or her attitude toward issues of privacy and perceptions of computer benefits and dangers.

This suggests to me that the sources of people's attitudes toward privacy and computers are very deep-seated matters relating to how well or badly each person feels American institutions as a whole are doing. Such orientations will not be easily changed by "better communications" campaigns or patchwork privacy laws. Rather, they imply that the 1980s may well see far more intense conflicts over computer uses in American society than anything that we have yet witnessed.

The Sentry survey demonstrates that while the public is most immediately worried about issues such as energy, inflation, and war and peace problems, most Americans now see privacy as one of the central quality-of-life issues of our time. For want of a better term, "privacy" has been adopted as the way to express the public's demand that powerful institutions engage in open, equitable, and procedurally fair relationships in dealing with individuals as consumers, employees, and citizens. To do this, the public wants a better balance to be created between information subjects and information keepers in both the private and public arenas, and especially where high technology information systems are involved.

Though the survey shows that the public generally appreciates the positive contributions of computer use, it also reveals a deep-seated fear that computer uses are not yet sufficiently controlled and safeguarded. When almost two out of three Americans say that computers will have to be sharply restricted in the future —far ahead of what leadership groups feel—the minimum conclusion is that the public does not believe that existing privacy protections are dealing adequately with the basic problem.

Furthermore, had the study been conducted after the Three Mile Island nuclear mishap, I believe a majority of the public—not just 43%—would have said that technology is almost out of control. Similarly, I think more than 63% would have said that computer use will have to be sharply restricted in the future.

Thus there may well be trouble ahead for some large new federal information system projects that have been proposed for the next decade, such as the IRS Tax Administration System, the FBI's Criminal History Project, and the Future Process Design of the Social Security Administration. The same may well be true of state and local government "big system" projects, as well as private sector developments such as EFT (Electronic Funds Transfer) proposals, and some of the plastic card, personal data base plans that are being discussed.

The reasons will be not "only" concerns over privacy of the kind explicitly registered in the Sentry survey. Public concern will expand outward to uneasiness over the effect of very large systems on equitable administration and provision of meaningful fair procedure rights in decision-making, and in the very capacity of such complex systems to be managed successfully in the real world of government and private organizations.

On this aspect, the Sentry survey offers a warning to the computer industry, computer users, and public policy makers. The privacy issue is not solved and fading away. It is going to become more intense in the next decade, as "privacy" serves as the handle with which a still considerably alienated public seeks to define and install greater measures of individual or social control over an organizational system whose powers have been vastly increased by computer uses in the last 20 years.

ALAN F. WESTIN

Dr. Westin has been professor of public law and government at Columbia University for 20 years. A lawyer and PhD in political science (both degrees from Harvard), he is the author of Privacy and Freedom (1967) and Databanks in a Free Society (1972), as well as monographs on privacy and computer uses in the fields of health care and personnel administration. He was the academic advisor to the Sentry Insurance survey described in this article.
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**COMPUTER FINDS FACTS**

Computer design consultant Dan Nay ran an ad in the *Los Angeles Times* about three years ago to solicit business. His only reply was from Michael Wurmbrand, president and founder of Christian Missions to the Communist World, a nonprofit organization that documents incidents of human rights violations in communist countries.

Nay’s assignment: design a portable computer that Wurmbrand could carry around and that would give him immediate access to a “zillion” facts his organization had compiled from its investigations behind the Iron Curtain.

The result is a very small computer and a new company in Torrance, Calif., called Findex, as well as a $1 million backlog as of late September, when the company turned out its first production unit. As with many of the hundreds of small business microcomputers introduced in recent years, it will be marketed by distributors and oem's, including one oemer that will incorporate an insurance package for sale to the insurance industry.

The Z 80-based microcomputer weighs 20 pounds and can be carried around like a briefcase. The single unit has a 6 line by 40 character plasma display screen supplied by Burroughs Corp., a 23 column electrostatic printer and a 77 key keyboard with a calculator pad and 17 programmable function keys. It can store up to 400K bytes of memory in a 500K bubble memory, or up to 2 512K bubble memories in the bubble memory, supplied by Rockwell Corp., being recommended for applications in rugged environments.

Wurmbrand, who developed the software, said he incorporated an index sequential file management system which eliminates the need for sorting. It is programmed in business BASIC, an adaptation of Microsoft BASIC, and provides users—such as salesmen—with a data base of price lists or insurance rate tables, and it allows users to keep track of appointments or gives them access to telephone numbers and addresses. Wurmbrand, the company’s executive vice president, and Nay, the 45 year old president, raised nearly half a million dollars to get the company going. In October they began turning out various models of the Findex at a rate of 25 devices a month, going to 50 a month before the end of the year. “After that, who knows,” says Wurmbrand.

**MICHAEL WURMBRAND—A bubble memory for rugged environments.**

“It’s hard to fathom the extent of the microcomputer market,” says Wurmbrand. “It’s as if the U.S. were to declare that Spanish was our second language and everybody had to learn it. Everybody in business now feels he has to have a computer, even though he’s baffled by it.”

So what does he do? He relies on his computer expert around the corner—that being the computer store, or a part-time programmer, or what have you. And that’s the way Findex will sell its computers—to experts for resale to businesses. Late September, the company had appointed dealers in California and overseas and had a marketing effort going to line up others, including possibly a “major calculator manufacturer” who expressed a need for 500 copies of the Findex computer.

Wurmbrand, 40, is an expatriate Rumanian whose training is in civil engineering. He formed the Christian Missions organization after coming to the U.S. 13 years ago and describes the organization, which last year operated on a $7 million budget, as “a sort of CIA, although we have no connection with the CIA.”

Wurmbrand virtually was orphaned at the age of 11, when his mother was arrested by government police in Bucharest in 1951 and forced to load boxcars for three years “without a trial or without even knowing why she was arrested.” His father, a Lutheran minister, spent 14 years in a communist labor camp. Wurmbrand worked his way through several universities studying civil engineering, managing to circumvent a law that prohibited children of jailed parents to go beyond the seventh grade. Wealthy relatives finally rescued his parents for $10,000 and the family came the U.S. “The communists say they hate capitalists, but they love capital,” Wurmbrand says bitterly.

**COMPUTING FOR NYC**

When New York City’s computer system went down briefly not long ago, the man in the news was David Woodbridge, the 44 year old executive director of the Financial Information Services Agency—the city organization that handles the Big Apple’s data processing.

In the private sector Woodbridge’s position would be on a par with the vice president of MIS at some of the biggest corporations in the country. In fact, New York City’s $14 billion a year budget and its enormous accounting and record keeping requirements—its payroll is well over 200,000 employees, as an example—make it one of the most demanding computer users in the country.

How does Woodbridge, whose department employs an array of processing gear including an IBM 3032, an IBM 3033, and a 370/168 that is being replaced with a 3033 equivalent, view this pressure cooker job?

“Unlike most big national or international corporations, all our efforts are consolidated,” says Woodbridge, who has several hundred people on his staff. “And everything is done through one system. Consequently, there’s a tremendous concentration of activity that is certainly unique.”

The pros and cons of this approach? “It’s easier to control a system like this and to realize economies of scale, but we have a number of restrictions a large corporation would never encounter.”

For one thing, Mayor Koch and the powers that be in city government frown on hiring people who live outside the five boroughs; salary ranges generally aren’t competitive with those at big firms and raises may take three or four months to get through.

Still Woodbridge, having put together a system that’s contributed in no small part to stabilizing the city’s rocky fiscal situation, has probably seen more action—and survived a greater number of crises—than many of his counterparts in the relatively subdued world of corporate dp, which he knows well.
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So contact us. Learn how we've raised communications to a fine art—in both our products and working environment.

And since computer control and processing are at the heart of all our programs, learn how your software accomplishments can bring advancement to positions of increasing sophistication and importance.
We have openings in the U.S. divisions listed below for entry-level and experienced software engineers. When you send your resume, indicate the area of technology that interests you most, as well as your divisional or geographic preference.

Avionics Division
ITT Avionics is involved in a wide diversity of areas including electronic defense . . . communications . . . navigation/identification. Software professionals have the opportunity to stay with a project from start to finish and be involved in integration.

Openings at all levels. Bachelors preferred in Electrical Engineering, Physics or Computer Science (experience in lieu of degree considered). At least 3 years real-time Assembly language programming desired. Responsible for software design, coding, testing and integration of the software program into the hardware systems. Experience should include one or more of the following areas: E/W Computer Systems; Multi-Computer System Architecture; Firmware Coding. Positions are in Nutley located in suburban northern New Jersey.

Business Communications Division
The ITT Business Communications Division is currently developing advanced communication systems which will encompass PABX functions and data switching capabilities. Add on modules will provide data processing facilities for implementation of the "Office of the Future".

Advanced software techniques used in these systems include structured analysis, structured design and the use of Problem Oriented Languages. Openings exist for real-time programmers, telephony switching programmers, data switching programmers and software utility programmers in Des Plains, Ill. (suburban Chicago).

ITT Courier
ITT Courier produces a full line of multi-microprocessor software-based computer display terminal and data communications products, and is currently the largest non-IBM producer of 3270-type devices. At the metropolitan Phoenix software engineering center, ITT Courier is developing state-of-the-art real-time, Assembly language software that will provide form and function to future product offerings. Software development areas include: SNA, SDLC, BSC, and IBM channel protocol communications software; real-time, multi-tasking operating systems; software development tools; intelligent terminal software; intelligent terminal software; and support/diagnostic software.

Software engineering openings exist at all levels at our facilities in Tempe, Arizona; West Palm Beach, Florida; East Rutherford, New Jersey.

Defense Communications Division
ITT Defense Communications Division is involved in research, development and manufacture of sophisticated communications equipment such as digital telephone circuit switching, message switching, narrow band digital voice processing, radio transmission and satellite communications and navigation. ITTDOD has been very successful in obtaining contracts in all the aforementioned technology areas during the past few years due in large part to an aggressive internally funded research and development program. We are interested in engineers (both in equipment and computer software design) to work in digital communications such as voice processing, circuit switching, message switching and radio transmissions . . . at our Nutley facilities in suburban New Jersey.

ITT North
ITT North Telecommunications Switching operates in a rapidly changing, micro-miniaturized computer-controlled environment. The impact of semiconductor and computer technologies on the telecommunications industry has resulted in the present conversion from analog to digital techniques which are, in fact, integrated information systems.

We seek individuals with backgrounds in computer sciences, telecommunications hardware and software development, systems analysis, programming, electrical/electronic and mechanical engineering . . . to assist in the data base design and implementation of a major digital telephone switching system in a real-time/batch processing environment. Openings are at our facilities in Johnson City, Tennessee; Delaware, Ohio; Cape Canaveral, Florida.

Telecommunications Technology Center
The ITT Telecommunications Technology Center . . . located in ultramodern campus type laboratories in suburban Fairfield County, Connecticut . . . offers Software Engineers the opportunity to apply their skills to state-of-the-art digital Telecommunications Switching Systems. Software design opportunities exist in diagnostic signaling systems, trunk and line maintenance, exchange administration, fault recovery, I.M.S. and data base administration.

New Graduates with Masters or PhD degrees in CS or EE, as well as experienced Software Engineers with similar qualifications, are encouraged to apply.

U.S. Telephone and Telegraph
Telecommunication operations are carried out by 21 companies servicing 185 countries. They provide business, government and the general public with some of the world's most advanced, diversified and reliable communications services including record, data and voice communications. Record and data communications historically include telegraph-type traffic and similar outgrowths, as well as international telex and computer-to-computer data communications.

Educational background in electronic or telecommunication engineering or CS with experience in systems analysis, applications programming or systems programming of minicomputer controlled telecommunication systems required. Hands-on knowledge of assembler type software required. Openings are in Manhattan.

Overseas
ITT units throughout the United Kingdom and Europe (Belgium, France, Germany, Italy, Spain and Scandinavia) periodically have openings for software engineers. Relevant language proficiency is required. When you send us your resume, indicate if you would also like to be considered for any overseas opportunities we might have.

Write to: Director of Professional Staffing, International Telephone and Telegraph Corporation, 320 Park Avenue, New York, New York 10022.

International Telephone and Telegraph Corporation
OFF-LINE

The Air Force Avionics Laboratory has awarded a $1.7 million contract to Rockwell International for work on bubble memories suitable for airborne digital avionics applications. The 29-month effort, part of a program to develop bubble technology for both airborne and spaceborne applications, aims to develop highly reliable, solid-state memories for use in place of disks, drums, tape, etc.

Racal-Vadic, Inc., the Sunnyvale, Calif., modem-maker, has reached an agreement in principle with Texas Instruments to supply modems for TI's 785 and 787 portable terminals (see product announcement, this page).

American Microsystems, Inc., and Tektronix, Inc., have begun a cooperative marketing program to place Tektronix 8002A microprocessor development labs with AMI customers.

TERMINALS

The Silent 700 line of terminals now has four 120cps members. The 780 series can be had in receive-only (model 781), keyboard send-receive (model 783), portable data terminal (model 785), and portable communications data terminal (model 787) versions. All use a dual-matrix thermal printhead that prints two characters simultaneously.

Common features of the four include 120cps bidirectional printing, full duplex operation, receive buffer, 21 character answer-back memory, and use of the 128 character ASCII set. All four can operate at data rates ranging from 110bps to 9600bps. Models 781 and 783 are both desktop models equipped with RS232 and current loop interfaces. As an option, the receive-only 781 can be fitted with a 2,000 character buffer, allowing the 781 to function as a demand printer in conjunction with a CRT terminal.

The 785 has an integral 1,200bps acoustic coupler, while the 787 has a direct-connect internal originate/answer modem with automatic speed selection. RS232 interfacing (and operation to 9600bps) are options on the 785 and 787. APL keyboards and character sets are available for the 783, 785, and 787. The 781 sells for $1,595, the 783 for $1,795, the 785 for $2,445, and the 787 for $2,895. Deliveries are scheduled to begin in the second quarter. TEXAS INSTRUMENTS, INC., Digital Systems Group, Houston, Texas.

MODEM

Compatible with Bell's 208A and 208B modems, this vendor's MX 48A/B 4,800bps synchronous modem allows leased-line multipoint and point-to-point operation as well as dial-up use. The microprocessor-based direct connect modem includes fault isolation and error detection capabilities. The MX 48A/B sells for $3,900, and rents for $110 per month, $90 per month, and $85 per month on one-, two-, and three-year leases, respectively. Deliveries begin next quarter. CODEX CORP., Mansfield, Mass.

SYSTEM

Extending the high end of its Reality Family of computer systems, this vendor has come up with the Series 8000, the first of the Reality line to use a new Performance Enhanced Processor said to provide a 20% to 30% increase in internal processing speed over previous processors. Main and secondary memory maximums have been increased to 512Kb and 514Mb, respectively. As with existing members of the family, the Series 8000 uses the Reality Data Base Management System.

Utilities provided with the system include the DATA/BASIC applications language, English data retrieval language, PROC (a prestored procedural language that handles job control functions), Screenpro input utility and screen formatter, and a word processing package, Runoff.

Two configured Series 8000 systems are offered initially. The 8750 system includes a 128Kb processor, 514Mb of disk, 800bpi, 45ips mag tape, 300 lpm printer, and two CRT terminals, and sells for $84,975. The 8770 has a 256Kb memory and a 1600bpi tape unit, in addition to the disk, printer, and terminals of the 8550; the 8770 sells for roughly $106,000. MICRODATA CORP., Irvine, Calif.

6250BP TAPE

For use with its Eclipse systems, this vendor's model 4307 magnetic tape subsystem provides IBM compatibility with
Does this look like a low profile?

Over a decade ago, we pioneered the concept of sharing time on a computer—enabling companies to access, analyze, and report vital business information quickly and efficiently. Today, we are the world's largest independent supplier of remote computer services with more than 10,000 clients in 20 industries, revenues in excess of $149 million, and offices throughout the world.

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**HARDWARE**

6250bpi Group Code Recording (GCR). It also can read phase encoded 1600bpi tapes. In 6250bpi operation, the 4307 transfers data at 486,750 bytes per second. The auto-load transport reads and writes at 75ips; rewind speed is 250ips. The 4307 subsystem includes a rackmounting transport, formatter, and other products to support color output, and the 3101 terminal, a Teletype-compatible unit at relatively low price subject to quantity discounts.

A member of the 3270 family, the 3279 can display alphanumerics and graphics in up to seven colors. Four models are offered, capable of displaying four or seven colors with 24 or 32 lines of 80 characters per screen. The 3287 color printer uses a replaceable four-color cartridge ribbon. The bidirectional matrix printer is offered in 80cps and 120cps versions. A Programmed Symbol Feature allows use of customer-designed additional character sets.

Prices on the 3279 color display terminals range from $4,300 to $6,700; two-year leases range from $105 per

**TERMINALS**

The Gray Giant has added a little color to its life with the introduction of its first color terminal, the 3279 color display terminal. Announced concurrently were the 3287 four-color printer, program products to support color output, and the 3101 terminal, a Teletype-compatible unit at relatively low price subject to quantity discounts.

A member of the 3270 family, the 3279 can display alphanumerics and graphics in up to seven colors. Four models are offered, capable of displaying four or seven colors with 24 or 32 lines of 80 characters per screen. The 3287 color printer uses a replaceable four-color cartridge ribbon. The bidirectional matrix printer is offered in 80cps and 120cps versions. A Programmed Symbol Feature allows use of customer-designed additional character sets.

Prices on the 3279 color display terminals range from $4,300 to $6,700; two-year leases range from $105 per

**HARDWARE SPOTLIGHT**

**MASS STORAGE**

Four mass storage processors (MSPs) and a large mass storage unit have joined this vendor's secondary storage offerings for its large-scale computers. Designed for use with its recently announced DPS 8 line of processors (see November, p. 56), Level 66 and Level 66/DPS systems, the company emphatically states the MSPs are not back-end processors, and no plans exist to transform these MSPs into back-ends.

Two of the MSPs, the MSP0604 and MSP0607, are single channel devices, while the MSP0608 and MSP0609 are dual channel devices. Each can support up to 16 MSU0400-series mass storage devices (for a total capacity in excess of 4 billion bytes); MSU0500-series storage devices also can be used, with a maximum of eight units on either the MSP0604 or MSP0607, 15 units on the MSP0608, and 16 on the MSP0609. Drives from both series can be mixed on a single MSP.

The buffered MSPs are intended to optimize data transfers between disks and the processor's I/O multiplexor, with the MSP handling address conversions, formatting, seek overlapping, command retries, and alternate track processing. The MSP0604, an integrated unit, sells for $39,000 and rents over a five-year term for $874 per month. The MSP0607 is a free-standing unit that sells for $44,000 and rents for $988 per month on a five-year contract. The MSP0608 consists of one free-standing module and one integrated module, while the MSP0609 consists of two free-standing modules. Purchase prices are $62,500 and five-year rentals go for $1,400 per month for either. For actual data transfer data (as opposed to helping it move between processor and peripheral), the MSU0501 stores up to 1.1 billion 9 bit bytes of data. The dual-spindle, fixed-disk device has 12 platters providing 20 recording surfaces. The MSU0501 has a peak transfer rate in excess of 1 Mbps, and an effective transfer rate of 983 Kbps. Average latency is 8.3 msec, and the average seek is 25 msec (10 msec minimum, 50 msec maximum). The MSU0501 sells for $49,650 or rents for $1,296 per month on a five-year plan.

**A full range of high resolution color and monochrome monitors with OFF-THE-SHELF AVAILABILITY**

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Aydin Controls has a complete family of RGB raster scan color video monitors available from inventory. These high performance color monitors are specifically designed for the display of computer generated text, graphics and image data. All Aydin displays come with a one year warranty and feature: high and ultra-high resolution shadow mask CRT's, high video bandwidth, long term convergence stability, modular construction, rack mountability, convenient control accessibility and simplified maintenance. A comprehensive list of options to meet any requirement is available.

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- **Data Administration and Data Base Administration** for individuals with experience in the integration and control of major IMS data bases.

- **Data Base Programming** for individuals with DL/1 and structured COBOL experience on large scale administrative applications involving both real-time and batch processing.

Lockheed Missiles & Space Company offers a full range of benefits including company paid life, health, and dental insurance, paid sick leave, vacations, and holidays, education opportunities, and relocation assistance. U.S. citizenship required.

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Distributing stacks of paper is a transportation problem your company is suffering unnecessarily. The critical problem of "distributing", a quick and clear understanding of the information buried in those stacks is solved easily with charts by TELL-A-GRAF.

TELL-A-GRAF, a conversational software system, puts quality graphics in your hands—fast. Bar, column, line, surface and pie charts can be generated in terms of minutes or hours rather than days or weeks.

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1. Built-in features for basic plotting . . . automatic layout, most-used axes, trial and error design aids, and much more;
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5. Available for IBM and DEC virtual machines... ask us about other versions we’re working on.

Puchase prices start at $17,950 for a B91 with 128Kb of main memory and a 6Mb Super Mini-Disk II, and $20,708 for a B92 similarly configured. Leases start at $683 and $775, respectively, including eight-hour-a-day, five-day-a-week service. Operating system software is licensed separately. Computer Management System (CMS) software licenses for a one-time fee of $3,040 or a monthly fee of $85. AC SYS can be licensed for a one-time fee of $2,050 or a monthly charge of $55. Applications packages are available for one-time licenses ranging from $915 to $7,000, or $25 to $915 per month. BUTROUGHS CORP., Detroit, Mich. *
Abqaiq, Saudi Arabia

No baseball, no morning paper, no pizza, no autumn leaves.
But here's the great life that makes Aramco people stay on and on.

If you never considered working in Saudi Arabia because you think it's all sand and hardships, consider this.

3,500 Americans like you work for Aramco in Saudi Arabia now. Ask them why they stay and they'll tell you that, besides money, it's the casual lifestyle, American-style hometowns, top-notch schools, and vacation travel they used to only daydream about.

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Yes! You get a base salary competitive with top U.S. oil firms. We compensate you for overseas cost-of-living differences.

On top of that, Aramco pays an incentive of up to 40% for overseas employment, and you are reimbursed for any foreign or U.S. Federal income tax on the premium. So your premium is tax-protected.

Another benefit: employees overseas participate in Aramco's Retirement Income Plan on an accelerated basis.

With this financial package, no wonder 3,500 Americans like you work for Aramco in Saudi Arabia today.

What can you do with all that money stuck out in the desert?
Aramco people use 40-day paid vacations (every 12½ months) and 12 paid holidays (average) to visit fabulous places like the Pyramids, Greek Islands, Mt. Everest, the Serengeti Plain, Hong Kong.

Doesn't a child's education suffer so far away?
No! Aramco has a modern American school system. Teachers are primarily American and more than 75% of them have master's degrees. The teacher-student ratio is 1 to 15 in grades 1 to 6; 1 to 20 in grades 7 to 9.

If you get seriously ill, or need dental surgery; where do you go?
Aramco's Dhahran Health Center is one of three hospitals outside the U.S. accredited by the Joint Commission on Accreditation of Hospitals. The Dental Clinic is as fine as any in the States. Better than most.

Aramco recruiting ads mention “comfortable housing for families and singles.” Is that on the level?
At first, you'll live 12 to 18 months in adequate but not terribly attractive off-camp temporary housing. Next, it's on to comfortable on-camp temporary housing. Then, based on a housing priority-point system using job level and length of service, you'll get your permanent residence that's a carbon copy of a home in a warm climate like Arizona or Southern California.

What jobs are open today?
Can a person advance?
Aramco's operations are so big that our job opportunities are probably unduplicated anywhere. Challenging jobs are open in administration, refineries, gas plants, support facilities, everywhere.

We need accountants, medical personnel, technicians, teachers, vocational trainers, communications specialists and materials forecasting specialists. And scores of engineers: in construction, project management, operations and maintenance—for operations in oil, gas, petrochemicals, EDP, computers, transportation, utilities, name it.

You'll have challenges, early responsibilities, learn new technologies, and management advancement opportunities.

Interested? Send your résumé in confidence to: Aramco Services Company, Department DM120079A, 1100 Milam Building, Houston, Texas 77002.
UPDATES

The Association of Data Processing Service Organizations (ADAPSO) has urged the Federal Communications Commission to amend the computer rules to force common carriers to provide maximum separation between computer services offerings and voice communications operations. In a formal submission under Computer Inquiry II, ADAPSO asserts the FCC’s Tentative Revised Computer Rules don’t go far enough, and should require maximum separation in financing, administration, R&D, maintenance, marketing, and other areas that might otherwise overlap. Concise separation, ADAPSO maintains, would avoid cross-subsidisation of voice communications operations.

RPG UTILITY

For System/34 users, the RPG II Source Storage and Retrieval System (SSRS) lets the user store, modify, and selectively extract commonly used segments of RPG II programs. One or more source data files can be maintained by SSRS, with each file containing whole programs or many program segments. Simple commands let users merge files programs and segments.

The vendor sees SSRS as especially useful for storing often used input file specifications and calculation subroutines. Complete SSRS documentation and source diskette can be purchased for $150. The vendor also offers, for $30 apiece, standard subroutines to aid applications development using SSRS. These subroutines include name reversal, numerical dollar to English conversion, and binary searches over sequential data files.

FUTURENOW SOFTWARE, Orono, Maine.

FOR DATA CIRCLE 384 ON READER CARD

MULTI-CPU UTILITY

The Shared Tape Allocation Manager, STAM, automates control of allocating shared tape units in multiprocessor installations running OS/MVS. STAM protects against allocating the same drive to more than one cpu, and it requires operator response only in unusual situations (routine allocations are automatic). Commands allow the operator to display the status of a drive on all systems, or to take a drive off-line on one or more systems. STAM also can handle mountable disks in addition to tapes. STAM is priced at $10,000 for two processors.

SOFTWARE MODULE MARKETING, INC., Sacramento, Calif.

FOR DATA CIRCLE 385 ON READER CARD

CONVERSION AID

This vendor has developed conversion aids to ease migration from IBM System/3s and System/32s to the vendor’s VS multi-user operating systems. The packages help convert data files and RPG II applications. One of the conversion programs provides semiautomatic conversion of programs using interactive screen operations under IBM’s Communications Control Program (CCP). Screen definitions are converted to specifications for this vendor’s workstations, and interface the generated specifications into using application programs. The vendor doesn’t claim fully automatic conversions, noting that users probably will consolidate logic into larger programs. The programs run on this vendor’s VS system, and are available at no charge to customers ordering hardware.

WANG LABORATORIES, INC., Lowell, Mass.

FOR DATA CIRCLE 386 ON READER CARD

STRUCTURED BASIC

Designed to run on this vendor’s microcomputers (equipped with 64Kb of memory), Structured BASIC is said to combine the advantages of a modular language with the ease of programming in BASIC.

An extension of the vendor’s 16K BASIC, Structured BASIC adds long variable names (to 31 characters), statement labels, and control structures including IF-THEN-ELSE, WHILE-ENDWHILE, and REPEAT-UNTIL. A Keyed Sequential Access Method (KSAM) also is provided, as is a facility for calling named procedures with global and local variables. Structured BASIC is available on either regular diskette or minifloppy for $295.

CROMEMCO, INC., Mountain View, Calif.

FOR DATA CIRCLE 387 ON READER CARD

SOFTWARE SPOTLIGHT

TRANSACTION PROCESSING

A transaction processing package, Pathway, allows users of this vendor’s Non-Siop systems to code applications without regard to the specific characteristics of the terminal used. The package combines a set of Terminal Control Processes, a screen formatting language, a user-controlled application monitor, and an interactive screen definition facility.

Pathway divides terminal control and file manipulation into separate programs, with the vendor-supplied software handling all needed data checking and format validation. Terminal-oriented functions are handled by the terminal control process (TCP). A TCP can control multiple terminals, each logically independent of the others. Terminal handlers are written in Screen COBOL, which allows the user to define formats, input and output data mapping, validation, and message routing.

The application monitor initiates the system and supervises and controls all working processes. It lets the user control the system and generate reports on the status of processes or error conditions. Pathway can be used with applications written in COBOL, FORTRAN, MUMPS, or the vendors proprietary T/TAL language.

Pathway licenses for $8,500, plus $2,000 per processor for microcode.

TANDEM COMPUTERS, INC., Cupertino, Calif.

FOR DATA CIRCLE 388 ON READER CARD
Easy to use

More organizations are using ASI-ST more heavily than any other data management system. Why? Because ASI-ST is so easy to work with. You simply enter language statements and parameters; there are few rules to learn and remember. You can even omit many parameters entirely; ASI-ST picks the most commonly selected condition for those entries.

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THE FUTURE WITH MICROELECTRONICS
by Iann Barron and Ray Curnow

This book contains the delayed report of the (mostly) 1977 research undertaken by the authors on behalf of the Computers, Systems and Electronics Requirements Board (C.S.E.R.B.) of the U.K. Department of Industry. Without probing deeply into the U.K. government's organizational structure, it is sufficient to say that the C.S.E.R.B. essentially acts in a customer role in allocating U.K. government funds to various research activities. Incidentally, the board has no telecommunications responsibilities, which has become a serious omission in the current technological world. Iann Barron, now director of strategy for the new U.K. semiconductor company, INMOS, was the leading investigator. Ray Curnow led the work at the Science Policy Research Unit, University of Sussex, which permitted the authors to access information from a number of ongoing S.P.R.U. projects.

This work was completed in January 1978. The delay in releasing the material for public examination has seriously reduced its impact because the semiconductor and electronics businesses move rapidly. There is some reason to suspect that the precise analysis and hard-nosed recommendations did not find favor with the then-incumbent government and that it consequently tried to bury the report quietly. Fortunately, the government was not able to suppress it. Indeed, the very soundness of the work is evidenced by the small number of points that would require change today. Conclusions are presented cleanly, without the usual elaborate footnotes and pseudoscientific references that tend to destroy readability. There is very little hedging or application of fudge factors; bold statements are made.

Barron and Curnow are professionals. They have been around this industry for a long time. They do not hesitate to speak the truth as they see it. Thus their diagnosis of ICL's troubles is to the point. Their explanation of the negative effects of an anti-PCM policy would gladden the hearts of the management of STC, Telex, and Memorex. They have nothing but scorn for flag waving, the "indigenous computer industry" approach so dear to those in power in many countries. Their theme is the application of technology, not its production.

What seems to bother Barron and Curnow most is that there is so little understanding in the U.K. of the need for grasping what can be done with technology to improve the quality of life as well as the stature of British industry in world markets. Doubtless governmental readers were less than enthusiastic over the description of the barriers to effective use of computing in the U.K. It is bluntly stated that there is a lack of collective awareness of computing, too much concentration on short range problems, too much protectionism, and too much historic, cultural, attitudinal emphasis. It is easy to see why Whitehall wanted to sit on this report as long as possible.

After all the forecasts and conclusions, the authors have provided a set of recommendations for new policies in a variety of areas—industrial, governmental, social, and educational. They stress exploitation of technology. While doubtlessly a correct analysis, it is likely to be poorly received in a country where support has been concentrated in the production sector in spite of very limited results. The "...you'll do it until you learn it" theory is not very good economics. They note that "...What is totally lacking is any institution with overall responsibility for creating and implementing the policy toward information technology ..." One might make the same criticism in the United States, although our plentiful resources have helped alleviate this problem.

Given the lengthy delay in circulation of this report, one must be less than optimistic in predicting widespread U.K. readership. One is also sure that the U.S.-based computer industry will take it seriously; competitive marketing is a specialty here. Knowing what the other fellow is planning is always an edge.

This book is a major contribution. Those who forecast the future with microelectronics and the implications of the emerging technologies will study it carefully. The logic of the arguments presented makes sense to strategic and tactical planners. One can only hope that the C.S.E.R.B., the D.O.I., and the new Conservative government in the U.K. take it quite as seriously. There is much truth buried in these pages for a country with limited resources to apply. Nichols Publishing Co., New York (1979, 242 pp., $17.50).

—Philip Dorn

370/360 ASSEMBLER LANGUAGE PROGRAMMING
by Stern, Sager and Stern

Many compiler language programmers have a secret desire to know assembler language. One reason is that no compiler language allows the user to actually program the computer. Assembler language is the only viable means of actually programming what happens inside the machine.

Nancy Stern and her coauthors produced this book primarily as a college-level textbook for first-year course work in assembler language. However, their book is also quite useful as a self-administered course in the subject and will quickly provide the reader with enough knowledge to write an assembler program.

After an initial description of the ground rules in assembler language such as statement format, syntax, and coding conventions, the book quickly establishes the "shell" of a working program. Then, functional clusters of instructions from this program shell are discussed according to their functional role in the program (such as housekeeping, input-output, etc.), rather than the usual statement-by-statement approach to teaching a programming language.

The authors limited this book to the 50 or so assembler statements that are used for 95% of applications programming work. It concentrates on coaching the reader to a point where he or she can do useful programming in assembler as quickly as possible. Some of the instruction sequences used for instruction are less efficient than is possible with the 360/370 instruction set; however, the reader benefits from the avoidance of too many complications during the learning process.

The scope of instruction applies to the Amdahl 470 and UNIVAC 9000 machines as well as the IBM 360/370 systems. A cursory treatment of Job Control Language for IBM DOS, OS and UNIVAC OS is included, which serves only as an introduction to the subject.

Perhaps the strongest feature of this book is the manner in which various statements and instructions are grouped together by subject area. For example, Branching and Looping with Registers is a chapter completely unto itself and provides sufficient knowledge of that subject for most initial programming needs. Even
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after gaining considerable efficiency in assembler language, the reader may later return to this book for further study of such subject areas.

One disappointment in this book is the omission of any discussion about how to write and use macro-instructions. The macro is the single most powerful feature of assembler language and is considered especially for applications programming. While a thorough study of macros may have been outside the authors' intended scope, several pages devoted to that subject would have been in order.

Ms. Stern and her associates have produced a fine classroom text and possibly the best available resource for self-instruction in introductory 360/370 assembler language. If you are a programmer and have not yet added assembler language to your arsenal of programming tools, this book is a very good way to start. John Wiley & Sons (1979, 516 pp., $16.95, softcover).
—R. Edward Mitchell, Jr.

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The book begins with computer fundamentals and continues with sections on dual input/output, blocking, disk file creation and loading, core index, choosing file types, file placement, file copying, sorting, indicators, initialization, array and table searching, number conversions, printing, and some miscellaneous topics.

Optimization Handbook is $24.50. Polaris Computer Corp., Ltd., 8411 177 St., Edmonton, Alberta T5T 0P1 (403) 487-1133.

NEW FROM FROST & SULLIVAN

“The Software Package Market Outlook in Small Business Computers,” F&S report no. 675, predicts a $700 million independent packaged software market for small business computers in 1988. That market is currently estimated at $241 million. The report divides the market into three segments: microcomputers; mini-computer-based systems with no more than a few terminals; and large, multiterminal mini-based systems.

Systems software as a market for independent suppliers is also expected to increase, to $55 million in 1988 from $14 million this year. “The micro and mini manufacturers have left themselves wide open to invasion,” claims the report, “by virtue of their pricing, licensing, support, and service practices.” The report adds, “Utilities tend to be the most overlooked part.”

The report, which includes a directory of 180 minicomputer packages and 35 microcomputer packages as well as 200 software suppliers, categorized as computer manufacturers, distributors, wholesalers, software firms, turnkey houses, and computer stores, $900.

Also new from F&S are a report forecasting the U.S. semiconductor market, no. 665 (also $900), and a report on energy management and facilities control systems, no. 673 ($850). Frost & Sullivan, Inc., 106 Fulton St., New York, NY 10038, (212) 233-1080.

DESKTOP COMPUTER COMPARISON

A new “Guide to Desktop Microcomputer Selection” compares the TRS-80, Apple, IBM 5110, Wang 2200 series, Hewlett-Packard 9800 series, and the Tektronix 4050 series in separate hardware and software sections. The hardware category compares machines with respect to cpu, peripherals, software, and environment. The software category compares machines with respect to the following variables: system control/utilities, file/file control, program control states, input/output, relational/logical operators, data elements, string functions, arithmetic functions, editing commands, and tape files. Application requirements are briefly defined, and there is a basic glossary of terms related to each of these hardware and software characteristics. Each machine is also briefly described.

The guide is said to be aimed not only at prospective buyers but at consultants, as an information directory, and at microcomputer programmers.


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A unique "picture-taking" system comprising five separate sensors will help the U.S. Air Force evaluate which imaging methods may be most useful for advanced airborne applications. The Hughes-developed system consists of one sensor that sees only visible light, another that measures thermal radiation (heat), two active laser systems that detect the amount of reflected light, and a millimeter-wave radar. Variations in the gray tones of panoramas made by the sensors, particularly in those made at night and during inclement weather, reveal the advantages and disadvantages of each.

A ground-based radar now being developed will be so "quiet" that anti-radiation missiles will be less likely to home in on its beam. The new radar will have two antennas, one to transmit low-energy beams continuously and the other to listen for returns. (Conventional radars differ by transmitting high-energy pulses so that one antenna can alternately transmit and receive.) A new antenna technique reduces the radar's side lobes -- the secondary patterns of energy that enemy missiles can home on. Hughes is building a prototype quiet radar antenna for evaluation by the U.S. Army.

Combat pilots will get a better view of the outside world with a cockpit display employing the technology of diffraction optics. The system has the same purpose as head-up displays using conventional reflective optics: to superimpose flight control information over the pilot's view of the outside world. The new technology, however, permits a wider field of view, brighter images, and a clearer view outside the cockpit. In fact, video pictures from radar or infrared sensors can also be displayed, allowing the pilot to see at night or in inclement weather. Hughes psychologists are now determining how to use the new capabilities of diffraction optics in ways that are most beneficial to a pilot.

The Manufacturing Division of Hughes Missile Systems Group in Tucson has immediate openings for engineers. Typical openings range from digital logic, analog, and IF/RF circuit design to electro-optical and IR system design. Also needed are industrial engineers and manufacturing production engineers to conceive and design production methods and tooling for the fabrication of complex hardware for missile systems. For immediate consideration, send your resume to Roy McCalla, Dept. SE, Hughes Aircraft Company, P.O. Box 11337, Tucson, AZ 85734. Or call (602) 746-6200. Equal opportunity M/F/HC.

Weapons equipped with electro-optical sensors can be guided with pinpoint accuracy from an aircraft by a specialized communications system. The new AN/AXQ-14 data-link weapon control system, developed by Hughes for the U.S. Air Force, performs two functions. First, it receives pictures from the electro-optical seeker in the nose of a GBU-15 guided weapon so the operator can guide the weapon to a target. Second, it transmits guidance signals from the aircraft to the weapon. Tests have been made in launchings from F-14, F-111, and B-52 aircraft.
A 4331 SETTLES IN

Nearly a year since IBM unveiled its 4300 series processor, the first 4331s are being delivered to those customers who fared well in the lottery for delivery position. Those users still awaiting delivery of their 4300s will be scrutinizing the reports of the early 4331 users whom IBM has been courting ever since the release of the delivery schedule.

Sweetheart Cup Corp. of Los Angeles (a division of Maryland Cup Corp.) received one of the first 4331s shipped to a commercial account in the Los Angeles area. Since I am a systems programmer at Sweetheart, I was able to get a good hard look at the 4331 from a user standpoint.

Sweetheart had made the decision to upgrade its hardware from a 360/30 to a 370/135 in December 1978, just one month prior to the 4300 announcement. This decision was made primarily to facilitate the installation and implementation of the corporate order processing system on which the parent company had spent an estimated 12 man-years developing. In addition, installation of more current and powerful hardware would hopefully attract and help retain skilled personnel.

Since rumors of the 4300 were flying everywhere, the order for the 370/135 was delayed. The 4331 appeared to be an ideal alternative for both the 360/30 and the 370/135, especially since the net cost of the 4331 was about the same as that of the 360 and only half that of the 370, and the same air conditioning could be used.

But when the 4331 was ordered, the Los Angeles division got a scheduled shipping date of July 26, 1981. It looked as though the move to the 370/135 was inevitable, because more computer power was needed in a short time and the lease on the 360 would expire at the end of October.

Fortunately, Sweetheart's corporate headquarters, currently using a 370/148 and a 370/145, had also ordered a 4331 (configured somewhat differently) with a tentative delivery of September 1979. Shipment of this processor was diverted to Sweetheart on Oct. 2. The other two pieces, accidentally shipped to Maryland, turned up on Oct. 4. IBM's field engineers encountered problems with the tape drives and the disk controller, which further delayed turnover until Oct. 9.

THREE-MONTH CONVERSION PLAN

In June, when Sweetheart learned that three months was all the time there was between the release of the delivery schedule and the proposed shipping date, the company knew conversion plans had to be formulated and carried out rather swiftly. To assist in the conversion, the corporate manager of systems programming, John Shasiek, flew to Los Angeles to meet with the IBM systems engineers with hopes of getting the conversion plans under way. At the meeting it was decided that we would generate our system on the weekend of Sept. 21, and John would return to Los Angeles at that time. The software was ordered early in August and should have arrived in plenty of time for the SYSGEN, but for some reason it wasn't shipped until Sept. 16—via ground. Since the SYSGEN had to be postponed, both John and the software arrived the following Monday, Sept. 23.

Graveyard shift was the only standalone time available on the Region 14 data center's 4331, with the first shot being Monday night, the evening of John's arrival. After speedy preparation we proceeded to generate DOS/VSE Release 35 on FBA DASD in the middle of the night. It looked as though the installation was running smoothly until we tried to assemble the Supervisor. Fifteen minutes into the assembly the system inadvertently dumped storage, giving no indication of what went wrong until the dump was finished. "Wrong length record" was the message provided as the reason for Abend. According to the messages manual, this was the result of having overlapping extents on the system work files.

After several attempts, and making sure that there was no overlap, we used Baltimore's access code to call the Software Center to try and resolve the problem. After a couple of days, we were informed that this message had been encountered before, but only on FBA DASDs. To get around this, we were told to enlarge the work files and leave 250 to 500 free blocks between each work file that was on the same spindle.

The problem disappeared, only to be replaced by another. Once we were able to receive the listing from the assembler, some mysterious errors were encountered: "Unexpected end-of-book" and "unexpected end-of-file" occurred for some of the macros used to assemble the supervisor. After many hours of unproductive work, we were able to pinpoint the problem. The PID tape for VSE Advanced Functions was defective and had to be replaced. This meant more waiting and frustration. John left for...
There are no operating system modifications or changes, a program using COBOL as its language and cataloged into the core image library. The application program inventory included roughly 350 programs, all but eight written in ANSI COBOL. Of the remaining programs, five were written in RPG and other three in assembler. The RPG programs were rewritten in COBOL, and the assembler programs, one of which was the BTAM telecommunications program, needed only minor modifications to run on the 4331. About 90% of the COBOL programs were successfully modified with the use of a program written to access the private source library on the 360. The remaining 10% had to be altered manually due to certain peculiarities of VSAM which could not be handled properly by the ISAM Interface Program (IIP).

Virtual Storage Access Method (VSAM) and Sequential Access Method (SAM) are the only file organizations supported for FBA DASDs. This means that all Index Sequential (ISAM) and Direct Access Method (DAM) files have to be converted to VSAM. This can be accomplished by offloading the existing ISAM and DAM files to tape and bringing them over to VSAM with the use of Access Method Services (IDCAMS). In addition to IDCAMS, VSAM provides the ISAM Interface Program, which allows the processing of VSAM files by program already written for ISAM, while remains totally transparent to the user.

Due to limitations in processor and disk storage, the 360 had been running without a spooling facility. POWER/VS added the benefit of spooling to the 4331 but also required more programming and Job Control considerations. Since the configuration of the 4331 was so different from that of the 360 and the facilities of the new Job Control Program were far greater (and also different), we decided it would be easiest to rewrite all of the JCL from scratch.

Hardware differences between the 360 and the 4331 meant additional software considerations. The 3203 mod 5 printer, for example, no longer uses carriage tapes for page formatting and has no operator control for page density (6 lines per inch vs. 8 lines per inch). Instead, these functions are handled by Forms Control Buffers (FCBs), which are coded in assembler language and cataloged into the core image library. The assembled FCBs are loaded by POWER/JCL (Job Entry Control Language) or by a supplied utility (SYSBUFLD).

The system parallel was scheduled for the month of October, but was cut short because of the delay in receiving the machine. Nearly all the programs and job streams have been converted or rewritten and the testing is nearly complete; by Nov. 1 all production was expected to be running on the 4331.

During the testing phase of the parallel, many benchmarks were run against the 360. For the most part the production job streams tested on the 4331 ran between 3.5 and 4.5 times faster than on the 360/30 with the exception of COBOL compiles, which ran between eight and 10 times faster. In addition to the increase in processor speed, the 4331 running DOS/VSE with Advanced Functions allows for up to seven partitions (five partitions without Advanced Functions). Throughput will be maximized using the spooling software (POWER/VS) and the development of on line programs is now being considered.

I feel that the 4331 conversion went far more smoothly for the most part than originally anticipated, and that the 4331 is a very attractive replacement for the 360/30.
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