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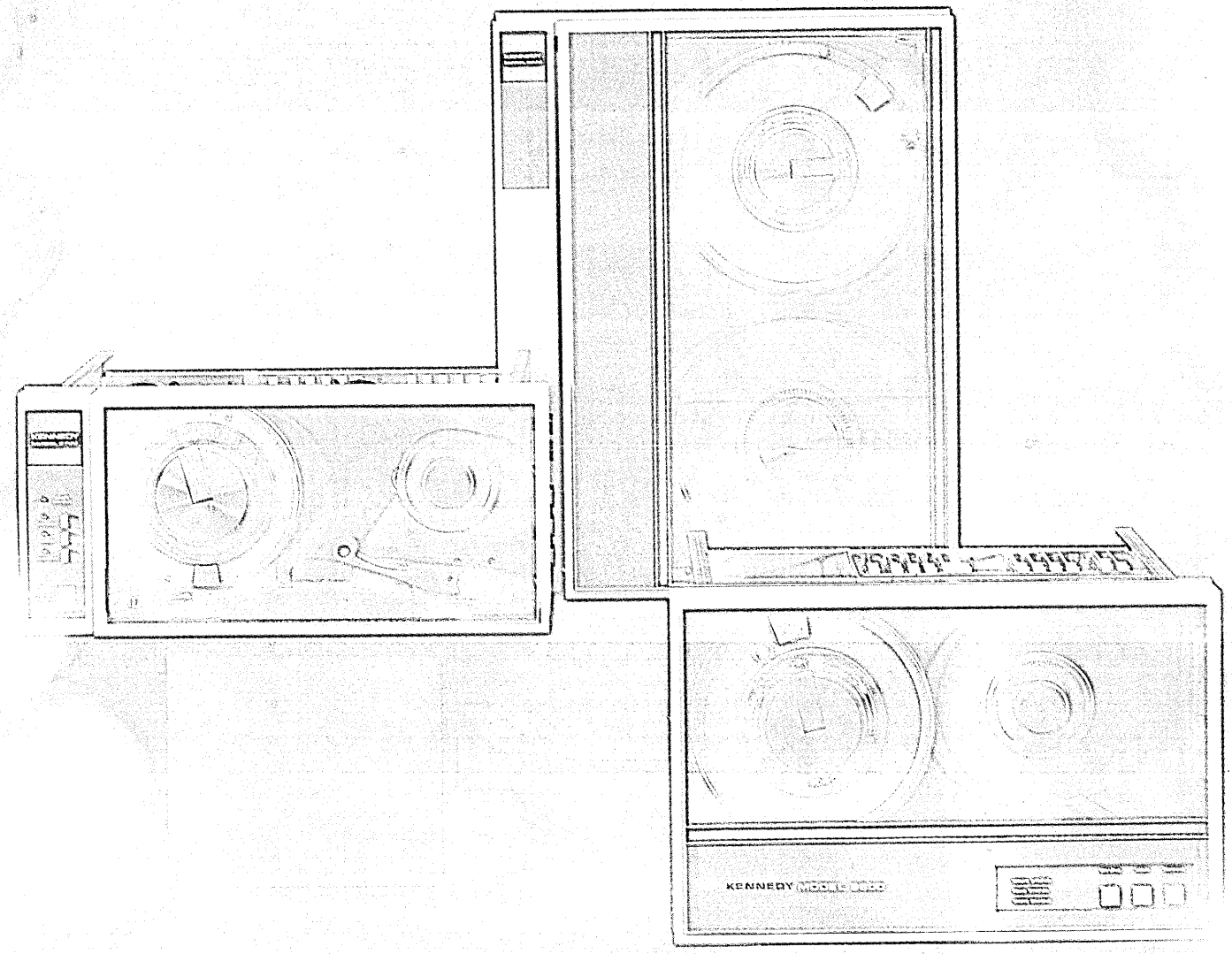

KENNEDY: QUALITY—COUNT ON IT

Julie's doing accounts payable

Mary's entering cash receipts

Norma's printing sales reports

And Sue's editing customer letters!

$3.29 an hour*

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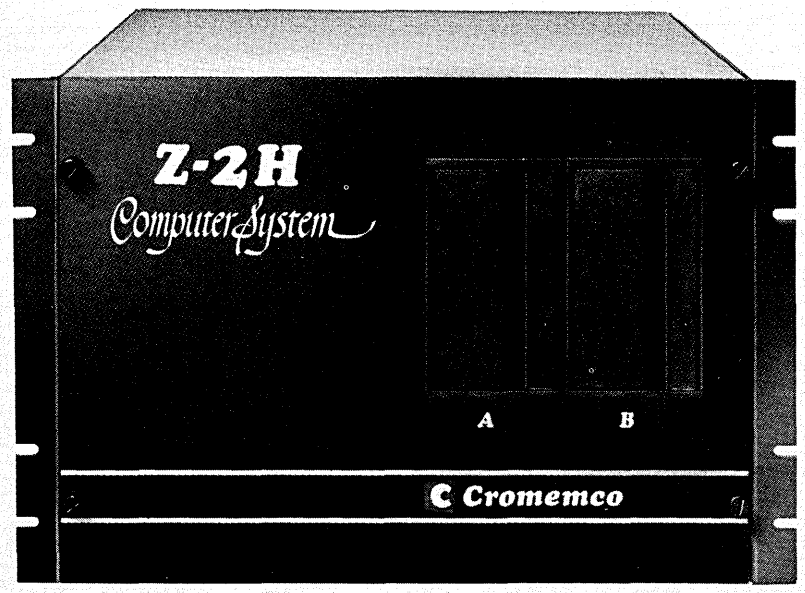


Low-cost hard disk computers are here

11 megabytes of hard disk and 64 kilobytes of fast RAM in a Z80A computer for under $10K. Two floppy drives, too. Naturally, it's from Cromemco.

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

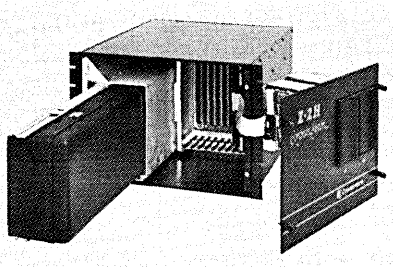
With the Z-2H you also get the broadest software support in the microcomputer field. Software Cromemco is known for. Software like this:

- **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.



Hard disk drive at lower left can be interchanged just by sliding out and disconnecting plug. Seven free card slots are available. Z-2H includes printer interface card.

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 @ +18 V, 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.

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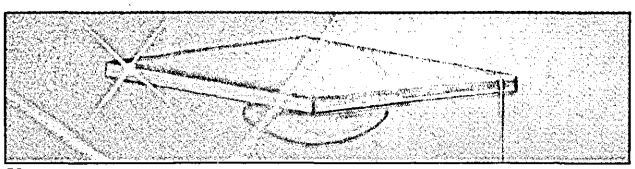
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NEWS IN PERSPECTIVE

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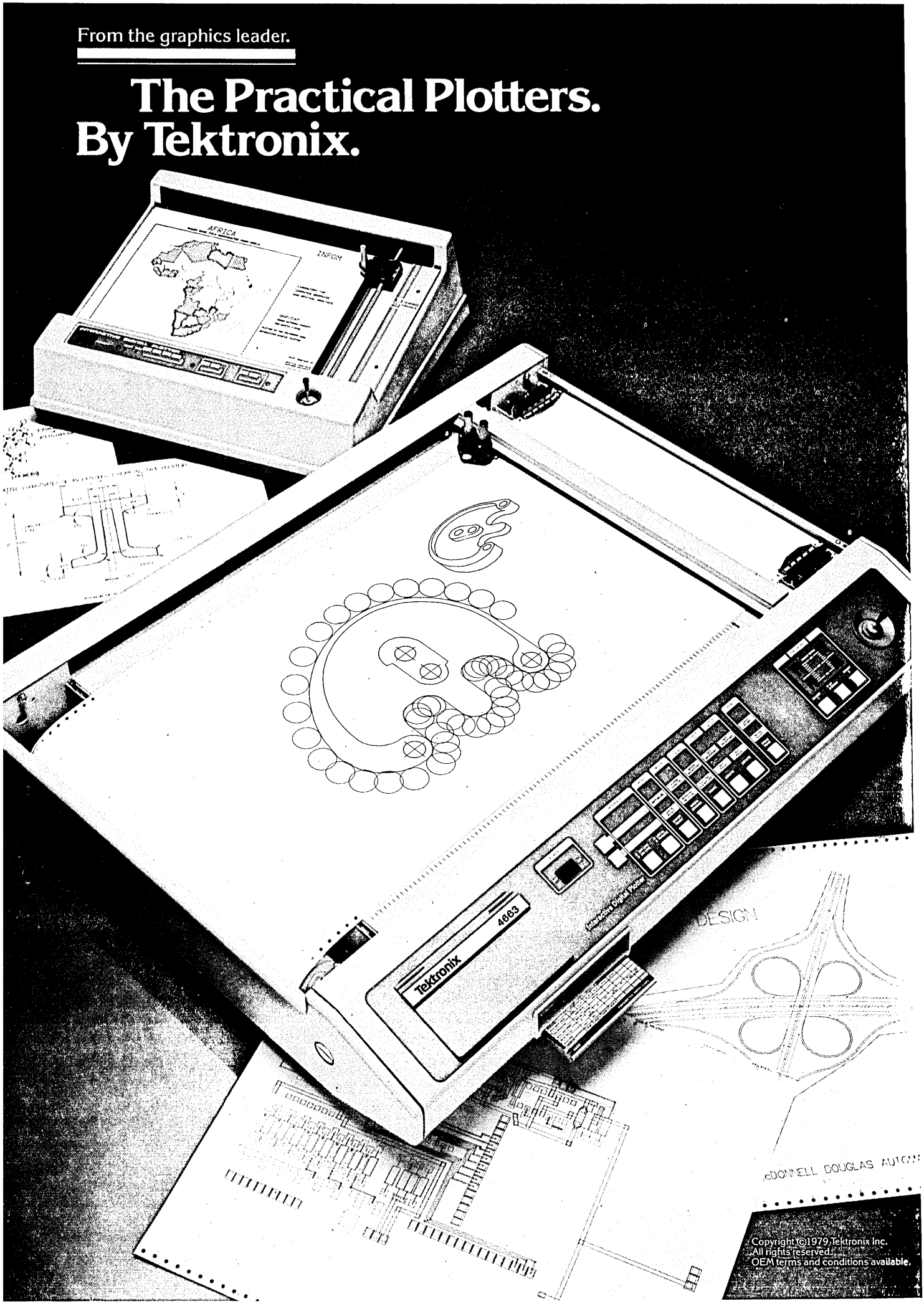

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Practicality is why Tektronix pioneered the smart small plotter. Why we led the move to more reliable, digital technology. We're proving that big plotter performance can take a small plotter price, with capabilities like those of our C-size (A2) 4663.

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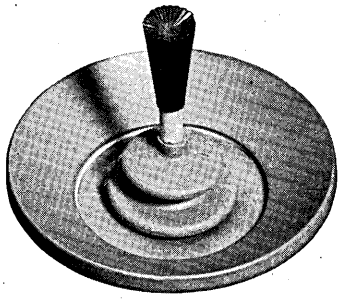
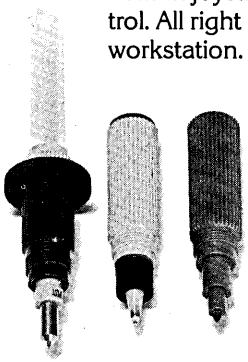
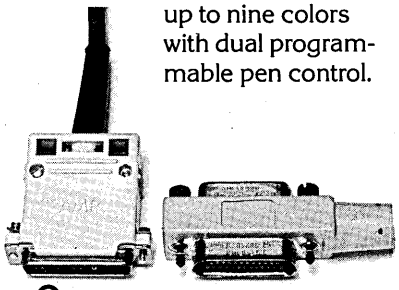


Interactivity. Microprocessor intelligence not only makes the 4663 semi-independent, it lets you draw real curve forms. Rotate characters. Digitize with built-in joystick control. All right at your workstation.



Versatility. The 4663 plots on paper, film or Mylar® With felt tip, wet ink or ballpoint pens. In up to nine colors with dual programmable pen control.



Compatibility. From its RS-232-C and GPIB (IEEE-488) interfaces, to options like foreign language fonts and circular interpolation, our plotters mesh with your present system and particular needs. Powerful, wide-ranging software routines are both inexpensive and easy to use.

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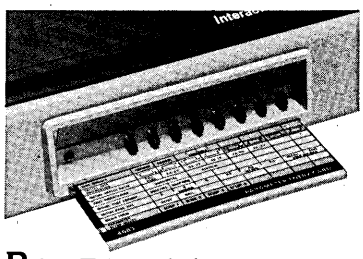

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CIRCLE 9 ON READER CARD

LOOKING BACK

JANUARY/FEBRUARY 1960

In May of 1959, the Committee on Data Systems Language met to establish a format for a common business language. Three committees were involved: the Executive Committee, the Intermediate Range Committee (Task Group #2), and the Short-Range Language Committee (Task Group #1). This first meeting instructed Task Group #1 to find out just how effective the business compilers that then existed were (i.e., FLOWMATIC, AIMACO, and COMTRAN). The committee was to report its findings on Sept. 1, 1959 to the Executive Committee. At this meeting, Task Group #1 brought in the basis of COBOL (COmmon Business Oriented Language), and stated that it had the "framework upon which an effective common business language can be built." It then requested an additional three months to complete its system. Task Group #2 had several meetings in October during which it expressed displeasure with COBOL and requested that the Honeywell Business Compiler be the basis for a common business language. The Executive Committee received this resolution, never acknowledged it, and the motion died.

Finally, on Jan. 7 and 8, 1960, the Executive Committee accepted the COBOL work done by Task Group #1, and began plans for publishing the system. However, acceptance of and enthusiasm for COBOL were far from unanimous. Critics felt the no-frills design left it open for alteration, rendering the common language "uncommon." Here are the members of the three committees:

Executive Committee

Chairman: Charles A. Phillips, Office, Secretary of Defense.

Members: E.J. Albertson, U.S. Steel; Joseph F. Cunningham, HQ, Dept. of Air Force; Robert B. Curry, Southern Railway; Gregory Dillon, Du Pont Co.; A. Eugene Smith, Bur. of Ships, Navy Dept.; Joseph Wegstein, NBS; Mel Grosz, Esso Standard Oil Co.

Advisors: Robert W. Bemer, IBM; Dr. Grace M. Hopper, Sperry Rand.

Intermediate Range Committee (Task Group #2)

Chairman: A. Eugene Smith, Bureau of Ships.

Members: John Backus, IBM; Robert Bosac, SDC; Donald Bradley, Chesapeake & Ohio Railway; Carl Byham, Southern Railway Co.; Les Calkins, U.S. Steel; Ben F. Cheydleur, RCA; Richard F. Clippinger, DATAmatic Div., Minneapolis-Honeywell; Gregory Dillon, Du Pont Corp.; Lt. William Fell, U.S. Army Signal Agency; Kenneth A. Foster, Sylvania Electric Products; Walter Frese, Harvard Business School; Roy Goldfinger, IBM; A. D. Hestenes, G.M.; Donald B. Houghton, Franklin Institute; Renee Jasper, Navy Dept.; Jack Jones, Air Materiel Command; Charlie Katz, GE; William P. Keating, NCR; George M. Perry, Travelers Ins. Co.; Howard E. Robinson, AMC; Robert Rossheim, Sperry Rand; Ja. Laurence Nelson, AF; Peter Sheridan, IBM; Albert E. Smith, Navy Dept.; John R. Smith, Aeronutronic; Jack A. Strong, North American; Dick Utman, Ramo-Wooldridge; Sal Pollock, RAND; Orren Evans, Hunt Foods; Lee H. Amaya, Lockheed.

Short-Range Language Committee (Task Group #1)

Chairman: Joseph Wegstein, NBS.

Members: Col. Alfred Asch and Duane Hedges, Air Materiel Command; William Carter and Charles Gaudette, DATAmatic Div., M-H; Howard Bromberg, Norman Discount, Ben F. Cheydleur, and Mary K. Hawes, RCA; Frances E. Holbertson, David Taylor Model Basin, Wash., D.C.; Jean E. Sammett and Vernon Reeves, Sylvania; William Selden, IBM; E.F. Somers and R.J. Rossheim, Sperry Rand; Gertrude Tierney, IBM; William Logan, Burroughs; Dan Goldstein, Sperry Rand.

(These names represent not only committee members but also some of the

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Six feature-laden models to fit any teleprinter network.

NEC Spinwriter™ terminals are fine-quality communications devices that are enriching thousands of terminal networks.

Users call them "super" terminals because Spinwriter devices are versatile, user-configurable, quiet, dependable, and print at rates up to 55 CPS.

They come in six models, including an APL/ASCII model. They have numerous operator convenience features. They are available in both RO and KSR configurations. And they offer a wide variety of forms handling options.

Our APL/ASCII model, for example, supports the APL programming language and character set. Automatic tab setting simplifies printing of columns. And our unique 128-character print elements allow you to convert easily—by switch or under software control—from APL to ASCII mode.

Spinwriter terminals offer more forms-handling options than other terminals: vertical, horizontal or bidirectional tractors; and pin-feed, friction-feed, bottom-feed, front-feed and cut-sheet devices. Most are operator-changeable.

NEC Spinwriter terminals are the most rugged, and the quietest, typewriter-quality terminals you can buy. Our 2000-hour MTBF assures maximum uptime. Our 60 dbA sound level lets you put them in an office.

For more information about NEC terminals, call our nearest sales office.

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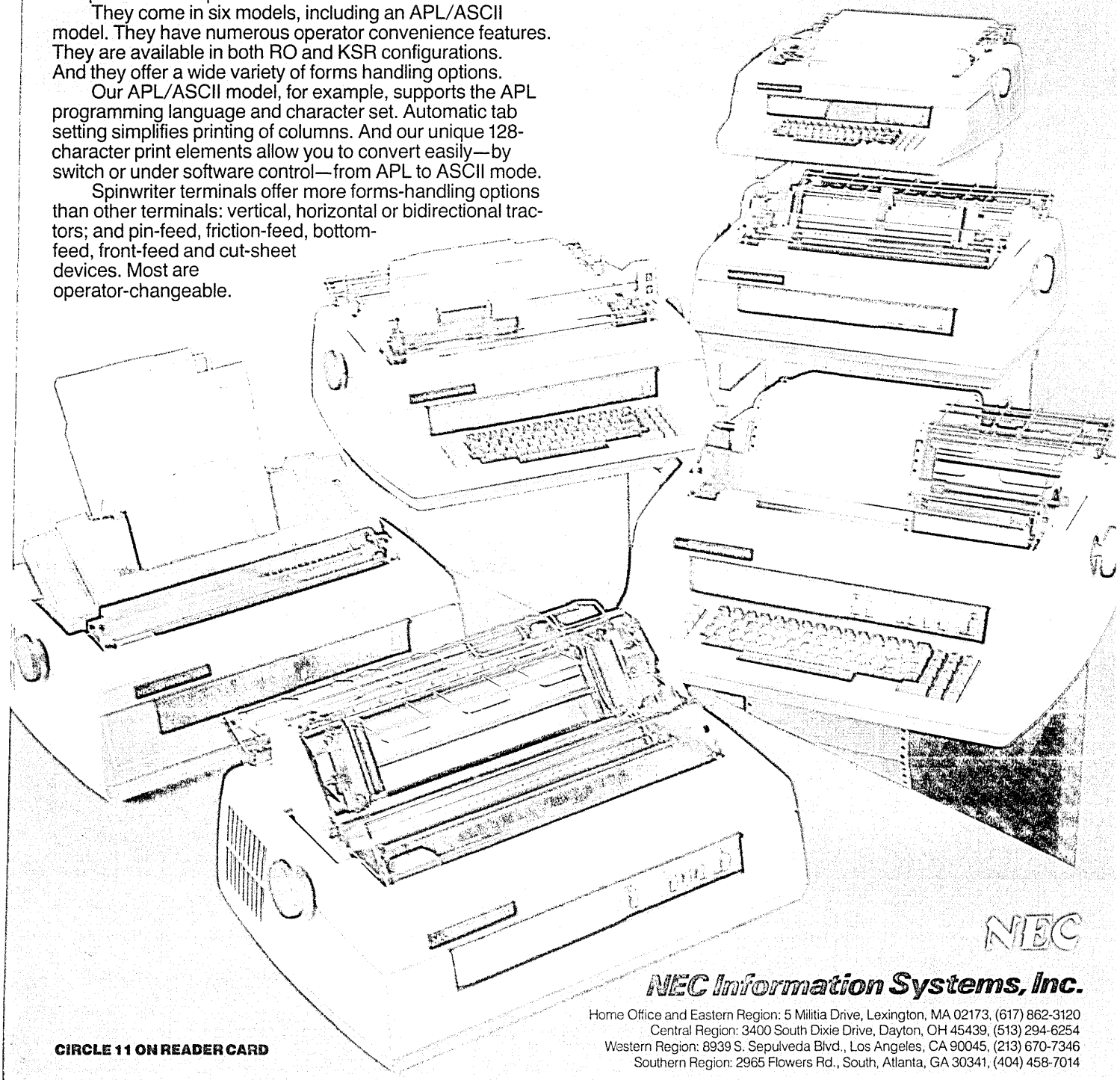

NEC

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Southern Region: 2965 Flowers Rd., South, Atlanta, GA 30341, (404) 458-7014

CIRCLE 11 ON READER CARD

LOOKING BACK

individuals who, at one time or another, assisted the three committees.)

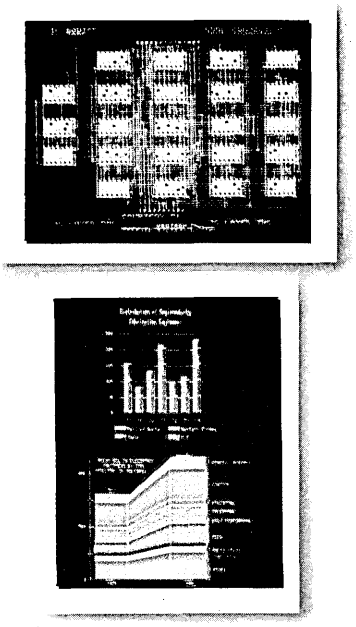
JANUARY 1970

The '70s brought sizable increases in the production of computers and computer-related equipment, along with correspondingly lower prices. Some products were purchased at 50% of the asking price only 12 to 18 short months prior to January 1970. The industry was growing rapidly and a new generation—the fourth—soon to burst on the scene, showed great promise. However, would this new generation be at all compatible with the old one? Or would users again have to discard complete, costly systems as they had in previous transition periods? Alas, there was no crystal ball to guide us through the new problems.

The usual apprehension present with any change was felt by those in the industry. There were many obstacles that required immediate acknowledgement and attention. One such problem that had to be grappled with was the pitiful lack of lack of communication the computer industry maintained with the noncomputer-oriented world. As stated by Fred Gruenberger, ". . . we blandly assume that whatever we conclude as computer people becomes public knowledge, only to discover some years later that we were really keeping our efforts hidden from outsiders. In short, our public relations work has been, and is, woefully inadequate." Those people not in close contact with the industry were constantly making suggestions that had already been thought of, activated, or canceled by the experts. The suggestions may or may not have been worthy ones, but the obvious importance of communication was clearly being overlooked.

Another problem mentioned was the lack of fresh new ideas and talented people to recognize the opportunities. As Edison Schroeder (then vp of Edutronics) put it, "The '60s have witnessed an incredible proliferation of computer hardware, software, jargon, and people; but actually, new ideas have been scarce. New people, on the other hand, are very much in evidence. These new people foul things up, and its's next to impossible to get enough qualified people to cope with the resulting problems.

In addition to the problems facing the industry in the new decade, there was a certain sense of loss. The dinosaurs from the '50s and '60s were slowly making way for the more compact newcomers. One such dinosaur was the AN/FSQ-7, known as the Q-7. This machine, which started many a toddling programmer on his way, was sophisticated in the '50s, modified in the '60s, and outdated by 1970. Of the nearly 30 duplex systems constructed and installed, half had been scrapped by January of 1970 (each machine amounted to approximately 300,000 pounds of scrap metal). **—Debbie Sojka**



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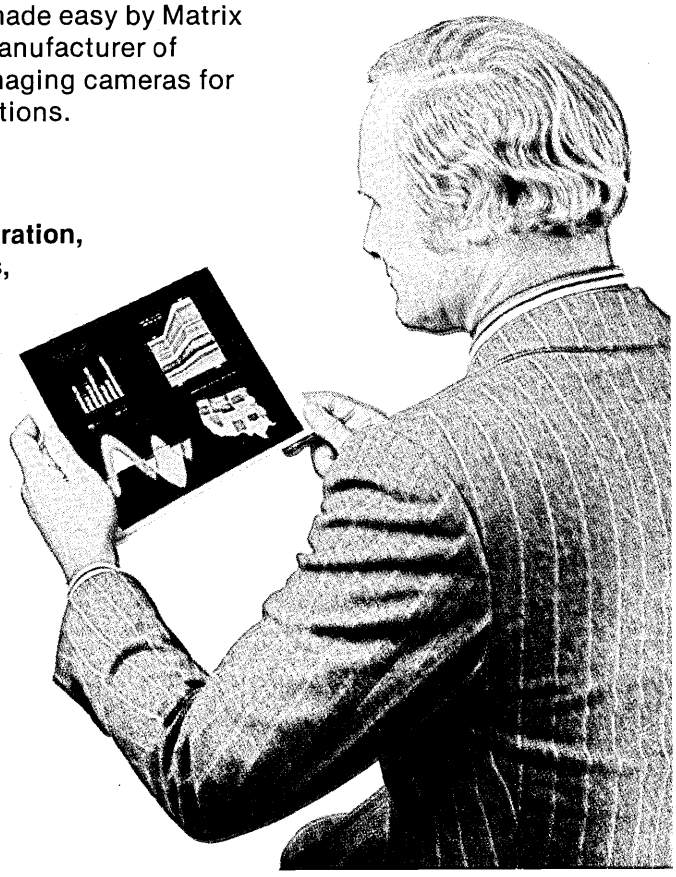

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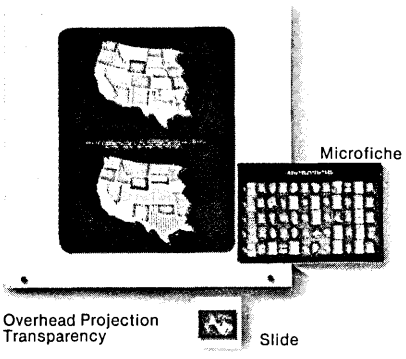

 # MATRIX INSTRUMENTS

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CIRCLE 13 ON READER CARD

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WE COULD MAKE JUST MINICOMPUTERS, BUT THERE'S NO FUTURE IN IT

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The basic V77-600 and V77-800 are super powerful, high performance, Pascal operating minicomputers. But standing alone they can't do everything for everybody.

That's why we've designed a complete line of competitively priced support peripherals. With Sperry Univac you can expand the utility of your system and continually provide capacity for growth with peripherals specifically compatible to your Sperry Univac minicomputer.

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INTRODUCING OUR FAMILY

Our minicomputer customers needed reliable, quality support from one source so we developed a complete line of peripherals. Some of the peripherals we now have available include:

Diskette storage system
10 MB cartridge disk system
30 to 232 MB disk storage system
800/1600 bpi mag tape units
Sperry Univac serial printer
300/600 LPM printer
Card reader
Asynchronous buffered terminal
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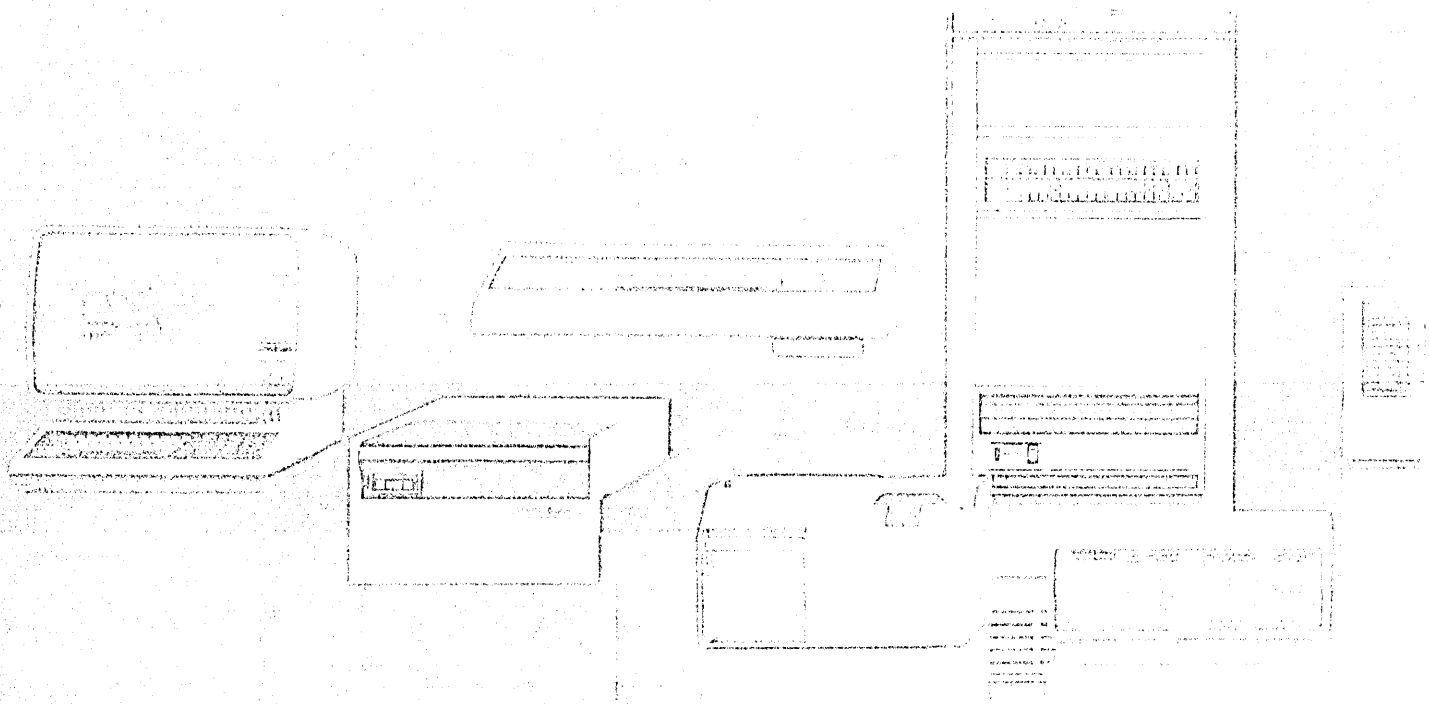
3270 compatible terminal



And of course, we introduced SUMMIT, the interactive, multi-terminal system with transaction processing and data base management. It gives you easy editing, screen formatting, and documentation aids, plus comprehensive program development.

SUMMIT also offers flexibility for software design and allows our system to speak not only Pascal, but COBOL, FORTRAN, and RPG II.

WE TAKE CARE OF OUR CUSTOMERS.

The Sperry Univac sales and service network is one of the largest and most responsive in the world. With over 8000 customer engineers available to keep our systems up and running, we can provide prompt, complete service for both our mainframes and peripherals on a worldwide basis.

And that service is the finest. We've established a major computer education center in Princeton, New Jersey and several regional training schools throughout the United States and Europe. Our educational system insures the degree of excellence and competency in our service staff necessary to maintain all our equipment at peak performance.

OUR TOTAL COMMITMENT.

At Sperry Univac we have a reputation for quality, performance and service in the computer industry.

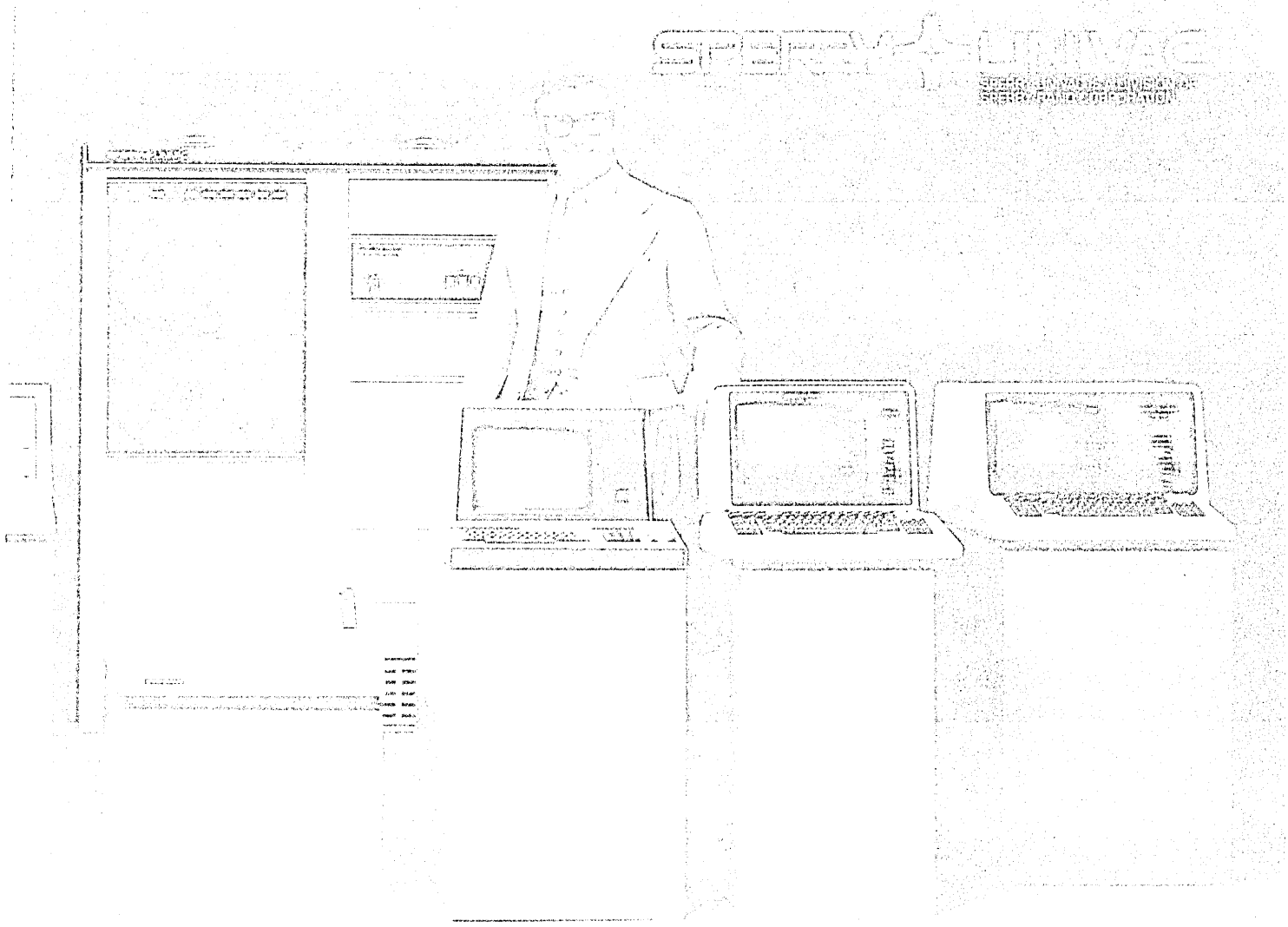
That's why we've committed ourselves to a major investment in facilities, research and development, quality control and worldwide service. We want to produce a complete line of dependable, reasonably priced minicomputer systems that are as respected as Sperry Univac mainframes.

We want to keep you in the family.

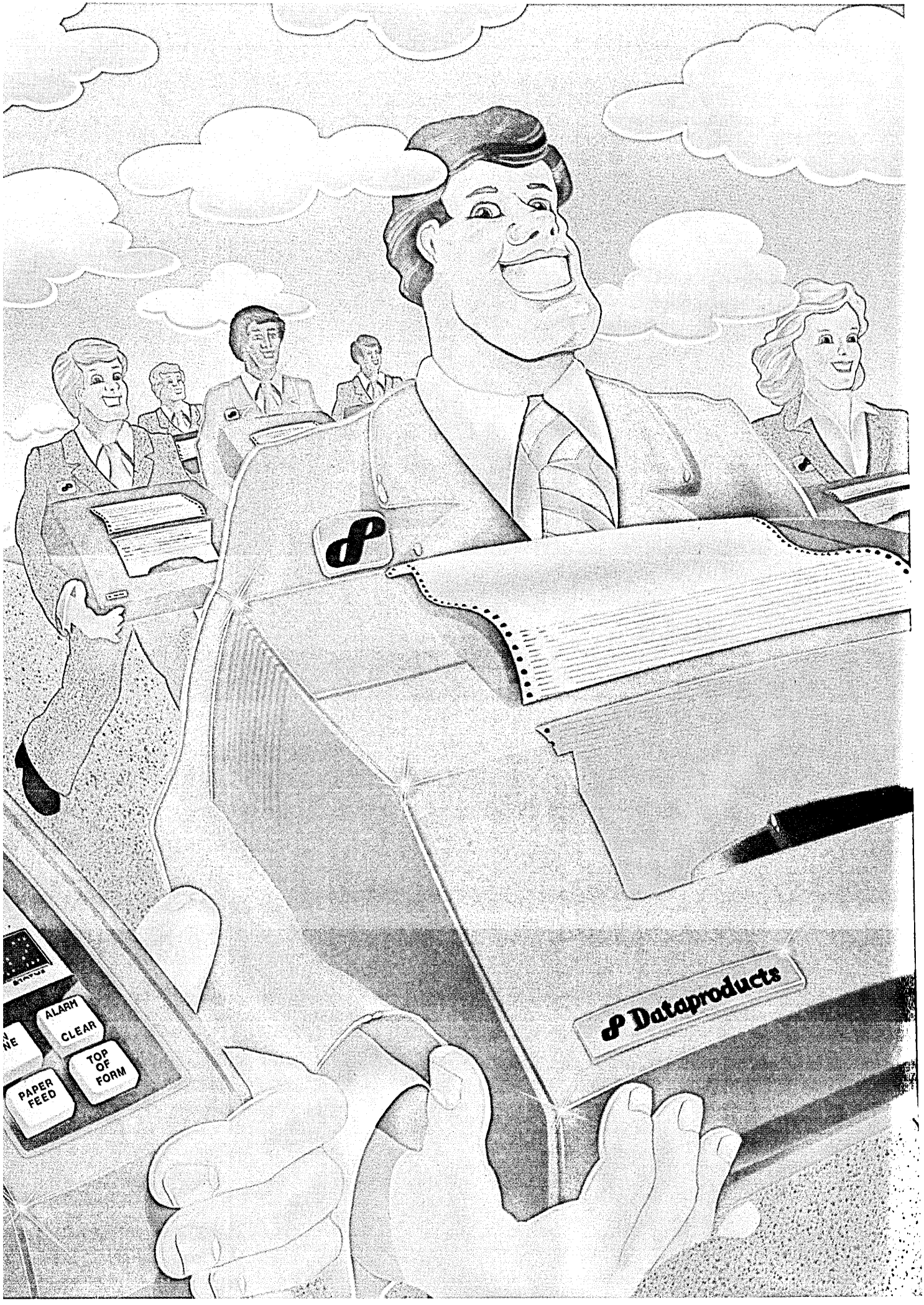
For more information, write to us at Sperry Univac, Mini-Computer Operations, 2722 Michelson Drive, Irvine, California 92713. Or call (714) 833-2400, Marketing Communications.

In Europe, write Headquarters, Mini-Computer Operations, London NW10 8LS, England.

In Canada, write Headquarters, Mini-Computer Operations, 55 City Centre Drive, Mississauga, Ontario, L5B 1M4.



CIRCLE 14 ON READER CARD


ALARM
CLEAR
TOP
OF
FORM
PAPER
FEED
Dataproducts

Big news from the printer giant.

Dataproducts introduces the 180 cps matrix printer with the features systems builders want.

A name you know you can trust.

We're the world's largest independent printer manufacturer.

(The giant, you might say.)

For 18 years, we've built printers for the biggest OEMs in the business—customers with some pretty tough standards. All our printers must be proven reliable before we can attach those big names to the cabinets. Our new M-120 matrix printer is now available with *our* name attached to the cabinet. Or with your name.

The M-120. Easy to recommend. Easy to own.

The M-120 is priced to be competitive with ordinary printers.

But this is no ordinary machine. This one prints as many as six copies at once. With crisp, easy-to-read print. In condensed, standard or expanded characters.

It's designed for minimum cost of ownership. There's no preventive maintenance needed whatsoever.

Its unique removable head is good for 200 million characters at least. Then the operator simply replaces it. No service call is required.

Its long-life ribbons come in cassettes, so they're easy to load, clean to handle.

It has its own diagnostics with LED status display available. The operator can identify troublespots and often correct them in a snap, without waiting for a service representative. Downtime is less.

Fully compatible with our 340 cps printer.

For customers who need a faster printer, we offer our M-200 model.

It combines the economy of matrix printing with remarkable speed—340 characters per second.

Its 14-wire printhead lasts through a 300 million character life. Over two years of typical use. No one else has anything like it.

30 day delivery.

Often we can deliver a partial order even faster than that. If time is a problem, give us a call.

Available locally. And around the world.

Some people prefer to deal with our sales offices directly.

Others like the convenience of a distributor nearby.

We have more than 50 distribution points in the United States alone.

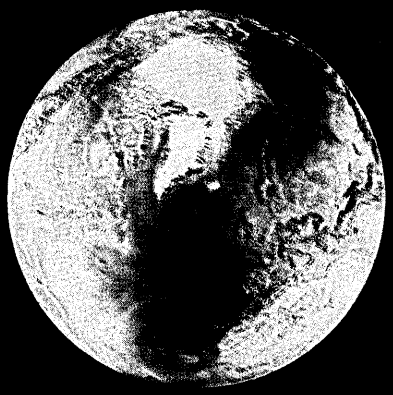
Call for information.

Call (213) 887-8451 to learn more about the M-120 or the M-200.

Or write to our marketing department at 6200 Canoga Avenue, Woodland Hills, California 91365.

Dataproducts

CIRCLE 15 ON READER CARD



T-Bar MASS+™

Network Command Control

T-Bar MASS+ is a micropro—cessor based, state of the art, data communications line accessing system. With T-Bar MASS+, an operator isolates line and equipment faults, restores failed service, reconfigures and expands — MANAGES — your network, using a CRT terminal at one or more dispersed locations.

Whether your needs require transferring a modem between front end ports in your own computer room, or monitoring and testing lines at distributed locations, there is a T-Bar product designed to enhance your system.

For all your network management requirements contact T-Bar.

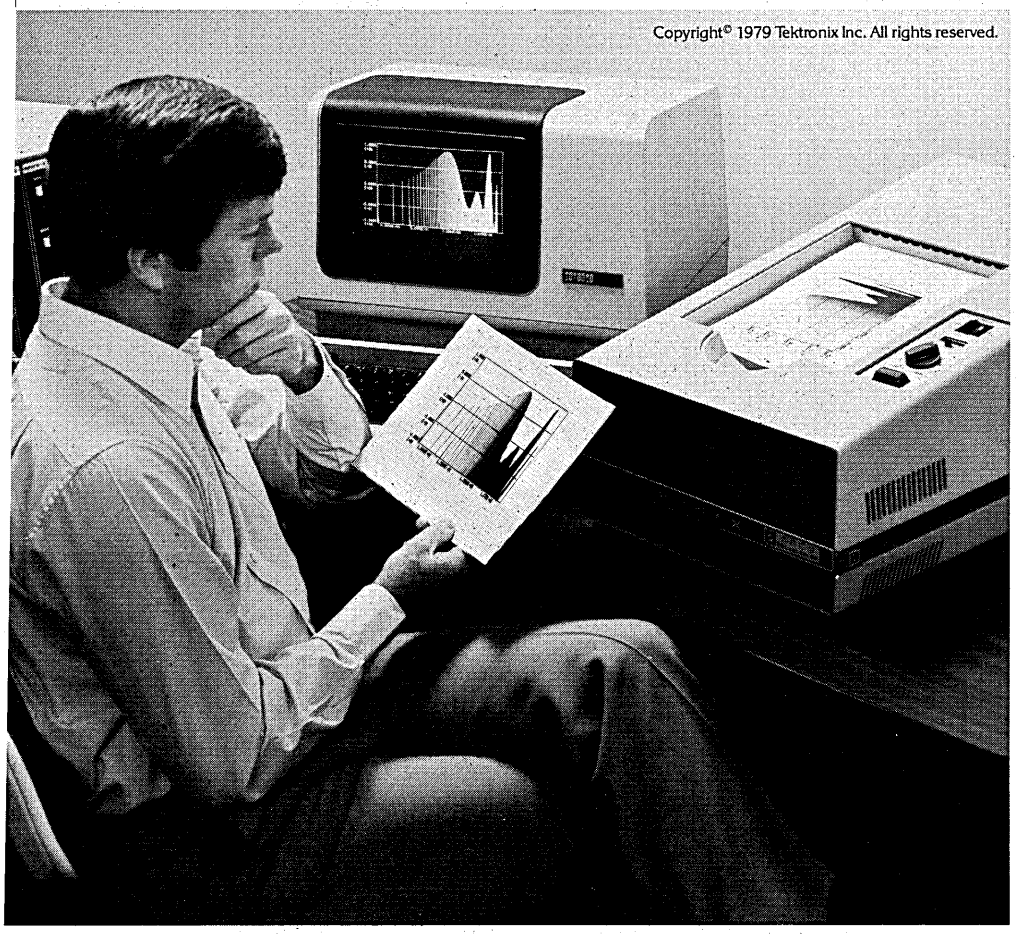
T-bar® INCORPORATED

141 Danbury Rd.
Wilton, CT 06897
203 762-8351

CIRCLE 16 ON READER CARD

From the graphics leader

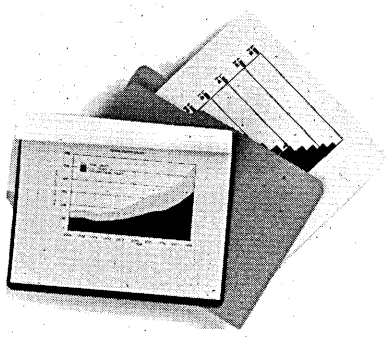
Push a button... put virtually any video display on paper in seconds.



Special symbols. Graphics. Multi-font alphanumerics. Gray scale. They're all easy to copy with the Tektronix 4632 Video Hard Copy Unit.

The 4632 provides high resolution copies of raster scan and other video displays. Their quality is excellent—perfect for formal reports. Yet their cost is low enough to use them for first drafts, and the image long-lasting enough for the file.

RS170 interface makes the 4632 a natural companion to most video systems. Users of video terminals and systems like the DEC MINC system shown here, are taking advantage of the 4632's high resolution hard copies, available at the push of a button. Our dry process means no liquid toner mess, no wasted copies. Operation is quiet and thoroughly dependable.



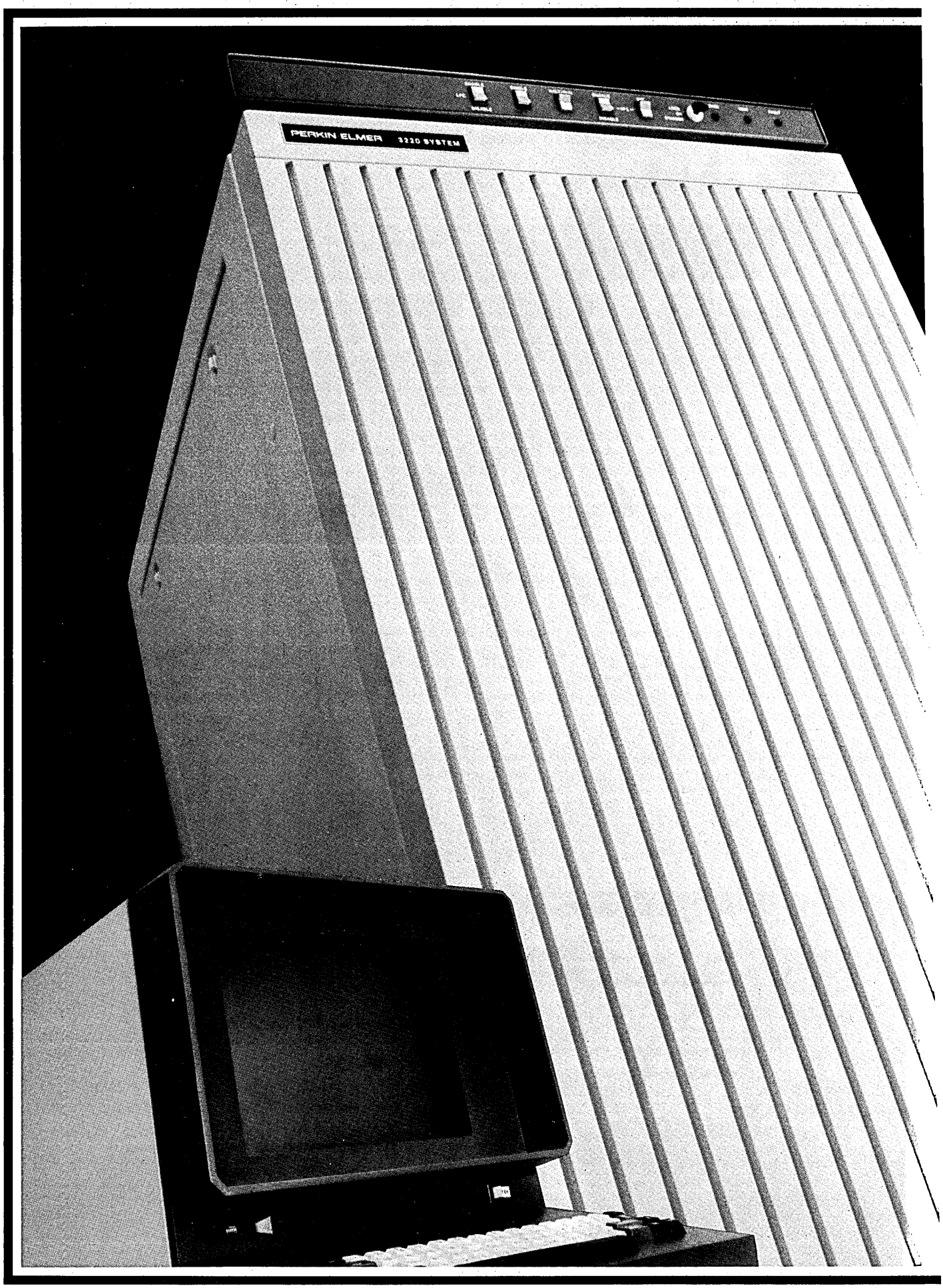
For years, Tektronix has been a leader in the fiber optic technology that provides fast, finely detailed raster scan reproductions. Find out what the 4632 can do for your system. Call your local Tektronix representative or our toll-free, automatic answering service at 1-800-547-1512. In Oregon, call 644-9051 collect.

OEM terms and conditions available.

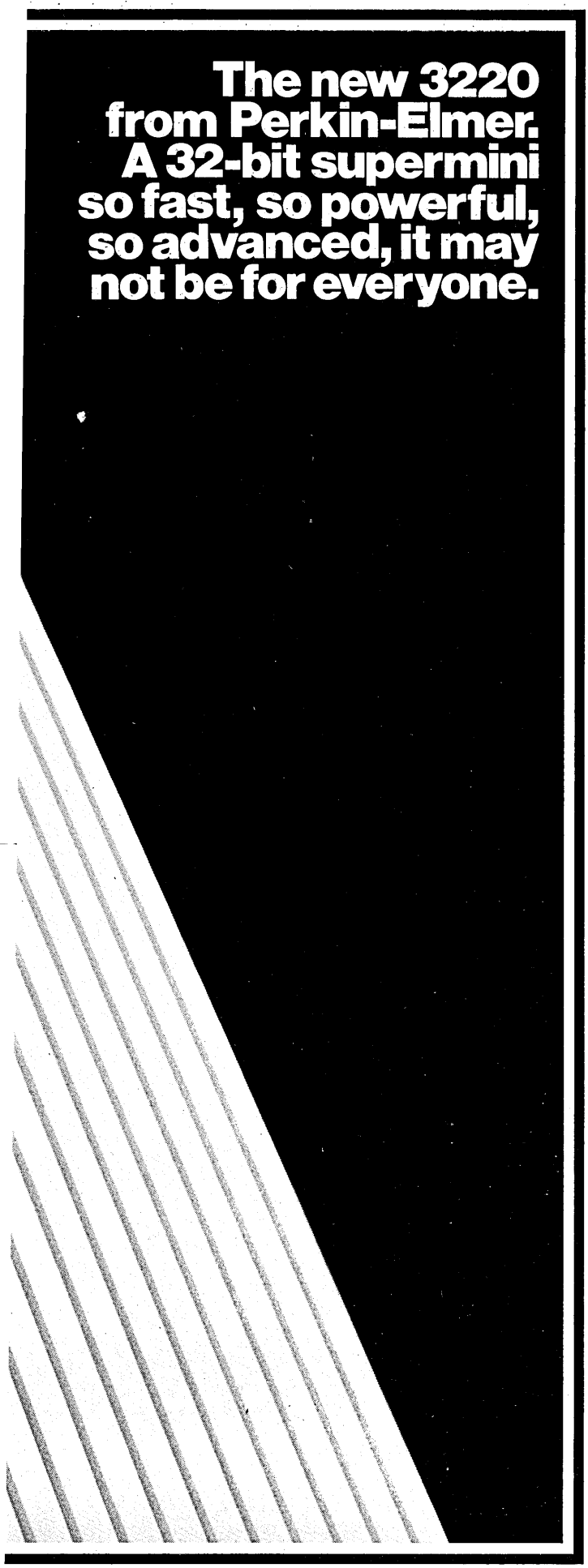
Tektronix, Inc.
Information Display Division
P.O. Box 500
Beaverton, OR 97077
Tektronix International, Inc.
European Marketing Centre
Post Box 827
1180 AV Amstelveen
The Netherlands

Tektronix®
COMMITTED TO EXCELLENCE

CIRCLE 17 ON READER CARD


PERKIN ELMER
3220 SYSTEM

The new 3220 from Perkin-Elmer. A 32-bit supermini so fast, so powerful, so advanced, it may not be for everyone.



Here are 5 ways to tell if it's for you.

1. You need 32-bit hardware and software performance: Your transaction processing system requires instantaneous terminal response. Your real-time control system must offer very high throughput. Your scientific programs must run incredibly fast and yield exceptionally accurate results.

2. You need help to develop programs quickly and easily: You need one language—COBOL—for all business applications, whether batch or transaction processing. You require multiple high-level languages. The faster you can identify programming errors, the faster you can correct them—so you really appreciate the value of our globally optimizing FORTRAN VII. It has a separate development compiler that produces object modules at a speed of 2,000 lines per minute. And with our Multi-Terminal Monitor, you can have 32 programmers working simultaneously with COBOL, FORTRAN, CAL MACRO, or RPG II.

3. You need a system with unmatched integrity: Your commercial data base needs to be fully safeguarded from media faults and system failures. Your scientific results require single- and double-precision floating point accuracy. And your time-critical, memory-resident programs for real-time control applications need the protection of our dynamic memory relocation and protect hardware.

4. You need 32-bit performance at 16-bit prices: The Perkin-Elmer Model 3220 starts at $33,500 (U.S. only). And our OEM terms and conditions are *unmatched* in the industry.

5. You need a vendor that stands behind its products: Perkin-Elmer maintains a worldwide field service operation and offers a variety of support program contracts. We offer comprehensive hardware and software training courses. And we pride ourselves on responsive systems and software support.

The Perkin-Elmer Model 3220. It may not be for everyone. But if even one of these points touched a nerve, you should find out more about this remarkable supermini. Send the coupon for a fact file. Or call toll free 800-631-2154. In New Jersey: (201) 229-6800.

Perkin-Elmer • 2 Crescent Place • Oceanport, NJ 07757

Please send me your fact file on the 3220.

Name _____ Tel. _____

Title _____

Company _____

Street _____

City _____ State _____ Zip _____

D1

PERKIN-ELMER

CIRCLE 18 ON READER CARD

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 management; and more.

Call us for details on the new BTI 5000/ES.

BTI COMPUTER SYSTEMS

* Single quantity; attractive quantity discounts for the OEM.

BTI, 870 W. Maude Ave., Sunnyvale, CA 94086. Sales Offices: Piscataway, NJ (201) 457-0600; Cherry Hill, NJ (609) 662-1122; Braintree, MA (617) 843-4700; Minneapolis, MN (612) 854-1122; St. Louis, MO (314) 878-8110; Dallas, TX (214) 630-2431; Sunnyvale, CA (408) 733-1122; Anaheim, CA (714) 533-7161.

CIRCLE 19 ON READER CARD

LOOK AHEAD

BIG SERIES/1 ORDER STIRS SPECULATION

Word has it that State Farm Insurance, Bloomington, Ill., has ordered "thousands" of Series/1 computers from IBM's General Systems Division. Though it puzzles us too, our most reliable sources say the systems will actually be Series/1s repackaged as 5110s. An IBM competitor called the mysterious model "a Chevy with a Ford engine." The systems will be used in on-line policy preparation, an application designed by GSD especially for State Farm. The contract represents a significant move for GSD into the multiple order, large corporation marketplace, a territory closely held by IBM sibling DPD, and a territory necessary for a division to stake out if it is contemplating independence. There is a triumph here, too, for the Series/1, a much maligned system initially marketed too widely for sufficient support...and support was needed on its lean, stiff RPS operating system.

NIXDORF SUCCUMBS TO COBOL

Nixdorf will offer concurrent ANSI-compatible COBOL this year: demos in the first quarter, delivery by the third. This will be a turnabout for the German computer corporation, which had previously defended its EDITOR, a COBOL-like language, as offering the best of COBOL without excessive overheads.

PRIME READYING LOW-END 50 SYSTEM

Prime Computer will reportedly offer a low-end extension of its 50 Series systems in February. Expanding the oem focus of the firm's bottomline Prime 450, the new machine will be aimed at the systems house market (although there may be a second version for stand-alone sales). The new system will be fully compatible with the rest of the Prime line, and priced at about $40,000. It will run PRIMOS, but limited horsepower will restrict use of more than one communications software package simultaneously.

AMDAHL V7 LESS THAN BARGAINED FOR

In some large on-line systems, Amdahl's V7 has apparently been performing considerably below benchmark figures collected from test runs on prototype systems. At the Bank of Montreal in Toronto, a V8 has replaced a V7. It ran the bank's CICS on-line banking system, handling up to 75 transactions/second. The V7 offered only 91% of the throughput the bank got in its benchmark tests on the PO V7 prototype. The bank blamed late engineering changes. "Amdahl hinted that some others had similar problems," said a bank MIS exec, "but none apparently as bad as ours." The bank says it's "very happy" with the new V8.

WP STANDARD IN THE WORKS

An important first step has been taken in the effort now underway within Ansi to formulate standards that will allow communications between word processors from different vendors. Working Group 4 of X4A12 has completed a working draft of a page image format. Although the format uses only the standard 128 character ASCII code set, it is

LOOK AHEAD

the first step towards allowing word processors to talk to each other. Future drafts may include an expanded code set, according to Ira Cotton, group manager for office automation projects at the National Bureau of Standards.

The initial draft includes 10 control functions, superscript, subscript, page format selection, and spacing increment commands. It does not cover such vital areas as tab setting, centering, paragraph, and page commands used in commercially available word processors.

The standard could be ready for adoption by this spring, which would mean that work could begin on the expanded code set. But many vendors have already assigned numerical codes for the expanded functions used in their systems. How receptive they would be to a more comprehensive standard, one that would require modifying their code sets, is anybody's guess. Meanwhile, users are hopeful that the current effort will ultimately allow all word processors to communicate in a common language.

IMS FOR THE EIGHTIES

"If you thought you would be rid of IMS in the 1980s, forget it," says the November 1979 issue of "Data Base Newsletter," published for customers of Performance Development Corp., a Princeton, N.J. software company. "IBM expects IMS to be the premier IBM data base product for the foreseeable future." Although IMS won't go away, the newsletter says, it will be easier to use in the 1980s because IBM is aware that IMS is complex, difficult to program, and doesn't solve all application problems. And IBM has the "technical smarts" and the "market incentive" to do something about those problems, the newsletter adds.

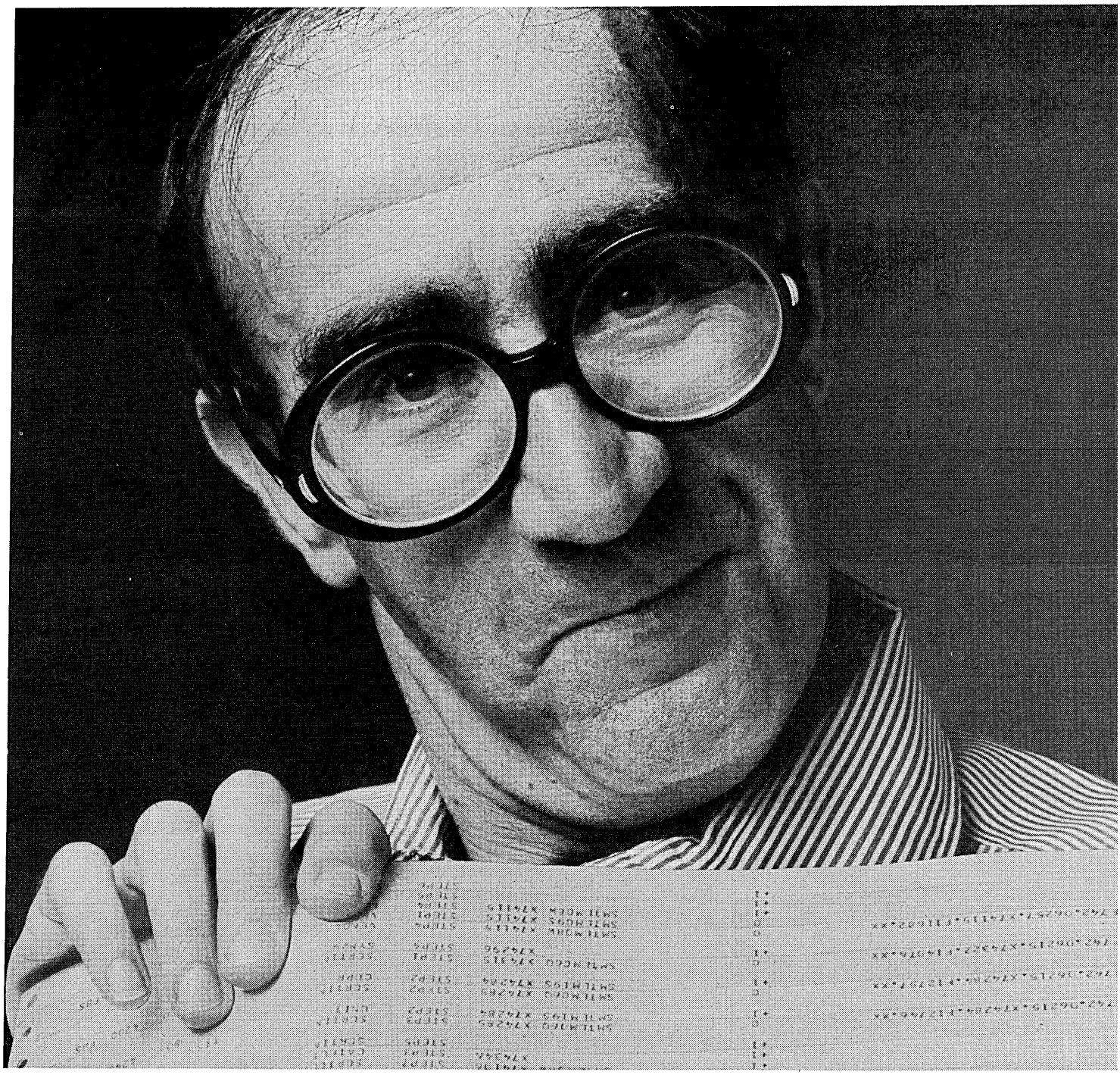
NEW VOICE/DATA SWITCH TO DEBUT

Intercom of Dallas will reportedly offer a digital integrated voice/data switch later this year, the product of a year-long development effort at the Exxon subsidiary. Such a device would offer full PBX-like management and accounting features for data terminals as well as voice units -- challenging the sophisticated PBXs offered by Rolm and Northern Telecom Systems, which offer terminal-connect features on their electronic telephone systems.

ICL TEAM SCOUTS U.S. MARKET FOR DAP

An ICL marketing team, believed to be about 15-men strong, is in the U.S. to evaluate the market for its DAP (distributed array processor), claimed to be the world's fastest and most powerful array processor. While ICL is particularly eyeing the federal marketplace, the British company has privately expressed doubts in the past that the Feds will allow ICL to tender its machine there. Former ICL product development head (and an American) Ed Mack has said in the past that the U.S. government has insisted on a "buy American" policy in its contracts. But ICL's U.S. boss, Dick Bright, is keen to push the DAP in the U.S., for the machine at the Plasma Fusion Research Laboratory, Princeton, N.J. But ICL's newly restructured marketing division is not very optimistic now on the Fed market front.

(Continued on page 65)



At last. The simple report writer.

We designed our new Answer/2 to be the simplest report writer you can buy.

It's so easy to learn, non-DP people can produce their own reports after just a few hours' training.

It's so easy to use, OS and DOS programmers can retrieve and format data in a fraction of the time conventional methods require.

It's so versatile, it handles repetitive production reporting as easily as the one-time ad hoc report.

All Answer/2 products are moderately priced. And they're backed by the support capabilities of the world's leading independent supplier of computer software.

Before you buy any report writer, just call us. Or attach your business card to the coupon.

It's that simple.

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I want to know more about the *simple* report writer, Answer/2.

☐ Please send me complete information. ☐ Please have a salesman call.

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Company_____

Address_____

City_____ State_____ Zip_____

Telephone_____

Computer_____ Operating System_____

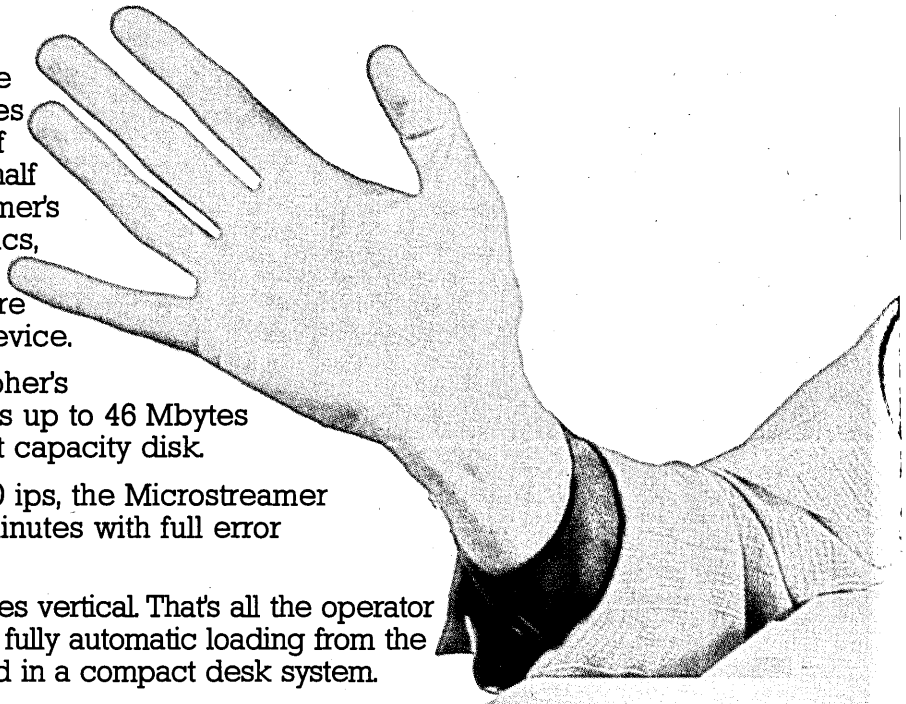
D 180

CIRCLE 20 ON READER CARD

Answer/2™ by Informatics

The Information Management Company

Introducing Microstreamer.™ The 100% solution to disk backup.



The Low Cost Solution! The Microstreamer™ Tape Drive provides the unique disk backup benefits of ½ inch tape for a cost of less than half of a standard tape drive. Microstreamer's price includes formatting electronics, power supply, chassis – even UL and CSA approval. There is no more economical tape based backup device.

The Capacity Solution! Cipher's Microstreamer Tape Drive provides up to 46 Mbytes of data to backup even the largest capacity disk.

The Speed Solution! At 100 ips, the Microstreamer transfers 46 Mbytes of data in 4.8 minutes with full error correction. No waiting.

The Size Solution! 8¾ inches vertical. That's all the operator sees, since Microstreamer provides fully automatic loading from the front and is designed to be mounted in a compact desk system.

The Compatibility Solution! The phase encoded Microstreamer is ANSI and IBM compatible using standard 10½, 8½ or 7 inch reels so the user gets worldwide interchange and access to common database.

The Reliability Solution! Spec'd at 1 in 10^{10} hard errors, the Microstreamer provides reliability approaching that of the Winchester disk – absolutely essential for effective backup.

The Tape Drive Solution! The exciting Cipher Microstreamer also functions as a 25 ips tape drive for traditional applications and operates in a daisy chain of up to eight streamers and/or standard tape drives.

Don't settle for less than the 100% solution. Orders for the Microstreamer are being taken now. Call Cipher Data Products, Inc., 5630 Kearny Mesa Road, San Diego, California 92111. (714) 279-6550.

cipher
data products, inc.

CIRCLE 21 ON READER CARD


Now, that's excitement!
Cipher
LOAD REWIND
UNLOAD
ONLINE
TEST 1
TEST 2
POWER

CALENDAR

FEBRUARY

SUGI '80, February 18-20, San Antonio.

Discussions and papers will include statistics, computer performance, information systems, and SAS training and support. Contact SAS Institute, Inc., P.O. Box 10066, Raleigh, NC 27605, (919) 834-4381.

IWP Spring Symposium, February 26-28, New York.

Topics discussed will include equipment procurement, text editing, functions, system integration, management methods, and work procedures. Contact IWP Conference Services, 2360 Maryland Rd., Willow Grove, PA 19090, (215) 657-3220.

MARCH

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 22209, (703) 243-4100.

The National Office Exhibition and Conference, March 10-12, Toronto.

The office of the future and methods of storage and transmission of information will be debated. Contact Paul Day, 2 Bloor St. West, Suite 2504, Toronto, Ontario M4W 3E2, (416) 967-6200.

Fifth West Coast Computer Faire, March 14-16, San Francisco.

Will focus on inexpensive computer power for home, business, and industry. Contact Computer Faire, 333 Swett Rd., Woodside, CA 94062, (415) 851-7075.

Interface '80, March 17-20, Miami Beach.

Will feature the data communications/ddp conference while the Datacomm School will be held to introduce newcomers to the fundamentals of data communications. Contact Peter Young, 160 Speen St., Framingham, MA 01701, (800) 225-4620; in Massachusetts, (617) 879-4502.

Eurocon '80, March 24-28, Stuttgart, Germany.

Under the slogan "From electronics to microelectronics," it will highlight the changes in worldwide microelectronic technology. Contact Dr. W.E. Proebster, IBM Deutschland GmbH, Postfach 80 08 80, D-7000 Stuttgart 80, Germany, 49-(0)7031-25855.

Viewdata '80, March 26-28, London.

The first world conference and exhibition on computerized tv-based information, education, and entertainment. Contact TMAC, 680 Beach St., Suite 428, San Francisco, CA 94109, (800) 237-3477; in California, (415) 474-3000.

APRIL

Tenth Conference on Computer Audit, Control, and Security, April 28-May 2, San Francisco.

Jointly sponsored by IIA and ATC. Contact John Sheehan, Manager of Public Relations, the Institute of Internal Auditors, Inc., 249 Maitland Ave., Altomonte Springs, FL 32701, (305) 830-7600.

Federal DP Expo, April 28-30, Washington, D.C.

Update on trends, applications, and state of the art of all facets of ADP. Contact Sheldon Adelson, Conference Director, 160 Speen St., Framingham, MA 01701, (617) 879-4502.

MAY

MUG '80, May 13-16, San Diego.

Will include papers and discussions on MUMPS language, systems, and applications. Contact Richard Zapolin, MUMPS Users' Group, Box 208, Bedford, MA 01730, (617) 271-2534.

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.

NAECON '80, May 20-22, Dayton, Ohio.

The National Aerospace and Electronics Conference is the oldest and best-known specialized national forum for the exchange of information on aerospace electronics. Contact Gordon Rabarus, Air Force Avionics, 140 E. Monument Ave., Dayton, OH 45402, (513) 255-2802.

NICE IV, May 27-30, Washington, D.C.

The National Information Conference and Exposition will be devoted to the needs of information managers and information providers. Contact Exhibit Coordinator, 316 Pennsylvania Ave., S.E. Suite 502, Washington, D.C. 20003, (202) 544-1969.

JUNE

DATA COMM, June 17-19, Geneva, Switzerland.

DATA COMM is an international forum where developments in microprocessors, mini/microcomputers and associated services can be seen, together with new equipment for data communications and distributed processing. Contact Industrial and Scientific Conference Management, Inc., 222 West Adams St., Chicago, IL 60606, (312) 263-4866.

World Computing Services Industry Congress II, June 23-25, San Francisco.

Geared toward the serious discussion of responsibilities as custodians of the international information resources. Contact ADAPSO, 1925 Lynn St., Arlington, VA 22209, (703) 522-5055.

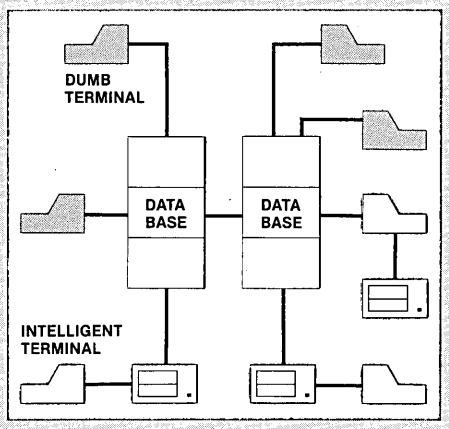
SEPTEMBER

Compcon Fall '80, September 22-26, Washington, D.C.

Theme will be Distributed Processing and Networking. Contact Executive Secretary, P.O. Box 639, Silver Spring, MD 20901, (301) 439-7007.

Microcomputing comes of age.

Ohio Scientific's OS-65U Level 3 operating system software brings new networking and distributed processing capabilities to microprocessor based computer systems.



Until now, the only alternative for low cost multiple-user computer applications was time-shared systems. However, a serious drawback of microcomputer or mini-computer multi-user time-share systems is the fact that under heavy work loads they slow down to a crawl since the central processor time in such a system is shared by all of the users.

In a microprocessor based distributed processing system, using floppy based microcomputers as intelligent terminals (local systems) most of the work load is handled locally. Overall system performance does not degrade under heavy job loads. Each local system performs entry, editing and execution while utilizing the central data base for disk storage, printer output, and other shared resources.

For more demanding applications it is desirable to have several data bases, each with its own collection of local systems. Such an inter-connected set of data bases is called a network. Each data base and its local intelligent and dumb terminals is called a cluster.

Level III

OS-65U Level 3 now supports this advanced networking and distributed processing capability as well as conventional single user operation and time-sharing. Level 3 now supports local clusters of intelligent microcomputer systems as well as dumb terminals for the purpose of utilizing a central Winchester disk data base and other shared resources. The system also has full communications capability with other Level 3 data bases providing full network capability.

The system utilizes Ohio Scientific's low cost, ultra high performance computer systems throughout for intelligent terminals as well as data bases. This general systems configuration provides a cost/ performance ratio never before attained in this class of computer power.

Level 3 resides in each network data base. A subset system resides in each intelligent terminal. Each data base supports up to 16 intelligent systems and up to 16 dumb terminals. However, since dumb terminals can heavily load the system, they should be kept to a minimum. Level 3 also supports a real time clock, printer management, and other shared peripherals.

Data Base Requirements

Minimal requirements for a Level 3 network data base are a C3-C or C3-B computer system with 23 or 74 megabytes respectively, console terminal, 100K bytes RAM and a CA-10X 16 port I/O board for network and cluster communications.

Intelligent Terminal Requirements

Any Ohio Scientific 8" floppy based computer with 56K RAM and one data base communications port.

Connections

Intelligent terminals and networked data bases are connected by low-cost cabling. Each link can be up to 10,000 feet long at a transfer rate of 500K bits per second, and will cost typically 30¢ a foot (plus installation).

Syntax

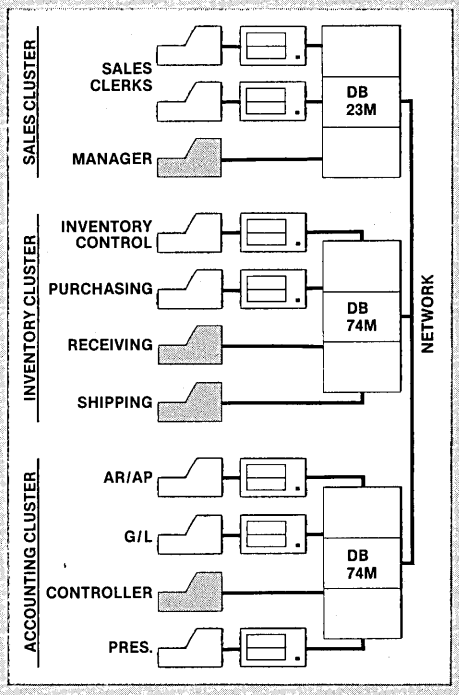
Existing OS-65U based software can be directly installed on the network with only *one* statement change! Level 3 has the most elegantly simple programming syntax ever offered on a computer network.

File syntax is as follows:

DEV A,B,C,D,	Local Floppies	} unchanged from single user and timeshare systems
DEV E	Local hard disks	
DEV K-Z	Specific network Data Bases	

Each of up to 8 open files per user can be from 8 separate origins. Specific file and shared peripheral contentions are handled by 256 network semaphores
with the syntax Waite N
Waite N, close.

The network automatically prioritizes multiple resource requests and each user can specify a time out on resource requests. Semaphores are automatically reset on errors and program completion providing the system with a high degree of automatic recovery.



A Typical System

A typical system with two network data bases will have 148 megabytes of disk, four intelligent subsystems equipped with dual floppies, two dumb terminals, a word processing printer, a fast line printer, network data base manager software and 1000 ft. of inter-connecting cable. Utlizing .7 MIPS processors throughout it will cost less than $50,000 plus installation. GT option computers (1.2 MIPS) can be utilized at a slightly higher cost.

One Step at a Time

Best of all, Ohio Scientific users can develop distributed processing systems economically one step at a time. A user can start with a single user floppy system, add a hard disk, then time-sharing, then a second Winchester data base for backup and finally cluster intelligent terminals to achieve a full network configuration.

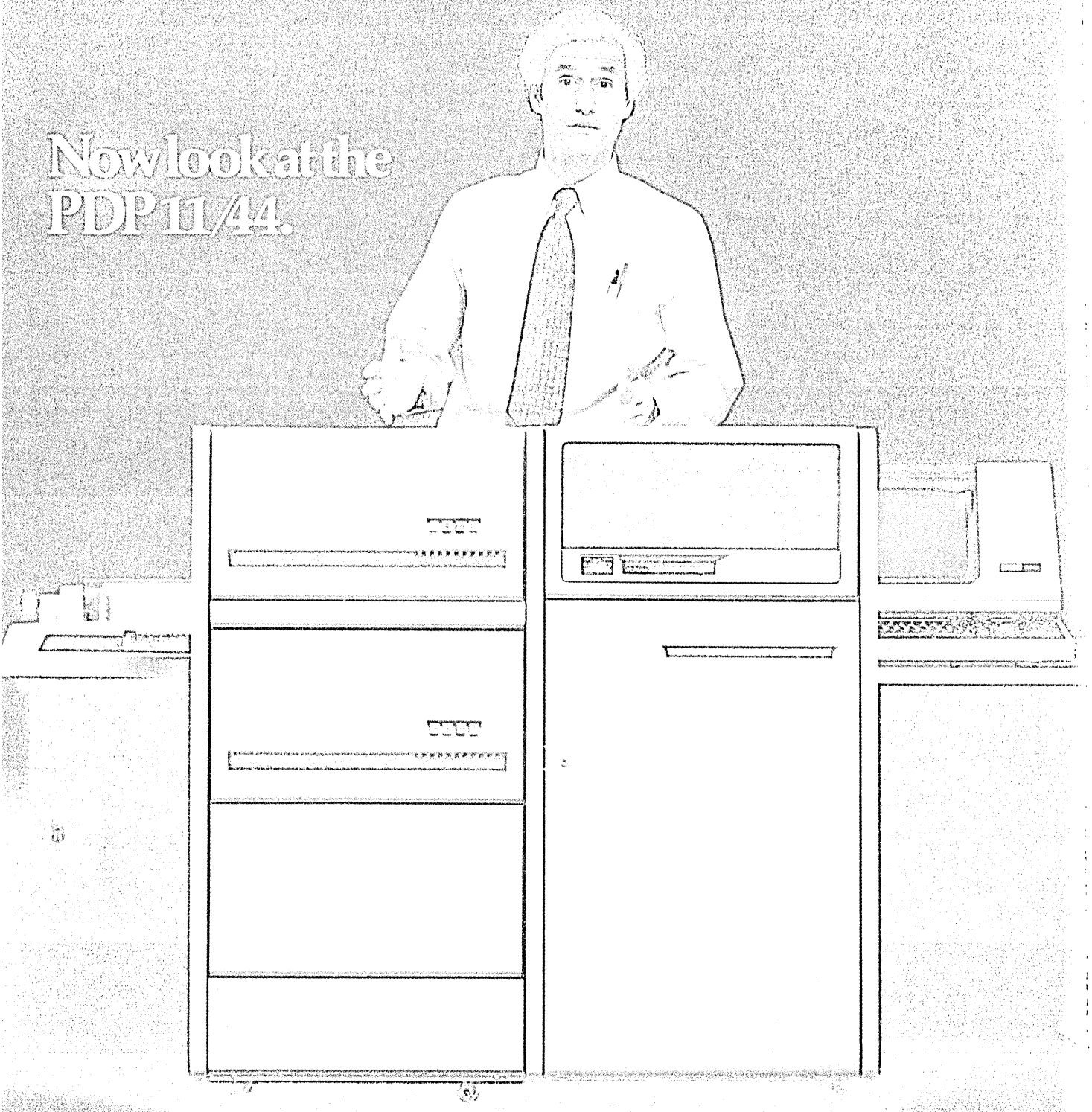
For literature and the name of your local dealer, CALL 1-800-321-6850 TOLL FREE.

OHIO SCIENTIFIC
1333 SOUTH CHILLICOTHE ROAD
AURORA, OH 44202 • (216) 562-3101

CIRCLE 22 ON READER CARD

You looked at the 11/34 and loved the price.
You looked at the 11/70 and loved the features.

Now look at the PDP11/44.



Digital introduces a mid-range mini with a megabyte of main memory, decimal arithmetic, and an expanded 11/70 instruction set.

Now for little more than the cost of an 11/34, our new PDP-11/44 gives you features previously found only on superminis. Like PAX, a physical address extension that gives you a full megabyte of main memory for more users, larger programs, greater throughput. A new MOS ECC memory with interleaving for faster access time. 8KB cache memory for faster program execution and greater DMA bandwidth. Sophisticated memory management. And an expanded 11/70 instruction set.

The 11/44 also offers significant performance advancements in two important languages. Our optimized FORTRAN IV-PLUS compiler and run time system, coupled with our floating point processor option, gives impressive performance advantages over conventional FORTRAN. And our enhanced COBOL compiler with our new optional Commercial Instruction Set processor, delivers powerful COBOL performance and data processing capabilities.

To keep the 11/44 on the job, you get plenty of reliability features, including a microprocessor-controlled ASCII console with extensive system diagnostic capabilities. A new built-in TU58 cartridge tape for easier servicing. 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.

Of course the 11/44 shares the design advantages of our entire PDP-11 family. Most importantly, it guarantees software compatibility the way only the world's broadest range of 16-bit compatible computers can. So your software investment remains intact no matter which system you choose. RSX-11M, the most versatile real time system in the industry. The new RSX-11M-PLUS. Or the new enhanced version of our proven general purpose and timesharing system, RSTS/E. You can also tailor the 11/44 to your exact application by choosing from a broad line of interfaces and peripherals, like our new 20 megabyte RL02 disk subsystem.

No matter how you look at it, the PDP-11/44 provides an incredibly powerful base for your interactive and distributed processing applications.

And that's saying a lot for a system that costs so little.

☐ Please send me more information about the PDP-11/44.
☐ Please have a salesperson call.

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Company _____

Address _____

City _____ State _____ Zip _____

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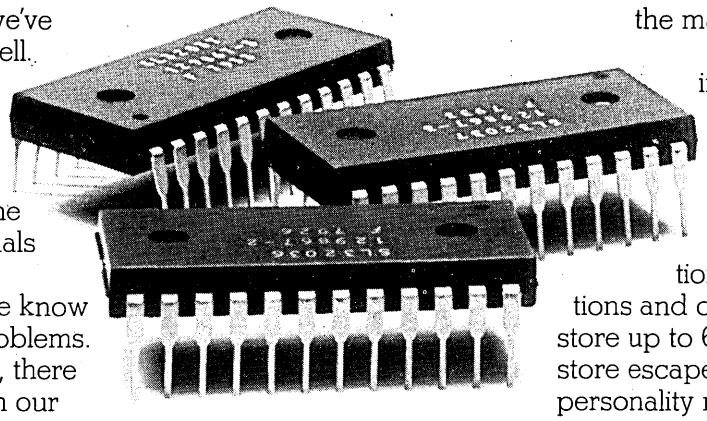
Send to: **Digital Equipment Corporation,** 146 Main Street, Maynard, MA 01754, Attn: Communication Services, NR-2/2, Tel. 617-481-9511, ext. 6885. Digital Equipment Corporation International, 12 av. des Morgines, 1213 Petit-Lancy, Switzerland. In Canada: Digital Equipment of Canada, Ltd. A-1-0

digital

CIRCLE 23 ON READER CARD

Learn Siegler brings you two steps closer to exactly what you need in an international



PERSONALITY PROMS AND FACTORY ASSISTANCE MAKE USER-REPROGRAMMING A SNAP.

At Lear Siegler, we've learned our lessons well.

We don't make five or ten different smart terminals. And we don't attempt to overpower you with the broadest line of terminals on the market.

Why? Because we know you've got enough problems.

The simple fact is, there are only two models in our line of smart terminals. But they can handle just about any application you'll run into. Something other manufacturers need terminals galore to accomplish.

The ADM-31 and ADM-42 can do so much, in fact, that you can't make the wrong choice, no matter which one you choose. Not only have we put an end to looking at dozens of models from dozens of companies — we've put an end to dozens of headaches.

NOW YOU CAN TEACH YOUR TERMINALS HOW TO BEHAVE.™

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.

Both the ADM-31 and ADM-42 have firmware (the instruction sets inside their PROMS) that you can easily reprogram. Just follow the directions in the fully-documented programming instruction manual we provide. And you end up with a terminal that's exactly what you want, even though it's not exactly what you bought.

And, if you run into problems, just call our special Applications Engineering Staff. They'll help you through any difficulties with reprogramming, interfacing, setting the terminal's personality, special applications, or understanding the features and functions.

Who knows? They could even come up with suggestions you never considered.

THE ADM-31 AND ADM-42. TWO TERMINALS, DOZENS OF FEATURES.

We built the ADM-31 and ADM-42 with all the standard features you've come to know, love, and need in smart terminals even without reprogramming.

For instance, you get full editing capabilities. Reduced intensity for identification of protected fields. Blinking, blanking, and reverse video. Formatting. High resolution monitors. Even limited line drawing capabilities.

And we've included the latest in microprocessor technology. Both are microprocessor based, which makes them reliable and, more importantly, easier to use. Because their design architecture has a microprocessor, with multiple microprocessor-based controllers that tie into the master microprocessor.

Nor did we forget those indispensable function keys.

Naturally, both the ADM-31 and ADM-42 have them.

On the ADM-42, for example, you get 16 function keys, shiftable to 32 functions and optionally programmable to store up to 64 characters. This lets you store escape code functions (such as personality modifications) to reduce several escape sequences to one key stroke. And you can store frequently-used phrases up to 64 characters, which provides you with impressive time savings.

When you get right down to it, the ADM-31 and ADM-42 are really functions of your imagination.

SMART TERMINALS. SMART CHOICES.

So there you have it. Two very good reasons why you only need to look at two very smart terminals.

Gone is the need for looking at dozens of terminals, from dozens of manufacturers, with dozens of high price tags. With our two models, you have everything you need. User-reprogrammable personality PROMS, function keys, and a willing-to-please Application Engineering Staff just aching to solve any problems you may have.

Sound interesting? Then call or write to us at Lear Siegler, Inc./Data Products Division, 714 N. Brookhurst St., Anaheim, CA 92803, (800) 854-3805. We'll tell all you want to know about the ADM-31 and ADM-42.

And then you'll see why your search for the right smart terminal just ended.

LEAR SIEGLER, INC.
DATA PRODUCTS DIVISION

Lear Siegler, Inc./Data Products Division, 714 N. Brookhurst Street, Anaheim CA 92803. (800) 854-3805. In California (714) 774-1010. TWX: 910-591-1157. Telex: 65-5444. Regional Sales Offices. San Francisco (408) 263-0506. Los Angeles (213) 454-9941. Chicago (312) 279-5250. Houston (713) 780-2585. Philadelphia (215) 968-0112. New York (212) 594-6762. Boston (617) 423-1510. Washington D.C. (301) 459-1826. England (4867) 80666.

CIRCLE 24 ON READER CARD

Foremost among the many demands placed on auditors and financial executives today is the need for expediency—audit deadlines must be met. And the methods of yesteryear just aren't equal to the task. Now, from Pansophic, comes the answer to timely completion of audits. It's called PANAUDIT, the new systems approach to computer auditing.

PANAUDIT, designed by an auditor, can solve your many computer auditing needs. Over 50 audit modules are provided as tools to do as complex an audit as your environment dictates. Some examples of these state of the art routines are: SMF ANALYSIS which provides access to system generated audit trails based upon auditor determined criteria; SYSTEM RANKING provides a consistent, rational and demonstrable methodology for prioratization of systems to be audited; DISTRIBUTION ANALYSIS can be used to identify unusual activity of quantitative versus quantitative, quantitative versus nonquantitative, and nonquantitative versus nonquantitative fields; and DATA SET COMPARISON provides the auditor with an automated regression test capability. Additionally, it can be used to identify unauthorized changes in programs by comparison to an audit copy.

PANAUDIT FREES UP VALUABLE AUDITOR TIME

PANAUDIT makes it possible to audit "through" the computer by retrieving information to your specifications without relying on data processing personnel. Combine this independence with ease of use—made possible by the Audit Command System and the Audit Data Dictionary—and you have a flexible audit system with which to produce your own reports without becoming a technician.

For more detailed information contact Pansophic, the people who bring quality systems software to a worldwide user base.

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CIRCLE 112 ON READER CARD

While you're waiting, Wang's VS could be working.

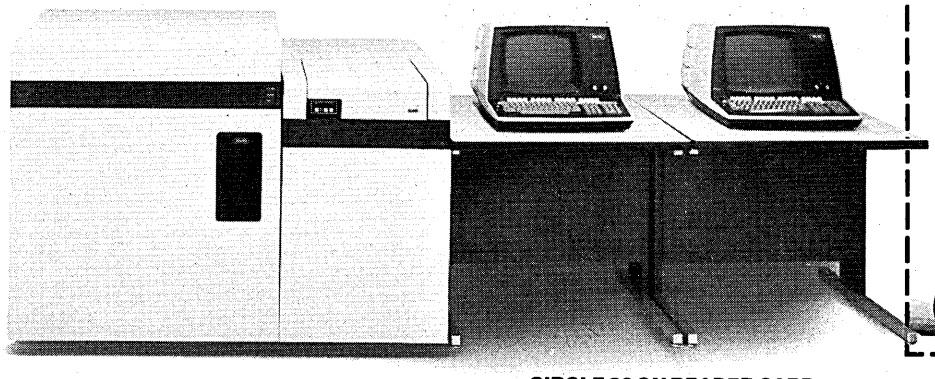
If you're waiting for an IBM System 34 or 38, you've got a lot of time on your hands. So why not take a few minutes and closely consider just what you'll be getting a year or two down the road. Most importantly, consider your options.

Options like Wang's VS virtual storage computer, for instance. Compare the Wang VS and the System 34/38. We think you'll find the VS consistently comes out on top. The VS will accept your RPG programs just like a System 3, with RPG II and CCP conversion aids available to protect your System 3 software investment. With Wang's VS, you also get interactive RPG II programming with compilations 5-10 times faster than those on the System 34. Extensive program development aids. On-line and batch operations. Telecommunications. COBOL and BASIC. A fully supported data management system. Up to 4.6 billion bytes of fixed and removable disk storage. And a data compaction feature that could cut your storage requirements by at least a third.

Best of all, Wang's VS gives you the flexibility to grow from a minimum VS configuration to a full-blown system with the power of a high-end 370, without reprogramming or major equipment swap-outs. Plus the ability to do data processing and word processing at the same Wang terminal. *All this now,* for no more than you'll pay for a System 34 or 38 next year.

If your data processing problems in the eighties won't wait for solutions, call or write for more information on the Wang VS family. Better yet, ask for a VS demonstration. We can *show* you what we've been talking about — today.

Wang Laboratories
Lowell, MA 01851
(617) 459-5000



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☐ Show me the VS in action.

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DP102/D10

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CIRCLE 26 ON READER CARD

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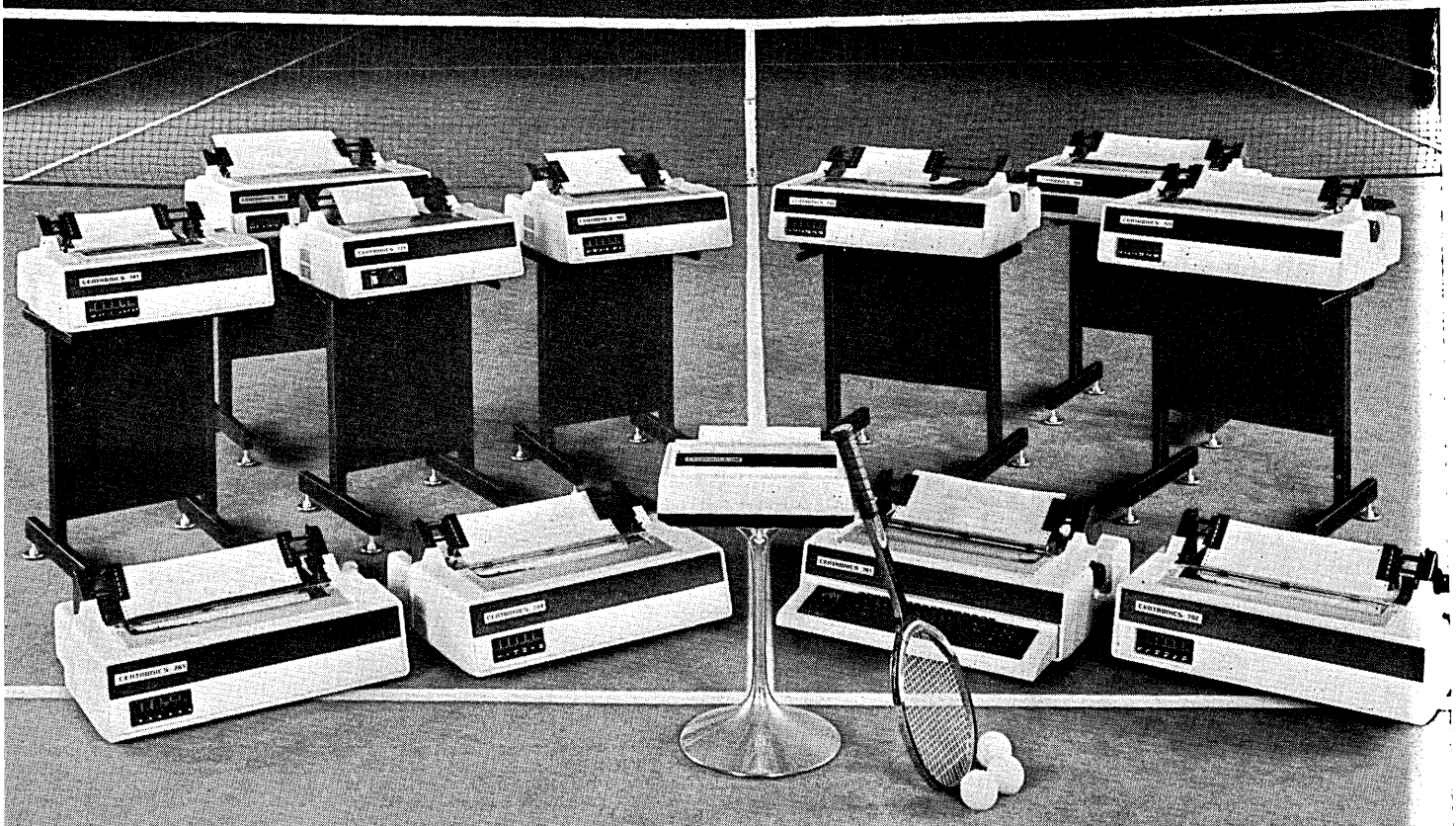
...with new, low-priced printers for small businesses

Now small businesses can have the advantage of Centronics performance. We have new models to meet the needs of small businesses—a selection that covers the court. And we've followed-through by pricing them lower than other printers that can't match Centronics' features and reliability.

TOP-RANKED TEAM We understand your small business needs—that's why Centronics has sold more printers to the small business market than anyone else. We have new, fully-featured models designed for small business applications. High throughput for inventory control. Full 132-column width for accounts receivable. Versatile forms handling capability for invoicing, payroll, and statements. Plus excellent print quality for labels and listings. The bottom line: with Centronics, small businesses can have mainframe performance at micro prices.

READY FOR ANY TOUR These printers are designed to deliver maximum in-service time, a key consideration for a small business. And we have the largest worldwide service organization of any independent printer company.

DON'T WRITE—phone Bob Cascarino today at (603) 883-0111, extension 4032, or contact any of our 15 U.S.A. or 9 international sales offices. Centronics Data Computer Corporation, Hudson, New Hampshire 03051.



CENTRONICS® PRINTERS
...the advantage

CIRCLE 27 ON READER CARD

LETTERS

THE BUGABOO

Re: "That Old Bugaboo, Turnover" (Oct., p. 97): What is happening today has happened several times in the past; we all made the same mistakes then, and we are making them again now. If I may share several mistakes I made during a seller's market, perhaps we can reduce the turnover problem a bit.

The pressure to hire people when you have positions open and it is costing your company money is tremendous. No matter how we try to maintain a minimum standard in hiring, sooner or later we violate it for any number of reasons: to get the head count up, hire in anyone and train them later, recruit from competitors or subcontractors and, the most dangerous of all, hire from the client.

In the '60s, I remember arguing with personnel over salary compressions in which new arrivals, with no experience, got salaries in excess of people who had been with us for two or three years. The solution to this is simple: don't do it, or else most of your two- and three-year people will leave.

Don't hire "grasshoppers" whose employment record shows six or seven jobs in the last eight years. They will leave you in a year or so. It's their way of life.

Don't hire people who "have problems" . . . chances are they will "have problems" in your group, too.

We have found an excellent source of qualified people to partially fill the gap. We went through the files of women who were former programmers who had resigned due to pregnancy. The babies had grown; some were even in school. We called these women back, and let them work hours they set around their other responsibilities. Generally, they can work 20 to 30 hours a week, and since they don't gossip or talk sports as much at work as the men do, their output is very close to many of the people who work full time.

WILLIAM A. DELANEY
President
Analysis & Computer Systems, Inc.
Burlington, Massachusetts

From a quick perusal of the October issue, it appears that more of ETHICS ("Effective Technical and Human Implementation of Computer Systems," Books, p. 203), with the accent on Human, would result in less of "that old bugaboo, turnover."

PETER KUSHKOWSKI
Manager, Process Computer Engineering
Northeast Utilities
Hartford, Connecticut

Where are your eyes? A significant proportion of those job-hoppers in the dp industry are women. Yet the photographs accompanying the article show only men.

CYNTHIA ZUJKOWSKI
Systems Analyst
Weston Components
Archibald, Pennsylvania

Your point is a good one. However, there is a reason for the lack of female representation—all the photographs for the story were of the same person. He wore six costumes.
—ed.

MORE OF THE ICEBERG

Re: "Getting Tough with Burroughs," Oct., p. 75: The article reflects only the tip of the iceberg. The vaunted MCP operating system is fine unless a bug arises—then try and get it fixed quickly. Copies of the source programs are not at the branch or state level, and fixes take days to arrive. Or what about the unionized service engineers even if you were prepared to pay for coverage outside of "normal office hours," as was offered, it was not available in practice. The six prior scheduled deliveries of similar equipment, so as to avoid trailblazing in our case, mysteriously evaporated, and we became the guinea pigs with no prior notice or advice. All these concerns had been strenuously covered in the sales pitch. I can think of no sufficient reason to "trust" Burroughs again. (The installation was at Abbott Laboratories, Sydney, Australia, where a B1726 replaced a B500 in February 1975. The MCP program bugs went to Palo Alto for fixes, and there were bugs in the B3500 to B1700 COBOL conversion aid.)

G. STEVENSON
Neenah, Wisconsin

MORE COMPLEX

Re: "The Next COBOL Standard" (Sept., p. 175): I am pleased the American National Standard Committee has evidently been infiltrated by machine language members with an intent of destroying from within what they cannot do from the outside.

COBOL is directed at solving the problems of people and not machines. Thus, management all over the world is forced to review and prevent implementation of techniques that add complexity rather than simplicity. The major interest of management is productivity; complexity is counterproductive.

A. VASEK
Data Base Administrator
Interstate System
Grand Rapids, Michigan

PL/1 VS. PASCAL

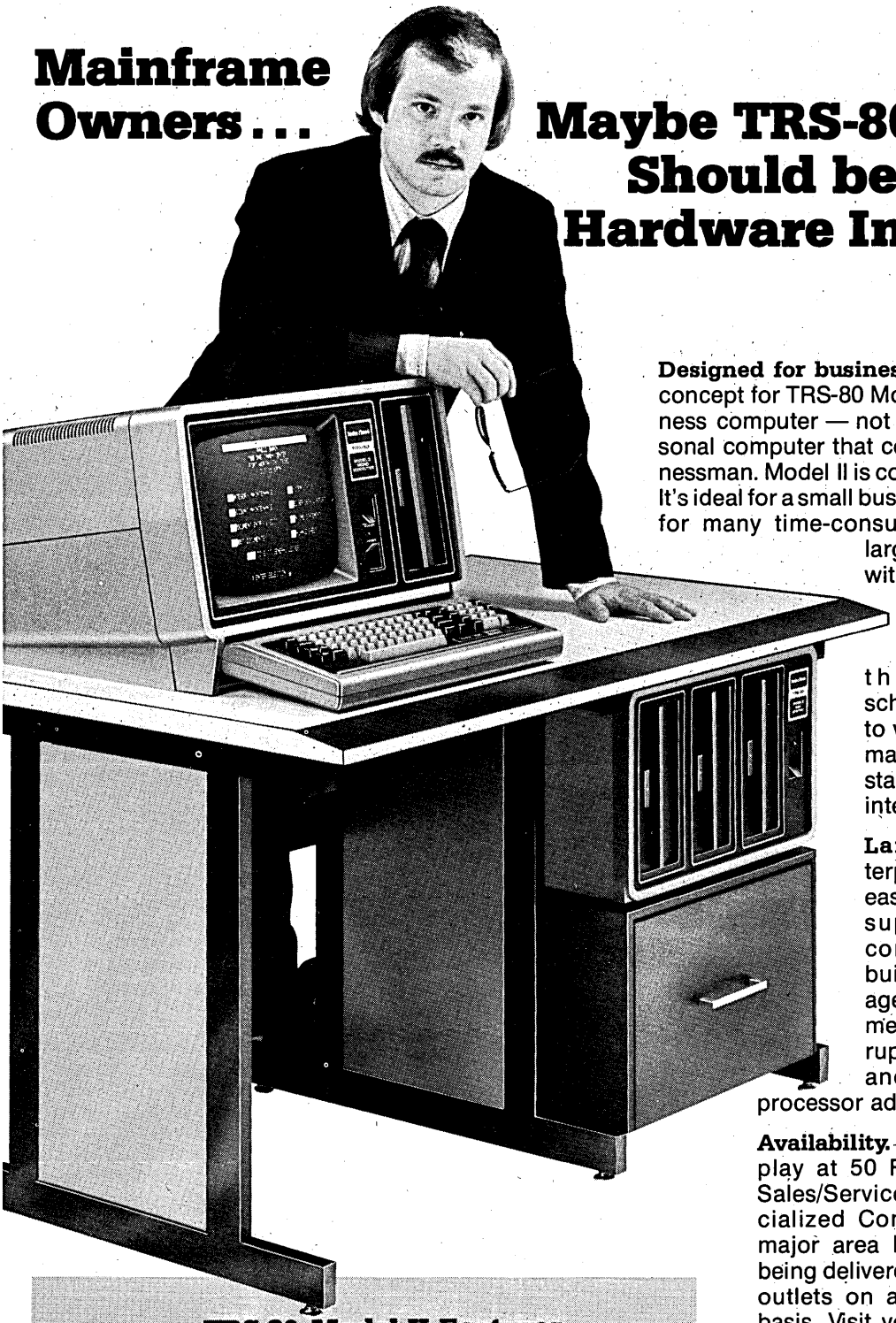
Re: "Pascal Power," (July, p. 142): Yet more tiresome evidence of the self-immortalizing efforts by individuals and institutions who cannot resist the ego trip of proposing or designing yet another "ultimate" programming language. If, indeed, the lack of "success" of PL/1 can be demonstrated only by its "resounding" rejection by programmers, then perhaps we should be looking more closely at the attitudes of programmers, most of whom, it seems, never really wanted to break off with Autocoder.

The specifications for PASCAL, ADA, etc., and ad nauseum are virtually all met, and generally bettered, by PL/1—even the terminology looks as if it had been lifted straight from the PL/1 Reference Manual. There are, it must be admitted, some substantial and, for some, unfortunate differences between PL/1 and these "new" languages—differences which PL/1's critics would rather not discuss:

—PL/1 works
—the compilers produce efficient code
—PL/1 has a well-defined, powerful, and machine-independent I/O system
—the language is stable
—over an incredibly broad range of applications and judged by al-

Mainframe Owners...

Maybe TRS-80™ Model II Should be Your Next Hardware Investment!



Designed for business. Radio Shack's design concept for TRS-80 Model II was to build a business computer — not a hobby, "home" or personal computer that could be used by the businessman. Model II is compact, fast and powerful. It's ideal for a small business, and also "just right" for many time-consuming small jobs within larger businesses. For firms with large mainframe computers, Model II can handle the jobs that constantly interrupt the data processing schedule — or those too hot to wait for open time on the mainframe. Use it either as a stand-alone computer or an intelligent terminal.

Language. Model II's interpretive BASIC language is easy to use, and will soon be supplemented by other compiler languages. The built-in half-meg disk storage can be expanded to two megabytes. Vectored interrupts, direct memory access and a separate keyboard processor add to the throughput.

Availability. TRS-80 Model II is on display at 50 Radio Shack Computer Sales/Service Centers and 100 specialized Computer Departments in major area Radio Shack stores. It's being delivered through our 7300 retail outlets on a first-come, first-served basis. Visit your nearest Radio Shack store for details or write the address below.

TRS-80 Model II Features

- 32K or 64K RAM
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CIRCLE 28 ON READER CARD

most any set of criteria one wishes to assume, PL/1 simply blows everything else into the weeds

The commonest and most irresponsible reason for ignoring PL/1 is that the main influence promoting its acceptance has come from IBM. Sniping at IBM, on principle, if for no other reason, is a good way to cultivate that independent, buccaneering image many dpers like to strut before their peers—and it's a lot easier to attract attention that way than by getting down to some useful work with a language that long ago solved the problems so "newly" addressed by these latest reinventions of the wheel.

GARTH KLATT
Chevron Standard Ltd.
Calgary, Alberta, Canada

BUSINESS, NOT SCIENCE

Re: "Ranking Graduate Schools" (Aug., p. 70): There has always been a great deal of confusion about the terms "computer science" and "management information systems." This confusion is widespread in our industry and deserves some attention in your publication as well as to clear up confusion that the article might have fostered.

In reviewing the list of subjects taught in the schools mentioned, it is clear a graduate would be qualified to work at a technical level, perhaps in the development of a new operating system, new techniques of data base design, or in software development.

However, the skills necessary to create management information systems are not developed in these curricula. These skills are developed in business schools.

Two types of programs exist: PhD and MBA programs. Schools that offer a PhD in management information systems include the University of Minnesota, the University of Arizona, Texas Tech Univ., Carnegie-Mellon Univ., and about 20 others. Gradutes of these programs have skills that allow them to consult at high levels in the development of management information systems and to accept academic positions to teach in the same areas.

MBA programs will, I believe, become the labor pool from which we will draw the majority of our future analysts and managers. Many programs, including the one at my own school, include concentrations in management information systems. These programs include work in systems analysis, design, and development; programming; data base systems; and other skills that the dp manager or analyst must acquire. In addition, because the programs are in MBA programs, graduates are well-versed in accounting, finance, marketing, management, and quantitative methods.

Business schools offer an ideal educational experience to satisfy the needs of the dp community. What more can we ask for than to have a new employee who understands the problems of management, and has the technical skills to respond?

LESLIE D. BALL, PhD
Assistant Professor
Babson Park College
Wellesley, Massachusetts

CORRECTION

Re: Unlikely Synergy (Oct., p. 67): Since all 75 of our employees are stockholders, it was rewarding for them to have a chance to read about the success of their company. There was, however, one detail marring the excitement. The story refers to DJC as a $1.7 million operation when in fact our shipments at the time the article was written were approximately $1.7 million *per month*. Sales for October of this year were in excess of $1.9 million and our recently ended fiscal year generated gross sales in excess of $16 million. For fiscal year 1980, begun as of Nov. 1, 1979, we are currently projecting more than $30 million in gross sales.

DENNIS J. CAGAN
President
The David Jamison Carlyle Corp.
Los Angeles, California

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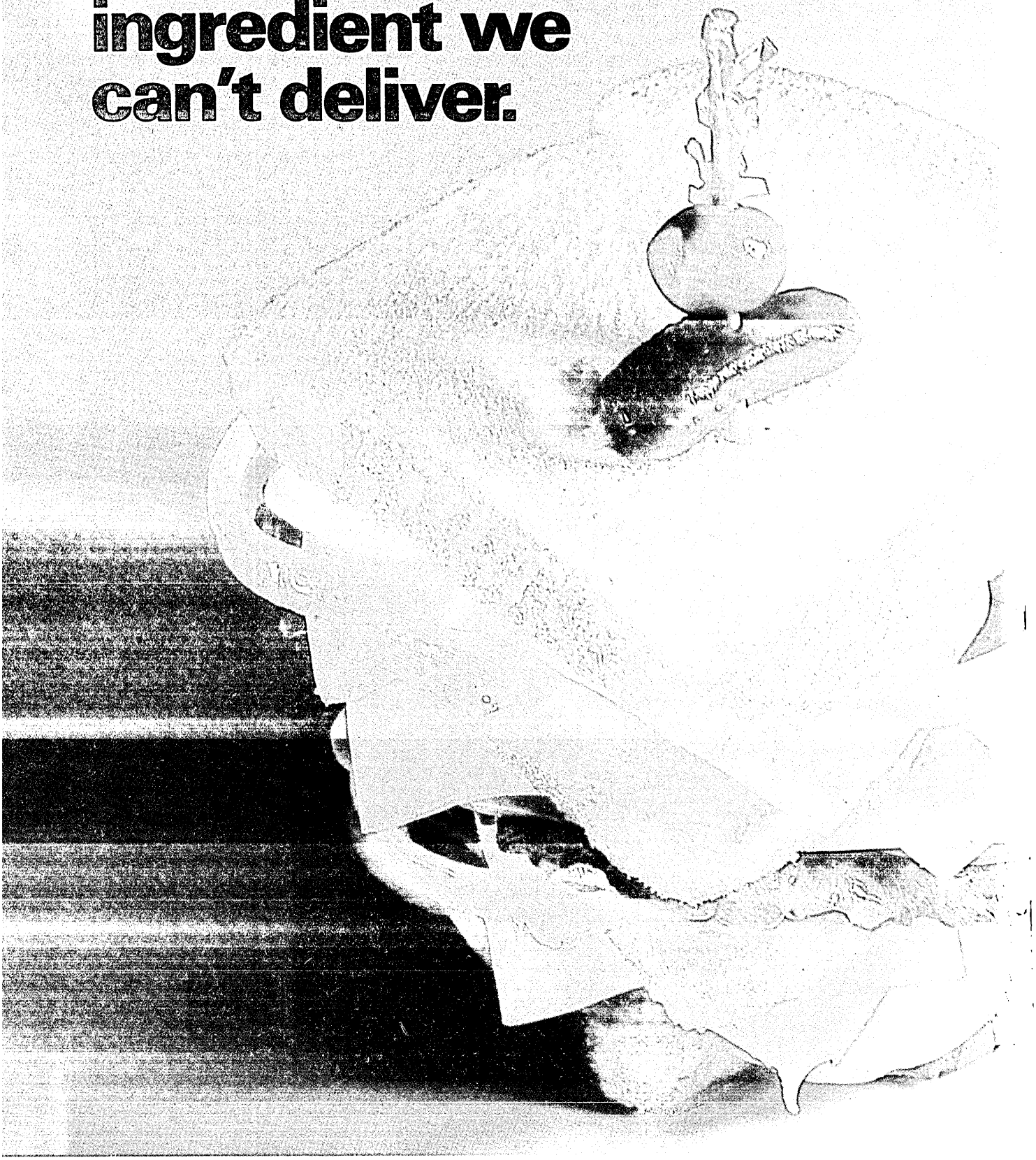

DDP. Data Entry. Remote Job Entry. On-Line. For every remote processing function, there's a state-of-the-art solution from Northern Telecom Systems Corporation.

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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.

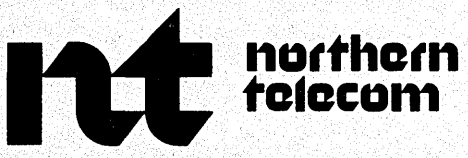
But the best reason to talk to us today—is tomorrow.

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.

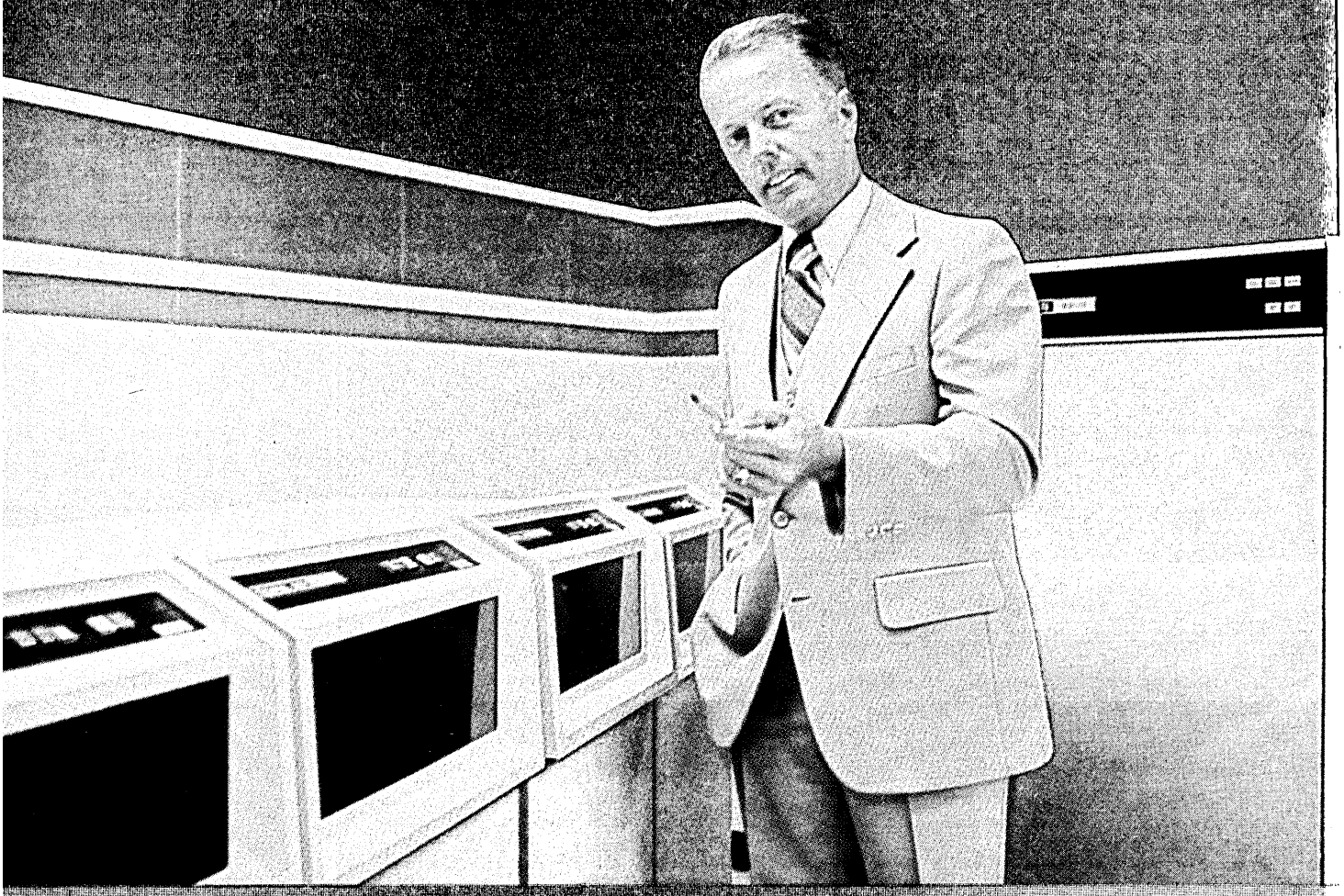
For the office nearest you, call our Marketing Services Department at 1-800-328-6760. In Minnesota call (612) 932-8202.
Or write Northern Telecom Systems Corporation, Box 1222, Minneapolis, MN 55440



Northern Telecom Systems Corporation

CIRCLE 30 ON READER CARD

"Our 33502, with 635 megabyte capacity, is the better business decision."



Jim Cron, General Sales Manager, Peripheral Systems Marketing

"Our 33502 has twice the capacity of an IBM 3350. So you can save dollars and floor space. And the improved technology behind our new 33502 data module offers other advantages.

"Better performance, for example. Track-to-track access time is faster than the 3330/3350 technology can offer. Average access time is faster too – 19 milliseconds per 317.5 Mbyte logical volume. And you get more optional fixed head storage – 1.72 Mbytes instead of only 1.14 Mbytes.

"Another technological innovation is our dynamic dual access. It gives you up to 25% greater throughput over a comparable switch configuration. And if you have a multiple CPU installation, we can offer you both string switch and dual access to provide four data paths to each spindle.

"And when you choose Control Data's 33502, you needn't worry about conversion or compatibility problems. It is totally compatible with all IBM 3330/3350 disks and controllers. Our Storage Controller lets you intermix 100MB, 200MB, 317.5MB, 400MB, 635MB – even Mass Storage all on the same unit.

"Besides technical considerations, there are many other reasons that make the 33502 a better business decision. Control Data's reputation is for reliability, service support and broad product experience. And there are more reasons. For the full story contact your local representative, or call 612/558-4158."

CONTROL DATA CORPORATION

Addressing society's major needs

CIRCLE 31 ON READER CARD

JOHN L. KIRKLEY, EDITOR

EDITOR'S READOUT

BUILDING THE DATA BARRIERS

Regarding TDF, the Great Canadian Data Wall, and other international matters.

ILLUSTRATION BY DIRK ZIMMER

Transborder data flow (TDF) is one of those issues that can glaze your eyes, numb your brains, and trigger your yawn reflex in a matter of moments.

It's complex and confusing. And, in the past, it has seemed irrelevant to most U.S. users of computers and communications.

To the Europeans, the Japanese, the Canadians, and the Latin Americans, the issues are very real. But not only the technologically advanced countries are concerned with the problems of the new information age; the so-called less developed countries, despite their rudimentary technology, are acting to control the flow of data across their borders as well.

It's not a new phenomenon. The Swedes passed their Data Act back in 1973. The Germans, the Danes, Norwegians, Belgians and many others have laws on the books or in the making. The Council of Europe has a draft treaty "harmonizing" many of these laws, and the Organization for Economic Cooperation and Development (OECD) recently finished a draft of voluntary guidelines governing transborder flows of personal data. Now the OECD will turn its attention to "legal persons"—the corporations.

But is this really a serious problem? Will it really have an impact on more than a handful of U.S. companies doing business abroad? Or is it simply one of those issues that a few people from industry and government have decided to hang their hats on, fomenting a sense of urgency where none really exists?

Well, there do seem to be problems.

For example, one would think that our most harmonious relations on this issue would be with our good neighbor to the north, Canada.

Not so. Earlier this year a Canadian committee on the implications of telecommunications for Canadian sovereignty (the Clyne committee) concluded, "The government should act immediately to regulate transborder data flows to ensure that we do not lose control of information vital to the maintenance of national sovereignty." This kind of concern has spawned the Canadian Bank Act, now being deliberated in its second version. Version one would have flatly prohibited any bank from exporting client data for processing and storage abroad. (Much of these data are being processed by U.S. service bureaus.) The current version would permit export of copies of such data but the Inspector General of Banks could still pull the plug on any U.S. operation.

In Japan, Control Data Corp. had to wait 27 months for a circuit, only to find that government restrictions on the circuit made it almost impossible to operate. And we hear that Germany is considering a law for implementation in 1982 that would give its government enormous power to restrict and regulate data being imported and exported across its borders.

These few instances, multiplied by endless variations around the world, can have a stultifying effect on U.S. trade and the world economic picture in general.

Part of the U.S. problem is that we are simply uninformed, a problem compounded by the fact that we have very little hard data from which to make decisions. At the December TDF'79 meeting in Washington, D.C., the only new information on the potential impact of restrictive TDF legislation on corporate data was a report on a client study conducted by a New York consulting firm. The "Seligman Report" appeared to be at best highly limited, sketchy, and, in some of its assumptions and conclusions, dead wrong. But we heard that this report may make its way to the OECD deliberations; nothing else of any substance is available.

We also lack a coherent voice. As the world closes in around us, we fumble and stammer. No one government agency, no one at the top speaks for the United States.

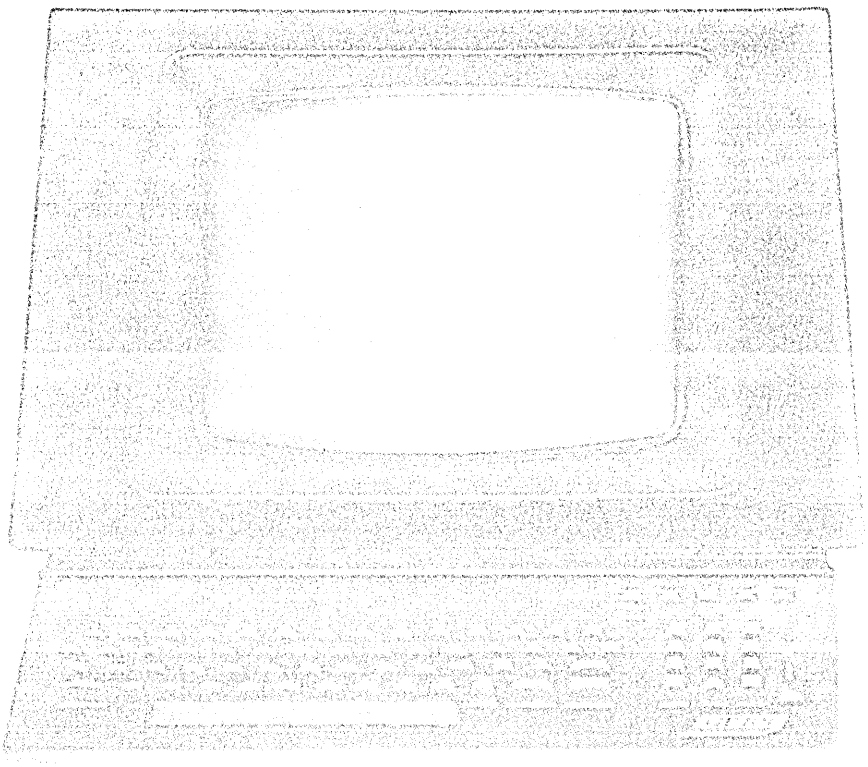
There are many proposed remedies but it seems to us that, at the very least, any data processing professional whose company is doing or contemplating business overseas should be acquainted with these issues. (If you'll write to us on your company letterhead we'll send you a starter set—some background articles and a bibliography.)

Also, it would appear obvious that industry and government should band together to develop real data about the potential impact of transborder legislation on U.S. business and trade.

And finally, a single voice should be selected to represent us at the world's bargaining tables on these issues. Perhaps, as Richard Brennan, director of international affairs at Union Carbide suggests, we should insist on GATT-like negotiations. There, agreements, prohibitions, and sanctions can be hammered out. The Special Trade Representative within the executive branch could be our negotiator and our enforcer. ✲

• *Options:*
user programmable function keys, 220V export option, composite video output

• *Insert/delete character, insert/delete line, full cursor control*



• *Visual attributes, block mode, protected field*

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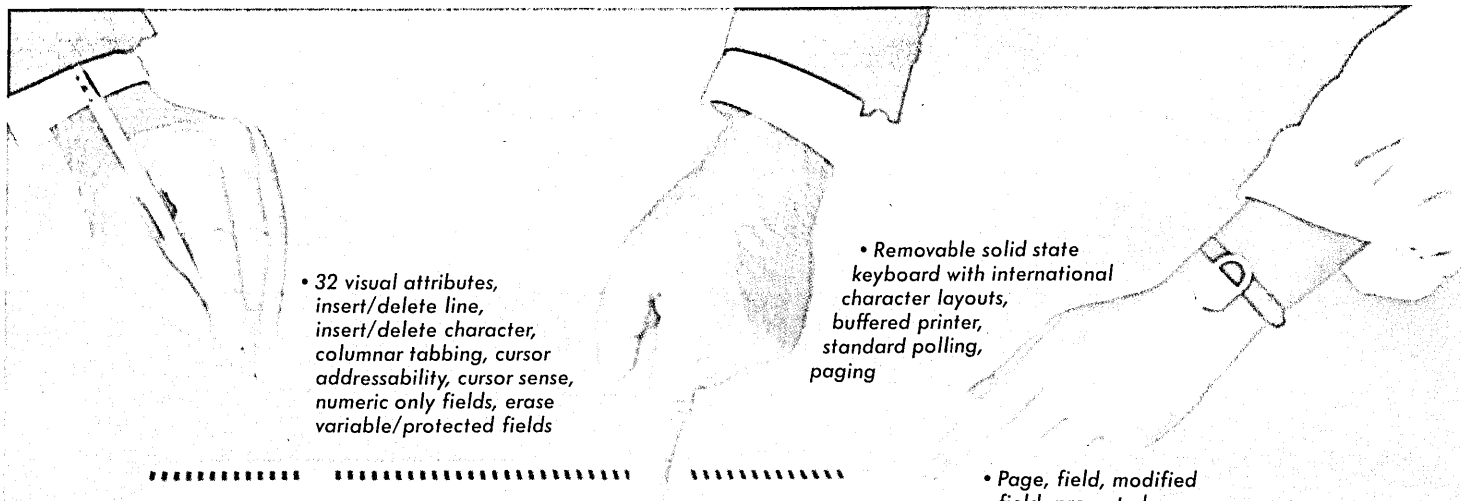
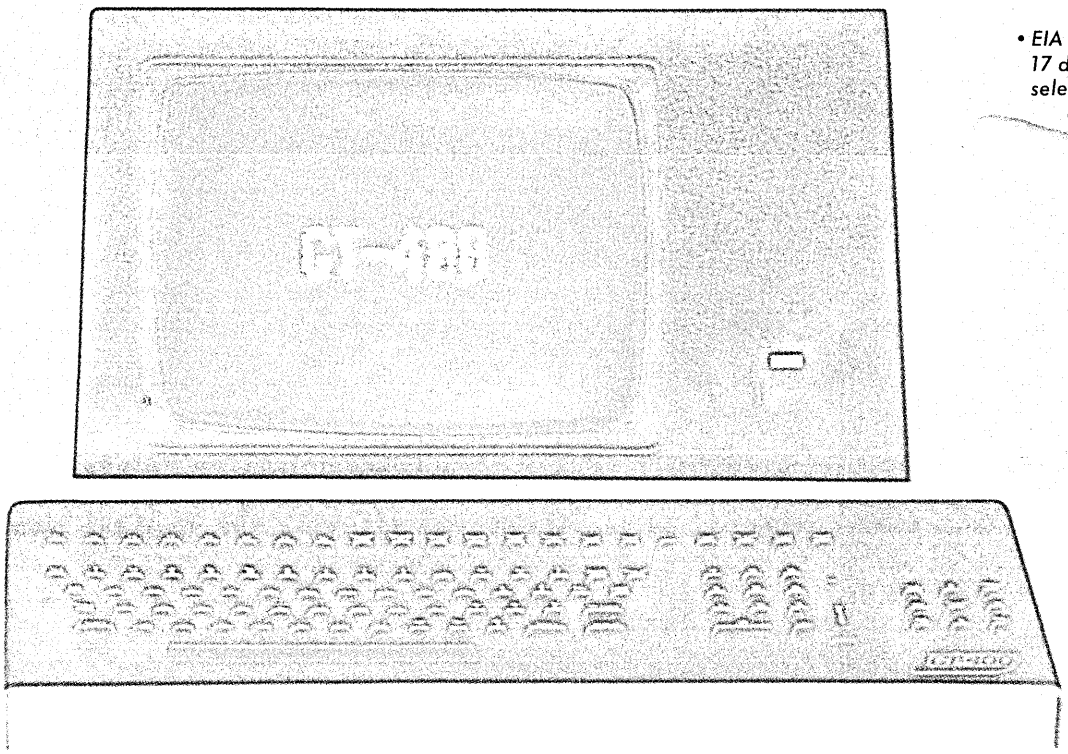


• 32 visual attributes, insert/delete line, insert/delete character, columnar tabbing, cursor addressability, cursor sense, numeric only fields, erase variable/protected fields

• Removable solid state keyboard with international character layouts, buffered printer, standard polling, paging

• Page, field, modified field, prompted transmission, device status, function keys



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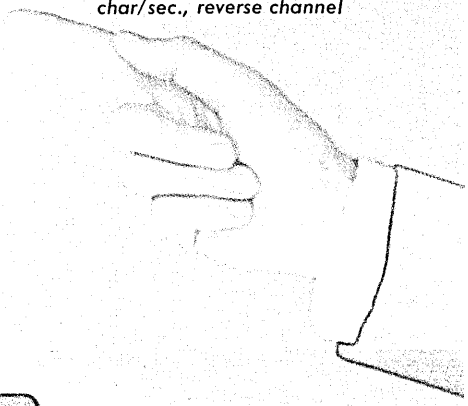

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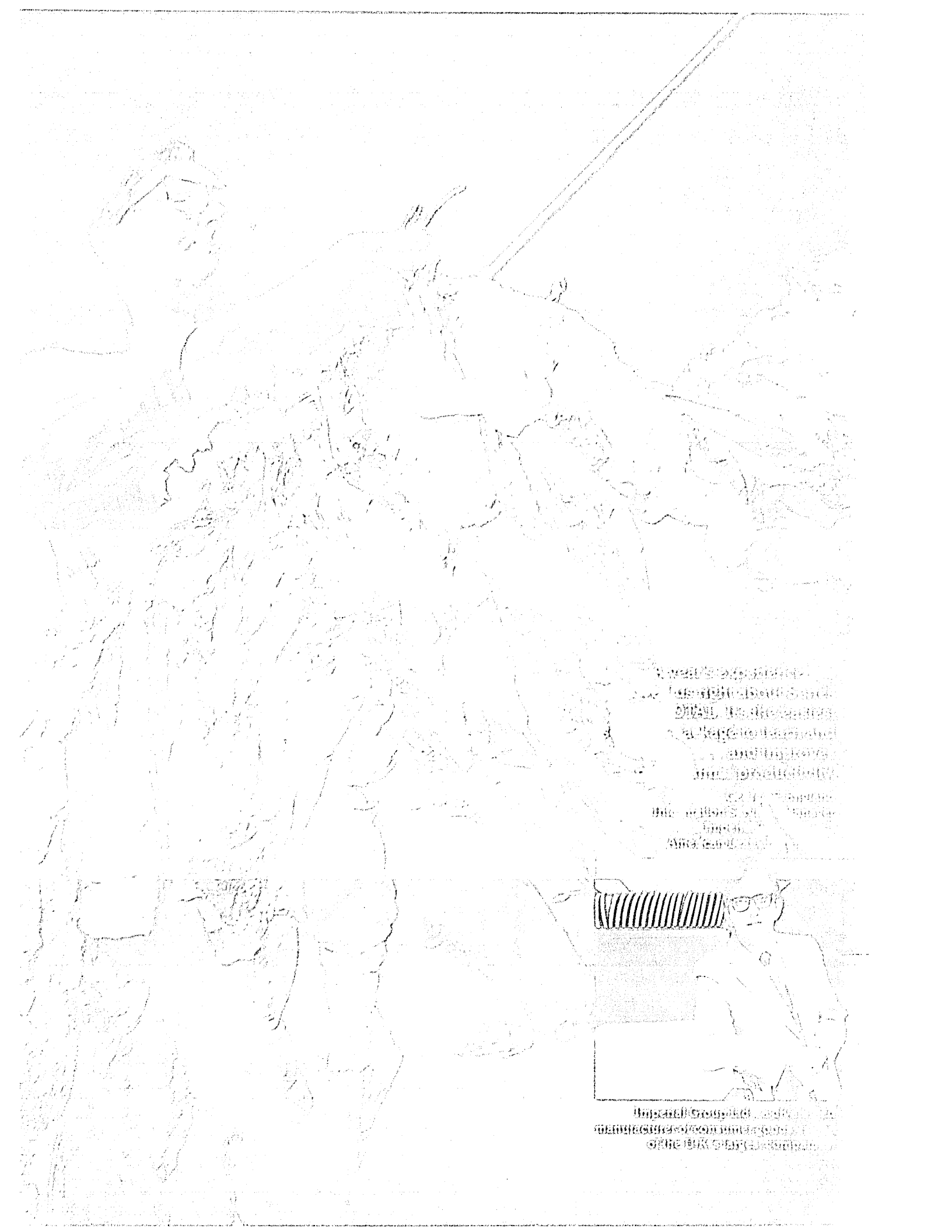

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CIRCLE 33 ON READER CARD

Good news for Word People.

In business, there are basically two kinds of people.

Word People. And Numbers People.

If you're a Word Person, this ad is for you.

And so is this new machine: The Xerox 860 Information Processing System.

It can rearrange paragraphs, change margins, correct misspellings and type out a virtually endless series of text revisions at the speed of hundreds of words a minute.

And it remembers everything it's done for future reference. Or additional changes.

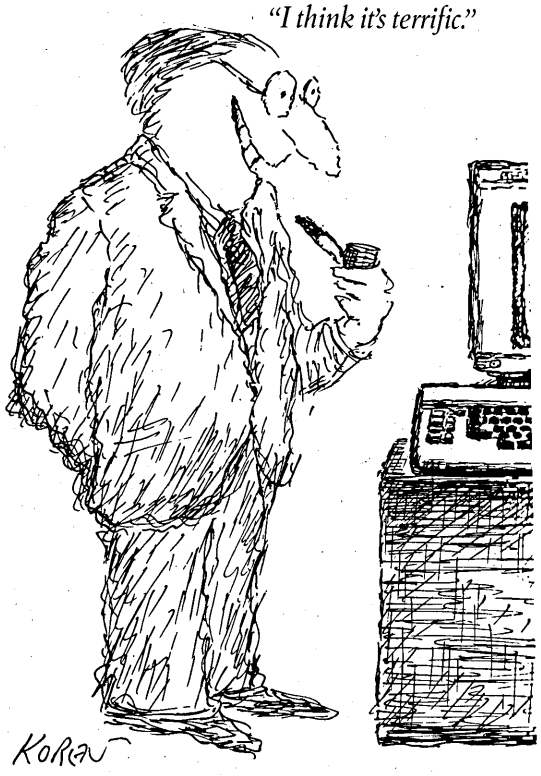
But it also does something you might not expect from a word processing system.

It processes numbers.

Because in business today, Word People have to manage numbers. And Numbers People have to manage words.

And everyone, but everyone, has to manage information.

XEROX



Good news for Numbers People.

In business, there are basically two kinds of people.

Word People. And Numbers People.

If you're a Numbers Person, this ad is for you.

And so is this new machine: The Xerox 860 Information Processing System.

It can compute, do statistics and perform the routine work that's essential in managing records, measuring work performance and so on.

And it remembers everything for future reference. Or additional changes.

But it also does something you might not expect from a numbers processing system.

It processes words.

Because in business today, Numbers People have to manage words. And Word People have to manage numbers.

And everyone, but everyone, has to manage information.

XEROX

CIRCLE 34 ON READER CARD

It took $300 billion to make IBM think compatible.

There was a time when IBM could do practically anything they wanted in hardware and software development. But times have changed.

User investment in software and systems, approaching $300 billion, has reached the point where a revolution in hardware resulting in the incompatibility of existing software would mean suicide, even for IBM.

A whole generation of computer buyers has grown up with the computer industry. They know computers aren't magic. They're expensive machines meant to perform specific functions efficiently. What users need is the ongoing dependability to protect their sizeable investments in software and systems.

Rumors regarding new IBM products still create apprehension in the marketplace. But the truth is, since the 360 computer line, IBM has announced the 370 Series, the 3000 Series, and the 4000 Series, each of which offered upward compatibility from their predecessor. You can bet that IBM won't deviate from this course in the future.

So we're in this together.

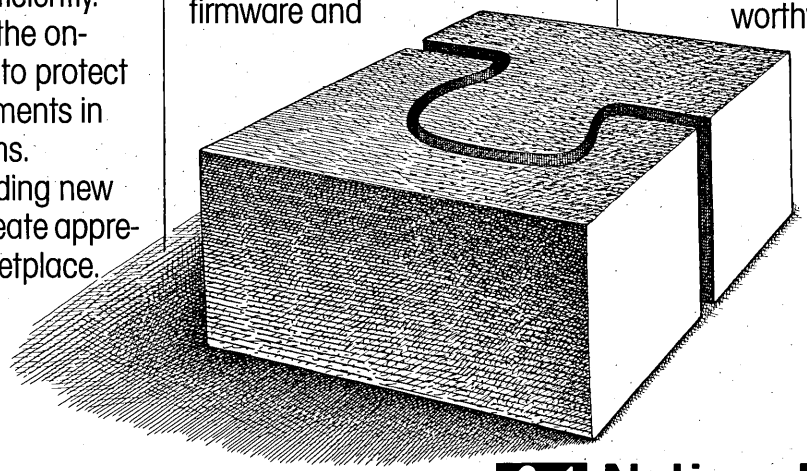
Apparently, IBM not only recognizes the compatible mainframes industry as viable, they now realize we're all playing in the same league. The independents are strong and resourceful enough to absorb and satisfy user hardware, firmware and software needs. Compatible computers have come of age. And we've made a firm commitment to that industry with the creation of National Advanced Systems.

A winning team.

National Semiconductor and Itel have worked together since 1974. National has built more compatible mainframes than any other independent manufacturer. Itel has installed more. By combining Itel's #1 Datapro-rated* service force and marketing expertise with National's proven technological and manufacturing capabilities we've developed a team worthy of the challenge.

So it looks like IBM will have to stay compatible, or else.

* Datapro Research Corporation's annual survey/1979.



National Advanced Systems

The Compatible Computer Company.

National Advanced Systems is a subsidiary of National Semiconductor.

CIRCLE 35 ON READER CARD

New From Raytheon:

A 3274-type SNA-compatible terminal that is upgradeable and programmable.

Picking a 3274-type terminal is like selecting a commodity. You can choose from a number of look-alike alternatives.

Until now!

Now, Raytheon Data Systems has introduced an "intelligent" 3274-type terminal system. It's part of our widely used PTS-100 terminal family.

Our new terminal does what most 3274-type products do. It emulates the large-cluster IBM 3274 display system. It supports from one to 32 remote devices. It offers both bisynch and SNA/SDLC emulators. It has cursor select, controller-managed keyboards and other advanced features. The system is plug-compatible at a coax cable level.

Other 3274-type devices have those capabilities too. But, of all the 3274-type terminal suppliers, only Raytheon offers these advanced features:

Upgrading. Because it is part of our PTS-100 family, our new terminal can be upgraded by users in the field from 2260- to 3277- to 3278-type performance. One system that supports three operating modes. That saves terminal equipment costs and adds great flexibility to your network structure.

Programming. Raytheon's 3274-type terminals are fully programmable.

You can store formats. Execute local print commands. Write or modify functions. Use variable device addressing. All without mainframe involvement.

Simple operation. Our new terminal system has an interactive configurator, which speeds up initial installation and allows for rapid reconfiguring. Thus, it eliminates labor-wasting complexity when using 3274-type displays.

Customizing. Because it is intelligent, our new system can be custom-fitted to your needs. With special keys, keyboards, program functions, printers and the like. Easily and quickly.

Little extras. A display that is smaller. A non-glare, non-smudge screen. A full-screen display. Field installation of every device at no extra charge. But you get the point.

Raytheon's new PTS-100 3274-mode terminal systems are available now. And at less cost than most alternative products.

Find out more by contacting the Raytheon Data Systems sales office near you. Or send us the coupon.

Raytheon terminals. 100,000 now, and growing fast.

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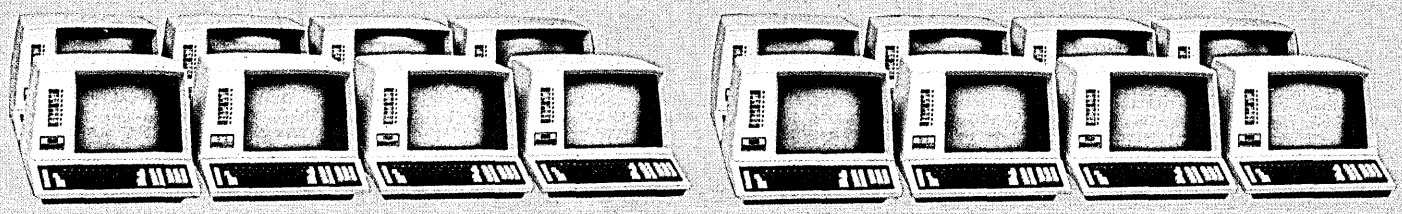
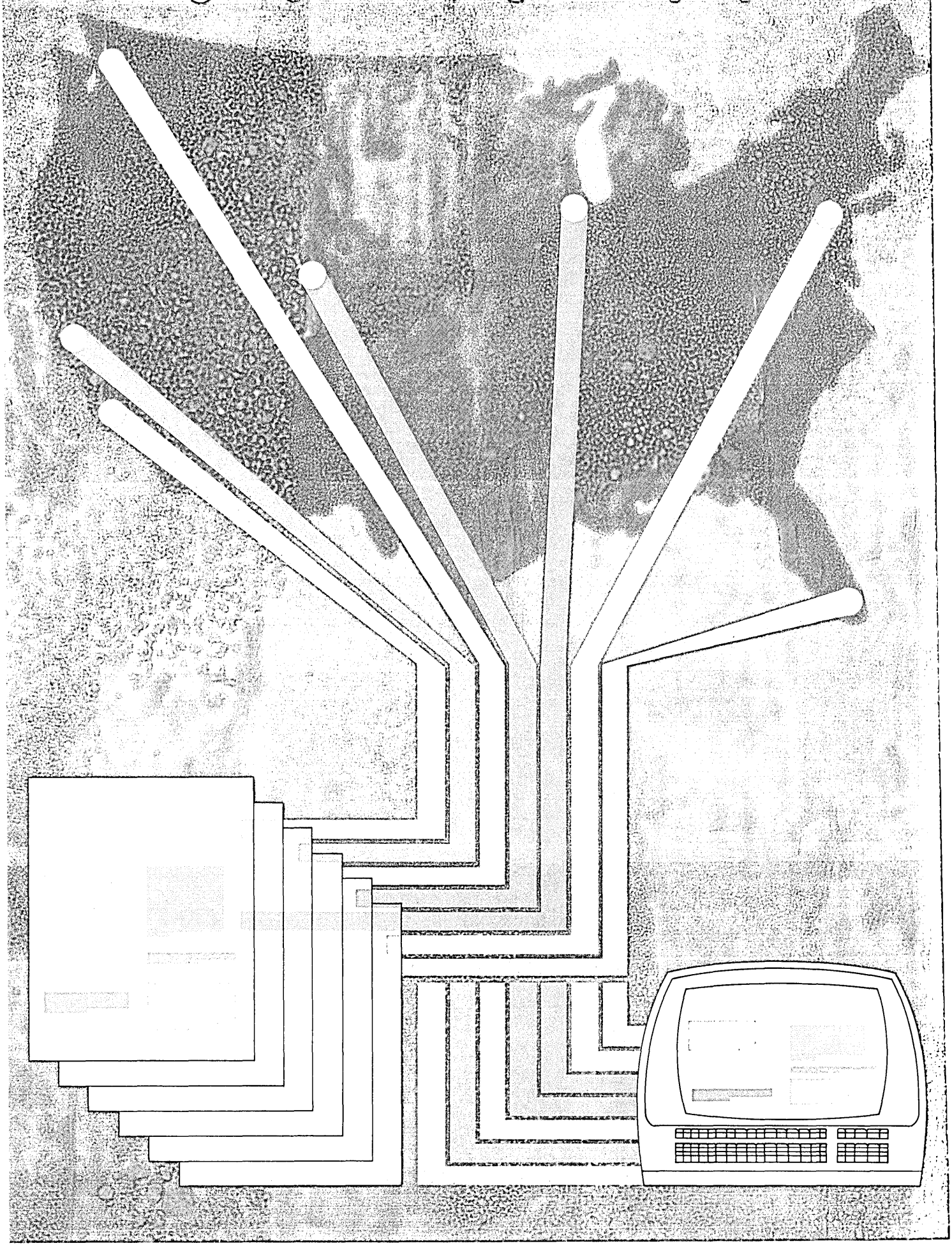


CIRCLE 36 ON READER CARD

Announcing a major breakthrough in Query/Report Writers



TANDEM ENFORM handles Queries and Reports from a distributed data base in one, powerful language.

What do you need to know about your business right now?

Access any file. From any location. In simple language. To any format which works for you. And you can change that format at will, without having to write or rewrite programs and without having to restructure your data base. From any terminal in the system, with proper security clearances, you can have any information in your files accumulated into a comprehensive report—at your fingertips. On CRT, print-out or spooled for delayed action.

The two important differences.

There are two major capabilities which differentiate Tandem Enform from anyone else's Inquiry Report Writer. It performs inquiries on a distributed data base. And, it defines relationships between separate records or files at the time of inquiry without affecting the data base. The results are phenomenal. In efficiency. In capability. In flexibility. And, of course, in economy.

It's a perfect relationship.

Enform is designed specifically for our relational data base and operates under the Tandem Data Base Manager, Enscribe. Simple and easy to use. There is no cast-in-cement, pre-set organization of the data base. File relationships are defined by common codes, keys or fields. And can be changed at will. Once Enform has been told how files inter-relate, it takes full advantage of all primary and secondary keys to locate called data in the most efficient way. Data base records are defined in Tandem's Data Definition Language (DDL) which closely resembles COBOL definition statements so the process is extremely simple and easy to learn. And once the fields are named and described, the DDL statements are logged and maintained in the dictionary file for easy retrieval.

The best of both worlds.

Because Enform uses the same English-like relational query language for both queries and reports, you get your reports at a fraction of the cost and in a fraction of the time imposed by conventional languages such as COBOL. Options allow sorting, summarizing and evaluation against pre-set or user-defined functions. Formatting is automatic, and readily changeable at will. And includes appropriate commas, decimal points and currency signs. You can build in automatic calculation of variable formulas such as sales commissions. And Enform can be used from COBOL, FORTRAN or Tandem's own T/TAL. A final note of worldliness: keywords may be easily redefined to a different language such as German, French or Spanish. We truly speak your language.

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FOCUS

IT'S STILL AN ANALOG WORLD

If digital transmission is the true path to glory, why did two major companies introduce some good old-fashioned analog modems in 1979?

Our industry has been besieged with the battle cries of "digital transmission" for almost seven years.

We have been promised—and rightly so—better performance, lower error rates, and maybe even lower costs. We are encouraged to install digital PBXs, and made to feel insecure if we are not stringing fiber optic cables throughout our offices and factories. Even this writer has abetted the digital mystique at industry conferences, training seminars, and in trade journal articles.

The emphasis on digital communications is not inappropriate; it unquestionably contributes to improved cost/performance. The danger, however, is that we can lose perspective in the face of exciting new technology, and incorrectly evaluate established approaches.

Unfortunately, the digital drumbeaters imply it's already a digital world, or it certainly will be in two more weeks. Those people persisting with analog systems are assumed to be either reactionary or ignorant, and should in any event be avoided socially.

Such views should have been tempered this past year by major product announcements from both AT&T and IBM. *If digital transmission is the true path to glory, why did the two major companies in the information systems business introduce some good old-fashioned analog modems in 1979?*

Very simply, in both intra- and intercity transmission, it's still an analog world, and it is likely to remain so for many years. Digital transmission is in use today on about 10% of Bell's interexchange trunking, but only a small portion of this has been arranged for user access on a direct digital basis, i.e., without modems. This is Bell's DDS or Dataphone Digital Service.

The rest of Bell's digital transmission capacity is assigned to its general interexchange plant, carrying voice, facsmile, or data—whatever a user may be sending. The general interexchange plant is an analog world, so if facsimile or data is being transmitted, there's going to be a modem at each end. The carrier may subsequently digitize the modem's output, and forward it over a digital transmission system for lower operating cost, but at the distant end, it will be converted into analog before being delivered to the user's remote terminal or computer.

Digital communications *is* becoming more important, but its major contribution in the '80s is going to be in the office environment. This will be via digital PBXs and baseband electrical transmission, with a gradual increase, perhaps, in user-owned coaxial cable and/or fiber optics.

When we need to cross the office boundary, however, we must turn to a common carrier. There, we're going to find a steady growth of the intercity digital service. But even Bell is only working towards a goal of 96 metropolitan serving areas, so much of the intercity service will continue to be analog. The public intelligent network services of GTE Telenet and Tymnet, Inc. are also referred to as digital transmission service alternatives, but this is erroneous. At best these services might be characterized as digital data handling services, but they are certainly not digital transmission services.

Indeed, since neither Telenet nor Tymnet build any of their own transmission plants, they must utilize the available common carrier services. So while there may be some isolated hosts or terminal clusters connected via digital service to these nets, and they may have some internode digital service, they are essentially still analog services at the user interface. Even as they expand, their principal access medium will continue to be common carrier intracity dial-up or leased services—and little has been accomplished in intracity digital transmission.

•

So, folks, it may be a digital era, but it's an analog world. And the introduction of significant, sophisticated modem products by the two info-giants confirms that belief and underscores the importance of the products.

The products are important in two respects. First, there is the basic dollar value of the product. A recent International Data Corp. study estimated an installed modem base of $1.3 billion at 1978 year-end, and forecast an 18%-per-year compound growth rate through 1983, which would mean about $275 million in shipments in 1980. Now that's impressive, but Bell's and IBM's shares won't be all that significant in relation to their total revenue.

So what's the big deal? It's the second aspect of the modems—that of their being an essential element in a *systems approach* to customer needs. Let us remember that the system is the solution . . . but it's increasingly apparent we're going to have at least a couple of major views of what that system should be. Until now, IBM has lacked a modem product line of any competitive substance. It now unquestionably has one, and one of which it can be proud in terms of traditional modem functions per se, and also in terms of the modem's impressive built-in testing and problem diagnostic aids. Furthermore, IBM has bridged the void between modems and the dp system. Traditionally, the modem has been a passive converter of signals between the transmission and processing subsystems. It has been viewed as part of the transmission system: the dp system could activate it, pass data through it, but nothing else. The new IBM modems, however, in an exciting precedent, can have testing and diagnostic features automatically activated and read by the network control software, with results passed to a network problem determination application program.

To one who was exposed to the IBM products before Bell's announcement, it appeared that Big Blue had about wrapped it up. One felt sorry for Bell, presuming it plodding along towards the introduction of ho-hum modems, while IBM had locked up all the bauds.

Not so: Bell has now introduced some important innovations, and also more of a systems approach. Unlike IBM, Bell has had a substantive modem product line. It has not, however, had any particular capability in user-operable testing and diagnostic aids. As a result, users have turned to independent modem manufacturers in order to get the auxiliary capabilities for remotely controllable testing and problem isolation.

With the October 1979 announcements, however, Bell is now offering very sophisticated remote testing and diagnostics. And while the modem can't be integrated with the dp system as can the IBM product, the Bell modem testing process is automatic, and can optionally notify a central Bell network maintenance center should problems appear.

Not only have the two companies both brought out a new modem product line; they've both taken a broader systems approach to user needs as well. And the two approaches are not "me too's," but give the users substantive alternatives.

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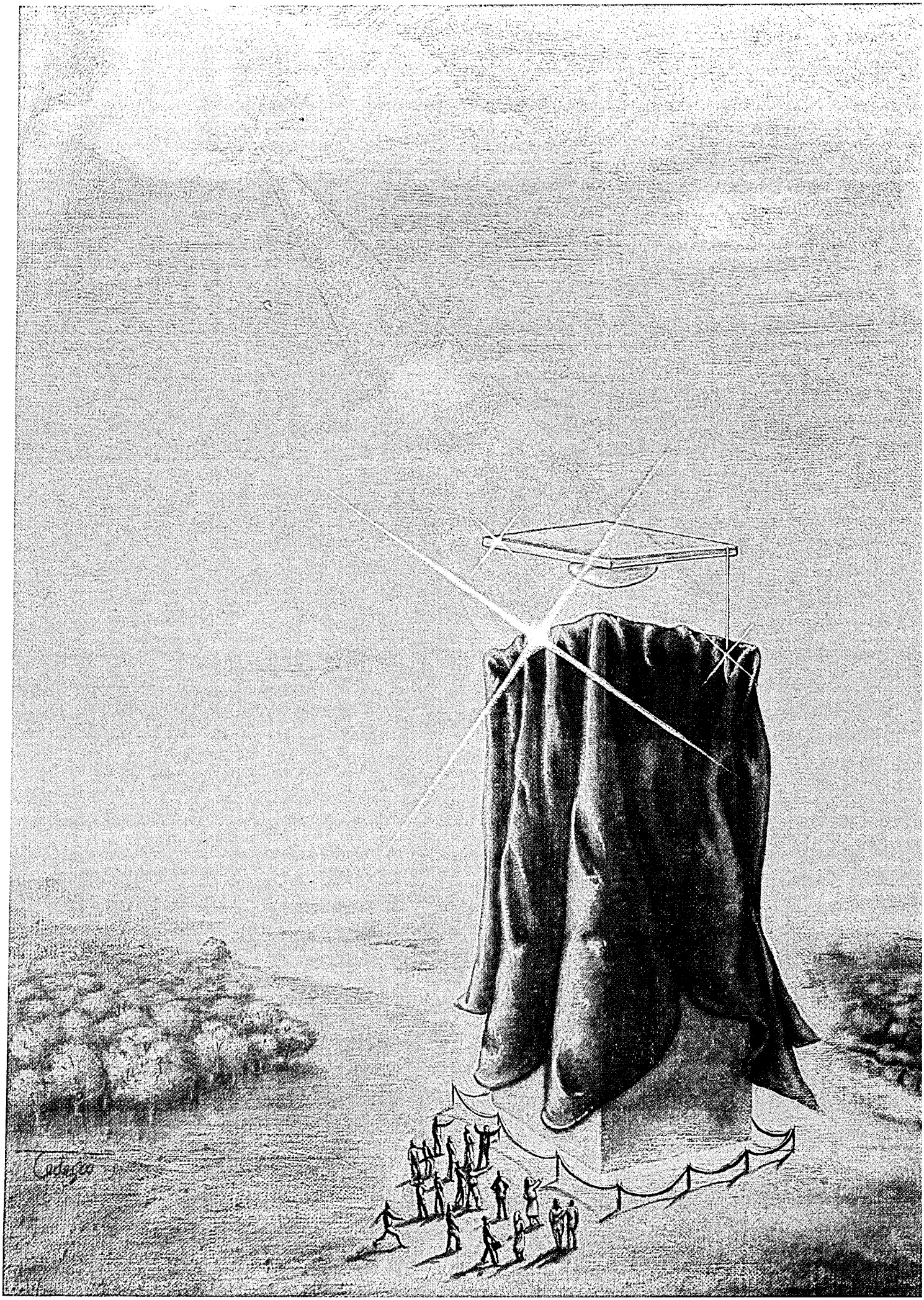
The IBM modems, announced in

ILLUSTRATION BY MICHAEL TEDESCO



June 1979, include the 2,400, 4,800, and 9,600 bps models. All have LSI construction, and incorporate a microprocessor for signal processing and to support diagnostic testing. The modems bore the code names of French universities Nice, Lyon, and Sorbonne. Development of the modems began at the IBM laboratory in La Gaude, France, and has been shared with the Raleigh, N.C., lab since 1977. All are suitable for private line service, in two-point or multipoint configurations, and all support switched network backup operations.

The 2,400 and 4,800 bps versions are also offered in models for general switched network use. Consistent with competitive developments, the 4,800 and 9,600 bps versions feature short clear-to-send delays of 24 milliseconds that aid in reducing response time. The modems are all automatically adaptively equalized, and line conditioning is not a requirement, although IBM notes that types D1 or C1 conditioning (on multipoint circuits) might occasionally be required in exceptional cases.

A fan-out feature is optionally available for all private line versions, enabling one modem to serve up to three machines. This might be three remote terminals or terminal controllers, or it might be a pair of front ends sharing the modem. As with other devices of this nature, only one of the connected machines can send at a time, while all can receive concurrently. Alternatively, where the protocol will support it (e.g., SDLC) one machine may send while another is receiving. The option is a nice cost cutter, eliminating up to two additional modems and local loops per installed modem.

The 9,600 bps modem also has an optional multiplexing feature, similar to the so-called split stream or multiport capabilities of competitive products. The feature supports any combination of 2,400 bps or 4,800 bps channels that add up to 9,600 bps or less.

A final interesting characteristic is that at all three speeds, remote modems automatically respond to the speed of the central site modem, which may operate at either full or half speed. In the event of circuit problems, for example, the central site might decide to drop speed to reduce error rate. This can be initiated at the central site, and the remote sites will automatically follow the speed change.

In diagnostics, the modems have a basic set of manual tests that can be run from modem front panel controls, and a powerful diagnostic support capability in conjunction with certain SNA program products. The manual tests include local self-test, local loopback, remote loopback, and a bidirectional end-to-end test. The self-test exercises the modem's microcode and its ability to handle a degraded receive signal.

The local loopback tests from the data terminal through its modem, across the analog interface, and back through the modem to the terminal. The remote loopback will cause a loopback at the digital interface of any desired modem on the link. This is novel; in the past, such capability has required some auxiliary hardware such as an extra logic card in the remote modems, and a central site controller. The end-to-end test is comparable but uses a modem-generated test pattern rather than terminal-generated data.

•

The more exciting diagnostic capability, however, stems from supported interaction between the modems and software of the communication controller and its host. As noted earlier, this is a revolutionary first—a bridge between modems and system logic. For years, terminals have been polled by the dp system to determine status; now modems are going to be polled and the acquired information used to help manage the network. This capability requires an SNA environment and two IBM program products: Network Communications Control Facility (NCCF) and Network Problem Determination Application (NPDA).

NCCF operates as a VTAM or TCAM application program and provides a program base for communications network management. While NCCF's functions are extensive and otherwise useful, it is mentioned here only as a necessary link between the network operator and NPDA. The latter, in turn, maintains a data base on network performance. The data is reported to NPDA on an unsolicited basis from NCP (Network Control Program) whenever a permanent error occurs, or whenever an error or traffic count threshold is exceeded. NPDA will also solicit performance data whenever the network operator requests a review of data for certain SNA controllers.

Digital communications is becoming more important, but its major contribution in the '80s will be in the office environment.

In addition to its data accumulation and management function, NPDA is also capable of performing differential diagnosis as to the probable cause of an error. The accumulated operating data and probable error causes are displayed at the network operator's request through NCCF. The operator's attention can be gained with an alarm message which will be displayed if previously defined error thresholds are exceeded.

The new modems were specially designed for this environment, i.e., system integrated testing and diagnosis. Whenever a permanent line or station error occurs, NCP initiates remote and local modem testing and sends the results to NPDA. Specifically, NCP initiates remote and local modem testing whenever a permanent line or station error occurs, and sends the results to NPDA. Testing can also be initiated upon overflow of an NCP event counter, such as upon achieving specific traffic volume counts, or overflowing temporary error count levels. The network operator can also initiate testing through NCCF, and the results will be displayed on the operator's crt. Because NCP controls the test sequences, though, they may be interspersed with session data in an orderly way. This means no destructive or lengthy interruptions of data flow in order to test, and it also means the testing process can use the entire circuit bandwidth, rather than just the sub-data-carrier bandwidth used in other systems. In fact, during the test cycle, the IBM modems drop down to a so-called service speed, operating at 1,200 baud and using a more noise resistant, bi-phase modulation. The logic is that if we're experiencing errors, it may be because of a degraded channel, so we'd like as much as possible of the best bandwidth available for our testing. One IBMer privately described the technique as good enough to get through a wet noodle.

The test cycle requires about two to three seconds, and elicits such information as line hit count, a received signal quality measure (based on quadratic error), absence of carrier signal, an indication of reinitializations, or the state of various EIA interface leads in response to an SDLC test frame. In some configurations, the test provides the options for which the modem is strapped, and—would you believe—the engineering change level of the modem. With an extended diagnostics option, a remote self-test can be initiated and the results returned to NPDA. With this option, loss of power at a remote modem can also be reported—a dying gasp to NPDA using capacitor stored power.

The Bell modems are also offered in the standard synchronous speed models of 2,400, 4,800, and 9,600 bps. To emphasize the new features, Bell refers to them as Dataphone II. To emphasize the importance to Bell, AT&T assistant vice president Roger Moody described them as "raising the curtain on the 1980s," because they are a "bellwether" of Bell's "change of direction—the change from product orientation to user orientation."

All of the new modems are intended solely for private line usage. The essential thrust of Dataphone II is network diagnostics and control, and these are of most concern in private line networks. In contrast with the IBM announcement and the capabilities of some independent modem manufacturers such as Racal Milgo, the new Bell 9,600 bps device still doesn't support multipoint operation, and still requires type D1 conditioning. But Bell has remedied its

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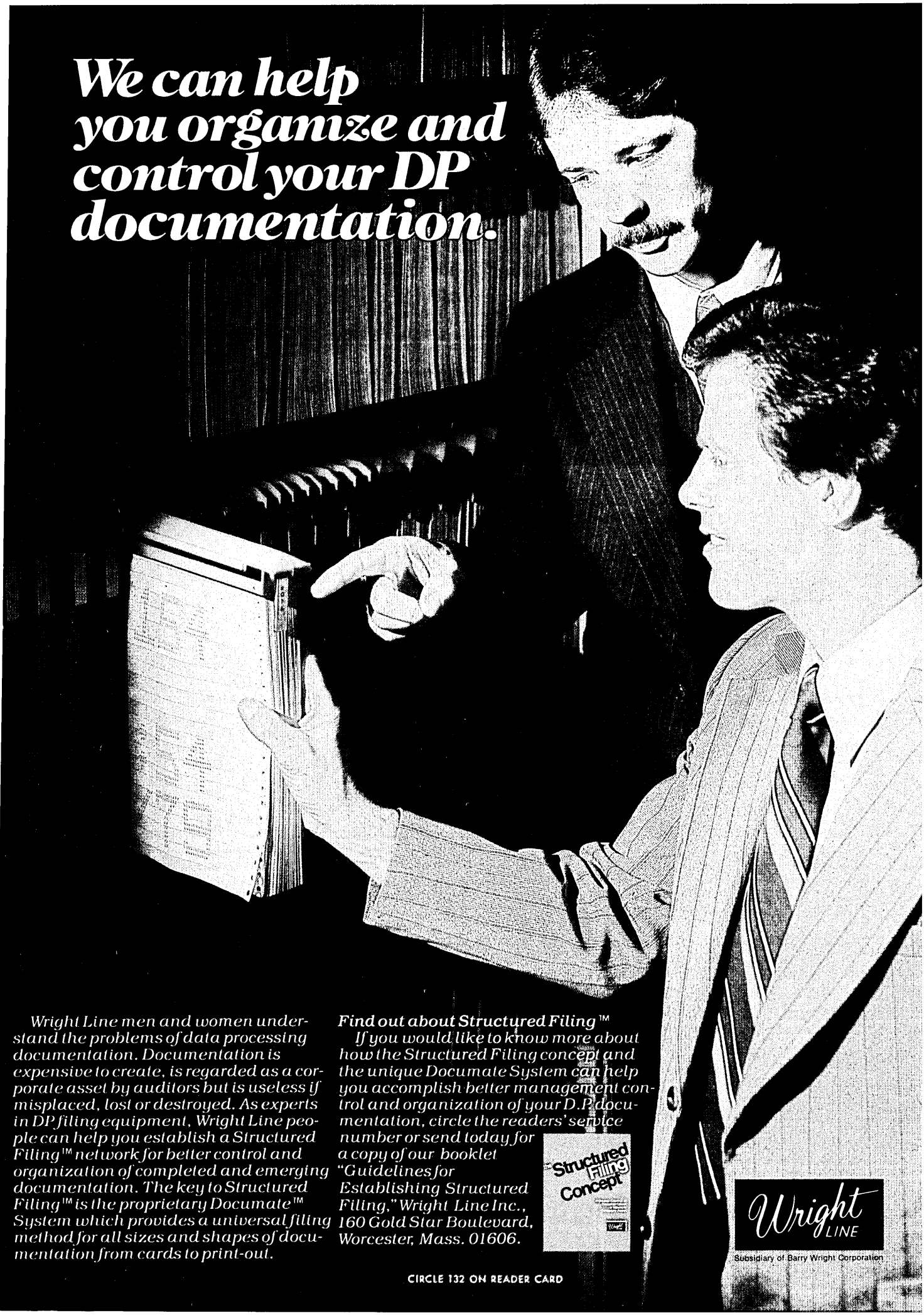

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relatively long 50 millisecond clear-to-send delay at 4,800 bps by providing a 20 millisecond delay in the new version for use at the central site. The new 2,400 and 4,800 bps modems are compatible with older 201C and 208A modems, thus enabling user migration to the new units on an as-needed basis.

Bell is also supporting the new EIA modem interface, RS449, as well as the older RS232C. IBM is supporting only the RS232C interface. As RS449 terminals and controllers become available, users can realize one advantage, which is greater distance—up to 4,000 ft. (only to 2,700 ft. at 9,600 bps) vs 50 ft.—between the modems and the terminal equipment.

The 9,600 bps model, as in the past, supports split stream or multichannel operation. In contrast with the IBM unit, however, Bell's testing and control capabilities can pass through the remote 9,600 modem to operate on the remote tail circuit modems. The central site operator can also reprogram the remote port speed configuration, but the modems do not otherwise support any speed changes. The testing and control capabilities are, as noted, the heart of the Dataphone II offering, and they are derived from a MAC-8 microprocessor incorporated in each modem. The MAC-8 was developed by Bell Labs; Western Electric manufactured the chip, which is described as being compatible with the UNIX operating system. That might prove a potential technical basis for linking the modems with intelligent front-end software as IBM has done.

The test and command capabilities are offered in three hierarchical levels. In all cases, the commands and test results are transmitted via a 110 bps sub-data-channel carrier signal. That is, both data and control signals can be sent concurrently. This is the conventional approach to implementing remote diagnostics, and allows some testing to proceed without any interruption to data flow. Level I is the basic capability of Dataphone II and is incorporated entirely within the modems. With a Level I system, the central site modem on a multidrop circuit becomes a "control data set" that continuously polls all modems on its circuit via the subchannel through a user-specified polling list. A polled modem will report back if it has suffered internal failure, if the signal coming into it has degraded in level or quality, or if a streaming condition exists. Results are displayed on a four-character display at the central site modem. In an interesting variation, an operator at a remote modem can request a test; the central site modem will perform it, and display the results at the requesting remote modem.

Both Bell and IBM did their homework; both have offered significant capabilities to aid the user in managing network problems.

In addition to the testing, which doesn't disrupt data flow, additional but disruptive tests can be conducted. These include a modem self-test, end-to-end tests with a designated remote modem, and loopback testing. Unusual capabilities include an end-to-end block error rate test of an entire circuit, and transmit/receive loss tests.

While all Level I features are integral to the modems, Level II capability adds a central site Diagnostic Console. The console will provide test and command capabilities for all circuits in the network, greater display capabilities, and extended testing. Noteworthy added testing includes obtaining measurements on a set of specific channel impairments, measuring circuit loss at any of three different frequency test tones, and obtaining "snapshots" of EIA lead status—all at any designated modem. The console also maintains a record of the 50 most recent network faults, their nature and their location. In the console's command menu, we find the significant capability to direct a modem to switch over to a standby facility, or to display and modify a remote modem's options.

Level III, the top of the line, is a Network Controller that provides monitoring and control via a necessary but strangely not included crt terminal. A Dataspeed 40/2 is a recommended device for the purpose. The controller also includes a magnetic tape cartridge unit and an interface for an optional printer, such as the suggested Model 43 Teletype unit. With the Network Controller, sequences of tests and commands can be stored and queued on tape and executed when needed or on a delayed basis. Network configuration data can also be stored on the tape for retrieval and display. The time of system fault occurrences is added to the displayed information. Up to 50 faults will be stored for display, but all faults can be logged on the optional printer.

At all three levels, Bell is offering very powerful network test and command capabilities. Further, it is a system that will automatically detect and report transmission and modem faults. However, without a link to the dp system logic, there can be no automatic response based on parity errors, or on communication controller or terminal controller detected logical errors. In general, one might argue that such system errors are going to be a result (in most cases) of degradation/failure of the modem or the transmission facility, and Dataphone II does track those conditions. In any case, a final and significant feature of the Network Controller is its optional ability to automatically report fault counts directly to a Bell System Test Center. This has the potential for placing the network problem management function where many feel it belongs—with the common carrier.

Both Bell and IBM are to be congratulated on the products. Both companies did their homework; both have offered significant capabilities to aid the user in managing network problems. And since the offerings have different capabilities and different network management philosophies, the users have some interesting issues to think about, and upon which to make a decision.

Ralph G. Berglund

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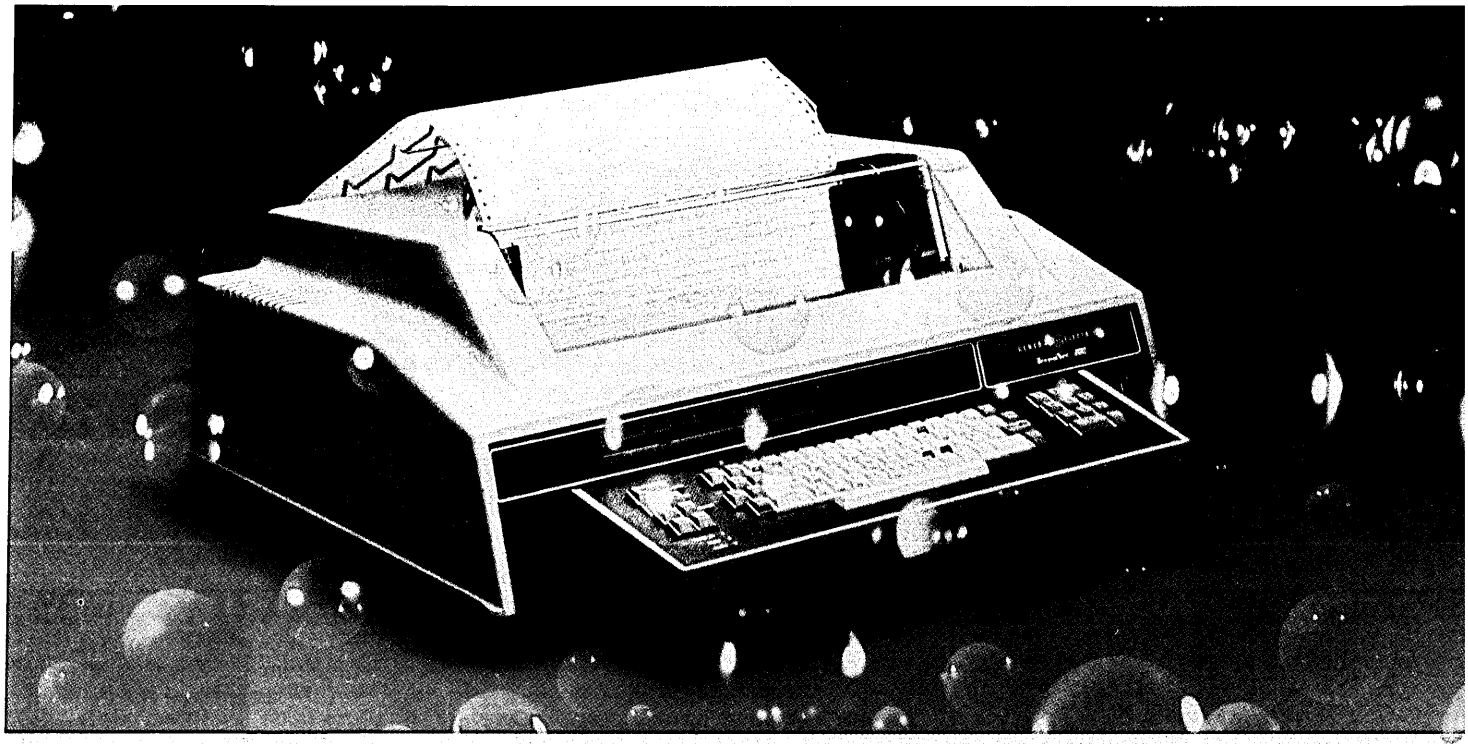

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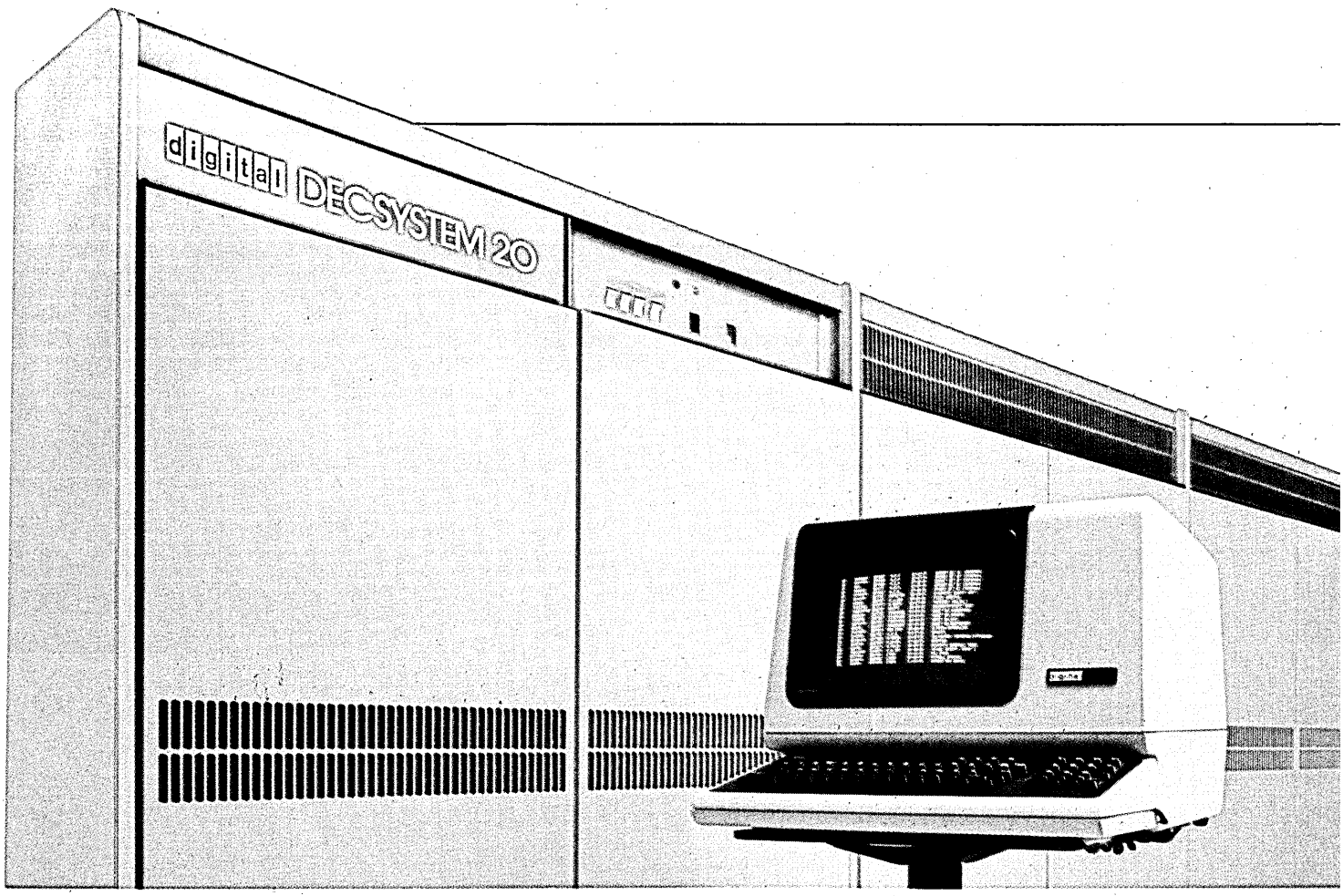
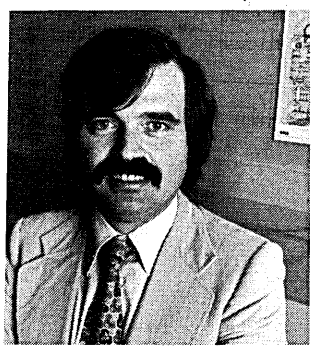
Charles Rossotti, President, American Management Systems, Washington, D.C.





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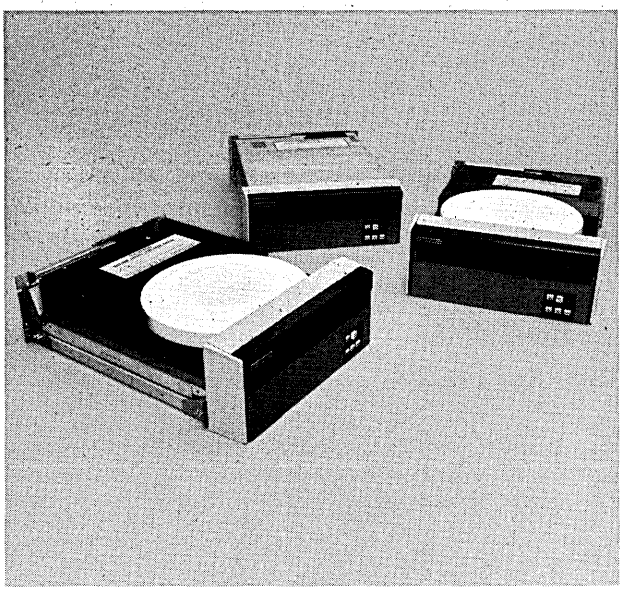

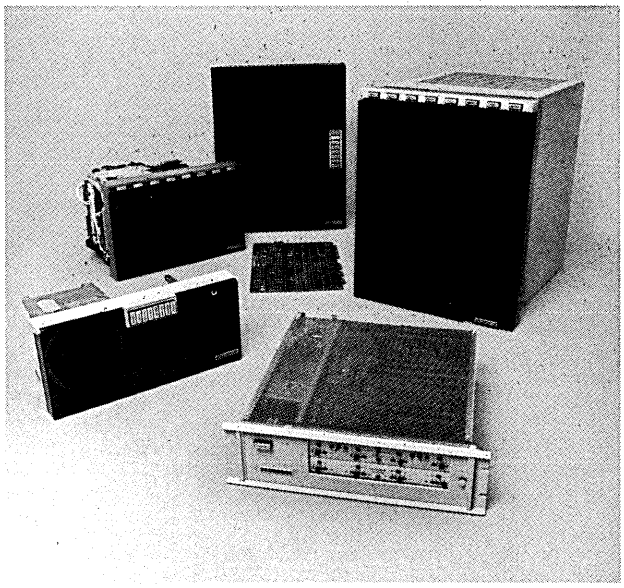

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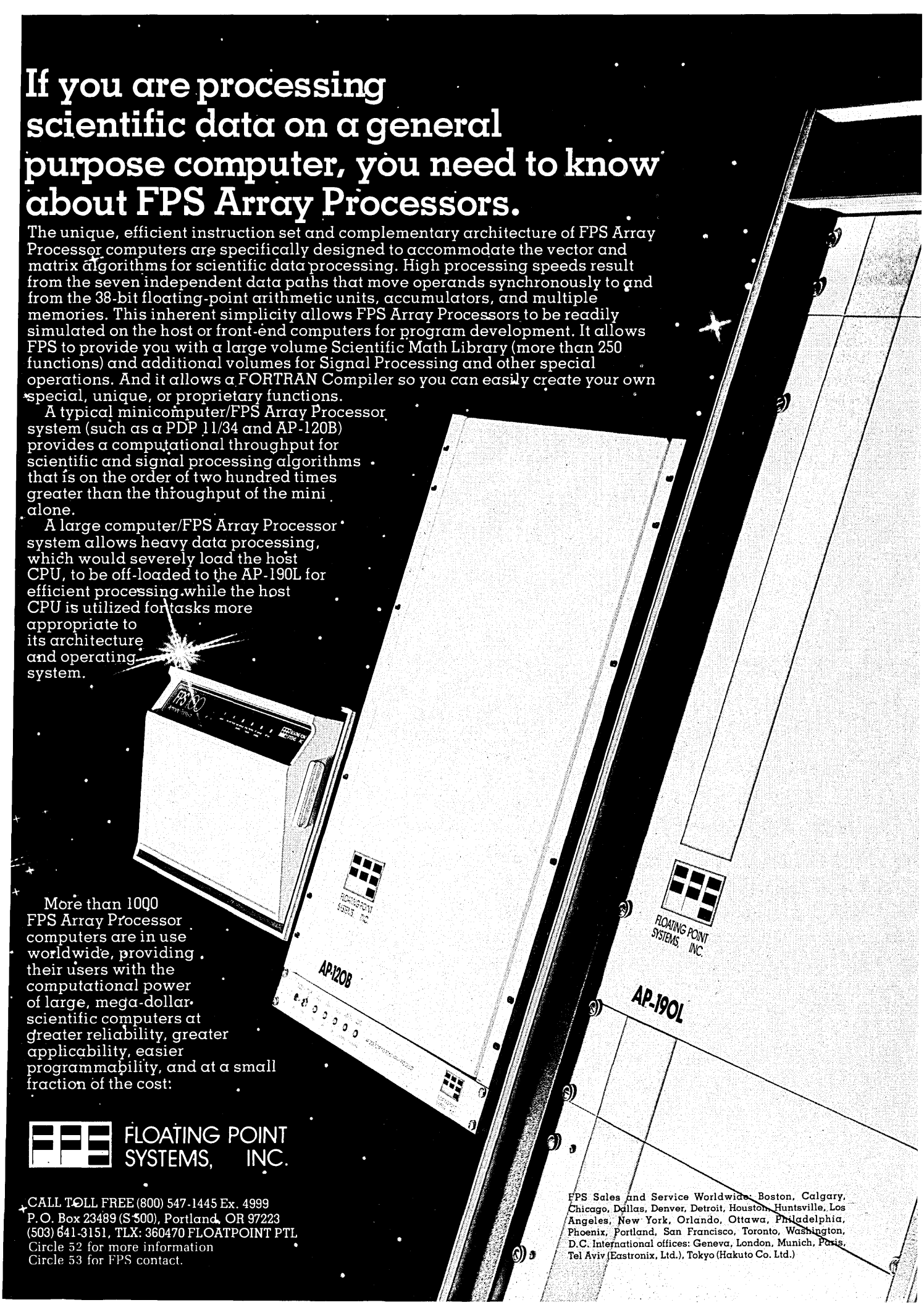

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CIRCLE 54 ON READER CARD

LOOK AHEAD

AUTOMATED BANKING BOOM EYED IN EUROPE

The explosion in European banking automation will be even more dramatic than expected, concludes a study due out this month from PA Computers & Telecommunications Ltd. Vendors have been far too conservative, the study finds, in viewing the banking market as essentially a replacement business. However, competition to make personal accounts profitable for the banks is going to force them to offer new services faster than market forecasts have predicted. These services will be possible only with the full range of automatic teller machines, text processing, electronic mail and OCR equipment, as well as new software now coming on the market.

JACKAL OF ALL TRADES

Robert Feiner doesn't like being called a jackal. He's president of a Van Nuys, Calif., producer of telephone call diverting equipment, which is one of 48 interconnect firms suing AT&T. In a letter to the New York Society of Security Analysts, Feiner took issue with a printed quote from an earlier address to the same society by AT&T Chairman Charles L. Brown. Brown was quoted as having said: "As for the Department of Justice suit, well, they say that when the lion goes into the street, a lot of jackals follow, and at this time the jackals number 48." Said Feiner in his letter: "For my part, I do not take lightly to being accused of (per Webster) 'one who for necessary or self-seeking ends serves or collaborates with another especially in the commission of base or sordid acts.' If Mr. Brown is correct that the lion is in the street and the jackals are following, then the prey is in the gutter."

STILL A LOT OF PAPER

Despite widespread predictions that tomorrow's automated office will eliminate the horrendous paper flow, there are many experts who think otherwise. "The office of the future won't be a paperless office," says James R. Mellor, president of AM International, which is aiming some of its future products at that market. "Paper," he says flatly, "will continue to be the most common medium used in the office," despite the many offerings of automated devices.

RUMORS AND RAW RANDOM DATA

IBM has asked for bids on "enormous" quantities of electrosensitive paper -- quantities so large, some paper brokers originally doubted the order. Among paper mavens, electrosensitive paper duplicating technology has been considered outdated. Could IBM be seeking suppliers for its long-rumored cheap and dirty printer?...Expect Exxon Enterprises, cash-rich and tech-oriented, to bid for a major minicomputer manufacturer, such as Data General or Prime Computer, warns the Yankee Group of Cambridge, Mass., author of an in-depth Exxon study...IBM may be doing some negative selling. DPD salesmen have approached several worried 168 users to convince them that their systems will provide enough power to get them through late 1981 workload peaks. Two large users given such a pitch were reportedly considering PCM options.

NEWS IN PERSPECTIVE

THE PCMS

WINDOW OPENS A CRACK

Study finds a 16- to 18-month period for PCMs to penetrate new IBM user accounts.

Manufacturers of IBM plug-compatible equipment, both peripherals and mainframes, are today facing a window to that market, an opportunity created by new IBM equipment announcements and delays in Big Blue's ability to deliver. It's a choice opportunity for the so-called PCs, makers of compatible peripheral equipment, and the PCMs providing mainframes, says consultant Steve D. Bishop of Input.

"Right now, in my opinion, what the PCs and the PCMs are looking at is a 16- to 18-month open window, based on IBM's definition of what they're going to do,"

IBM will make life more difficult for the PCM vendors, making it tough for them to take and use IBM system software.

Bishop says. He adds that it's a rare chance for those vendors to get into user accounts that they never before had been able to penetrate. And their ability to stay in those accounts will be determined by their maintenance, support, and software capabilities.

"If they don't take advantage of it, they're going to have a very difficult time once that window closes," says Bishop, who has just completed a survey of 150 users and 20 plug-compatible vendors for the Palo Alto, Calif., research firm. He sees the window closing when IBM gets into volume deliveries of its 4300s and 8100s and their associated peripherals and has defined its H-series machines.

As with many others, Bishop observes that IBM of late has been cutting its hardware prices and making up for it by charging for support, software, and maintenance. This, of course, has affected manufacturers of plug-compatible equipment, who have been in the position of having to react to IBM announcements. They have been developing hardware that works as well as or better than IBM's and offering it at a lower price. "Now," says Bishop, "they're having to look at areas where they can add to the performance of the device."

But Bishop's study of user attitudes, being released this month, finds that the vendors cannot get too far ahead of the industry leader. The users were asked whether they would be willing to accept a new technology not offered by IBM. Among medium-sized users, the response was split down the middle. Which is to say that if someone were to offer a bubble memory system that sat between main memory and disk drives in a cache capacity, for example, half the people said they wouldn't be interested—unless IBM did it first. (A medium-sized user here is defined as one having a machine with a power in the range of a 370/125 to a 148.)

The study also found that "disk files are growing a lot faster than most people think they are," says Bishop. Medium-size users said that by the end of 1980 their on-line storage would increase by 112% over their capacity in 1979. And by 1984 it would be 354% over the capacity in '80. For those interested in knowing only what the big boys are doing, large-scale users say their disk drive capacity in 1980 will increase 83% over '79 and capacity in 1984 will be 446% more than in '80. That's a lot of data sets.

In the same time frame, the market for tape drives appears to be falling more quickly than anyone else is predicting. There will continue to be an increase in the number of drives installed, explains Bishop, but the bulk of the increase will be in the number of 6250bpi cartridge drives to be used as backup for Winchester disks. The study sees users beginning to store everything on disks and using tapes as backup.

"So we're going to see a change in end-user utilization of storage."

That end user, the subject of this study, appears unwilling to specify just how much of a price reduction will be necessary for him to switch from IBM to a compatible-mainframe supplier. Users tend to say that price is not important, that they consider vendor support, service, software, and reliability more significant in their selection.

Users are confused, Bishop says. IBM has announced, but not yet totally defined, the 8100 and the 4300. And in the meantime the H-Series mainframes are still "rattling around in the background." And

PCMs are having to look at areas where they can add to the performance of the device.

their confidence in manufacturers of plug-compatible peripherals and mainframes has been shaken by the abrupt withdrawal of Itel Corp. from this business. He further believes that IBM will make life more difficult for the PCM vendors, making it tough for them to take and use IBM system software.

"The PCM companies are moving toward and should move toward integrated adapters and their own peripheral devices, their own software, compatible with IBM's at the user interface," Bishop says. It must

continue to be possible, of course, for the user to move his IBM applications programs onto the PCM's hardware. "It's almost a given that if IBM is going to make its money off its software and maintenance and product support, and not off the hardware itself, that the systems software is going to be embedded inside the device to a level where it's going to be almost impossible to emulate. So what the PCM should be looking at is providing a complete system that is compatible at the user interface level."

—Edward K. Yasaki

THE PCM BOOM IN EUROPE

While Europe eyed IBM's 4300 series as a line the PCM manufacturers just couldn't beat, the PCM appeal now appears greater than ever.

Strangely enough, European interest in medium-size IBM plug-compatible mainframes (PCMs) is now much greater than it was before IBM announced its 4300 series at the beginning of last year.

When that announcement came, the thinking was that the price/performance breakthroughs the new machines brought were unbeatable by PCM manufacturers. But, as happened once before with the 303X series announcement at the end of 1977, the price/performance improvement has resulted in a boom in demand that IBM production is quite unable to meet.

The strong demand for medium-size PCMs in Europe dates precisely from the moment early last summer when long delivery delays for the new 4300 processors (24 months for the 4331, 27 to 28 months for the 4341) became public knowledge. The result is that manufacturers of medium-size PCMs now compete with IBM on the basis of earlier deliveries rather than lower prices.

Two questions still remain unanswered. First, why the sudden surge of European interest in these medium-size PCMs? And, just which companies will rise to the occasion of meeting this increased demand? The answer to the first question may lie in the new and much greater memory demanding DOS/VSE and VM operating system releases that IBM announced at the same time. This was a way of mopping up some of the additional performance that IBM was "giving away" at small- to medium-size IBM 370 prices, and encouraging its 370 users to use the 4300 series' better price/performance ratio to upgrade rather than downtrade.

These new operating system releases offer very attractive new interactive data entry and program development features like VSE/ICCF, IPCS, IPF and the VM/CMS version without a guest operating system for small entry-level systems. They also include new features that make it easier for multiple host processors to share common disk held files, thus opening an alternative growth path through the addition of cpu's rather than their replacement of more powerful ones.

The first half of 1980 is likely to see a number of new entrants into the medium-size PCM market from among well-established European companies.

Many users appear to have revised their growth plans to make use of these aids after the 4300 series announcement, and they are now reluctant to postpone their implementation until they can receive a 4331 or 4341 processor.

So, who will sell these PCMs in Europe? Only three U.S. manufacturers of medium-size PCMs have so far been represented in Europe—IPL Systems, Magnuson and Cambridge Memories.

As of mid-December, there was still some uncertainty as to who would market the IPL-built AS/7020 and AS/7030, the machines with which Itel had competed since July in Europe against the IBM 4341 for the medium-size IBM 370 replacement market. In renegotiation of contract terms with National Semiconductor, which took over Itel's former Data Products Group, IPL appeared to be holding out to sell its systems oem to all comers, whereas National wanted exclusivity.

While the outcome of that tussle was still uncertain last month, one thing seemed clear. If National and IPL failed to reach an agreement and parted company, the near-term result would be an increase rather than a diminution in the number of competing medium-size PCM processors offered on the European market.

IPL Systems would close a deal with one of the other European suitors for its product line, while National would seek to plug the gap in its PCM product line as quickly as possible, if not with the National-built C400, then with one of the many other U.S. or Japanese-built processors that can run under IBM operating systems.

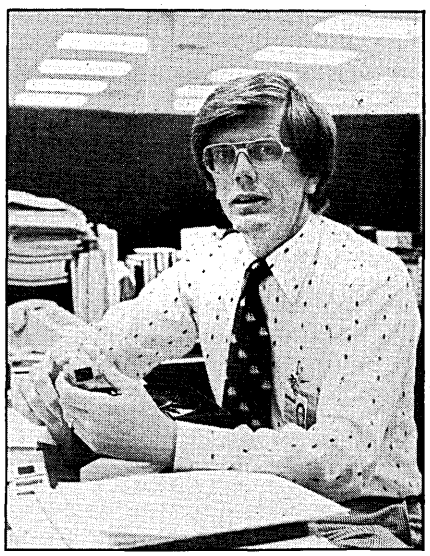
As for Magnuson and Cambridge Memories, neither has a great market penetration in Europe. Magnuson markets its

KVAMME'S CHALLENGE

Floyd Kvamme, president of National Advanced Systems Corp., the company that National Semiconductor formed to handle Itel's computer operations, faces major hurdles in his new post. First, he's got to keep Itel's computer sales and service force together. Next, he's got to give them something to sell.

In December Kvamme was negotiating with Japan's Hitachi to make sure the Japanese company could come to terms with National on whether National will be able to introduce Hitachi's new computers, billed earlier as the AS-7 and AS-8. That kind of arrangement was in doubt in mid-December, as was an arrangement with IPL Systems, maker of Itel's AS/7020 and AS/7030. IPL's medium-size systems, sold in the U.S. by Control Data under the Omega trade name, had been sold overseas by Itel with the AS designation. IPL was reported to be reneging on offering National exclusivity in Europe and a National spokesman said the company in mid-December had no formal agreement with IPL.

Kvamme, a founder of National Semiconductor who continues to serve as vice president and general manager of the semiconductor division, also must cope with the differences between the Itel and National corporate styles. Itel officials refer to the National counterparts as "cavemen," who worked out of cinder-block offices while Itel brass was housed in plush suites in One Embarcadero Center, Itel's elegant San Francisco headquarters tower. Itel's flamboyance was a motivating factor in its outstanding computer sales and service force, now embodied in National. Industry sources wonder if its sales force will stick together under National's more austere style. And National needs those salesmen more than ever if it is to make good with its new Advanced Systems division.



FLOYD KVAMME—His work's cut out for him.

M 80 only on the British market and has not yet achieved any sales. Cambridge Memories started offering its 16XX series last summer, but so far only in West Germany.

As PCM manufacturers, both these companies are unusual in selling their systems directly through wholly owned subsidiaries, and are thus circumscribed by the limits of the marketing and support overheads that they can carry.

The first half of 1980 is likely, however, to see a number of new entrants into the market from among well-established European companies.

Last fall, Olivetti, the large Italian typewriter and office computer manufacturer, announced an interest in reentering the general purpose mainframe market, which it left 12 years ago when it sold its remaining shares in GE-Olivetti to GE (and which has now become Honeywell Information Systems Italia). Olivetti has already incorporated a subsidiary company in London—Olivetti Computers Ltd.—with the task of looking for suitable U.S. and/or Japanese systems to market.

Siemens is reported to be evaluating a medium-size Fujitsu model that would be price/performance competitive with the IBM 4341.

Olivetti may well be one of the other contenders for the IPL systems product line, and this may be one reason IPL is reluctant to put all its eggs in the National Semiconductor basket. Olivetti is also reported to be showing an interest in medium-size Hitachi M Series models—below the level of the AS/6 and AS/7 models that Hitachi builds for National. Olivetti would sell these in complete configurations running under an IBM JCL-compatible Hitachi operating system, but with the alternative possibility of running directly under an IBM operating system.

Nixdorf may well be another major market contender. The company's main reason for getting involved in the running of the big computer manufacturer Telefunken Computer in 1972 to 1974 was to have a German base from which to market computers from Amdahl, in which it had a 15% shareholding at the time.

Telefunken Computer's losses forced Nixdorf and its partner, AEG-Telefunken, to sell TC to Siemens in 1974, and Nixdorf reluctantly abandoned plans to sell large Amdahl systems which were too far removed in size from Nixdorf's own office and small business computers. Now with medium-size PCMs appearing on the market, and strengthened with a cash injection from a West German bank, Nixdorf is eager to reenter the mainframe market, as a seller of IBM-compatible processors.

Rumors last fall held Nixdorf to be negotiating with Two Pi, manufacturer of the CSS 3200 which CSS International, National CSS's European subsidiary, is showing no inclination to introduce on the European market. If Nixdorf did start selling Two Pi systems, it would be a paradoxical deal since Two Pi is a subsidiary of North American Philips, whose Dutch mother company has been Nixdorf's leading competitor on the European office computer market. But having withdrawn from the European mainframe market as recently as 1975 on the collapse of the Unidata consortium, parent Philips is showing no inclination to reenter it, and has recently placed an order for several large Amdahl systems to replace its own P1000 series mainframes used in its own plants and offices.

Then there is Siemens, which has been offering the Fujitsu M 180 II and M 200 under the label Siemens 7.88 series since November 1978. The last quarter of last year saw the first half-dozen orders placed by large West German users, and some of these intend to run their 7.800 systems under IBM's MVS rather than Siemens' BS 3000 (alias Fujitsu OS/IV F4) operating system.

The current Siemens 7.800 models compete against the IBM 3032 and 3033, but the company is reported to be evaluating a medium-size Fujitsu model that would be price/performance competitive with the IBM 4341.

Finally, at least one Norwegian service bureau and one British small business computer company are reported to be showing interest in Nanodata's VMX series.

—Fred Lamond

SOFTWARE

A GREEN LIGHT FOR ADR

Software company gets U.S. license to sell software to Russia and Bulgaria.

With an aggressive political and PR campaign, Applied Data Research, Inc., of Princeton, has wangled an Eastern bloc export license from the Commerce Dept. and the defense-oriented Washington Interagency Committee on Export Control.

It was the first time a license had been approved for the independent sale of proprietary software to Communist bloc nations, according to ADR—although there have, of course, been numerous full-system sales into the COMECON market.

The three licenses approved allow ADR to deliver on 1977 sales agreements with Russian and Bulgarian clients. ADR, which specializes in packages which increase the productivity of programmers, had a $220,520 contract with the city of Moscow and a $169,243 contract with the Soviet-Bulgarian Institute in Sofia, Bulgaria. "Discussion in both countries," said ADR, "indicate the potential for additional sales in the future."

CAROL COHEN: She orchestrated a broad-based attack on the export control system.

Industry sources seemed hopeful that the ADR licenses would mark a breakthough in the bureaucratic red tape which has reportedly tied up a number of similar efforts to sell commercial software packages widely available in the West to Eastern bloc customers.

Under the Export Administration Act of 1969, the U.S. government restricts exports which could "make a significant contribution to the military potential" of any nation or nations which "would prove detrimental" to the national security of the U.S.—while otherwise generally encouraging export sales, to West or East. In practice, charged Informatics vp Bruce Coleman, ADAPSO spokesman on software issues, the required export review process is a bureaucratic tangle in which key officials seem to view software as sorcerers' chants: the deeper magic of the mysterious computer technology. It's a problem of perspective and "ignorance," said Coleman; the limitations of the process are "exacerbated by the fact that the Department of Defense people who control the process don't really know what software is!"

ADR's final success—after a two year struggle to get a decision from the Commerce Dept., the nominal licensee—will undoubtedly benefit the independent software industry, he said, by both having forced the system to work and educating the people involved as to the nature of software. Although, as director of Informatics' software products group, Coleman is not particularly interested in selling into the "bloc nations" because he doesn't trust their com-

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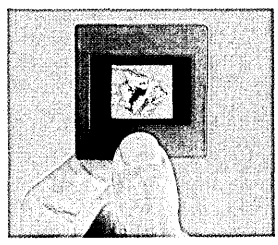

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DUNN INSTRUMENTS

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mitment to honor royalty and use agreements, he said he saw concrete benefits in forcing the system to review the difference between commercial and military value in softwear technology, and hopefully develop a consistent policy on technology transfer.

Edward Kritzer, deputy director of the computer division, Office of Export Administration, in the Commerce Dept.'s bureau of trade regulation, said that he was barred by law from commenting on specific license requests. Kritzer did acknowledge, however, that a number of American software firms have now expressed interest in the Eastern bloc market, where the computer industry is dominated by the Soviet systems built around IBM 360 operating systems.

Last Nov. 23, the Commerce Dept. issued the Bulgarian licenses, for software tools which will be used by the Sofia institute developing application packages for the Bulgarian metals industry and the Bulgarian Committee for a Unified System of Social Information. On Dec. 3, the Moscow license was issued, releasing software packages which will be used by city authorities who manage Moscow housing.

ADR said the licensed program products, all of which have been widely sold both in the U.S. and abroad, were LIBRARIAN, ROSCOE, MetaCOBOL, ETC, AUTOFLOW and ASC. And although the export approvals are for one-time, single-site sales, said ADR executive vp Martin Goetz, ADR is considering the possibility of seeking U.S. approval to sell for multiple-use, mutiple-site contracts with central authorities in the European Communist nations.

With over 10,000 packages sold, ADR in recent years has become a more international company. In 1978, according to ADR vp Carol Cohen, overseas sales brought in approximately half the company's $17.6 million sales. In the early '70s, she said, ADR's sales were almost entirely domestic; now ensconced in the European market, the firm has recently focused its market development efforts in South America. For the future, she said, the Eastern European bloc nations seem to have become ADR's "next market of opportunity."

"The Department of Defense people who control the process don't really know what software is."

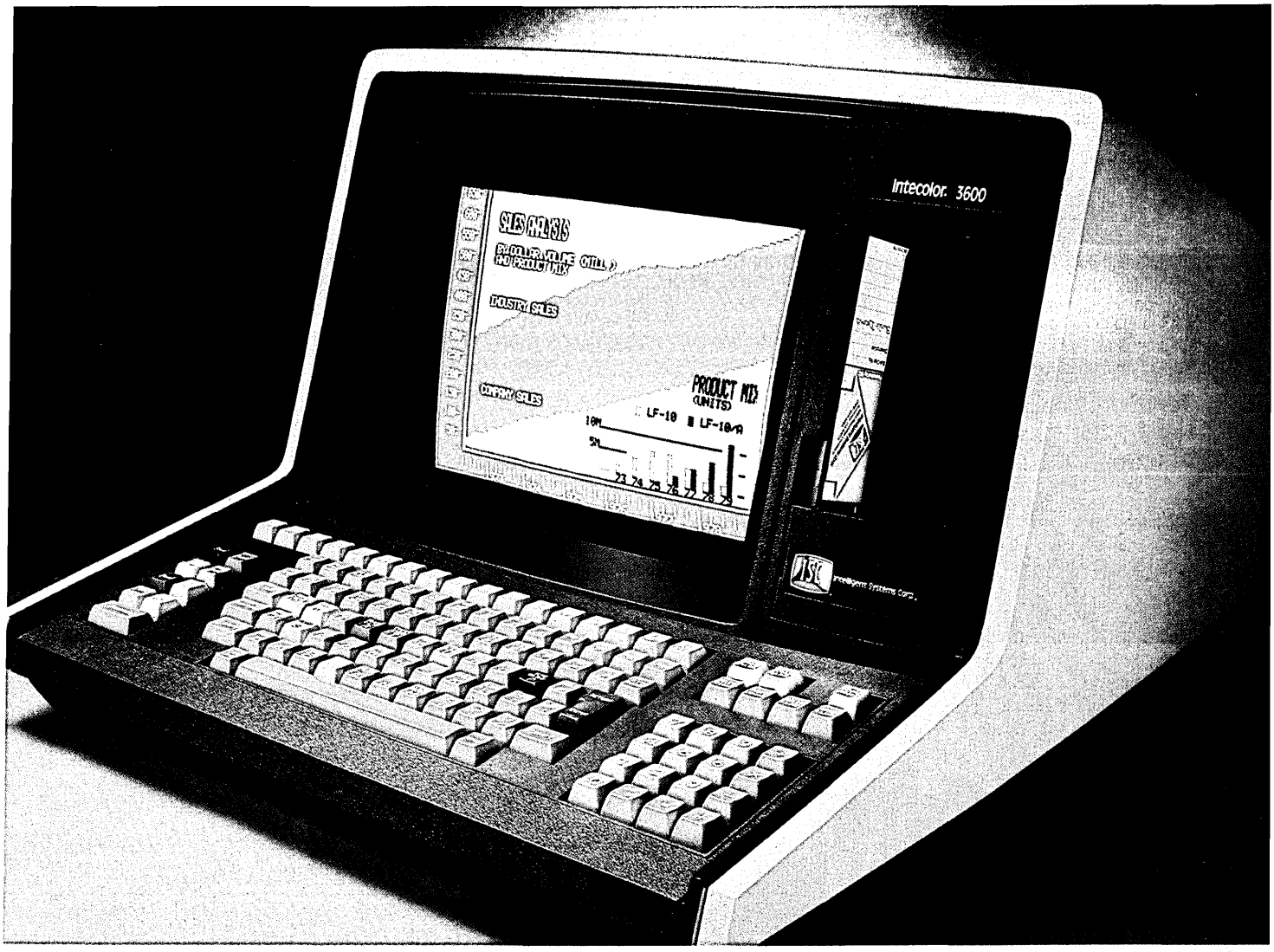
Cohen, who as ADR general counsel guided the firm's efforts to clear export controls, orchestrated a broad-based attack on the export control system, with blustery press releases, active congressional lobbying, even a direct plea to the White House for Presidential intervention. The Commerce Dept., with DOD guidance, simply stalled and refused to rule on the export license application, she explained, even after an industry/government DOD review by the Computer Network Critical Technology Expert Group (CTEG) resulted in an April 1979 report recommending uncontrolled export of commercial software products freely sold in the international non-Communist market.

DOD, said Cohen, seemed determined to equate any product that could be valuable to the Soviet bloc computer industry, *per se*, as a factor contributing to Soviet military potential.

ADR's program packages "do not provide any unique contribution to user hardware or software," argued Cohen. "They merely accelerate the process of developing software, software that could be developed more laboriously and less economically though other systems available to any computer hardware owner."

"The prospect of their being pirated for some farfetched military purpose is far less through the direct sale of these packages with their inspection and royalty arrangements," she added, "than through pirating from packages available in the commercial market in the United States and throughout the world."

—Vin McLellan



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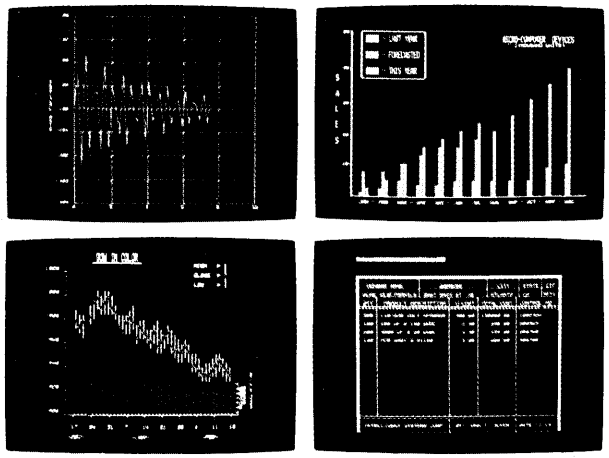

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COMMUNICATIONS

GTE FORMS NETWORK GROUP

Telenet packet network is focal point for broad spectrum of networking capabilities.

Using its recently acquired Telenet packet network as the focal point, GTE has formed a major new group dedicated to bringing value-added integrated network services to users.

Called the GTE Communications Network Systems group, the organization will combine Telenet with existing equipment operations, such as Sylvania, and financial data base services to provide a broad spectrum of networking capabilities. Also included will be the British viewdata system to which GTE has the U.S. rights.

Greatly expanded services have been introduced for Telenet, putting the packet carrier squarely into the domain that has been touted by AT&T's Advanced Communications Service, Xerox's Xten, and the Satellite Business Systems offering.

As described by Telenet chief Lawrence Roberts, the network will upgrade its terrestrial facilities, add satellite communications, and open the door to expanded terminal support plus office automation services—all by 1981.

Breaking out from its self-imposed limitations of supporting asynchronous interactive terminals at speeds up to 1,200bps, Telenet will support 3270 Binary Synchronous terminals from IBM and others, Hasp spooling, 2780 batch devices, and full X.25 protocols. SDLC support is planned for later. Tariffs for these services will be filed early in 1980.

Perhaps more impressive is the plan outlined to provide an electronic message service for office automation applications that will allow crts, word processors, cpus, TWX terminals, and other devices to interact in an electronic mail service that will include terminal-to-terminal capabilities, Telenet sources said.

Communicating word processors will be supported initially under existing protocols such as 2741 and 2780, but vendor specific communications features may later be supported, depending on customer demand. Telenet is also looking at the feasibility of providing turnkey electronic mail service by providing a customized terminal designed to make network sign-on automatic. Designed for users who want electronic mail but may not be familiar with terminal usage, the special Telenet terminal would take care of all log-on and other housekeeping.

Store-and-forward, delayed delivery, and unattended delivery of messages will be included in the electronic message offering which will be filed for tariff approval by spring of 1980.

The expansion into satellite facilities will include packet radio technology to be used for local distribution, thus providing Telenet users with an alternative to telephone company facilities. The packet radio capability will use a reservation scheme that is an outgrowth of the Aloha network technology, first pioneered in Hawaii.

Network will add satellite communications and open door to expanded terminal support and office automation services —all by 1981.

Although Roberts said a satellite carrier had not yet been selected for the service, set for 1981, plans call for operation in the four and six GHz frequency bands which encompass proven operating capabil-

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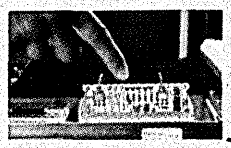

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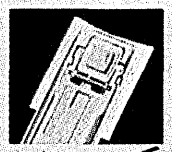

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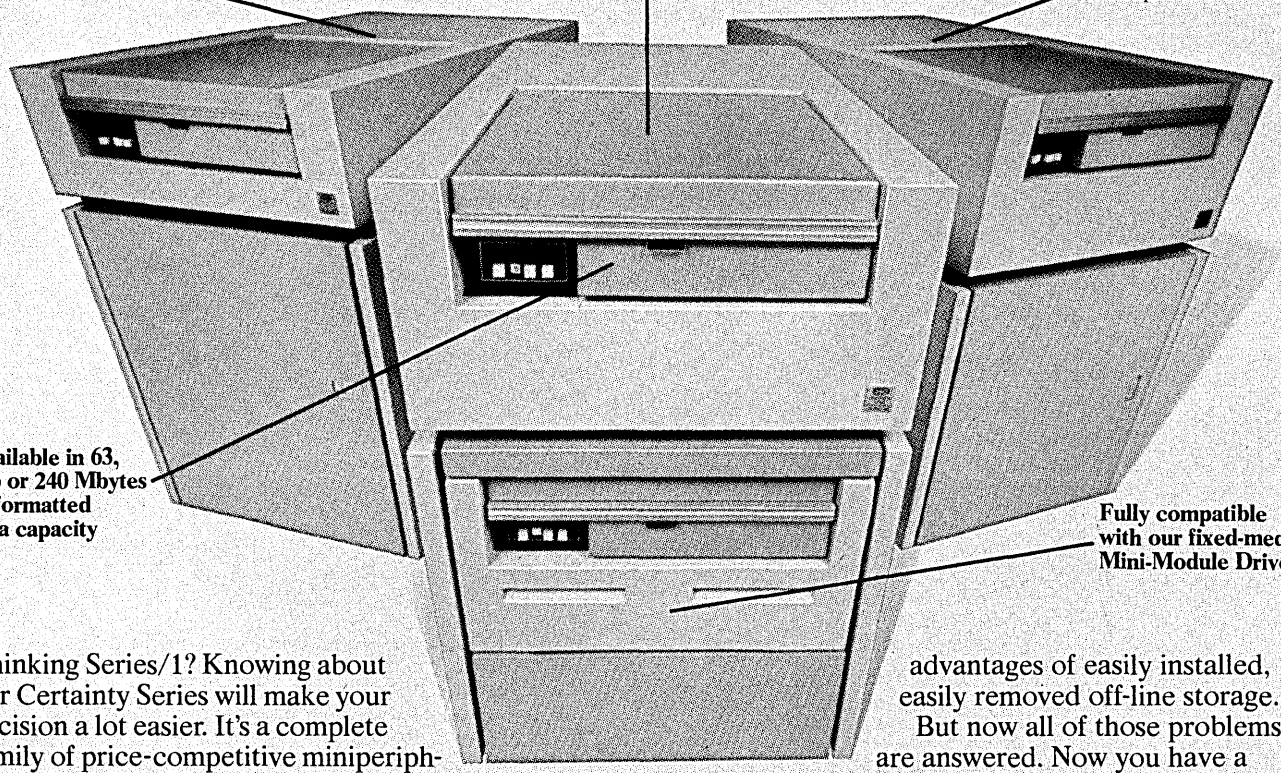

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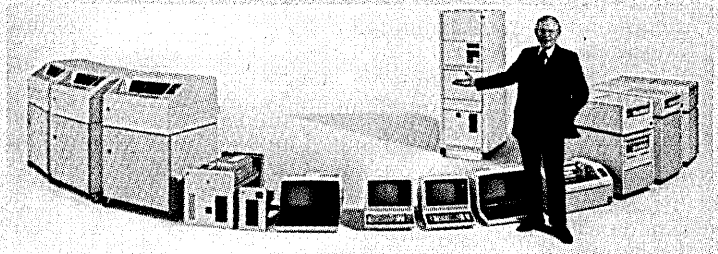

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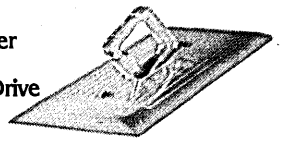

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ities. The satellite service will begin in 30 cities at Telenet locations where five-meter antennas, already commercially available, will be installed.

On the ground, Telenet will begin to add its own electronic network control capabilities, thus lessening the current dependence on AT&T central office facilities, Roberts said. Also to be integrated into the network backbone will be T-carrier facilities providing higher speeds and more bandwidth to users, Roberts said.

The satellite service will use a version of time division multiple access technology that avoids the relatively wasteful preallocation of frequency slots planned by other carriers, Roberts said in an obvious reference to SBS.

In the viewdata area, Roger Vallo, president of the new GTE group, said a test is being conducted for business users with a GTE data base in Tampa, Fla. Before a viewdata-type service can be included in GTE's offerings, a market trial will be needed. Thus far no dates have been set for such a trial, he added.

As part of the Communications Network Systems group, GTE will configure customized voice/data networks for CCSA and tandem tie-line type customers, according to David J. Horton, vice president for marketing in the new organization.

The new terminal protocols to be supported in 1980 will be based on design upgrades in the Telenet TP-4000 intelligent network processor and capabilities in the 9100 network machine supplied by Cambridge Telecommunications Corp., the new Telenet subsidiary.

—**Ronald A. Frank**

NEW ROLE FOR OLD AT&T FOE

Lead attorney in Carterfone decision heads U.S. operation of Britain's Cable & Wireless Ltd.

Bill Brice's battle plan sounds as if it could come from any of the emerging firms in the telecommunications industry: "We intend to be an applications-oriented company that will solve customer needs all the way from equipment to telemanagement."

But his claims are not describing just any company. He is talking about Cable & Wireless North America, Inc., a group formed with little fanfare less than a year ago to make its mark on U.S. communications users.

The parent company is Cable & Wireless Ltd., the old-guard British firm that operates around the world providing carrier services, running telephone companies, and providing turnkey telecommunication systems. Last year it earned a pretax profit of $71.6 million on revenues of $355.6 million.

In 1978 Cable & Wireless, with remarkable determination, purchased three major U.S. firms—Carterfone, Incotel, and TDX—and thus put itself squarely into the emerging competition of the telecommunications scene.

And Bill Brice, who is now chairman and chief executive officer of the new North American group, knows better than anyone else the importance of the competition first spawned by the 1968 Carterfone decision. For it was Brice, as lead attorney, along with his colleague Ray Bezing, who won for Tom Carter the right to attach noncarrier equipment to phone company devices and ultimately to the telephone network itself.

Today Brice says he knew his hard fought case against the seemingly insurmountable odds of the phone company's

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☐ PM-DSW11/300	RWP04,05,06	254MB disc pack storage for the PDP-11/70, with controller. Emulates DEC's RH70.	$33,875	$27,100
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☐ PM-DC8	RK8E	Disc controller for the PDP-8 for 1.66MW, 3.32MW, or 6.64MW drives.	$ 2,125	$ 1,675
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☐ PM-DC11/300C	RH11+RJP04 control logic	Mass storage disc controller for the PDP-11. Operates up to 8 254MB drives. Emulates DEC's RH11.	$ 8,955	$ 7,164
☐ PM-DCW11/300	RH70	Mass storage disc controller and coupler for the PDP-11/70. Emulates DEC's RH70.	$17,650	$13,590
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legal armies would have far-reaching implications. And one senses that he enjoys playing a part now in shaping the new industry.

In reviewing the pieces that the North American group is putting together, Brice says Carterfone provides the equipment base in the terminal area, Incotel is providing switching processors, and TDX is operating in the important toll accounting area. Cable & Wireless North America could provide everything short of plain old telephone service, Brice points out, and the company will carefully pick and choose the most desirable options out of that broad spectrum.

"We intend to move toward an integration of product and service offerings so that within the next year the user will get telemanagement terminals, switches, and expertise to tie them all together," Brice says. The company might well become a value-added or specialized carrier, Brice suggests, and industry sources confirm that he is talking to some of the companies in this group. But Brice seems to return several times to the resale possibilities of buying lines in bulk from existing carriers and adding some type of value to those facilities. He also does not rule out further U.S. acquisitions, especially in the intelligent PBX area —though he says that Rolm or Danray are not among the companies he has his eye on.

And would Cable & Wireless Ltd. bring its resources into the picture? The answer is obvious as explained by David W.B. Bull, director of market planning for the North American group. Described by Brice as a "career Cable & Wireless employee," Bull sounds almost like a diplomat in the British Foreign Service when he explains: "Cable & Wireless will bring worldwide expertise together with local expertise to provide total systems to specific areas."

One of the first new products of the North American group is a glass teletypewriter introduced by Carterfone. Purchased under an oem agreement from Digital Equipment Corp., the modified VT 100 crt can be used in a variety of low-speed message networks now limited to paper tape operation, Bull explains. Caterfone has service centers in 40 cities and provides the key field force to launch a future integrated service. Incotel is a supplier of message switches that will soon have an X.25-compatible product. And TDX provides a least-cost routing service for business users. Its Vienna, Va., computer center monitors the long distance calling patterns on 4,500 business lines.

Cable & Wireless could provide everything short of plain old telephone service.

The possibility of TDX becoming a specialized carrier is not ruled out by Brice. "We are not afraid of regulation, and once you are a carrier, you have greater flexibility," he explained.

Because of its foreign ownership, Cable & Wireless North America would be limited to acquiring no more than 20% of a U.S. carrier. But he has no intention of becoming a telephone company, and these restrictions would not apply to a specialized or value-added carrier.

Exactly how Cable & Wireless will operate in the coming years is under active consideration by Brice, Bull, and their six-member staff in Dallas.

"We have three firms all positioned at pinpoint places to take the best advantage of this blending between computers and communications. We will be in the business of assembling, processing, moving varied types of data base information," Brice says.

Shuttling between the Cable & Wireless office and his law practice, which are on the same floor of a downtown Dallas office tower, Brice seems very unlike an attorney satisfied to bask in having fostered a new, competitive environment. He seems more like an executive determined to get a piece of the action.

—Ronald A. Frank

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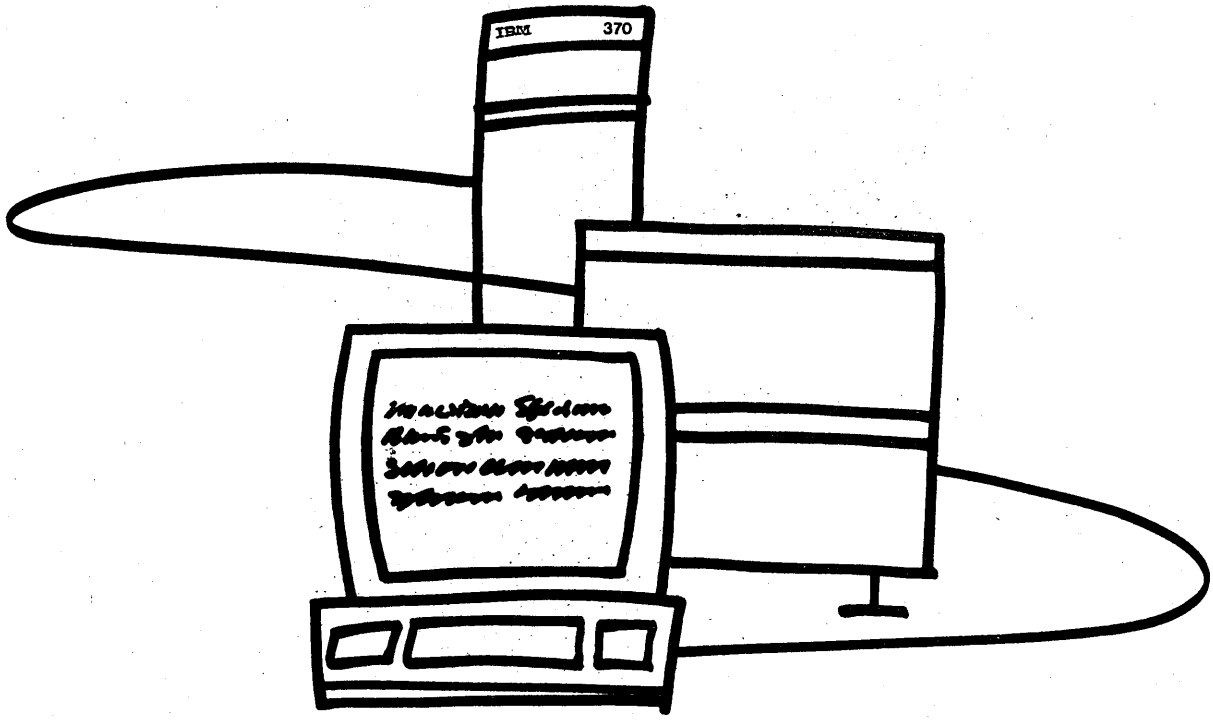

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DSA: FOR AN OPEN STRATEGY

Honeywell's distributed systems architecture implements an open systems strategy announced two years ago.

Honeywell's new Distributed Systems Architecture (DSA) is being regarded by observers as a practical networking system with a broader framework of its Distributed Systems Environment (DSE) announced two years ago. Both were developed jointly by Cii Honeywell Bull (CiiHB) of France and Honeywell Information Systems (HIS) in the U.S.

DSA, announced this summer by CiiHB, comprises a number of hardware and software elements that implement the open systems networking strategy of DSE. It distinguishes between primary networks that comprise DSA hardware and software elements and secondary networks that may comprise any other terminals and line control procedures, but which may interface with a DSA primary network via a DSA network access mode.

A DSA primary network is made up of a number of Honeywell Level 6 (called Mini-6 by CiiHB) minicomputers in either of their two DSA versions:

—Datanet 7102 or 7103 front end communications processors (FECP) or remote communications concentrators.

—Mini-6/DSS distributed satellite systems.

These may be interconnected in hierarchical, ring or mesh networks by any desired combination of leased lines and/or public circuit; or packet switched data networks, such as France's Transpac, Euronet, the West German Datex and Datex-P, and the Nordic NPDN.

The DSA communications control procedures governing messages sent through this primary network are divided into six layers for the following: applications interfaces between programs on the host and satellite processing systems; message format control; session control; transport control; path control; and link access control. The first four layers of procedures are end-to-end handshaking procedures between the transmitting and receiving nodal processor. Among these, transport control determines the path through the network taken by messages belonging to this session.

Honeywell's DSA communications control procedures governing messages sent through the primary network are divided into six layers.

Path control and link access control procedures involve handshaking between each of the processors at each end of an intermediate link. When a session is routed through a public packet switching data network, like Transpac or Euronet, these link access control procedures will conform to CCITT X.25 standards.

Beside X.25 "virtual circuit" procedures, DSA path control procedures allow also alternative "datagram" and circuit-switched procedures. Circuit-switched procedures will be followed when using a circuit switched public data network such as Datex and NPDN. Any of the three allowed procedures can be used on leased lines.

Datanet 7102 and 7103 FECPs belonging to a DSA primary transport network can also front-end Honeywell Series 60 Level 64, 66, and 68, DPS 8 and CiiHB DPS 7 host mainframes. Interfacing software is currently being developed to allow them to front-end also IBM System/370, 303X or 4300 hosts, as well as Univac Series 90 and 1100 hosts.

Whether front-ending a host mainframe or being used solely as remote concentrators, Datanet 7102 and 7103 processors can also control a "secondary network" of local and/or remote terminals. These may interface via any commonly used IBM or Honeywell procedure—Character Start-Stop, BSC, VIP, etc.—unlike the primary transport network on which only HDLC procedures are allowed.

Mini-6/DSS distributed satellite systems are the standard satellite systems in

DSA primary networks. They may use Level 6 Model 6/43 and larger Level 6 CPUs running under GCOS Mod 400/DSS or GCOS Mod 600/DSS operating system. This incorporates software for "cooperative transaction processing" (CTP) between the Level 6 satellite and a Level 64, 66, DPS 7 or 8 host mainframe, whereby the satellite can interrogate and/or update the host mainframe's backing disk files interactively. Similar CTP software is currently being developed for IBM host mainframes and is expected to be announced by the end of 1979.

In addition to Mini-6/DSS satellite systems, any other unbuffered, buffered or intelligent Honeywell terminal can belong

Mini-6/DSS distributed satellite systems are the standard satellite systems in DSA primary networks.

to a "secondary network" controlled by a Mini-6/DSS or Datanet 7100 processor, which thereby interfaces it to a primary DSA network. Any other manufacturer's terminal can be interfaced via compatible communications procedures to a "secondary network" in the same way.

Honeywell's and CiiHB's DSA thus conforms to ISO "open network" principles, and follows closely the distributed network architecture first pioneered by Digital Equipment (DECnet), with Level 6 minis on DSA primary networks playing the role of DEC PDP-11s in DECnet.

—Fred Lamond

MICROCOMPUTERS

SPEAKING OF CHIP SHORTAGES

New compiler can be used on any 8- or 16-bit micro now or to come.

Microprocessors are finding their way into more and different kinds of equipment and devices every day—but there is a hitch. Designers face supply and delivery problems with the chips.

The California Div. of Washington, D.C.-based Systems Consultants, Inc., headquartered in San Diego, may have a partial solution. Its newly announced PLMX, billed as the first universal high level language for microprocessors, could at least free designers from dependence on one source for chips. PLMX, say its developers, can be used on any 8- or 16-bit microprocessor now or to come.

Not only can a user implement PLMX with any combination of existing chips, its flexibility allows him to gain from new advances in microprocessor architecture without having to develop new software for each microprocessor change, said Dr. Jack Ingber, manager of product development for SCI. And, he said, it is priced at half the cost of PL/M and other nonuniversal microprocessor software packages. PL/M, he explained, originally derived from PL/1, is used only on Intel 8080 or 8086-based microprocessor systems. Other versions, such as PL/Z for Zilog's Z-80 and PL/65 for the Motorola 6500, are used only with those specific microprocessors.

Ingber said PLMX syntax is identical to PL/M's, which means that the entire library of existing PL/M programs can be compiled under PLMX and that PL/M programs can be used on microprocessors other than the 8080 through the PLMX compiler.

PLMX has been under development at SCI's San Diego facility for two and one-half years. "We started out to develop it for our own product development activity."

Ingber said PLMX can be adapted to interface with "practically any operating system." Internally, at SCI, it has been running under CP/M, an operating system that can support just about any 8080-based system in use today, including hobbyist and small industrial systems.

"When we decided to take it to the commercial market," said Ingber, "we looked around at existing universal microprocessor development systems and decided Tektronix's 8002A was the most universal." So SCI developed an interface for PLMX to run under TEKDOS, the 8002A's operating system, and secured a marketing agreement with Tektronix under which the Beaverton, Ore., firm can sell PLMX with the 8002A. "We feel this will generate significant international interest," said Ingber, "since Tektronix does a substantial amount

NEWS IN PERSPECTIVE

of international marketing."

He said interfaces to other operating systems will be available this year.

Ingber stressed that PLMX "is a true compiler, not an interpretive compiler such as BASIC or PASCAL in some of their current implementations. Since an interpreter must be resident in ROM for execution of programs, an interpretive compiler requires a considerable amount of memory space, thus restricting its usefulness in developing ROM-based products. The programs compiled by PLMX, however, run much faster than those on an interpreter—an average of 15 times faster—since the programs are already in memory in executable form at run time making PLMX ideal for real-time applications. Because most microprocessor programs reside in ROM, PLMX provides rigid separation of ROM and RAM areas."

PLMX is priced at $1,000, which includes an eight-inch compiler diskette and instruction manuals. Additional copies for the same microprocessor type are substantially discounted, Ingber said. Copies of PLMX are available for immediate delivery.

Although SCI is aiming initially at the industrial market, Ingber does not preclude the possibility of some day selling it through computer stores to hobbyists.

SCI has been active in computer sciences and technology, management consulting and systems engineering since 1966. The California Div. is its largest operating group and is involved in software development systems analysis and integration, communications, military radar surveillance and warning systems, configuration management and verification, and validation. PLMX is its first commercial product.

—E.M.

PERSONNEL

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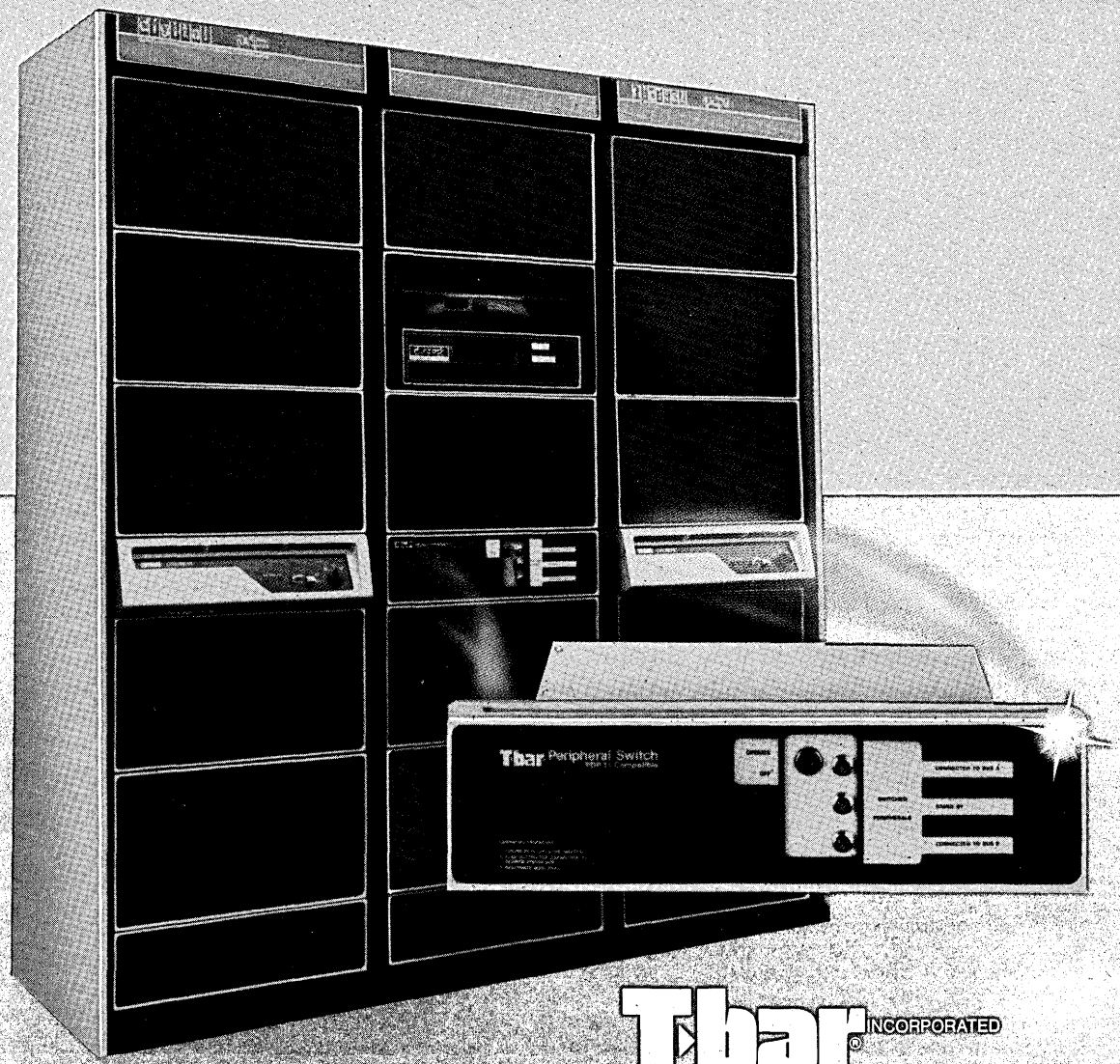

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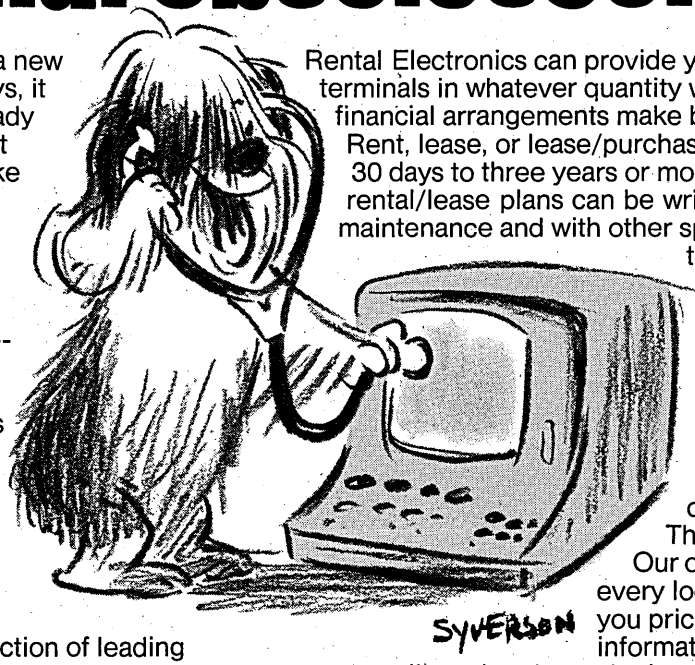

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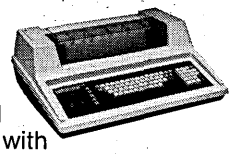
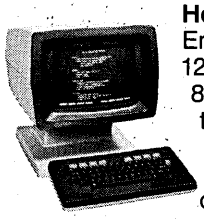
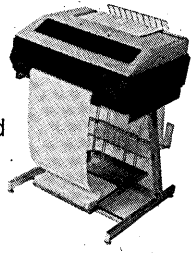


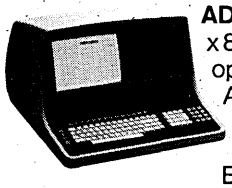
TI Model 820 Keyboard Send-Receive Data Terminal/Printer Printer operates at 150 cps on 9 x 7 wire matrix assembly printhead. Full ASCII Keyboard (ANSI-compatible) with N-key roll over. Operates in Asynchronous, USASCII, RS232C interfaces and is compatible with Bell 103, 113, 202 and 212 units. Selectable baud rates of 110 to 9600.



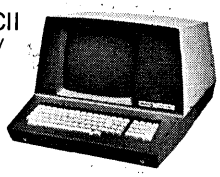
Hewlett-Packard 2621A/P Terminals Enhanced 9 x 15 dot character cell, full 128-character ASCII character set in 24 80-character lines. Two pages of continuously scrolling memory. RS232C and Bell 103A compatible. 110 to 9600 baud. 2621/P includes built-in printer operating at 120 cps.



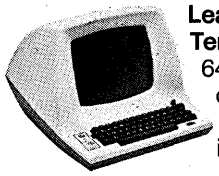
Tally T-2000 Hush-Tone Line Printer Acoustically designed enclosure. Operates at 125 (Model 2100) and 200 lines/minute (Model 2200) with standard 64 character USASCII. Line spacing switch selectable, 6 or 8 per inch.



ADDS Regent 200 Terminal 24 lines x 80 characters, 25th "status" line shows operating mode. 128 character ASCII. RS232C/CCIT V.24 communications interface operating 75 to 19.2 BPS, switch selectable. Buffered transmission, auxiliary ports.



Beehive Micro B 1A Terminal 128 ASCII character set; switch selectable scroll/non-scroll mode; X-Y addressing; 24 x 80 display format; single key memory lock; fully buffered communications to auxiliary peripheral device.



Lear Siegler ADM-3A Data Entry Display Terminal 12" diagonal, 24-line screen. 64 ASCII characters. Full or half duplex operating modes, switch selectable, baud rates from 75 to 19,200. RS232C interface, 20mA current loop.

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CIRCLE 68 ON READER CARD

NEWS IN PERSPECTIVE

"The use of computers is multiplying so fast across the U.S. among businesses of all sizes that there simply aren't enough skilled specialists to go around," said a '79 annual nationwide survey of data processing job/salary conditions conducted by Fox-Morris Personnel Consultants, Drexel Hill, Penn.

At the annual meeting of the Assn. of Data Processing Services Organizations (ADAPSO) last fall, a new member asked ADAPSO executives, "What is ADAPSO doing about recruiting? It's our biggest problem." The Data Processing Management Assn. (DPMA) in a recent (late 1979) issue of its *Compu-Fax* newsletter for executives said, "So far this year the demand for data processing professionals has

The demand for dp professionals in 1979 was up 21 over the year earlier.

risen over 21%." It said programmers were found to be highest in demand, climbing 41% in employers' needs. Software and systems programmers were second highest, scoring a 35% growth in demand. Systems analysts were close behind with a 29% rate gain. The newsletter said data base managers were 15% more in demand, scientific programmers, 14.6% and computer science graduates, 9%. It said management information system directors were 8% more in demand than the year before.

The Fox-Morris study showed other high-demand specialists included telecommunications personnel (up 21.3% in late '79 over '78 demand), dp auditors (up 20%), and senior programmer analysts (up 18.2%).

Ideas as to what to do about all this also are legion.

Paying bounty is a solution being tried by many firms. This can take the form of money, personal computers, trips and other awards given to existing employees who recruit new ones who last for a prescribed amount of time.

Intel Corp., Mountain View, Calif., offers a sliding scale of $50 to $200 in bonuses or "bounties" to existing employees if they refer a prospective employee who is hired and shows up for work.

For a similar feat, Imperial Computer Services, with data centers in both northern and southern California, offers its employees paid trips to Hawaii.

Informatics, Inc., offers $600 and Microdata Corp. $500 for recruiting new employees who stay six weeks. Companies in New England reportedly are giving personal computers.

Tandem Computers, Inc., Cupertino, has a form of bounty aimed at keeping employees. It offers stock options and innovative benefits, including a paid six-week leave for all full-time employees after every fourth year with the company.

And there are some firms that capitalize on regional problems of others. Northern California's Silicon Valley has a particularly severe recruitment problem due, in part, to the high cost of housing there. When *San Jose Magazine* published an article about job-hunting in Silicon Valley last spring, Melbourne, Fla.-based Harris Corp. boasted in a display ad, "Affordable living in an ocean-front community at a fraction of the costs of 'The Valley'."

Firms in areas where high housing costs are a problem, particularly California's Orange County and Silicon Valley, are moving or considering moving portions of their operations to less expensive areas. Don Fuller, president of Microdata Corp., said he anticipates expanding staffs in other areas, including Puerto Rico, rather than at the firm's Irvine, Calif., headquarters. Dwight Mensinger, president of Imperial Computer Services, says he is considering moving the development staff of his northern California Data Center "to the Mojave Desert. Cohabitation [of development people and the data center's operations personnel] is not necessary."

And more firms are paying attention to employee retention. A speaker at a packed session on this subject at a San Diego DPMA conference advised rotation of assignments. He said the reason he hears most for people changing jobs is "I have limited exposure. I'm not learning anything. I'm not going anywhere. I'm doing the same thing over and over."

Donald W. Cole, speaking at the ADAPSO conference, advocated "management by group commitment," as opposed to self-commitment or company commitment. He heads Organization Development Institute, Cleveland, a consulting group which helps companies to do just that.

They could be well worth the cost. A survey of "individuals who hold professional level positions in the computer and communications fields" done by Conec Company, Inc., a Worcester, Mass., personnel search and placement firm, showed that "12% are actively engaged in finding a new job, 17% are inactively seeking a new job, and 51% would consider a new position. Only 20% of the respondents indicated they would not consider a new position."

"The dp job market picture for both the immediate and long-range future is unmistakably clear," says Sanford L. Fox of Fox-Morris. "Demand will continue to escalate for both skilled and entry-level specialists and the talent supply will continue scarce at all levels."

A plaintive comment from the audience at the ADAPSO conference session on recruitment and retention summed it up another way. "I've gotten to the point where I'll look at any resume of any person who's ever even heard of a computer."

—E.M.

COMPANIES

DG'S RISKY MOVE WITH THE NOVA 4

The company tossed out a small lure and caught a whale.

Data General's fourth quarter earnings—the first to show frost on the margins in DG's 11-year courtship with Wall Street—launched the company's stock into a panic dive and led to a series of late fall postmortems in the office of J. Bradley Stroup, DG's director of investor relations.

With 1979 earnings of $49,814,000 (or $4.82 per share) on record sales of $507,483,000, DG's returns were hardly embarrassing, but the company reported a fourth quarter that gave Wall Street heartburn. DG's first "down" quarter: earnings of $13,361,000 on sales of $170,910,000, compared to 1978 earnings of $14,312,000 on $134,574,000 sales.

The company did a public *mea culpa* when it announced the figures in October, as the stock dropped 10 points overnight. It didn't help that DG had all but pleaded guilty to allowing controls to slip in one of the most responsive segments of its business, field service. In the process of rapidly expanding service and support, said Data General, the effects of a number of decentralized decisions on hiring, training, facility setup and parts stockpiling had unexpectedly compounded.

In announcing 1979 results, DG had also blamed competitive price cuts in memories and disks, reduced investment income with cash drawn for component and parts stockpiles, and lower than expected margins on new products, particularly the Nova 4 and microproducts. A number of leading investment analysts worried over the figures and declared themselves dissatisfied with the explanations.

It was some time later that Stroup began offering a more dynamic explanation of DG's 1979 profitability problem. Although the field service problem had been real and costly, he explained, DG profits had been vulnerable because management had already cut the cushion by going into an expansive realignment of production facilities to hype production of the new Nova 4.

In fact, said Stroup, Data General had actually cut production of the high-margin Eclipse in order to dedicate more manufacturing facilities to the new Novas—even though that trimmed still further the slim margins on the Novas.

Why? It was a calculated risk, explained Stroup. A marketing strategy that sought to exploit a new opportunity among oem customers who had been wed to the smaller mini vendors.

"It's still not generally recognized that some major changes are taking place in this industry," Stroup argued. "It's become a tiered industry." On top, there are DEC, HP, and DG—big companies that compete but really don't take much business from each other. The struggle among them, he said, is for the newcomers and the customers being lost by the smaller mini vendors who fall ever farther behind in the race.

"The business was there and we got a hell of a lot more of it than we expected."

In late 1978, according to the Stroup Scriptures, many of the smaller mini vendors—the second tier: Computer Automation, General Automation, SEL, ModComp, Microdata—started to look very shaky. Suddenly, there seemed to be perhaps $300 million worth of oem business up for grabs.

Yet, with the industry bearish, the major vendors moved into 1979 cautiously. With the February introduction of the Nova 4, the microdesigned upgrade on Nova 3,

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CIRCLE 530 ON READER CARD

DG tossed out a small lure and caught a whale. The business was there, "and we got a hell of a lot more of it than we expected," said Stroup.

Data General saw a unique opportunity, a limited window into a giant oem market. "We felt these customers had to go somewhere. They had to settle somewhere for at least 12 months. And," thought DG, "many would decide where depending on where they could get the product shipped." Data General saw the "window" between June 1979 and June 1980. To take advantage of it, Stroup said, management decided to go into the risky process of disrupting production plans, renegotiating chip orders, even cutting Eclipse output, in order to deliver Nova 4.

By May of 1979, Nova 4 delivery was out to six months. In June, the decision made, DG began to reassign production capacity. In July and August, mid-swing in the change, came the semiconductor crunch, which painfully crimped output. Nova 4 lead-time remained near six months though the summer, sighed Stroup, and only began to drop when the additional production facilities hit stride in the early fall. By November, Nova 4 delivery was down to the standard 90 days—and Data General had one very expensive net out for that new business.

—V.M.

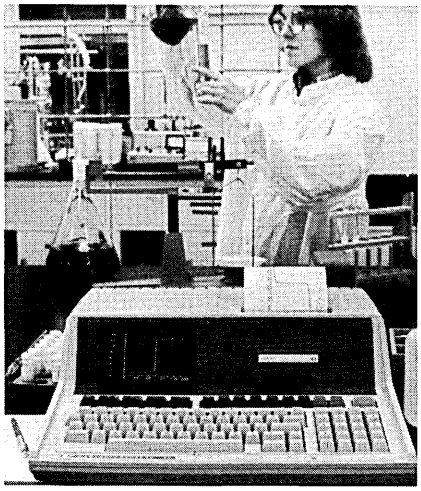
PERSONAL COMPUTERS

CAPRICORN FOLLOWS COCONUT

Hewlett-Packard's newest personal computer shouldn't cause too many home computer makers to lose sleep.

Hewlett-Packard announced its long-awaited personal computer, Capricorn, Jan. 4, and the next day held its first public showing in Las Vegas at the Consumer Electronics Show.

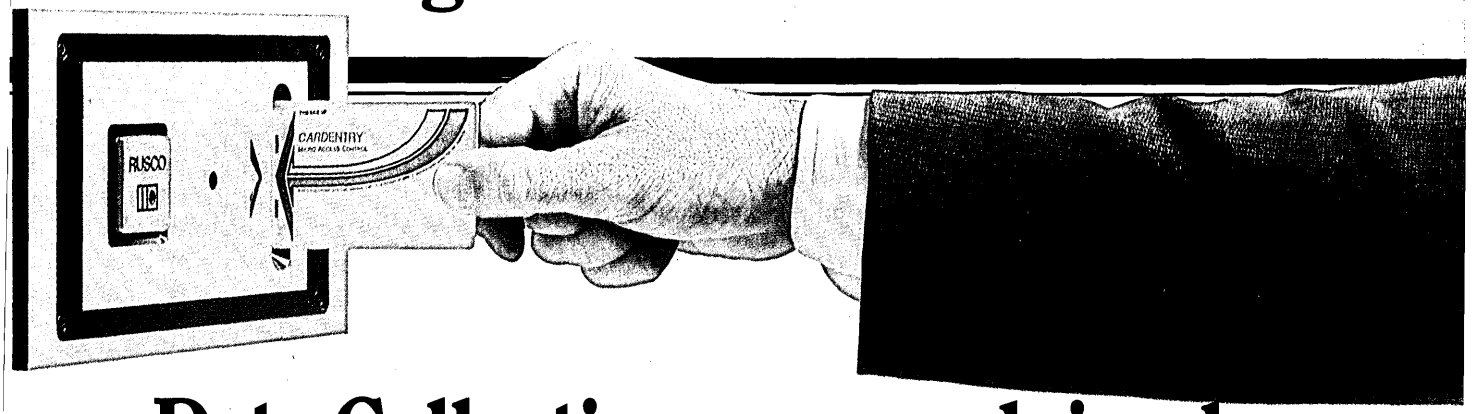
Described by the company as a "professional personal computer," Capricorn shouldn't cause too many home computer makers to lose sleep. HP places the home at the bottom of its target market list, projecting only 1% of the units sold will wind up at home. The lion's share (90%) of the HP-85 (Capricorn's official name) market is the professional: 65% of projected sales is expected to go to technical types, with the remaining 25% going to business professionals.



HP'S MODEL HP-85, the company's recently announced computer for "professionals," was displayed early this month at a consumer electronics show in Las Vegas, Nev.

If Capricorn's major markets aren't in the consumer area, why show the machine at CES? A frequent CES attendee, and a computer retailer himself, explained: "Some may have figured out what Radio Shack already knows: you get to meet a lot of computer dealers at CES."

Introducing the Identification Network.



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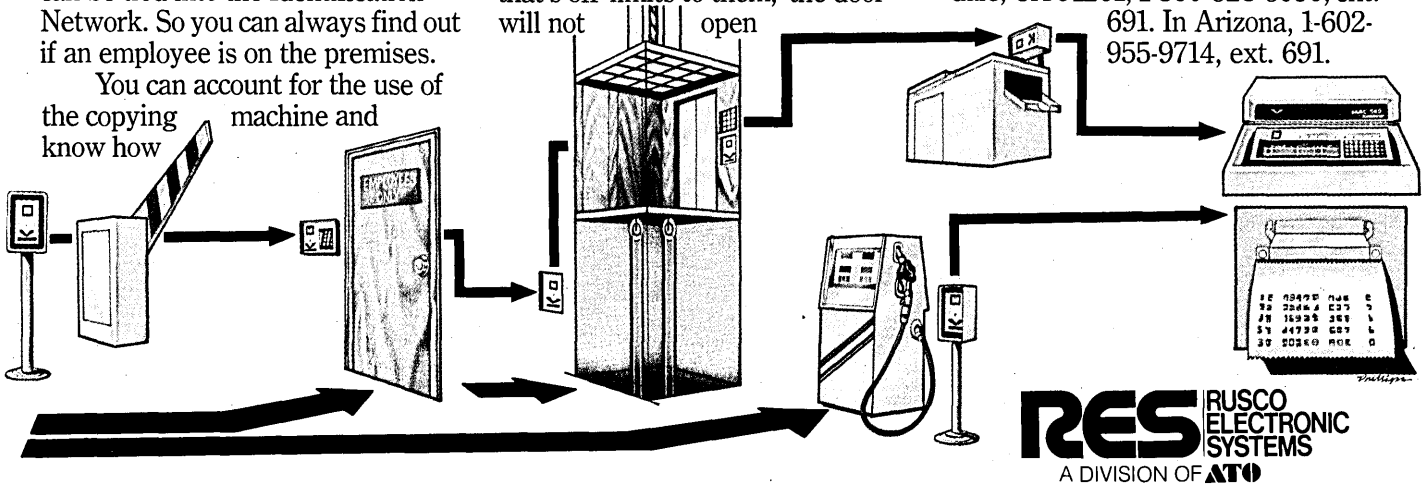

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CIRCLE 74 ON READER CARD

Basically, Capricorn is an integrated system including processor and memory, data cartridge tape transport, thermal printer, 5-inch crt display, and typewriter-style keyboard, all packaged in a low-profile desktop enclosure. System software, including the BASIC interpreter, is in ROM. As functions are needed, say disk operating system functions to support a planned floppy disk subsystem, additional ROM's can be added. This approach means that adding DOS functions doesn't reduce user RAM (the machine can be had with 16KB or 32KB of RAM). The basic 16KB Capricorn carries a $3,250 price tag.

Capricorn comes from HP's Corvallis, Ore., Division, which evolved from the old Cupertino-based Advanced Products Div. APD made its first big splash in 1972 when it announced the first highly sophisticated scientific pocket calculator, the HP-35. About two years after the 35, APD again caused a stir with the introduction of the first fully programmable handheld calculator, the HP-65. Until 1975, APD maintained a handheld orientation. Then the division branched out into small desktop units, such as the model 97 (announced in March 1976). In August of that year, APD relocated to its new home in Oregon; company policy dictated a name change to identify with the new location, and "Corvallis Division" replaced the APD designations.

Corvallis facility is indeed a personal computer company.

Before the move, planners already had defined two new products, code named Coconut and Capricorn, explains Dick Moore, the general manager. Coconut bore fruit last July 16, with the introduction of the HP-41C, a handheld, programmable calculator with alphanumeric LCD readout, continuous memory, a software-redefinable keyboard, and provision for attachment of peripherals and additional memory. Essentially, Coconut is the pocket-sized processor for a very small computer system.

A visitor to the Corvallis facility leaves convinced that this is indeed a personal computer company. "Corvallis Division builds personal computing devices," proclaims one sign. On the second floor, there's a "Personal Computing Kiosk," consisting of several magazine racks holding personal computing magazines, along with mainstream technical publications that also cover personal and microcomputing. Out in the manufacturing area, numerous photocopies of Capricorn the Zodiac goat have been taped up. And at least one desk is adorned with a pink football pennant rooting for Coconut.

Most of Capricorn is manufactured in house. HP has a large semiconductor fabrication line in the Corvallis plant, and there is room in the building to double the space for semiconductor manufacture. Some semiconductors may come from other HP divisions, and memory chips are standard parts bought from outside suppliers. At this point, Coconut takes much of the Corvallis plant's semiconductor capacity, according to Ed Shideler, the division's components manager. By fall of last year, about 15,000 Coconuts had been made; today the figure may have passed the 20,000 mark. All of the chips and LCDs used in Coconut are made in-house. Capricorn requires about half a dozen proprietary chips, which are also made in-house. In comparison to the Coconut project's requirements, Capricorn takes little capacity. Shideler says doubling requirements over projections won't overtax his operation.

The division's software and hardware designers, knowing Capricorn will go to many computer-naive users, want their machine to be both friendly and immediately usable. About a dozen applications packages are available, with several others due by midyear. In addition to applications packages for text editing, general statistics, regression analysis, circuit analysis, linear programming and games, there's a computer-assisted instruction package to teach a

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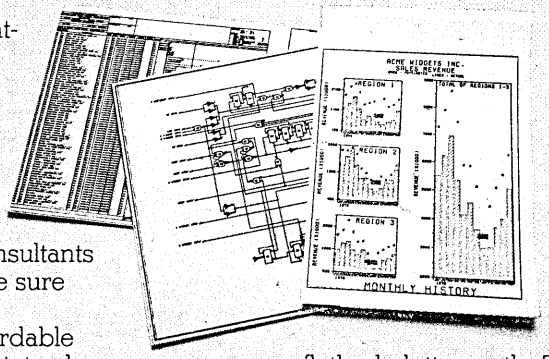

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CIRCLE 77 ON READER CARD

novice how to program Capricorn in BASIC. Capricorn's BASIC is powerful, with 146 total commands, 42 predefined functions and unlimited string lengths. Floating point numbers can have 12 significant digits, and exponents ranging from -499 to +499; there also are short floating point and integer data types with five-digit accuracy. Editing is friendly, with keys for INSERT, DELETE, and REPLACE. Commonly used commands can be invoked with a single keystroke. TRACE and STEP commands aid in debugging.

Capricorn, which also functions as a desktop calculator, can execute statements in immediate mode. Like the HP-300 (Amigo) and the 250, Capricorn has user-definable function keys with legends displayed on the crt screen. Press the KEY LABEL key, and the bottom lines of the 16 line by 32 character crt shows the functions associated with each of the four function keys under the screen (the function keys can be shifted, providing eight user-defined functions).

The crt display has independent alphanumeric and graphics memories. The alpha memory holds up to 64 lines; users can scroll in either direction. In graphics mode, the 85 has a 256 by 192 resolution. The integral thermal printer prints alphanumerics bidirectionally at two lines per second; graphics output is unidirectional. Again, to make things easy for the user, a COPY key is provided to produce hard copy from the screen.

Data cartridges for the 85 can contain up to 210KB of data or 195KB of programs. Up to 42 named files can be stored in a cartridge; to speed access, Capricorn maintains a partial file directory in memory.

—Bill Musgrave

SERVICES

DESA: A SINGLE SOURCE

Four data entry firms combine their resources to aim at large jobs.

Four data entry service companies this month combined their resources to form a national joint venture company called DESA (Data Entry Services of America). Its founder, Richard C. Thompson, said it is the first such organization in the computer industry and represents "long overdue recognition of the need for such a resource."

The four companies, which will continue to operate as independent concerns, are: Dataco Inc. of Morrisville, Pa., Data Systems Inc. in Minneapolis, Information Control Inc. in Kansas City, and Atlanta-based Input Services Inc. Through DESA, these companies can offer clients services based on a total capacity of nine OCR systems and 12 key-to-disk systems at seven metropolitan area locations (Atlanta, Dayton, Detroit, Kansas City, Minneapolis, Philadelphia, and New York). More than 750 key-to-disk operators and OCR typists are employed by the DESA companies.

Thompson said the organization intends to open branches in Texas and on the West Coast within six months to a year by adding companies to the joint venture or by having existing members expand their operations to these areas.

Thompson, a former vice president of Scan-Data Corp. who now is associated with Dataco, is the president of DESA whose headquarters are in Plymouth Meeting, Pa. He said demands for outside data entry services have been increasing every year, particularly by large computer users who up to now have relied on large numbers of small companies to get a job done. "With DESA," he said, "the customer will now have a single interface, a single contract governing price, turnaround, accuracy—all the things that go into a service agreement. We are eliminating the need for the client to form a consortium of companies, and we are guaranteeing a consistent product."

Besides, outside service companies can offer customers significant cost savings, he said. DESA believes a customer doing his own data entry might be paying as high as $10 an hour per operator. Outside services, he said, average $6 an hour with a profit margin built in.

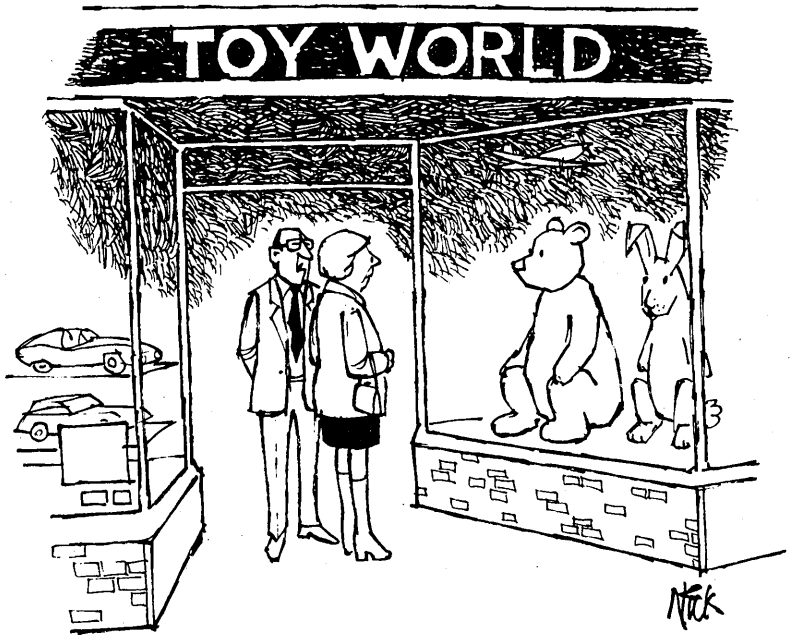
The four companies in the new organization use a "type and scan" method of data entry, with the typing being done on a piecemeal basis by typists who work at home, and scanning being done at the service bureau. He said nearly 70% of the 750 persons employed by the four companies work at home.

Although the organization was started Jan. 10, the member firms began seeing the benefits of a confederation as early as last December, when Information Control, Inc., in Kansas City, found that it was doing data entry services for a firm in Dayton, where Dataco has a service center, and was able to refer additional business to the Dayton operation. Data Systems, Inc., in Minneapolis, which had a large job with a Minneapolis mail order house, was negotiating to subcontract some of the work to other members.

Although industry statistics are hard to come by, Thompson said some sources estimate major metropolitan areas like Philadelphia, Los Angeles, and Chicago generally support 10 to 25 local data entry service companies. Even in medium-sized areas like Minneapolis or Atlanta, six to 10 such companies can be found. Few have the facilities to handle large contracts or contracts which require service in several locations. Thus, said Thompson, DESA with its multilocation presence, is unique.

Who will use DESA? Four fields stand out: the auto industry, legal service firms, direct mail organizations, and insurance companies. These fields have the greatest demand for data entry, and often require multilocation services. "Our emphasis is on the very large volume opportunities and the ability to address those opportunities," Thompson said.

—Josh Martin



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CIRCLE 106 ON READER CARD

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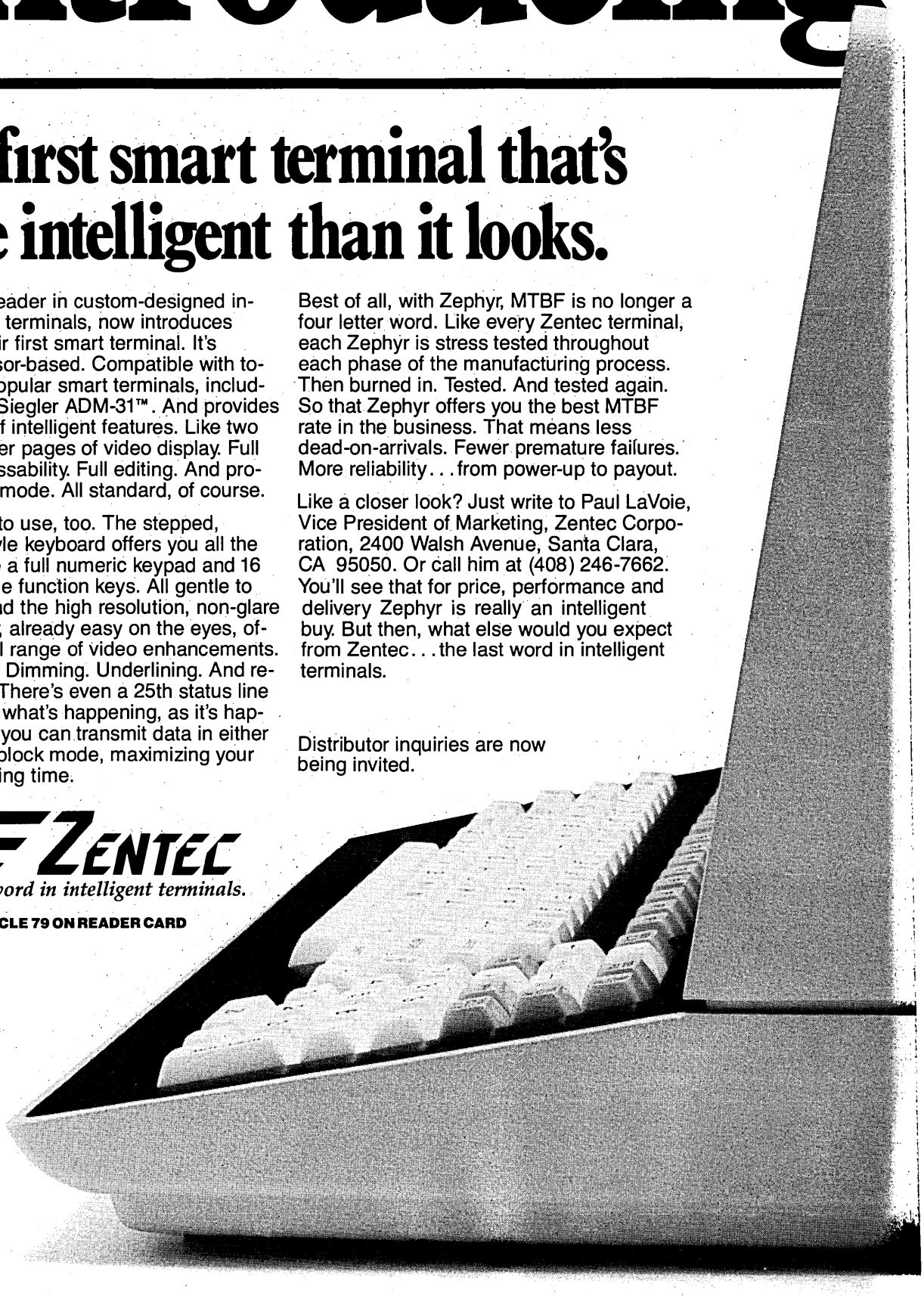

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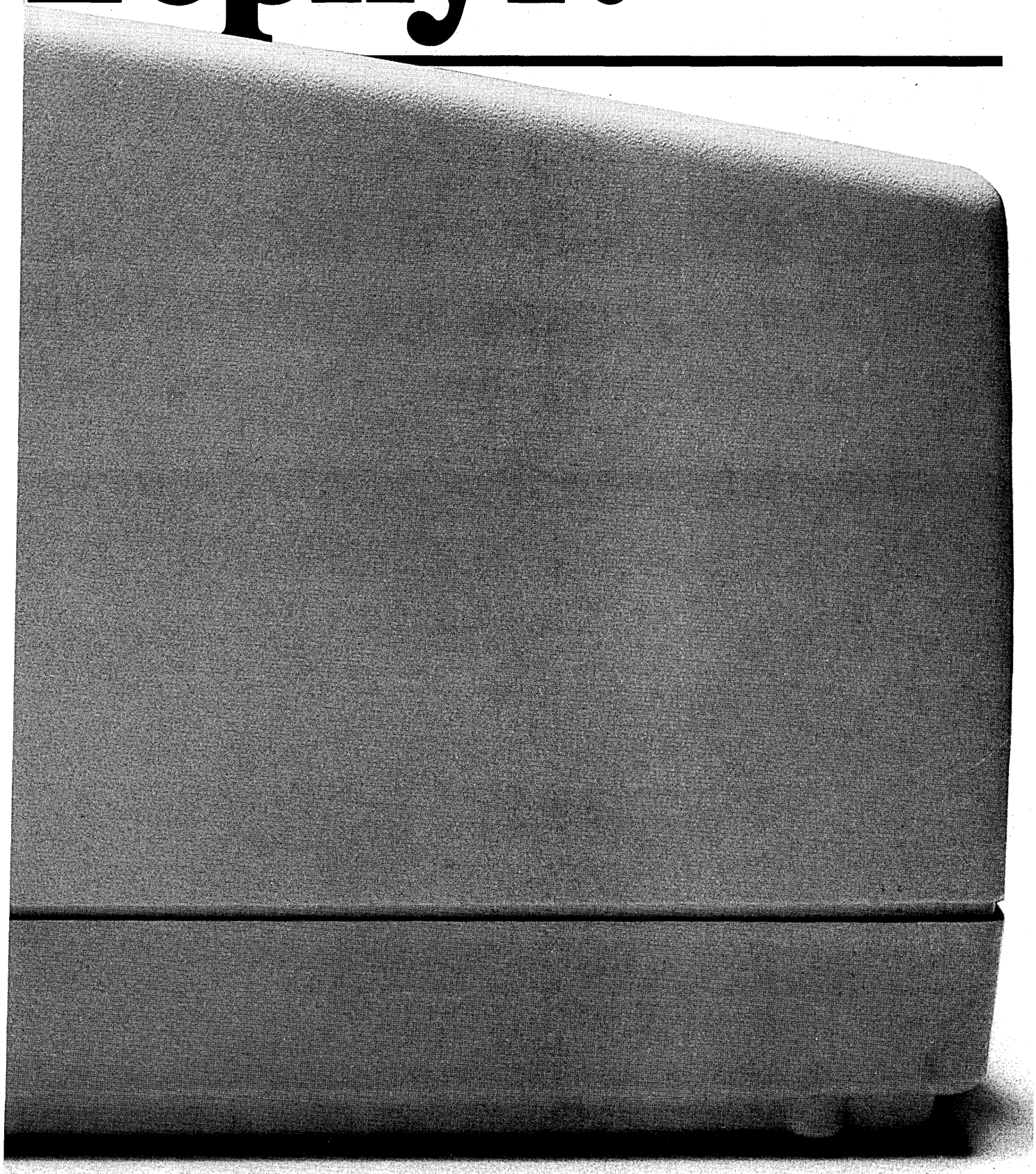

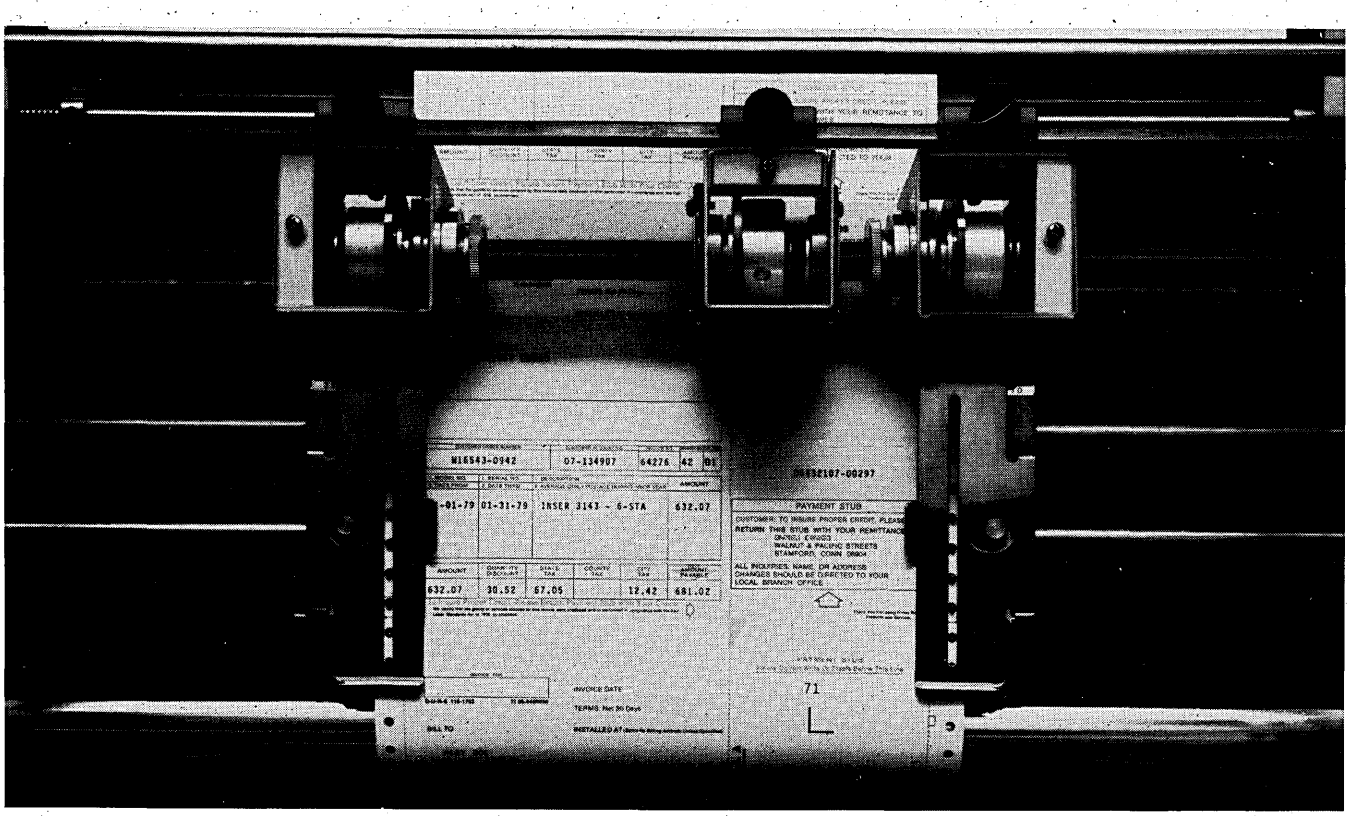

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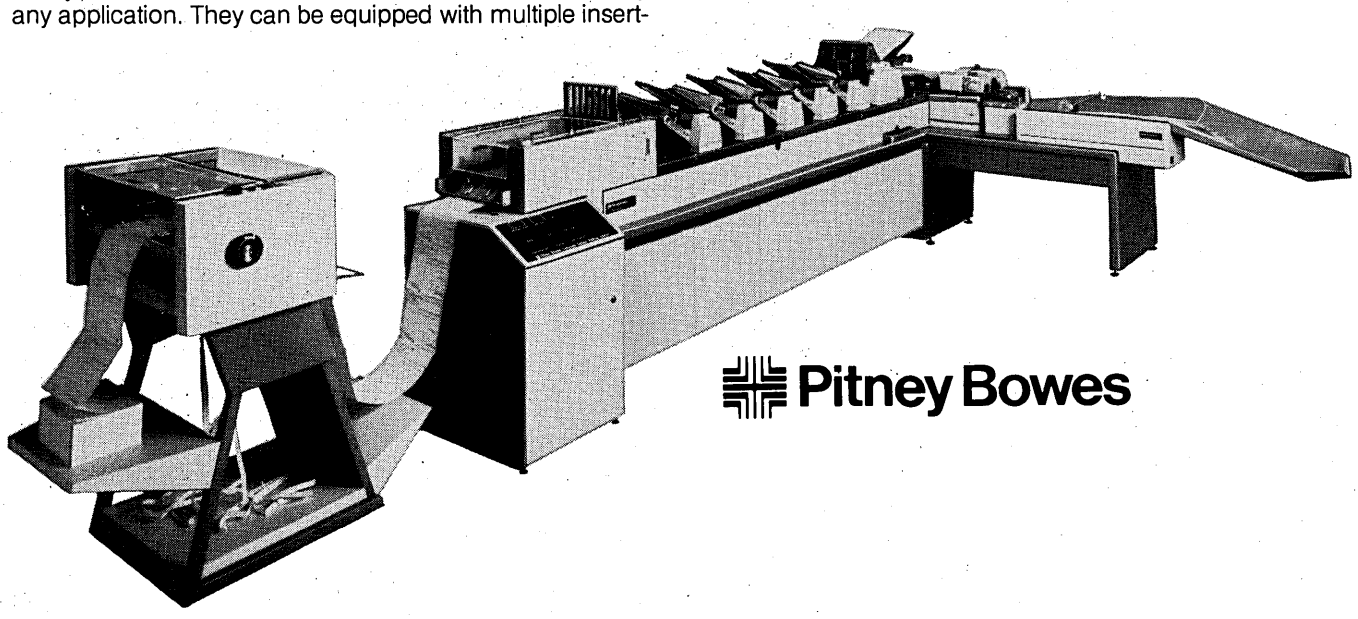

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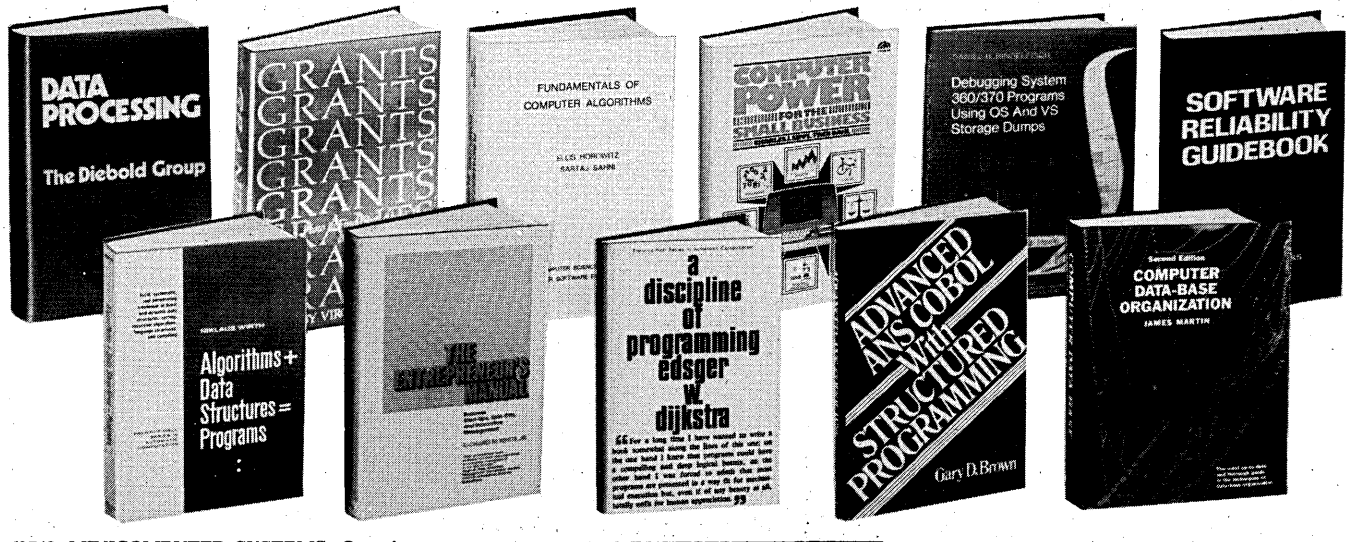

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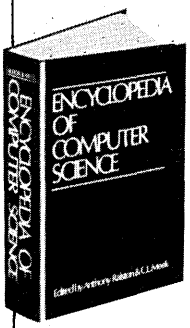

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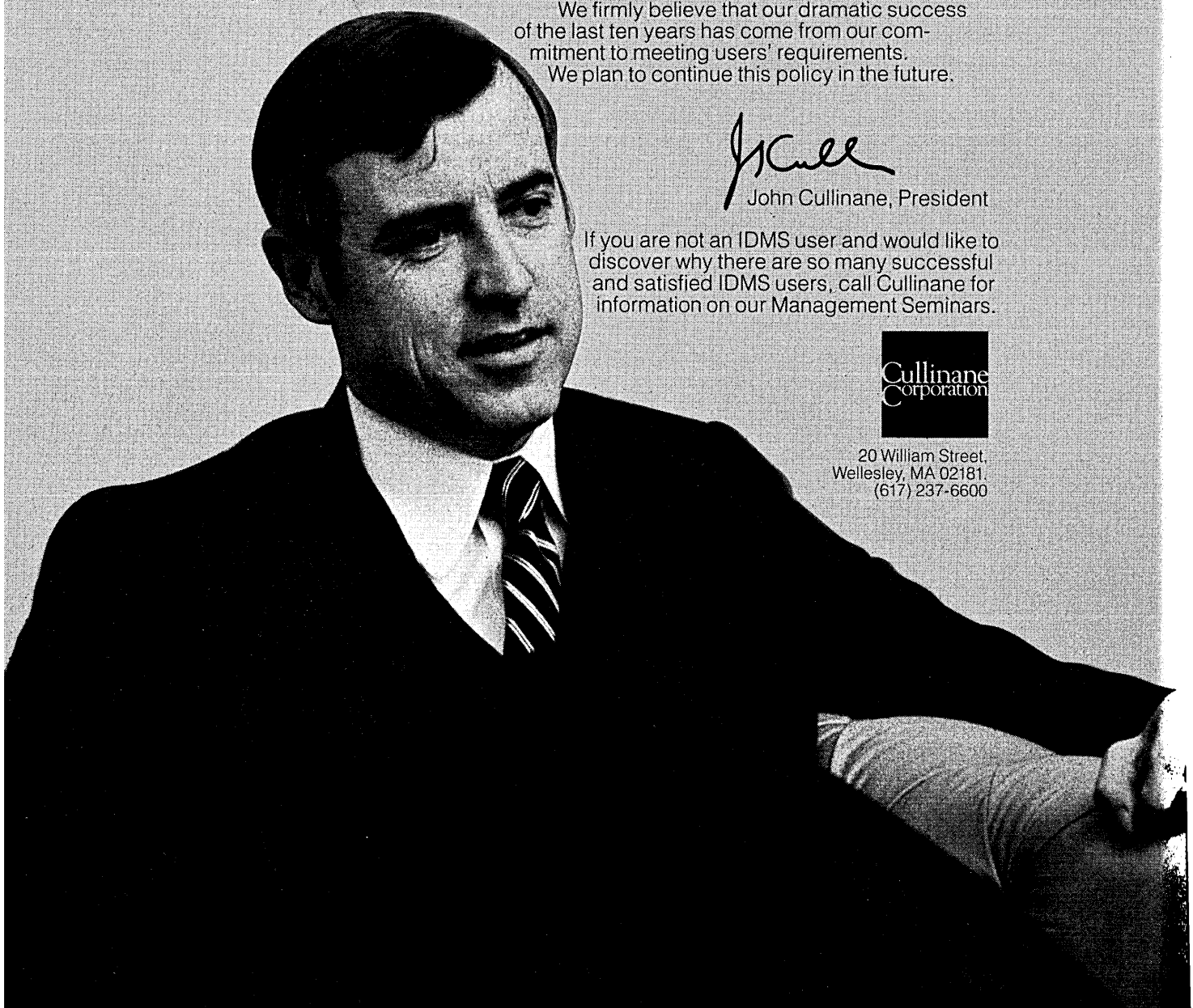

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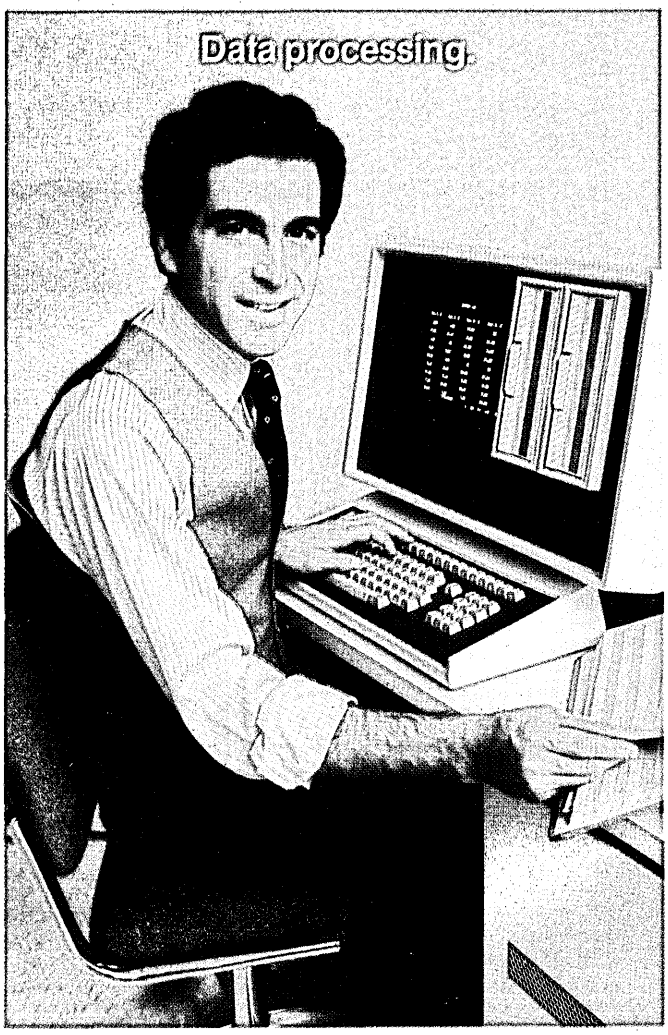

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The Iowa Transfer System is the first electronic funds transfer system to operate statewide. Over 85 percent of the commercial banks in Iowa are supporting members. We recently installed an NCR 8450 as the central element — the switch — in our network.

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Dale A. Dooley (left) is executive director of Iowa Transfer System, Inc., in Des Moines. Jim Schulte is NCR district manager.

NCR's SCHULTE:
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DOOLEY:
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Finally, our decision was influenced by the dependable performance of the other NCR systems within the network. And we have had the same experience with this system. Our uptime level has been very high — a critical consideration when you're talking about a network switch.

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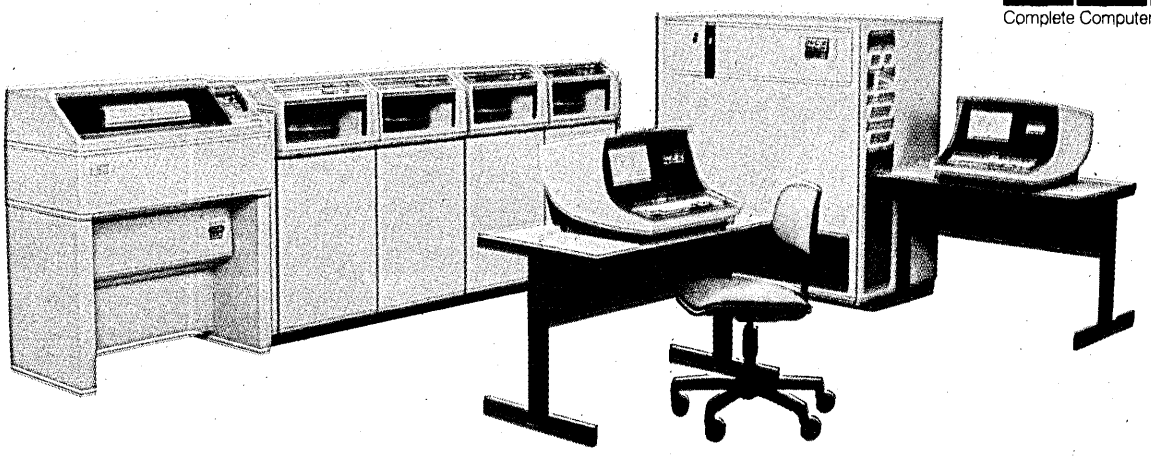

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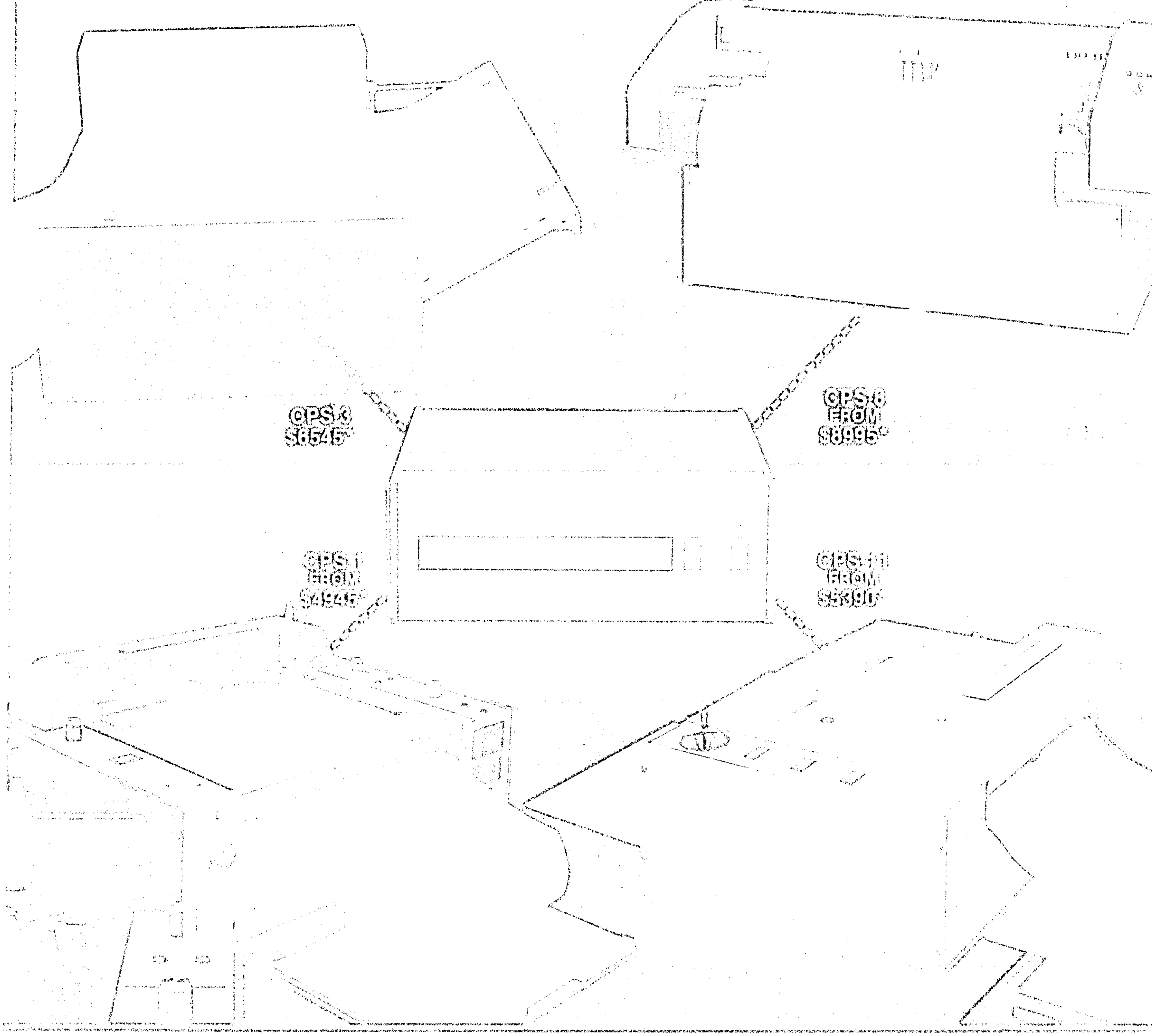

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As a Data Processing manager, you've probably thought of Remote Computing Services (RCS) only in terms of functional applications such as financial analysis, problem solving and analytical forecasting.

But, now there's a computer services company that has expanded the scope and flexibility of RCS so that it can be of greater use to you.

The company is General Electric Information Services Company. And the reason we now can offer you this increased range of data processing capabilities is our new intelligent terminal, the MARKLINK Terminal. And MARK III® DDP. A fully integrated distributed data processing system from one supplier—General Electric Information Services Company.

Our intelligent terminal is a better means to more ends

What makes our MARKLINK Terminal so smart? Incredible versatility. In fact, it gives you local processing, distributed processing *and* timesharing capabilities, for either interactive or batch processing. Even more remarkably, you can use all of these capabilities *simultaneously.*

The more it does, the more you can do

By doing more, the MARKLINK Terminal opens up to you a whole world of computing possibilities.

Local Processing. As a minicomputer, the MARKLINK Terminal is ideally suited for local data entry, editing and storage. So, offices and factories can use it for everyday jobs such as local financial accounting, inventory control and order entry—without the expense of always being on-line to a large host computer.

Transaction Processing. The MARKLINK Terminal, accessing the host computers of General Electric Information Services Company, gives you the transaction power you need for large centralized data bases like master inventory files, consumer credit histories or international reservations information that must be continually accessed from multiple locations. And it does it more economically than simple timesharing.

Interactive Timesharing. The MARKLINK Terminal gives you direct access to our MARK III Service command system or our IBM compatible MARK 3000℠ Service. So, you can talk directly to the host computer for ad hoc reporting, program development and control of production runs.

Remote-Batch Processing. For scheduled daytime or overnight and weekend jobs like payroll and invoicing, large volumes of data can be captured and edited on the MARKLINK Terminal to be processed by our host computer on a delayed basis.

You even get more options

Another reason the MARKLINK Terminal is a better choice is the additional options it gives you. Like access to our extensive software library, including more than 1800 different programs covering key industry areas. You also get access to both Honeywell and IBM equipment, whichever best suits your needs. And the flexibility of both CRT and print capability.

Yet for more, you pay less

Your MARKLINK Terminal is linked to GEISCO's host computers by a single, synchronous 2400 baud communications line. This gives you high speed communications and flexibility at a low cost. Though you pay for only one line, its multi-stream capabilities can do transaction processing, timesharing, batch transfer—all at the same time.

The team behind the terminal

When you build your distributed processing around the MARKLINK Terminal, you get more than state-of-the-art hardware and software. You also get state-of-the-art services. Like a customer service desk that you can call 24 hours a day, 7 days a week. Like the attention of our technical support staff. And a training program that will give your people the documentation and expertise they need to get the most out of our services.

Who we are

We're General Electric Information Services Company. One of the world's leading companies in remote computing services.

We help make business more effective, more efficient and more profitable for our customers, over 5000 of them around the world.

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Do you have a specific application in mind? If so, please specify.

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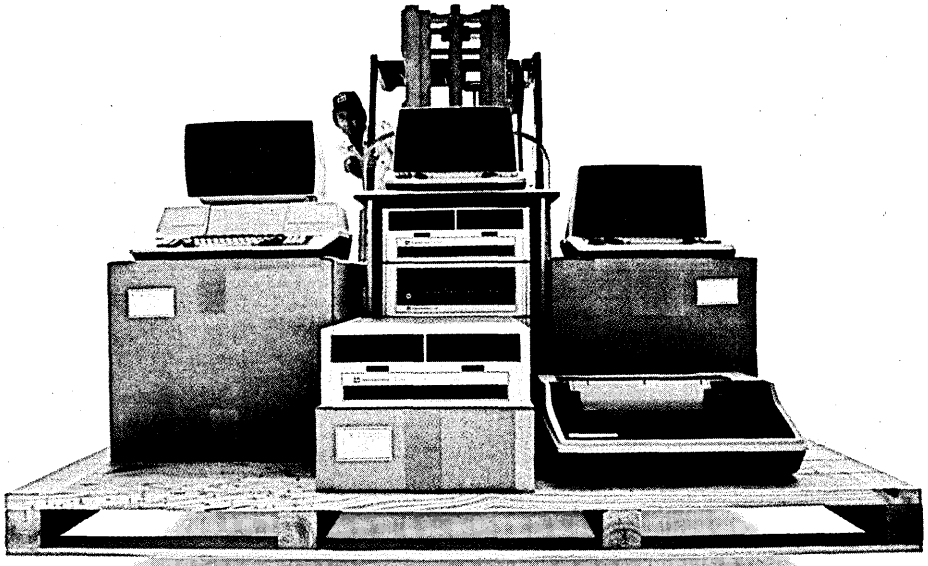

Our new DS990 business systems deliver four times the data storage you'd expect for the price. In short order.

Here's some very good news. Our powerful new business computer systems, the DS990 Models 1 and 2, are affordable. For example, the Model 1 starts at under $10,000*.

Here's even better news. You don't have to wait for them. Our recent manufacturing expansion now allows normal delivery within 30 days.

Now for the best news. We packed our new systems with double-sided, double-density diskettes that provide four times the data storage of many comparably priced single-sided, single-density diskette systems.

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Now you can 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.

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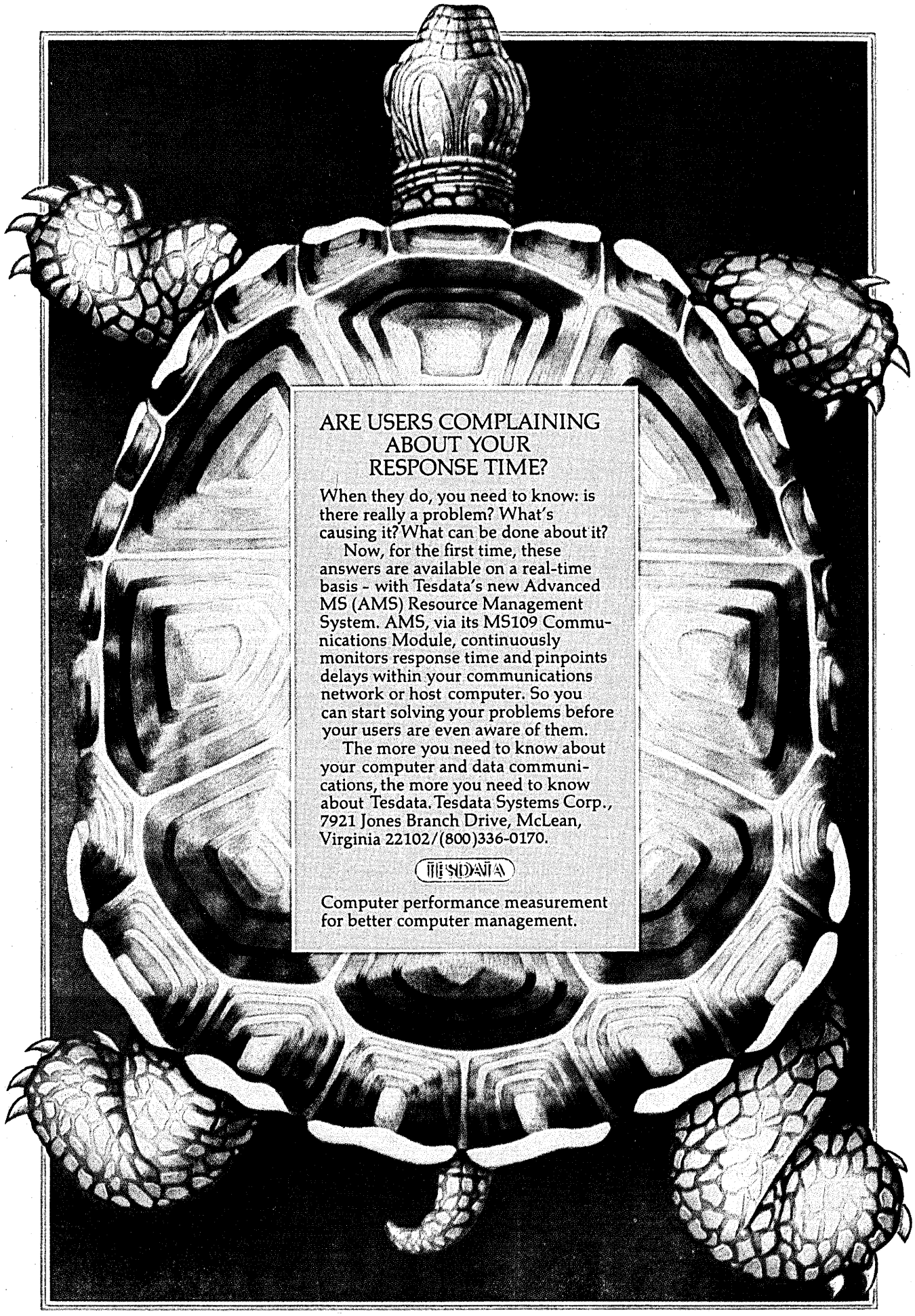
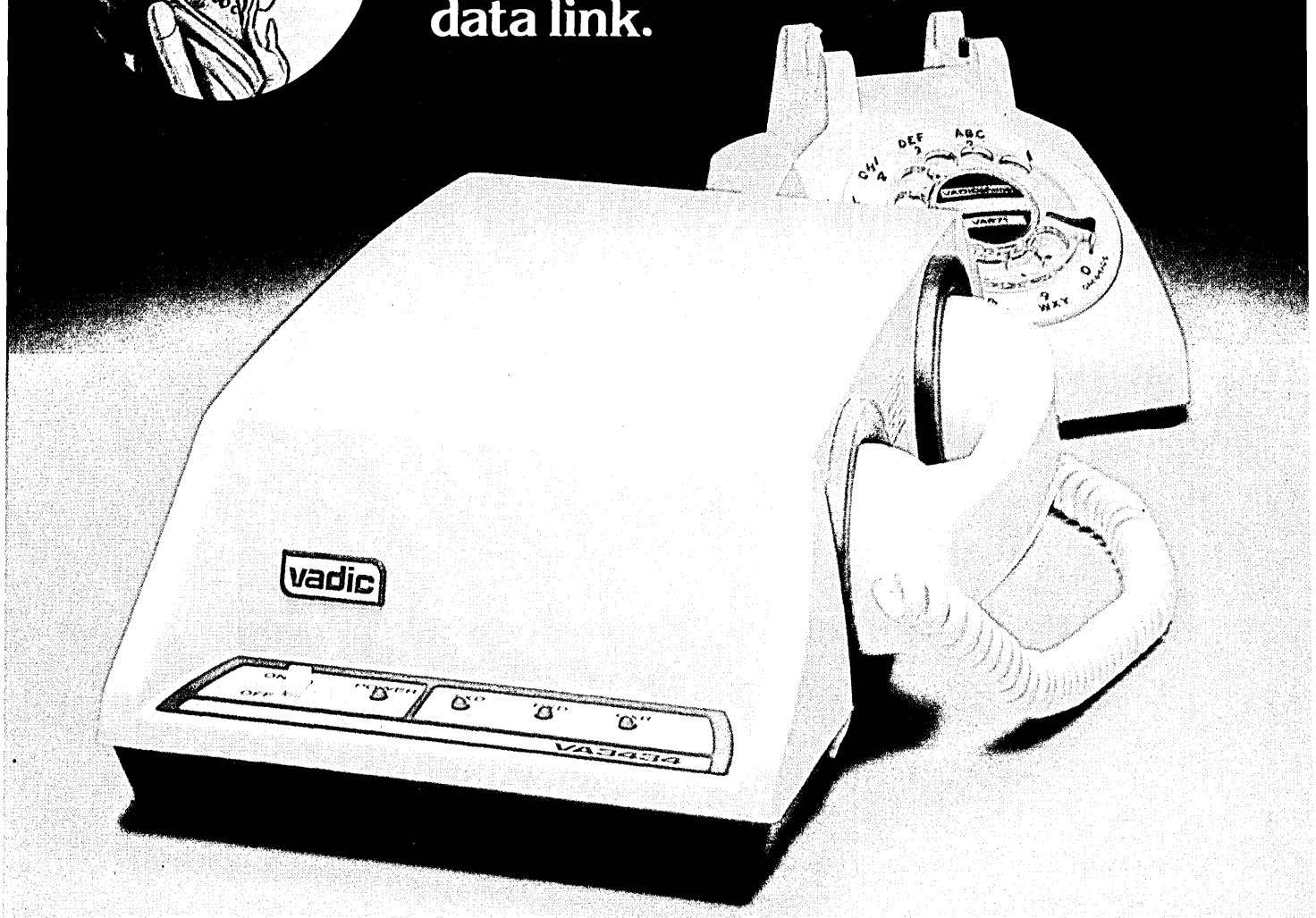


Dear Ma:

With Racal-Vadic's VA3434 acoustic coupler, every telephone becomes a 1200 bps full duplex data link.



Racal-Vadic is in full production on an acoustic coupler that operates at 1200 bits per second, full duplex. Thousands are already installed and operational.

This is great news for remote terminal users who will no longer have to settle for 300 bps acoustic operation. Now, merely by replacing your present coupler with the VA3434, you can step up to 1200 bps full duplex, using the same 103 type protocol, yet retaining the portability that only an acoustic coupler provides. And since data flows 4 times faster, phone charges may be less, too.

More good news. The VA3434 is compatible with Racal-Vadic's VA3400 Series, including the VA3467 computer site triple modem.

Where can you obtain the VA3434? Easy. Just phone the nearest Racal-Vadic stocking rep. They're listed below.

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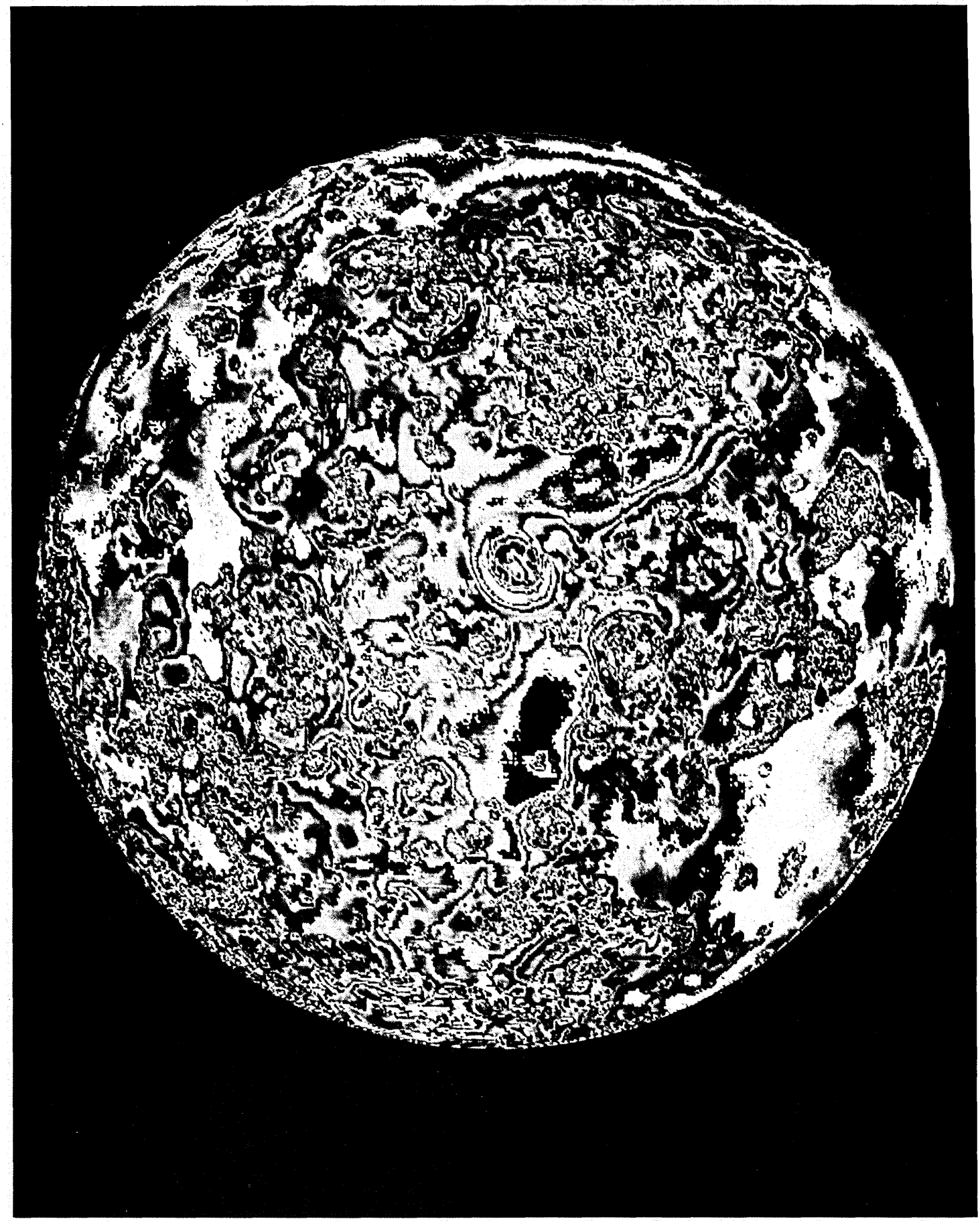

Actual-size reproduction of a Polacolor 8 x 10 hardcopy of Io, moon of Jupiter, taken by Voyager satellite. An example of remote sensing. Photo courtesy of JPL/NASA.
All photographs taken with a Dunn Instruments 631 color camera.

Now, direct from your computer-big instant pictures.

Now your computer can immediately deliver sharp pictures in brilliant colors on Polaroid 8 x 10 Land film.

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The pictures shown here were made by new computer peripherals—color cameras. They are manufactured by Dunn Instruments and Matrix Corp. Since the cameras use standard video (RS 170) signals, you can conveniently interface them with computers or color-raster based terminals.

The Polaroid 8 x 10 print produced by the camera is the highest-quality instant record available. Since you receive your hardcopy immediately, you can be sure you're getting exactly the record you want, exactly the way you've seen it displayed on your monitor. And you can distribute it at once if the data is urgently needed. The pictures are distortion-free, and their bright, saturated colors yield superb results.

The print can also record continuous-tone images from digital color TV signals in such applications as remote sensing, animation and geological sounding. Its resolution surpasses the resolution of present color digital TV systems. As the technology of digital TV advances, these large Polaroid prints will be able to record even greater detail and more information.

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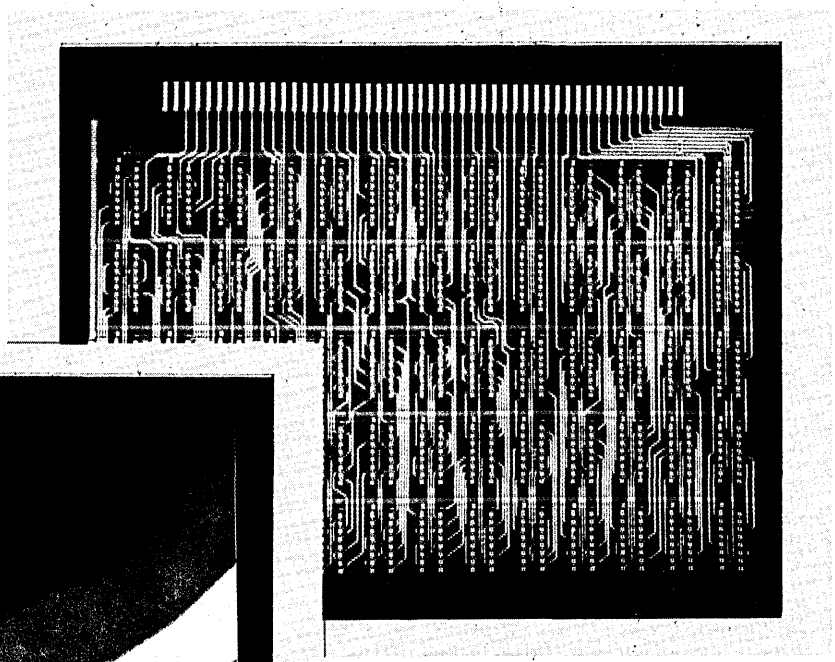
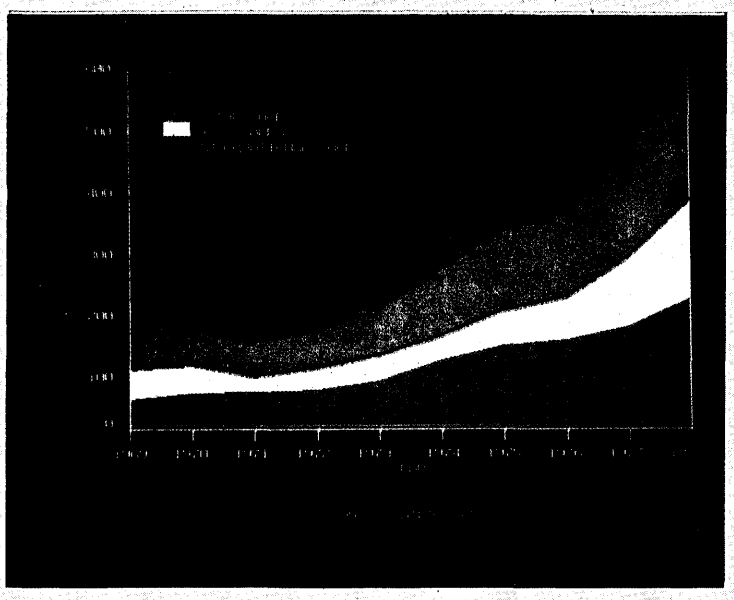
For more information or a demonstration, write to: Polaroid Corporation, Dept. A428, 575 Technology Square, Cambridge, Mass. 02139. Or call toll-free from anywhere within the Continental U.S.: 800-225-1618. (In Massachusetts call collect: 617-547-5177.)



Computer-aided design of IC clip from Ramtek color terminal. (Reduced from Polacolor 8 x 10 print.)



Typical management information graphic from Tektronix color terminal. (Reduced from Polacolor 8 x 10 print.)

Polaroid

Instant 8x10 color film

CIRCLE 92 ON READER CARD

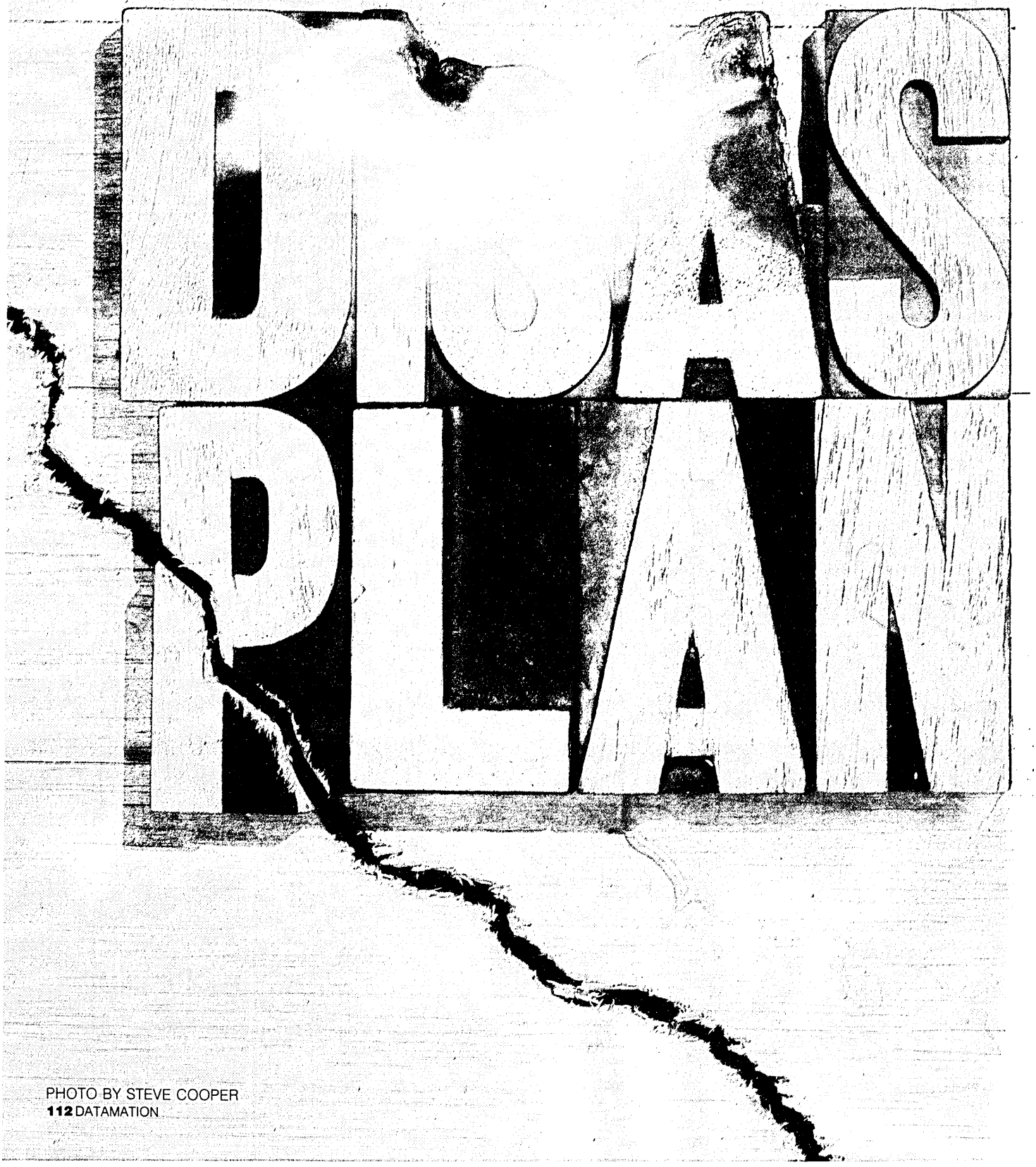


PHOTO BY STEVE COOPER

Come fire, flood, earthquake, or tornado, your data center will soon be up if you have established efficient contingency plans.

PICKING UP THE PIECES

by R.P.R. GAADE

The objective of disaster recovery planning is to get down systems operational again and to maintain secure custodianship of data.

When we talk about disaster striking the data center, we usually mean things like a 747 dropping out of the sky onto our building. To get right down to basics, I looked up the word disaster in the dictionary, and it is defined as "A calamitous event, esp. one occurring suddenly and causing great damage or hardship." The two items most applicable to our subject are "suddenly" and "great damage." *Suddenly*, because if a situation occurs slowly, you can adapt to it as it changes. *Great damage*, because if a situation causes little damage we can make do by patching.

Among the events that can be classified as disasters I would include fire, water damage, earthquake, tornado and other weather hazards, structural collapse, and explosions. The only omission is war or major civil insurrection. If three-quarters of your data center staff suddenly become a rebellious mob hurling Molotov cocktails, there is very little you can do except lock up and go home.

Briefly, then, we can define disaster recovery planning as the process of defining, developing, and subsequently documenting emergency contingency plans to deal with the sudden calamitous event.

To recover successfully from a disaster, the following subjects should be ad-

dressed: personnel safety, records recovery, salvage of equipment, alternate facilities and equipment, and availability of software support.

People are the greatest asset of a dp department; therefore, our prime responsibility is to ensure personnel safety. Enough has been written about data center protection so that you should already have defined evacuation plans, fire suppression teams, firefighting equipment training, instructions issued to each staff member on emergency procedures, and bomb threat procedures.

I shall assume your company has effective personnel safety procedures in place, and will concentrate the development of disaster recovery plans on the reestablishing of facilities, computer systems, and data.

If the job is done properly, disaster recovery planning is expensive. You may have trouble selling the concept to executive management when expenditures of thousands of dollars are involved. But remember, your company probably cannot operate profitably without dp.

It is essential to keep the company operating profitably. Additionally, there are many areas at risk, ranging from the provision of service to customers, to meeting reporting requirements set by executive management, state laws, and federal laws. The important thing to realize is that *any* breakdown of the support the dp department provides to user departments affects them, and the larger the outage the greater the impact (see Fig. 1, p. 117).

When you start disaster recovery planning, you will encounter two problems. Most corporations have become dependent on dp so gradually over the years that most user management cannot visualize what the effect would be of a sudden and complete outage. This leads to a "conceivability gap," which must be overcome. Since you are concerned with data center recovery, your executive management should also have someone in charge of coordinating each user department's own contingency plans. That person is also likely to suffer from the user's "conceivability gap," but since you will be working fairly closely with him, it will impact your work as well.

IT'S NEVER BEEN DONE BEFORE

The other problem, however, is your biggest worry, and that is that nobody has ever done this effectively: the state of the art is virtually nonexistent. Everybody working in this field has the same questions, and as yet nobody has the answers. The only people who have achieved anything are corporations with multiple data centers with similar hardware that can back each other up. If you have one big central site, you have problems. When you get into intercompany mutual aid agreements, very few people have workable propositions. Most bog down on operational or legal problems such as "What if several participants need the installation at once?"

TABLE I
IMPACT OF DATA CENTER DISASTER ON COMPANY OPERATIONS

- INTRODUCTION
- TEAM ORGANIZATION CHART
- TEAM FUNCTIONS AND STAFFING
- NOTIFICATION LISTING
- CONTROL CENTER
- TRANSPORTATION PLANS
- EQUIPMENT INVENTORY (FULL AND MINIMUM)
- SOFTWARE RECOVERY PROCEDURES
- PROCESSING PRIORITIES
- IDENTIFICATION OF ALTERNATE SITES
- REQUIREMENTS FOR CONSUMABLES, FURNITURE, AND OTHER BASICS
- OFFSITE STORAGE INDEX
- SUPPORT AGENCIES AND SUPPLIERS
- COPY OF LOCAL EMERGENCY PROCEDURES
- DISASTER MANUAL DISTRIBUTION LIST

Some companies are considering the standby data center approach, but the costs of paying for a redundant big processor and facility are enormous, even when shared. So, the problem is this: we know what we want but we have no precedent for how to get there. My recommendation is to go to as many workshops and courses as you can and then do your own thing: likely as not you'll be right.

So much for disaster recovery planning in general. Now let us get into a greater level of detail and study one approach. The first thing to do when setting up a disaster recovery planning project is to define the terms of reference. These should be along the following lines:

> "The purpose of the project is to establish an approach to disaster recovery planning, lay down the functions to be performed both before a disaster and afterwards, and to document this in a disaster Manual which will be used as the basic recovery plan should a full or partial disaster arise."

With regard to that last phrase, we will plan for a total loss. Then in the event of only partial loss of the data center, only certain parts of the disaster plan need be set in motion.

The project can be split into four phases.

Phase 1 covers the definition of the basic approach taken, the statement of the assumptions on which the planning is based, the initial definition of team functions and staffing, and getting management to agree to all these concepts.

Phase 2 initiates the planning stage of the project. Disaster recovery teams are brought together and preplanning functions are performed. Where necessary, a search for backup premises can start.

Phase 3 takes the results from Phase 2 and brings them together during a documentation process, in which the Disaster Manual is compiled.

Phase 4 is the actual execution of the disaster recovery process. Apart from a dummy run to test the procedures, it is hoped this phase will never be entered.

What we will concentrate on is Phase 1, the definition phase. Phase 2 is done by many of your colleagues and Phase 3 is just a lot of paperwork and compilation. The groundwork for the project is laid in Phase 1.

One thing corporate management will want, and which you are likely to have trouble providing, is an accurate dollars-and-cents breakdown of the risks and exposures during a data center outage. When you sit down with users and try to quantify what a disaster would cost the company, you run into the "conceivability gap." The only thing everybody agrees on is that the cost depends on the length of the outage, and that it increases exponentially with time: your financial liabilities could run into megabucks if the outage goes on long enough. There are also a number of intangible exposures, such as loss of interest on income, liability to litigation, exposure to fraud, temporary or permanent loss of customers, loss of control over the business, and staff overtime costs.

The main conclusion to be drawn from all this is that it is imperative to limit the length of the outage if the cost is to be kept within bounds. And it is a fact, proved by past experience during disasters, that recovery time is directly related to the availability of disaster recovery plans. Where plans existed, recovery took days or a few weeks. Without them, recovery extended into months, even years.

DEFINING PLANNING PRINCIPLES

A number of planning principles will have to be defined on which the preplanning process can be based. In your particular environment you may have some of your own, but I have listed nine assumptions that have to be made, no

Any breakdown in the support the dp department provides user departments affects them; the larger the outage, the greater the impact.

TABLE II

DISASTER RECOVERY PLANNING TASKS

I. Definition Phase
1. Set disaster recovery objectives
2. Choose a planning perspective

II. Functional Requirements Phase
1. Take inventory of resources listed in sections II-VII of Table III
2. Analyze applications and installations against recovery objectives
3. Determine what is to be covered in plan
4. Set priorities based upon critical time frames.

III. Design Phase
1. Identify design alternatives
2. Specify the details of feasible design alternatives (including such things as hardware, software, telecommunications, staffing, etc.)
3. Identify potential vendors and price their services
4. Select the final design

IV. Implementation Phase
1. Acquire any hardware, real estate, telecommunications lines, etc.
2. Negotiate and sign contracts
3. Write procedures
4. Train personnel
5. Prepare site(s)
6. Develop test plan
7. Develop maintenance plan

V. Testing and Parallel
A. Parallel
1. Schedule individuals to be "on call"
2. Make arrangements to use facilities external to your company
3. Attempt to run backup systems
4. Compare results obtained in back-up system with those obtained in the "live" system
5. Correct errors in plan
6. Repeat 3-5 until no more errors are found in plan
B. Live Testing
7. "pull the plug" and attempt to run using only the plan
8. Correct any defects noted
9. Repeat 3-8 until no more errors are found in plan
C. Maintenance Testing
1. Repeat 3-6 for all revisions to plan
2. Repeat 7-9 annually

VI. Maintenance Phase
No tasks to be performed during plan. The maintenance plan is developed during the implementation phase and applied during the maintenance phase. Two tools that can aid in maintaining the software portion of the plan are software change control authorization procedures and software library packages such as PANVALET. Items that are frequently in need of maintenance in a plan include:
- Names, titles, and phone numbers
- Backup libraries (data, systems and applications software)
- Documentation and procedures

TABLE III

COMPONENTS OF A DISASTER RECOVERY PLAN

I. Statement of Purpose
A. Objectives
B. Scope
C. Priorities

II. Hardware
A. Cpu(s)
B. Peripherals (printers, tape/disk drives, consoles, etc.)

III. Telecommunications components
A. Message switches
B. Multiplexors/concentrators
C. Diagnostic devices
D. Modems
E. Terminals
F. Lines

IV. Data Conversion/Entry Devices

V. Firmware

VI. Software
A. Operating system
B. Utilities and compilers
C. Data base and data communications management
D. Applications (source, object and JCL)

VII. Data
A. Master files
B. Input
C. History
D. Logs and journals
E. Tables

VIII. Forms
A. Flatpacks
B. Checks
C. Turnaround documents
D. Input forms
E. Coding sheets
F. Special forms (if any) for backup procedures

IX. Procedures
A. Backup installation operation
B. Applications
C. Clerical procedures for manual operations
D. Software/data control
E. Training

X. Space
A. For hardware
B. Storage of files
C. Terminals, data entry/conversion systems, clerks
D. Storage of forms
E. Input/output control functions

XI. Utilities (power, air conditioning)

XII. Personnel Assignment
A. Recovery management
B. Site preparation
1. Site selection
2. Construction
3. Hardware installation
5. Telecommunications installation
5. Supplies and forms
6. Messengers, clerical assistance, administrative aides
C. Application Management
1. Application manager
2. System maintenance
3. System development
4. System reconstruction
5. Data base reconstruction
6. Supervision/performance of transaction procession
- transaction authorization
- input preparation
- data conversion/entry
- output proof/control
- error correction

7. Staffing and training
D. Data center recovery
1. Installation management
2. Shift supervision
3. Computer operation
4. Media librarian
5. Systems programming
6. Scheduling, input/output control
E. Plan maintenance
1. Overall administrative responsibility
2. Application responsibility
3. Installation responsibility
4. Testing of the plan

TEAM FUNCTIONS

Facilities Team

Objective: To prepare the backup site for occupation and operation.

Staffing: Manager, data center facilities
Plant engineer
Building consultant
Representative from head office—real estate dept.

Preplanning: Obtain power and cooling requirements
Obtain short list of backup sites
Draw up tentative floor plans with New Hardware Team
Establish minimum requirements for furniture and office equipment; prepare list of suppliers

Disaster functions: Obtain decision on site selection from Management Team
Check out power, heating, and air conditioning
Install any further cooling needed
Arrange furniture and office equipment
Supply details of phone requirements to Communications Team
Ready site for occupation by personnel and hardware
Set up catering arrangements
Set up cleaning arrangements
Provide ongoing maintenance support

New Hardware Team

Objective: To obtain new hardware, to be combined with salvaged hardware to meet minimum processing needs.

Staffing: Manager, dp planning
Manager, hardware
Manager, data preparation
Manager, dp administration
Mainframe manufacturer's representative

Preplanning: Define minimum configurations needed
Advise Systems Software Team of preplanned configurations
Establish contacts with manufacturers, brokers, dealers, etc.

Disaster functions: Locate new hardware required to meet minimum needs
Order new hardware: computer equipment, data preparation, paper handling, microfilming, photocopying
Liaise with Transportation Team to arrange transport to backup site
Liaise with Facilities Team on floor plans, wiring, etc.
Supervise hardware installation and commissioning
Hand over replacement site to Operations

Communications Team

Objective: To reestablish the teleprocessing network and supply communications facilities to the backup site.

Staffing: Manager, communications
Communications analyst
Representatives from common carriers

Preplanning: Set Minimum line needs
Establish minimum equipment needs
Define telephone requirements
If possible, put basic lines into backup site and test
Establish contacts with suppliers

Disaster functions: Order telecommunications equipment as needed
Assist with installation
Supervise testing and commissioning
Arrange telephones and Teletypes for other teams as needed
Arrange additional lines as needed

Systems Software Team

Objective: To supply a working version of the Operating System and Control Systems to the computer(s) installed at the backup site.

Staffing: Manager, control programs
Manager, DB/DC
Operating system specialist
Manufacturer's software CE

Preplanning: Establish addressing schemes for preplanned configurations
Establish systems software reactivation priorities
Arrange off-site storage of test programs
Confirm arrangements for off-site backup media storage

Disaster functions: Obtain operating systems program listing microfiche
Obtain backup media
Arrange for transfer to service bureau
Supervise restoration of systems packs at service bureaus
Supervise system generation to accommodate new configurations
Transport generated systems to backup site and install
Supervise testing and debugging

Applications Software Team

Objective: To supply working versions of all application systems needed to satisfy minimum processing requirements.

Staffing: Manager, operational applications support
Applications control analyst
Senior dp auditor
Technical support analyst

Preplanning: Confirm program and file offsite backup arrangements
Review each system's file backup and retention arrangements
Review application JCL to reduce device dependency
Establish arrangements for the index to the off-site storage to be kept off-site

Disaster functions: Access off-site storage, obtain listings, backup programs and backup files
Arrange for transfer to new site
Reestablish software and procedure libraries
Restore user packs and tapes
Provide new copies of Operations Manuals to backup sites
Supervise resumption of critical processing

Operations Team

Objective: To bring up the new installation and operate the computers to meet minimum processing requirements.

Staffing: Manager, computer operations
Manager, teleprocessing
Manager, production support
Operations shift leaders

Preplanning: Obtain staff home phone numbers
Define computer consumables requirements and inform Supplies & Administration Teams

Disaster functions: Assist with planning of staff transportation to new site
Notify staff to report to new site
Test installed equipment with CEs
Establish processing schedule
Bring up systems in the required sequence
Supervise operation of equipment

Data Preparation Team

Objective: To reestablish data preparation services to meet minimum processing requirements.

Staffing: Manager, data preparation
Data preparation shift supervisors
Key-to-disk console operator

Preplanning: Define minimum configurations needed
Compile list of compatible installations
Set up off-site storage arrangements for backup program tapes and keying instructions
Obtain staff home phone numbers

Disaster functions: Identify resources available
Obtain off-site backup program tapes and keying instructions
Draft revised production schedules
Supply operators to interim installation or bureau if required
Assist with new hardware installation
Assist with planning of staff transportation to new work location
Contact staff with transportation arrangements
Supervise data preparation support

Data Control Team

Objective: To reestablish the Data Control function for critical systems at the backup site.

Staffing: Manager, data control
Supervisor, user liaison
Supervisor, quality assurance
Scheduler

Preplanning: Obtain staff home phones
Prepare user list of emergency numbers
Define forms usage, notify Supplies & Administration Team
Confirm off-site storage of manuals

Disaster functions: Assist with staff transportation planning
Notify staff to report to new location
Obtain backup manuals
Notify users of new location to send input
Establish liaison with Data Prep. Team
Schedule resumption of input and output control functions.

Salvage Team

Objective: To appraise the damage, minimize further losses, and salvage what can be saved.

Staffing: Manager, insurance
Plant engineer
Field manager of mainframe supplier's CEs

Preplanning: Establish directory of outside contractors, suppliers of heavy machinery, etc.
Set up off-site storage of As Built drawings

Disaster functions: Identify materials and hardware to be salvaged
Prevent further damage
Obtain generators, cranes, plant, etc., as needed
Initiate insurance claims
Liaise with loss adjusters
Assist with planning of transportation of salvaged equipment to new site
Arrange insurance for new site and equipment
Arrange crews for salvage and cleanup
Establish security at destroyed facility

Transportation Team

Objective: To meet all needs for transportation between old and new sites, and for delivery of hardware, other materials.

Staffing: Manager, traffic
Manager, dp personnel
Administration assistant

Preplanning: Establish contacts with bus and truck companies
Prepare list of taxi companies
Plan car-pool arrangements

Disaster functions: Arrange transportation for salvaged materials, new hardware, personnel, media
Define courier schedules where appropriate
Arrange hotel or other temporary accommodation
Set up customs clearance with brokers if needed
Bulk-purchase transit system tokens if needed.

Supplies & Administration Team

Objective: To supply consumables and provide administrative support to other teams.

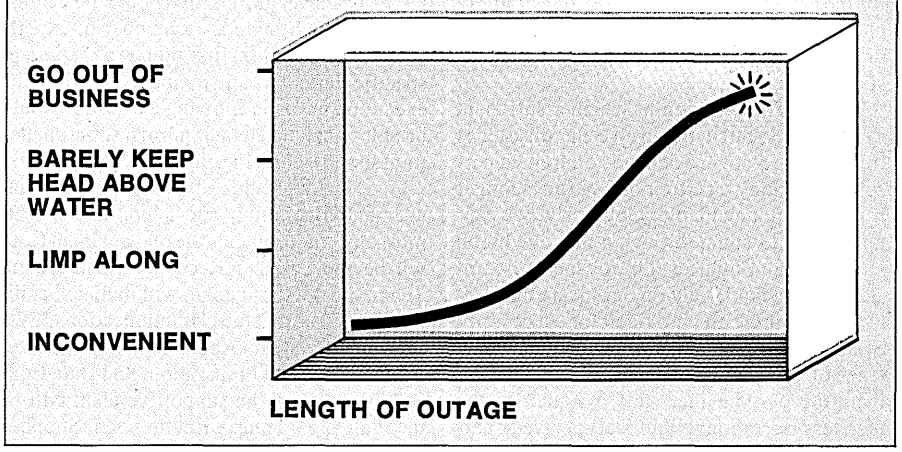
Staffing: Manager, administration
Senior representative from corporate treasurer
In-house auditor
Supervisor, secretarial services
Supervisor, mailroom
Supervisor, stationery

Preplanning: Prepare list of weekly consumables usage by each data center department
Set up off-site emergency stockpile of consumables to cover lead time taken to reorder

Disaster functions: Distribute emergency stockpile to new site
Order replacement supplies
Provide administrative and secretarial support
Notify post office of new delivery address
Set up internal mail arrangements
Provide a channel for authorization of expenditures by other teams
Record emergency extraordinary costs and expenditures

The state of the art in disaster recovery is virtually nonexistent. Everyone has the same questions and nobody has the answers.

FIG. 1
SECTIONS FOR DISASTER RECOVERY MANUAL



matter what industry is involved.

1. In order to be able to assess how long we need backup arrangements to be operational, it is necessary to know how long it would take to rebuild the data center. For the average large computer facility, clearing the rubble and rebuilding would take a minimum of six months.

2. We need to know how much preplanning must be done. If we go for a separate backup site, a large amount of preplanning is required with a good possibility of ready availability should it be needed. On the other hand, if we rely on our mainframe supplier's service bureau to see us through, a much smaller amount of preplanning is needed, but there is the risk of low availability if it is needed. We can therefore assume that any "portable" systems can be taken to a service bureau for a short while, but that we would set up our computers at a backup facility to run our dp requirements until such time as our own data center was rebuilt. The alternative of running at a service bureau for six months can be ruled out on the grounds of cost and nonavailability of processing time to meet our ongoing requirements.

3. What type of accommodation should we look for in a backup facility? The two alternatives are centralizing all functions at one location or splitting up the various functions and distributing them all over town. It would probably be easier to find room for the various departments with the latter choice, but there would be extensive transportation needs, and effective communications between units would also be a problem. It would therefore be better to have all our data center departments under one roof, as they are at present.

4. To define our facility requirements, we must work out what hardware is needed to run our vital processing. To do that, users and management should decide which systems are vital to continued operation of the company. Previous experience has shown that hardware suppliers are able to put a backup site on stream within eight to 10 days. Knowing this, users can plan their own contingency measures for a minimum 10-day outage and can define which systems are to be brought back up again and in what sequence.

5. Whereas most functions in bringing up a backup site can be performed quickly, the provision of telecommunication lines can take a fair amount of time. If you have an extensive TP network, it is important to know whether you need to reestablish the lines or whether you are going to have couriers flying tapes back and forth. One problem with putting lines into a site before they are needed is that it is usually done on a several-year contract basis, and if we change our backup site, we could be stuck with paying for the unexpired portion of the contract. Discuss this with your technical people; usually circumstances dictate that a courier service is unworkable. We assume, therefore, that a certain minimum number of telecommunication lines need to be put into the selected backup site before a disaster strikes.

6. The list of vital processing to be performed is likely to exclude the development of new systems. This decision could cause reverberations which would be felt for months, if not years, after a disaster. Consideration should be given to performing development work at a bureau, since a total moratorium on such work would be unacceptable.

7. To be able to define facilities requirements, it is necessary to define utility requirements. Basic air conditioning and main computer electrical power should be available, or installed before a disaster occurs. In view of the fact that the backup site is not a permanent feature, the cost of installing a UPS system is probably not warranted.

Existing department boundaries should be dropped when assigning staff to recovery functions.

Computer room air conditioning, if worked on 24 hours per day, could be installed in time for the arrival of new hardware; and similarly chillers could be installed within a week, thus obviating the need to have this equipment installed beforehand.

8. The question of whether sufficient experienced staff will survive the disaster is important. Recovery depends on trained personnel and may take four or five times longer if they are not available. Obviously, we cannot expect to come through a massive bomb attack without injuries, but for most circumstances we should rely on our local emergency procedures to provide for successful evacuation. Also, survival of staff is a basic tenet of disaster recovery planning, and we therefore assume that staff assigned to the recovery operation will in fact survive to perform their designated functions as planned.

9. Effective communications are vital during a disaster recovery. It is important to cut through red tape and get the job done in the most efficient and quickest manner. Your existing department structures may not achieve this. We therefore propose that existing department boundaries be dropped when assigning staff to recovery functions, so that personnel is available from the total pool of talent employed by the company. Notwithstanding this, existing department heads have a real role to play in the recovery and should therefore be assigned senior positions in the recovery organization. They should be free to call on anyone to assist them in the most effective execution of their designated tasks. Such a crossover will enhance the speed with which decisions can be made, advice given, and the recovery completed.

SETTING UP THE TEAMS

The next thing to do is to define the approach to personnel organization. There can be a mass of people doing various things, or each person can do tasks specifically defined for him alone. Between the two extremes are a number of alternatives; the approach I favor is the "Functional Team." Here we have groups of people on teams, each of which includes a number of experts with specialized skills doing a series of specific tasks. Team members, during the execution of plan following a disaster, would be able to call on all their normal subordinates to assist in achieving the team's objectives.

There are three types of teams: management, operating, and supportive. In almost any environment, the management team will be the Disaster Recovery Management Team; the operating team will include Facilities, New Hardware, Communications, Systems Software, Applications Software, Operations, Data Preparation, and Data Control Teams; and the supportive team will be the Salvage, Transportation, and Supplies and Administration Teams.

In addition, you may want to add other teams that are relevant to your particular industry. Certain additional functions are performed by data processing staff on the periphery of the disaster recovery process. Examples are a liaison group to maintain contact between users and recovery teams (because users will constantly be checking on progress), and the computer security and audit function, which touches on most teams' activities. The advice of the Security group will be valuable input to the management team's decision-making process but can be regarded as a peripheral activity.

At this stage of the game you will begin to get a feel for what persons should be team members. Don't make the mistake of saying, "Let's get Joe Soap, he's a bright kid." Instead, select your people because "The manager of such-and-such will be able to contribute these needed skills." In other words, select by function, not by name. We assume the incumbents of those job functions are competent.

Senior dp management will be able to suggest team leaders. Sit down with these people for a while and kick some ideas back and forth. You will find that you come away with a start of a list of tasks for the team to do, during both preplanning and plan execution. This can also become the basis for Phase 2, preplanning. During Phase 2, when the teams get together, they will come up with more activities, but at least you have given them a foundation. Suggestions as to possible team members and their tasks, applicable to most large installations, will be found on p. 116.

The last thing to be done during Phase 1 of the project is not really a definition task, but a preparatory activity for the next phase: establish a complete equipment inventory. Various teams will find that useful during preplanning, and it will go into the disaster recovery manual anyway. So draw up a list including description, manufacturer, model number, and any special features of all equipment in every data center department, from calculators in data control to disk drives on the raised floor.

During Phase 2, the disaster recovery teams will be meeting on a regular basis to develop their functional tasks and perform their preplanning duties. Contacts can be established with suppliers and contractors, and future requirements such as facility needs can be worked out. You, as person responsible for disaster recovery planning, will act as coordinator during this phase. After teams have been given some initial orientation guidance, they can be left to work individually. You will be involved with team liaison, problem solving, and progress tracking.

Phase 3 is where you will shine again. There, you will compile all the results from Phase 2 into the disaster recovery manual. Your particular manual could well have sections not included in other manuals. For instance, the first activity to be performed after a disaster could read: "Step 1—Break open a six-pack . . . ."

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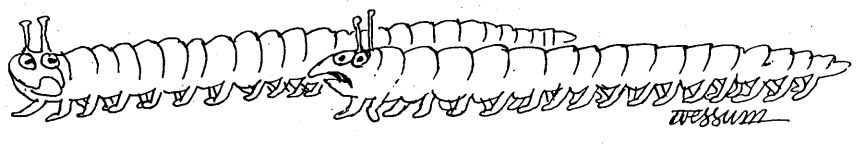
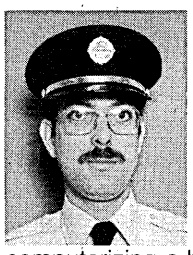
This article draws on work done by several Canadian banks and by the Bendix Corporation, acknowledged leaders in this field. The author thanks them for the ideas they have provided.



"No, it's 15 pair, I'm sure of it. I walked over a pocket calculator."

R.P.R. GAADE



Rem Gaade is research officer with the Toronto Fire Department. During his 16 years in dp he has been involved in a wide range of applications, from computerizing a banana auction to automating insurance schemes.

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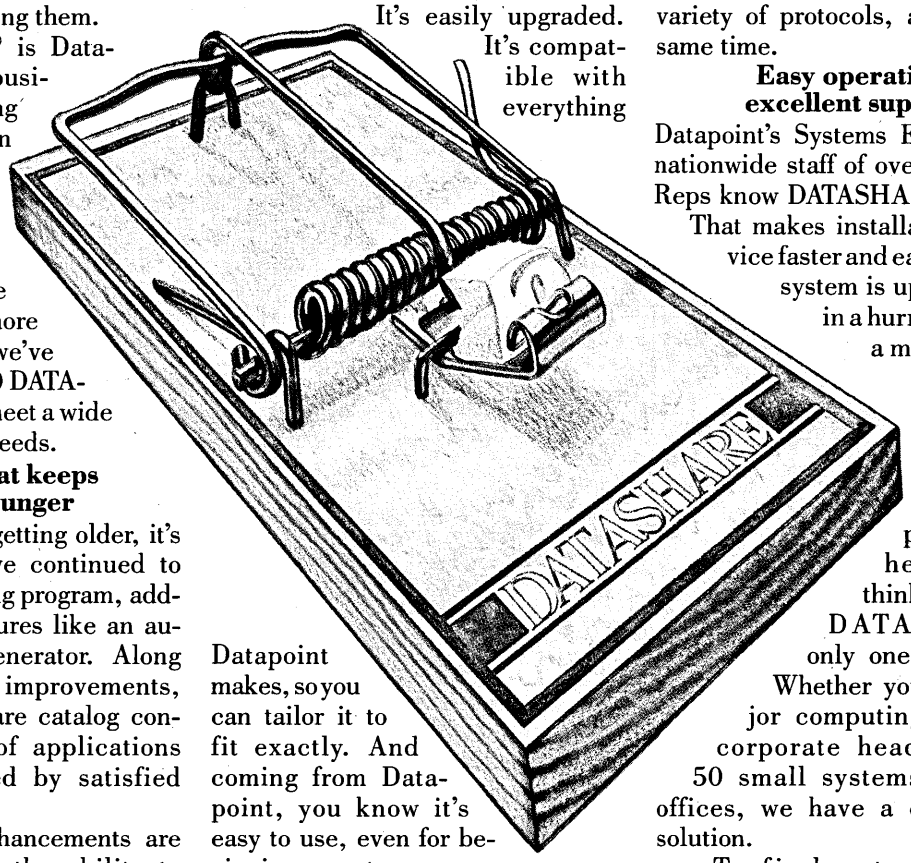

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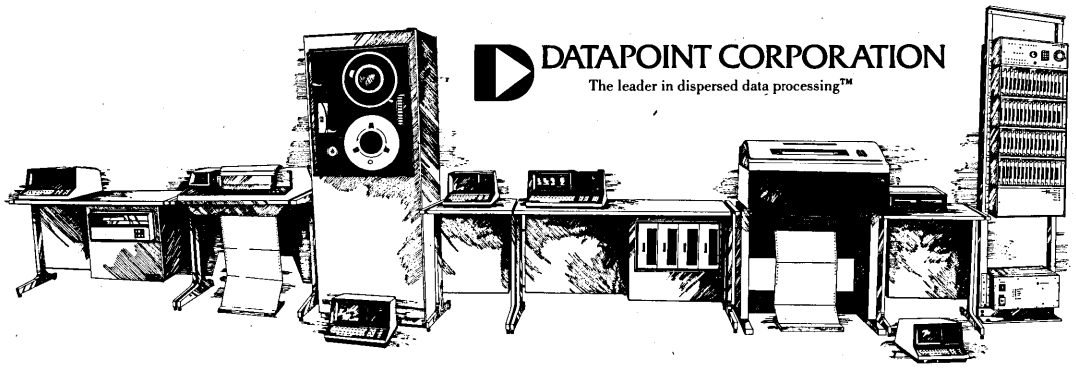

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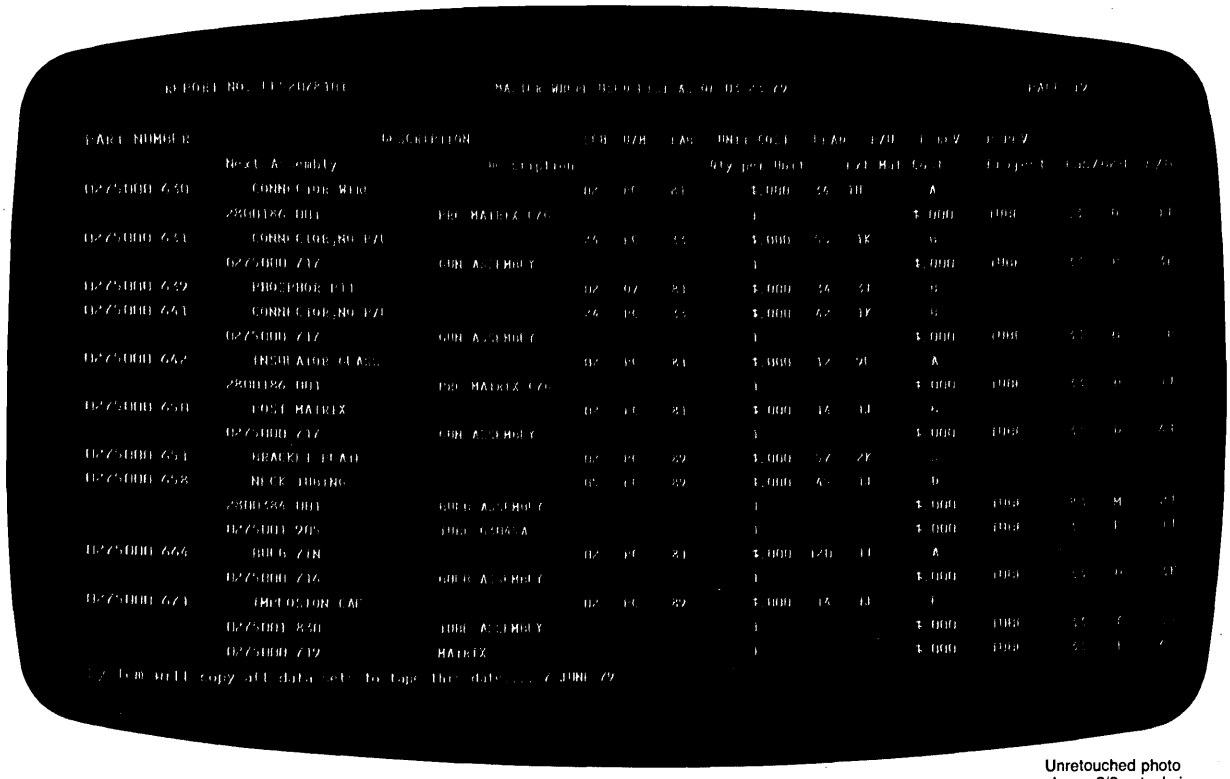

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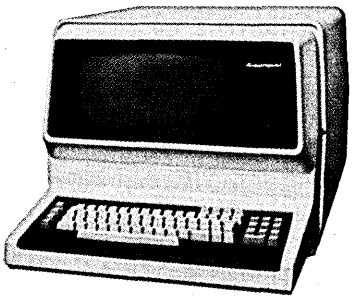

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CIRCLE 94 ON READER CARD

Citrus College is meeting heavy demands for data by using a high level procedural language.

SQUEEZING MORE FROM DP

by William L. Bearley

At the same time as top management is beginning to question why data processing cannot react to the changing requirements of an organization, dp is suffering from a proliferation of applications that now require maintenance. Most departments are behind in new applications development—not to mention being bogged down in day-to-day operations.

How can data processing deal with the problems of maintenance, a changing environment, and the increasing demands for information for decision making? To begin to deal with these issues we must give up the traditional ways of doing dp and adopt new methods and techniques. Citrus College, in Azusa, Calif., has done this, calling a moratorium on all development using the traditional procedural language approach and adopting a high level nonprocedural language built around a central data base management system.

Citrus College has had a computer since the early 1960s, first an IBM 1130 and then a 360/40 running DOS, batch only. By the '70s we were using our present computers, a Xerox 560 and a DEC 20, and there were hundreds of programs written in several languages, including 1401 Autocoder, 360 assembly language, and COBOL. Some applications were being totally emulated, some were partial emulation, some were native code, and a few were completely converted to COBOL or 360 assembly language. Almost all programming effort was being spent on maintenance with virtually none on new development.

Many applications at a college are the same as those in any business. There are the financial applications with budget accounting, payroll, purchasing, accounts payable, and accounts receivable. The personnel system supports a variety of employees including a large number of part-time student employees. The major system schedules classes, registers students in classes, then tracks their progress throughout the term. Since the college is part of the state school system, it is subject to a number of requirements imposed by various government agencies at both the state and federal levels. Since government requirements often change, it used to be difficult for the dp department to keep up with them, let alone with the needs of the organization.

The solution was not obvious; some trial and error was required before the current approach was adopted.

In 1969 I taught a class in systems analysis. As a project, the class developed a textbook order and inventory system for the college bookstore. During the next term an advanced programming class implemented the system using traditional procedural languages. By the end of the term it became apparent that a typical application monster of more than 30 programs had been created and now required maintenance.

This triggered the development of the nonprocedural language named IRMS (Information Resource Management System), now used at Citrus and at several other schools and commercial organizations. IRMS grew out of the realization that there is a high degree of commonality among most commercial applications. These generic data processing functions such as reporting, sorting, selecting, updating, and calculating vary in format and data but not in basic logic.

IRMS was first developed as an academic experiment based on the concept of a generalized file maintenance and reporting system. It was used for the textbook order and inventory system and as a utility for quick one-time applications. It was not until 1972 that the decision was made to incorporate the data base functions that would permit IRMS to support the major applications at the college.

Originally it was estimated that IRMS could support 70% to 80% of all applications with the remaining requiring some programming in COBOL. In fact, no programs written in traditional procedural languages are running at Citrus. The nonprocedural approach is used for all applications—approximately 98% by IRMS and 2% by a nonprocedural statistical package.

This has been accomplished by making the system hierarchical, which provides more processing flexibility at each level (see Fig. 1). The most powerful level, which we refer to as level 3, provides procedural capabilities for special applications. Level 1 provides the easiest to use functions, which are those most often used by people outside dp. To take full advantage of the system, the programmer chooses the highest level that will meet the requirements of the application.

Level 3 can also be used to add new specialized, nonprocedural functions to the system. One example was the addition of a simple text processing function to maintain the documentation for IRMS. Sophisticated on-line update/inquiry procedures are often done at this level.

At Citrus approximately 60% of all applications are implemented at level 1, often with one to six statements. Only about 10% require the use of level 3. These are applications that use complex logic or calculations or special control for unique devices such as an optical scanner.

SYSTEM OVERVIEW

The use of a nonprocedural language for information management frees users (including programmers) to solve data processing problems by telling the system what they want rather than telling it how to carry out the logic of processing.

The system is complete, incorporating data base management with generalized data processing functions in a single package.

The system is driven by data dictionaries, which provide for processing and data independence. The data base is adaptable and relatively easy to change. Fig. 2 depicts the components of the system. The data are at the center, and they are accessed through a common data base manager. The generalized processing functions are accessed through a command language which can be used in both batch and time-sharing environments. For users with special processing needs that cannot be accommodated by the functions provided, there is a procedural language interface.

A system like IRMS can be used for most information processing within an organization, as a powerful application development language for new applications, as a utility for handling ad hoc requests, or for one-time applications. It can be used in a batch and an on-line environment by programmers and users. It can carry out production applications as well as ad hoc requirements.

The use of the system can be divided into two categories—use by dp and use by those outside dp. Within dp there are the routine day-to-day processing and one-time demands. Routine processing is accomplished by programmers writing procedures at the appropriate level. These programs are stored as files, then invoked by the system on demand. One-time demands can often be completed by operations using the highest level of the nonprocedural language. As long as the data are in the data base, the most complex one-time requests can be completed by a trained programmer in hours, if not minutes.

Access by users outside dp can be divided into three areas. Clerks will use procedures written by programmers. These are the typical on-line data collection, inquire, or update applications. Users who have been trained to use the first level of the nonprocedural language will often write and store for future use procedures they find useful. Users can also carry out ad hoc requests in a matter

FIG. 1
THE HIERARCHICAL SYSTEM

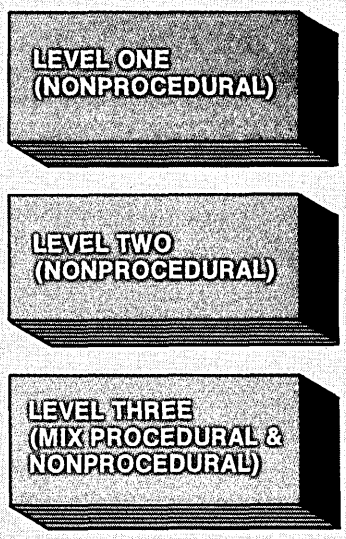


FIG. 2
COMPONENTS OF THE SYSTEM

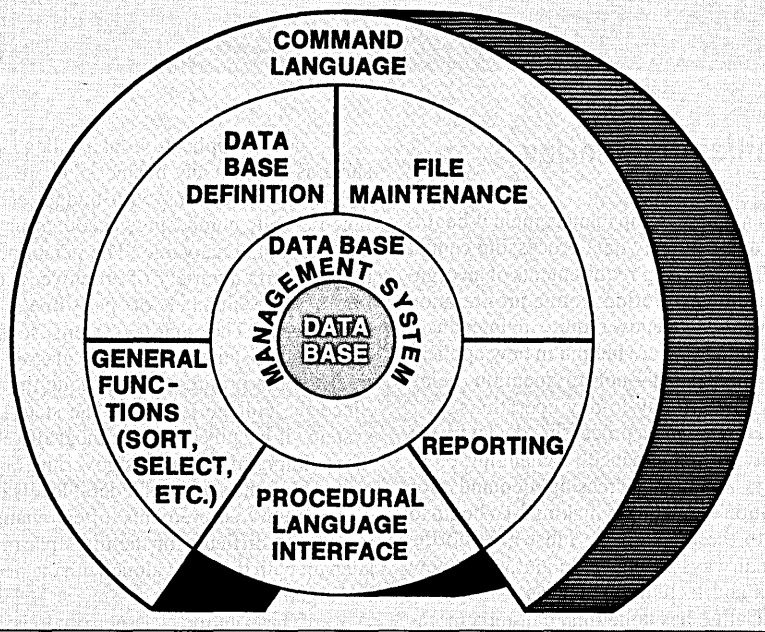
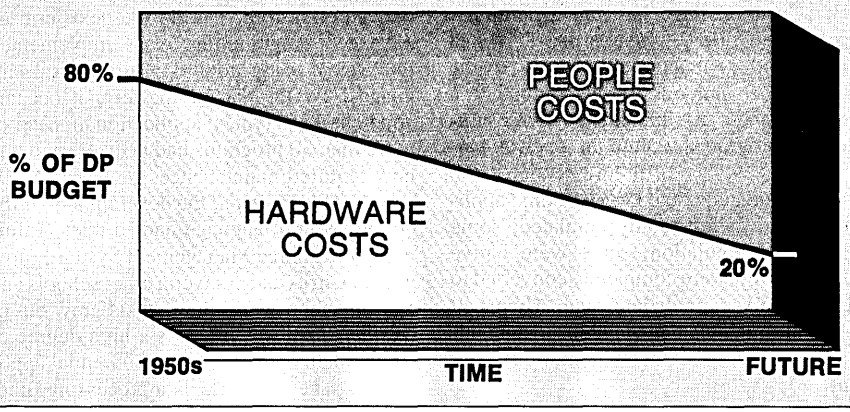
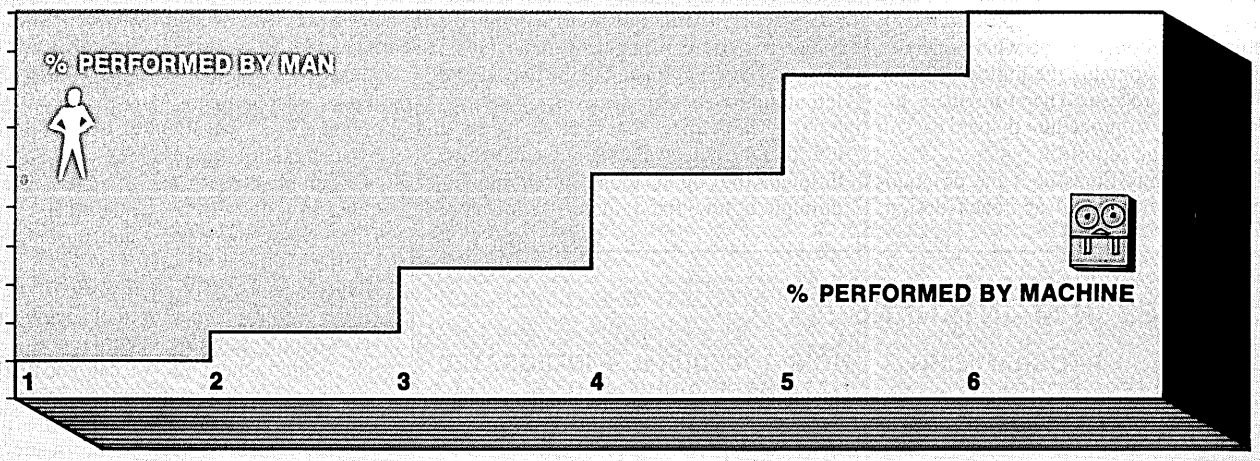


FIG. 3
CHANGES IN DP COSTS



Only 10% of the dp department's programming effort now goes toward maintenance, instead of the former 80%.

FIG. 4
COMPARISON OF MAN AND MACHINE



MACHINE LANGUAGE	SYMBOLIC LANGUAGES	ASSEMBLERS WITH MACRO & SUBROUTINE CAPABILITIES	PROCEDURAL LANGUAGES	PROGRAMMING AIDS—DBMS REPORT GENERATORS QUERY LANGUAGES	NONPROCEDURAL LANGUAGES + INTEGRATED DBMS

of minutes to provide timely information for decision making.

At Citrus over 250 programs provided the processing for the student records system. If we estimate that the average size was around 500 lines (which may be low since many were in assembly language), there were 125,000 lines of code to track and maintain. This system was totally batch. The new system, which provides total on-line services plus batch reporting, requires 16,400 lines of procedure. It is totally integrated with a single data base.

Estimated cost of fully implementing a program runs between $5 and $7 per line. Using these figures, 125,000 lines at $5 a line equals $625,000; 16,400 lines at $5 a line equals $82,000 or a difference of $543,000. Much of the cost of writing code in traditional languages is in the design of the logic and debugging the program once it is written. The cost of implementing one line of nonprocedural code will be much less since there is little logic design time, and debugging is much easier since there are considerably fewer statements. Assuming that the cost is closer to $2 per line, the saving is $593,000.

The time element is also significant. The previous student system was written over a period of four years by three programmers. The new system was written in less than a month by one programmer.

Instead of taking 80% of our programming effort, maintenance has been cut to 10%. Under the old procedures we were usually at least six months behind; now we are caught up. Our method is simply to discard the old report, and while the user is describing the new report to the programmer the report specifications can be completed. Most new reports require only a few minutes to implement.

Citrus is now in a proactive mode of operation rather than a reactive mode. Adaptation due to change in the environment is handled as it is needed, and new applications are developed in a fraction of the time and cost. Users carry out many of their own ad hoc requirements without help from the computer center. Another organization using IRMS reports it implemented a major system in less than one year, although it had anticipated it would take three years, using COBOL and a CODASYL-type data base management system.

THREE REASONS FOR USE

While there are a number of reasons for using the nonprocedural language data base approach, there are three significant ones: decreased cost, increased productivity, and increased system availability to users.

Most installations are quite aware that their people costs are going up while their hardware costs are going down. Fig. 3 represents the movement over time. It has been estimated that at the current rate of change, by 1985, some 90% of the costs of dp will be spent on training and support of people rather than hardware.

If we compare the development of programming languages in the same manner, we find the amount of work required by a programmer has decreased while the amount of work done by the hardware has greatly increased, with major strides being made at steps 4 and 6 as shown in Fig. 4. These advances in programming technology have been overcome by problems of maintenance caused by a backlog of operational applications developed using traditional languages.

Maintenance can be divided into two categories: fixing errors in the program which occur after it is in operation, and adapting an application to a changing environment. It is estimated that on the average across the nation dp installations are spending between 60% and 70% of their programming time doing maintenance and that this will rise to 80% by 1985. Studies indicate the majority of the maintenance in a well-run installation is adaptive. Reports from installations using nonprocedural languages show significant differences in this pattern as represented in Fig. 5.

To understand this significant difference, compare the traditional programming approach with the nonprocedural approach in preparing a program to print a simple report (see Fig. 6). Once the report is defined, the COBOL programmer must design the program logic, code the program, debug the program, then finally run the program to get the results. It would not be unusual for a report with two levels of control break to take 200 to 300 lines. Using a nonprocedural approach the report description can be directly defined to the

Nonprocedural languages permit installations to carry out all their dp needs at a fraction of the overhead of traditional programming techniques.

system and may take around a dozen lines.

A traditional programmer must design, code and debug the logic of how to do each report, then must maintain several hundred lines of code. With a nonprocedural approach one need only define what is needed and the system contains the logic of how to carry out the process. Therefore there are only a few lines of procedure that are easy to relate back to the report.

How many times does the programmer using the traditional approach design, code and debug file update logic, basic report logic, control break logic, record selection logic, etc.? How many lines of code does this "how to" logic take? What does it take to adapt all those programs to a changing environment? You can begin to understand the dilemma of many installations and why different approaches are necessary.

The typical interface between end user and the data available in the data base is through the applications programmer or through a few fixed inquiry applications. Users must wait while a new requirement is designed and programmed. Ad hoc demands are difficult, if not impossible, to meet in a timely manner. With the nonprocedural approach ad hoc or new requests can often be taken care of by the user. If not, the reaction time of programmers can be reduced from weeks or months to hours or days. The increase in system availability to users provided by such facilities goes a long way in answering complaints by users and management concerning the response time of dp.

Even more important in the user-dp interface is the ability of the system to rapidly adapt to change. Given powerful and flexible languages the adaptation to change becomes an easy process rather than the normal reactive, behind schedule, "we can't do that" approach.

The need to program in the traditional sense is a major obstacle in information processing since most users, especially upper management, need timely, accurate data for decision making. Nonprocedural languages can provide a user-friendly interface between the user and the computer that does not require knowledge of a data processing language or of the data base structure.

Powerful and flexible nonprocedural languages provide enough capabilities for many installations to carry out all their data processing needs at a fraction of the overhead of traditional programming techniques. These languages combined with data base management systems provide complete data integration and independence from a user's point of view. They provide a method for new installations to avoid the problems of the past and a way for existing installations to get out of the drudgery of maintenance into the world of innovation. ❋

FIG. 5
CHANGES IN MAINTENANCE

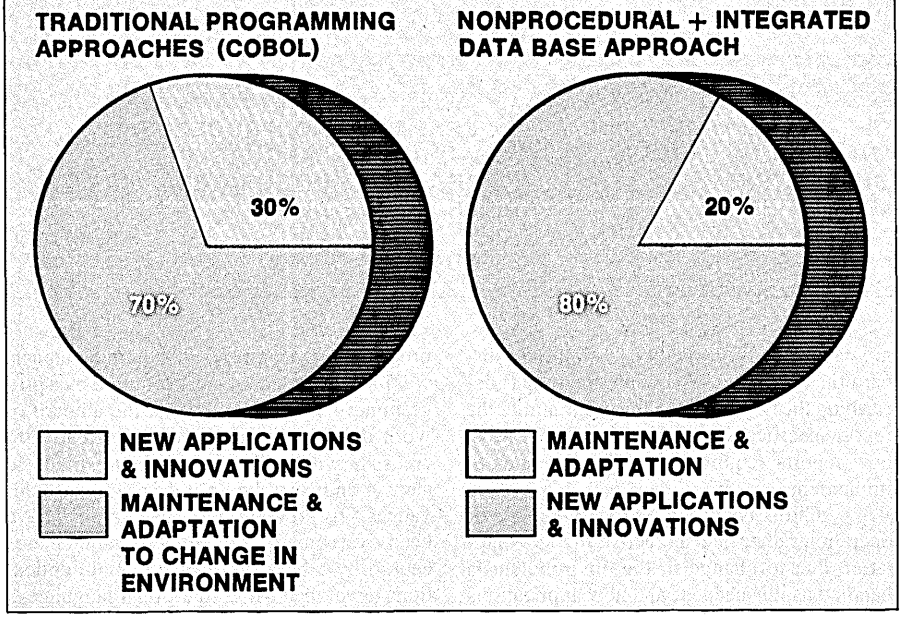
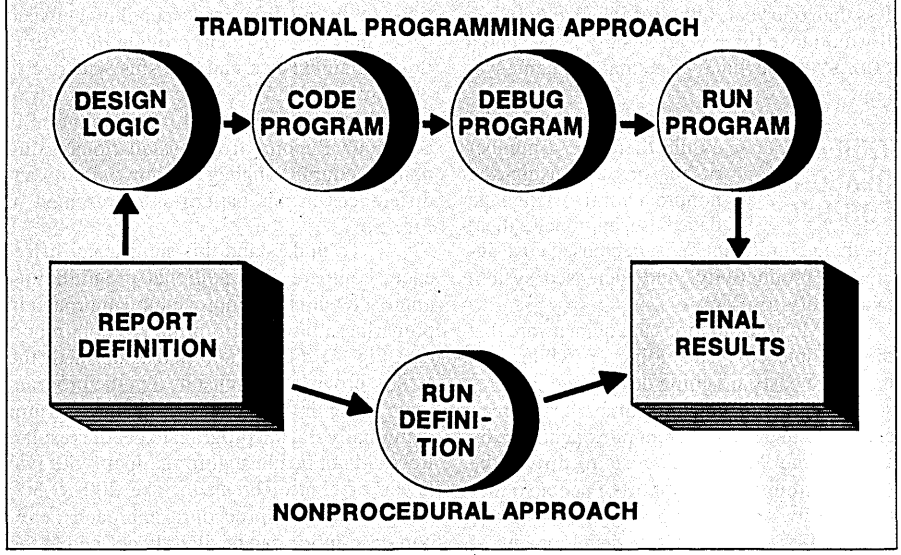
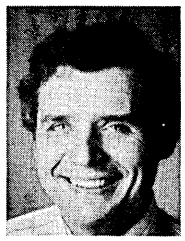


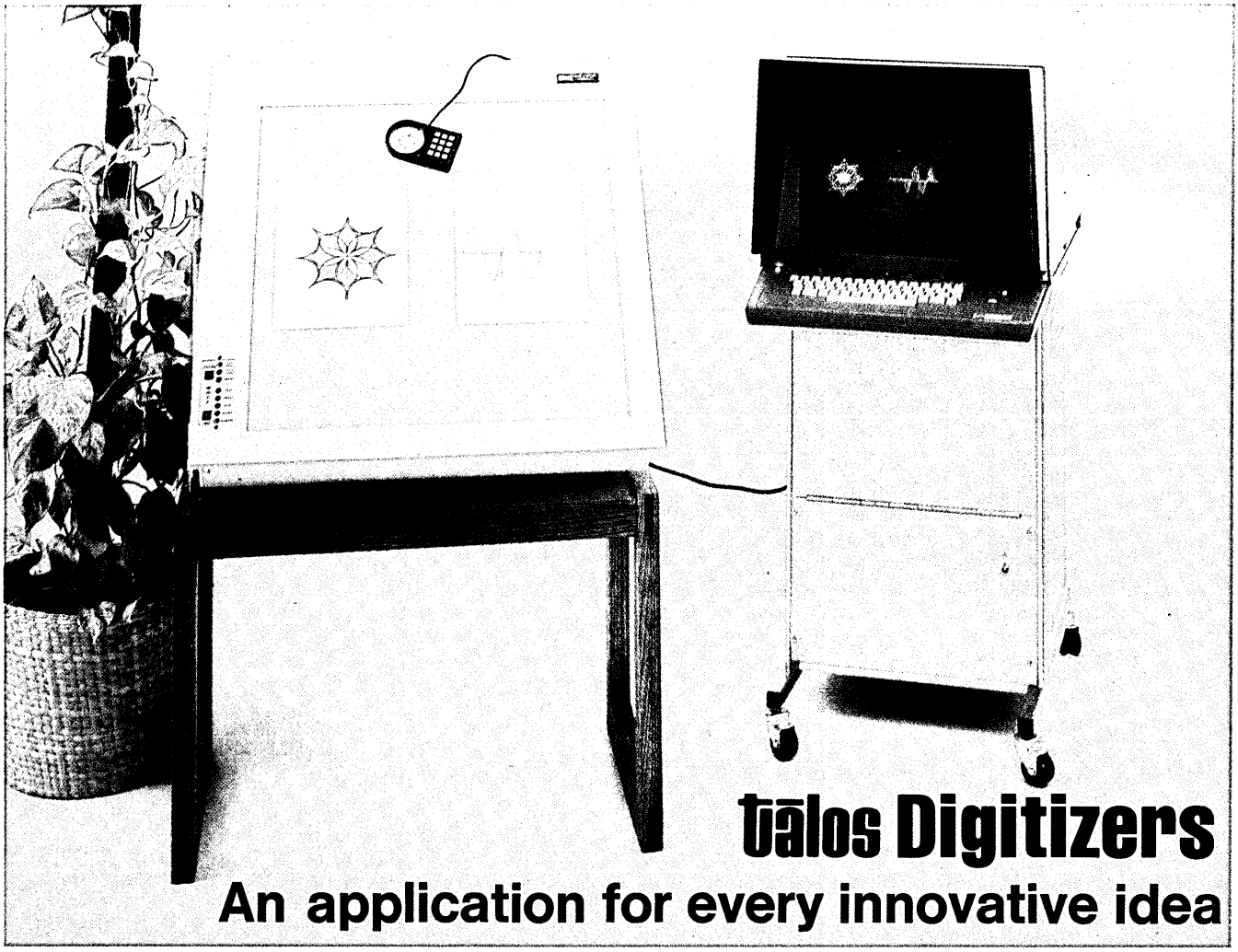
FIG. 6
TWO APPROACHES TO PREPARING A PROGRAM



WILLIAM L. BEARLEY



Mr. Bearley is director, Computing & Information Systems at Citrus College in Azusa, Calif. He also teaches classes in computer science and does management training and consulting. In addition, Mr. Bearley is vice president of Computer Results, Inc., a Pasadena, Calif., consulting firm that specializes in helping small businesses design and implement information systems, stressing hardware independence through structured concepts and logical systems design.



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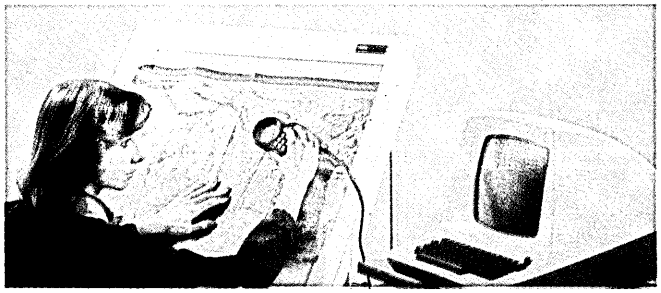

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CIRCLE 95 ON READER CARD

Outwardly, industrial, educational and government dp budgets will look the same. Internally, the dp pie will be divided up differently.

BUDGETING IN 1980

by Louise C. Shaw

Uncertainty best describes the atmosphere in which most dp managers and executives drew up their 1980 budgets.

"Future requirements for hardware is the hardest to get a handle on," said one insurance dp executive, "and add to that software prices—which are going out of sight."

"It's not just a question of inflation

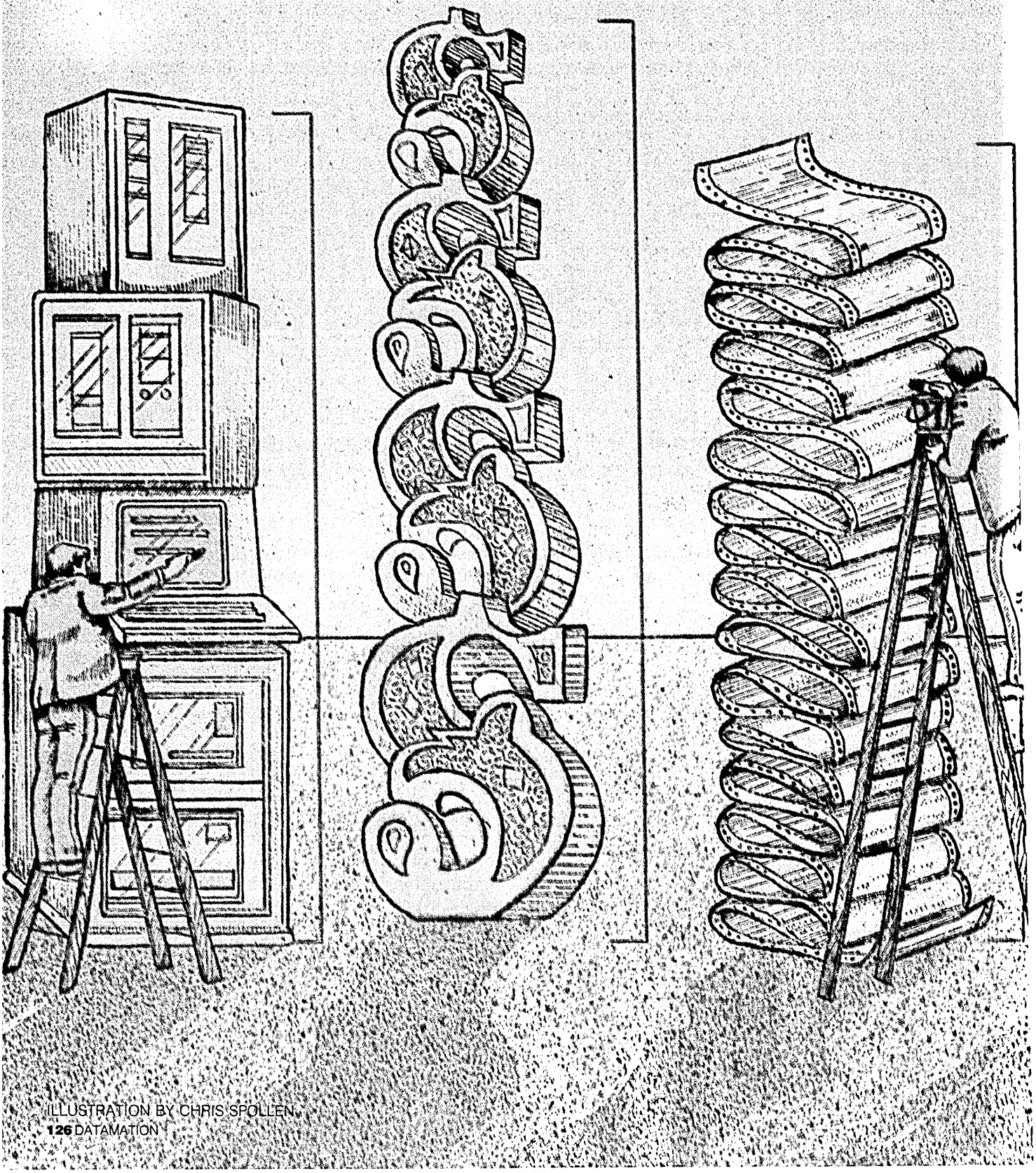


ILLUSTRATION BY CHRIS SPOLLEN

pushing people costs up—there's a shortage in the marketplace that's getting worse." This from an executive of a chemical company in the Midwest.

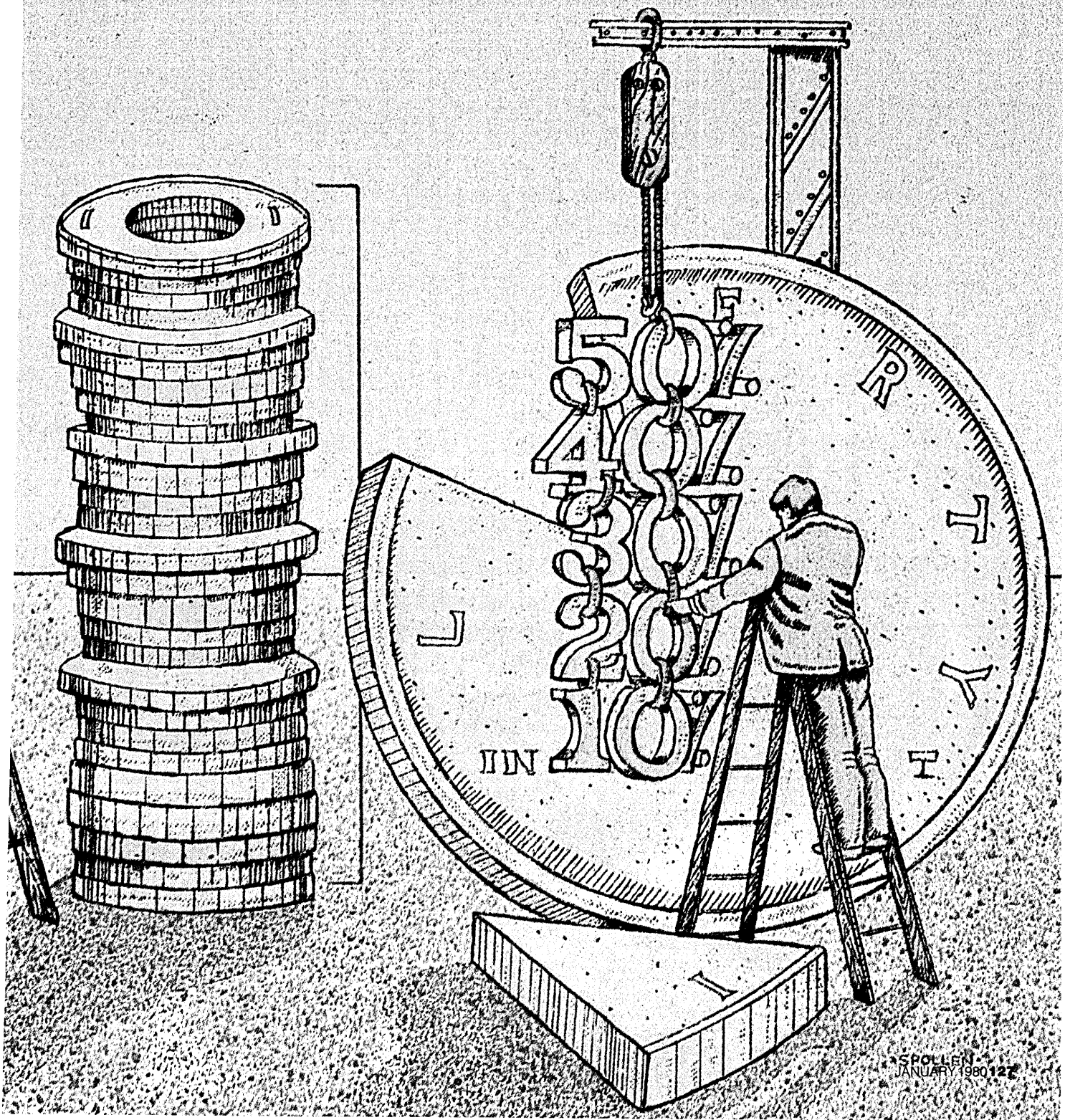
As the decade of the '70s closed with world economies buffeted by events over which no one seemed to have control, statements such as "We believe the U.S. economy entered a recession in April 1979" were followed by "The third quarter GNP grew at a strong 3.5%." Predictions ranged from "Any recovery will be only temporary; the economy will turn down in the fourth quarter" to "Industrial production remains at a high level" but "leading indicators point to a softening."

IBM's announcement of the 4300 last January stirred up dust that still hasn't settled. The bargain basement price tags coupled with hints of new hardware left users running in circles trying to meet present hardware needs, and ordering new equipment with the hope there would be a workable delivery date.

"I've got a 4300 on order," related one dp manager, "and IBM says no delivery until February 1981. At the same time, it tells me it will be able to move that date up, but it can't tell me by how much. The longer we stay with the older machines, the most costly it is to maintain them. It's now almost to the saturation point . . . it is costing us more to keep the older systems intact."

In spite of all this, budget designers are geared to making needed adjustments to keep costs at controllable levels.

"We've gone to third-party mainte-



Hardware and people remain the top allocations in most budgets.

nance and third-party purchase to hold down hardware costs, and we aren't buying too much software," reported a manager from a metal manufacturing plant in the Northwest.

In the last 20 years, two major events have had the most effect on how corporate monies are appropriated for data processing: the transition from batch to transaction processing, resulting in new pressures on salaries and personnel; and the continued unbundling of software by IBM.

Although salary percentages have remained somewhat constant, managers have been plagued by internal changes. Central keypunching has been replaced by on-line data entry, resulting in skyrocketing costs for systems programmers as software environments become more complex. As reported by DATAMATION (November 1979), not only is the programmer marketplace rampant with what seems like free agent demands, but job loyalty and long-term commitments are rare. As a hedge against this trend, many dp managers still live under the axiom, "When push comes to shove, the hardware stays and the people go."

"One of my full-time staffers left, so I made the position part-time and reduced my payroll by half a person," noted one manager. There is, of course, a price for this policy. "When you give up people, you give up part of what you wanted to do," said another dp manager who recently went through a budget retrenchment.

Another factor keeping dp staffs small is the inability to find enough qualified applicants at reasonable prices. "I have no problem getting authorization to fill vacant positions, but most of the time, the applicants are asking more than what we are authorized to pay," reported one Texas dp manager at a large county government shop.

HARDWARE, PEOPLE BIG ITEMS

In this year's budget breakdowns, hardware and people are the major expenses across the board. The category in which there has been the most change is called "other." For instance, in 1973, 40% of the total dp dollars went to hardware, 45% for salaries, and the remaining 15% was "other" (software 0.9%; supplies 5.9%; consulting 0.4%). In 1979, software is garnering 6.2% of the total dp dollars, supplies 6.5%, and communications—a category that did not appear in our earlier surveys—1.2%. Consulting, training, conference attendance are also costing more—8% this year, as compared with 2.8% in the early part of the last decade.

That brings us to the second major influence over dp budgeting: IBM's unbundling. Although it began with the unbundling announcement in June 1969, it was several years before the full impact of that decision

FIG. 1.

MAIN BUDGET EXPENDITURES

OVERALL BREAKDOWN OF DATA PROCESSING BUDGETS. HARDWARE AND SALARIES CONTINUE TO CONSUME THE MOST DOLLARS BUT SOFTWARE IS MAKING ITS PRESENCE KNOWN.

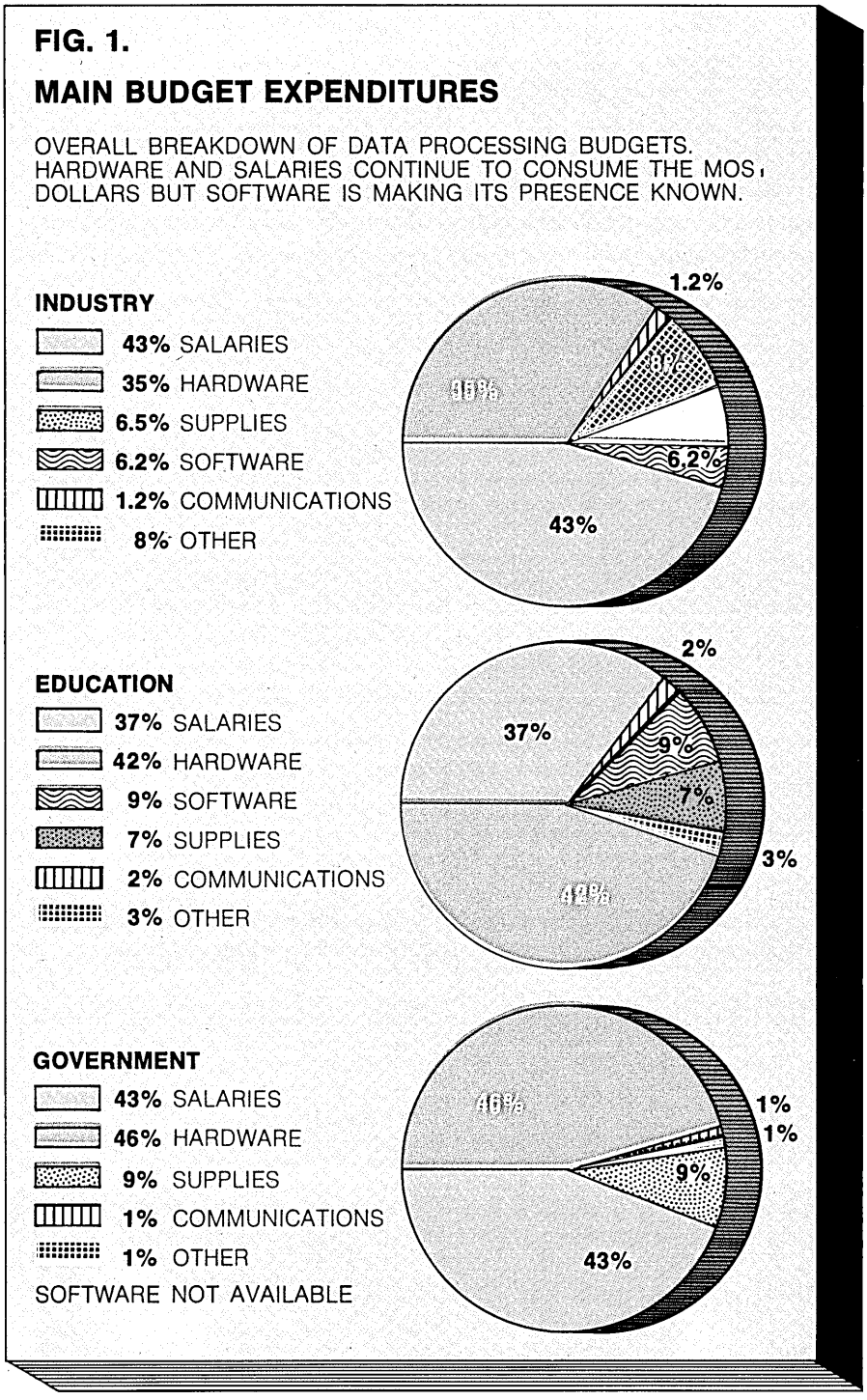
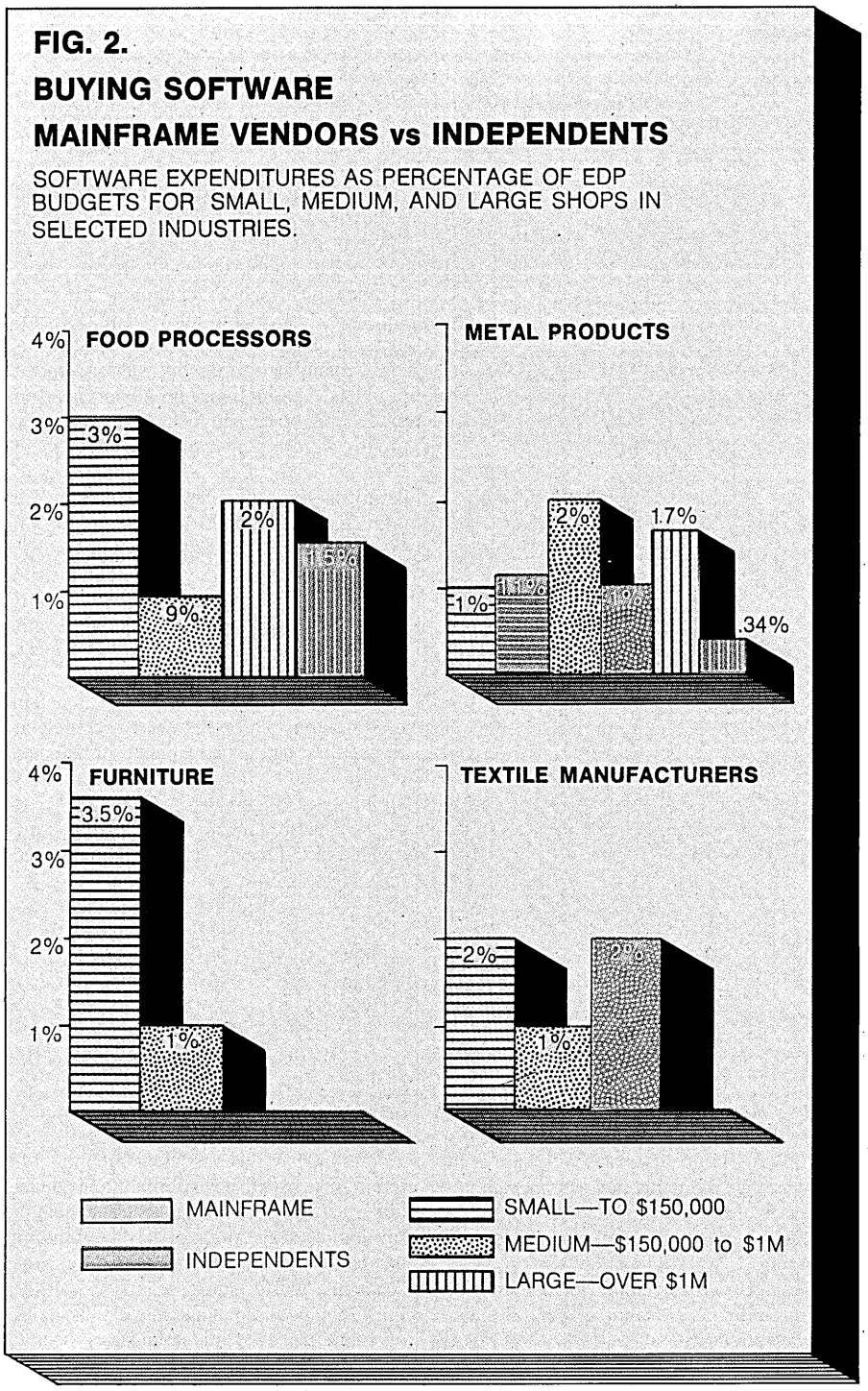


FIG. 2.
BUYING SOFTWARE
MAINFRAME VENDORS vs INDEPENDENTS

SOFTWARE EXPENDITURES AS PERCENTAGE OF EDP BUDGETS FOR SMALL, MEDIUM, AND LARGE SHOPS IN SELECTED INDUSTRIES.



began to take effect. With software now viewed much the same way as hardware by the budgeteers, it receives annual appropriations and long-range planning.

Buying packages and services as stand-alone items is giving dp managers yet one more tiger to wrestle. As one executive in the health care industry said, the software he installed two years ago for $6,000 is now going for $25,000. "Horrendous!" cries a manager in an insurance shop who tells of a processing system he is eyeing that costs in the neighborhood of $250,000. One dp manager reported he is encouraging his users to have their software developed in-house. "I can tell them exactly how much it is going to cost; there is nothing but uncertainty on the outside."

For all this uncertainty, the majority of questionnaires returned to us this year carried notations such as "Upgrading to a System/38, to a Univac 90/30, going from a 138 to a 4341, moving up to a Univac 1100/81." Or, as one respondent flatly stated, "We are expanding in hardware and software, implementing new systems, and increasing the dp budget."

Data processing is now entering a new decade following 10 years of rapid technological change. Some manifestations of that change include implementation of multimedia networks that handle data, text, voice, and images, and the wide dispersal of multifunction terminals that interface with data and text file processors. One industry expert's comment was, "Of course, the main indication of this trend is that budgets will be more difficult to establish and costs will be more difficult to measure."

The new category of communications will see expenditures rising, but only moderately, as the move to transaction processing requires more dollars for communications packages. There continues to be confusion over what to include in the communications category. Budgets are tangled. Some have hardware on each end included, others don't. Modems, controllers, multiplexors, and phone lines end up as items in several different categories. Also difficult to isolate is voice vs data communications.

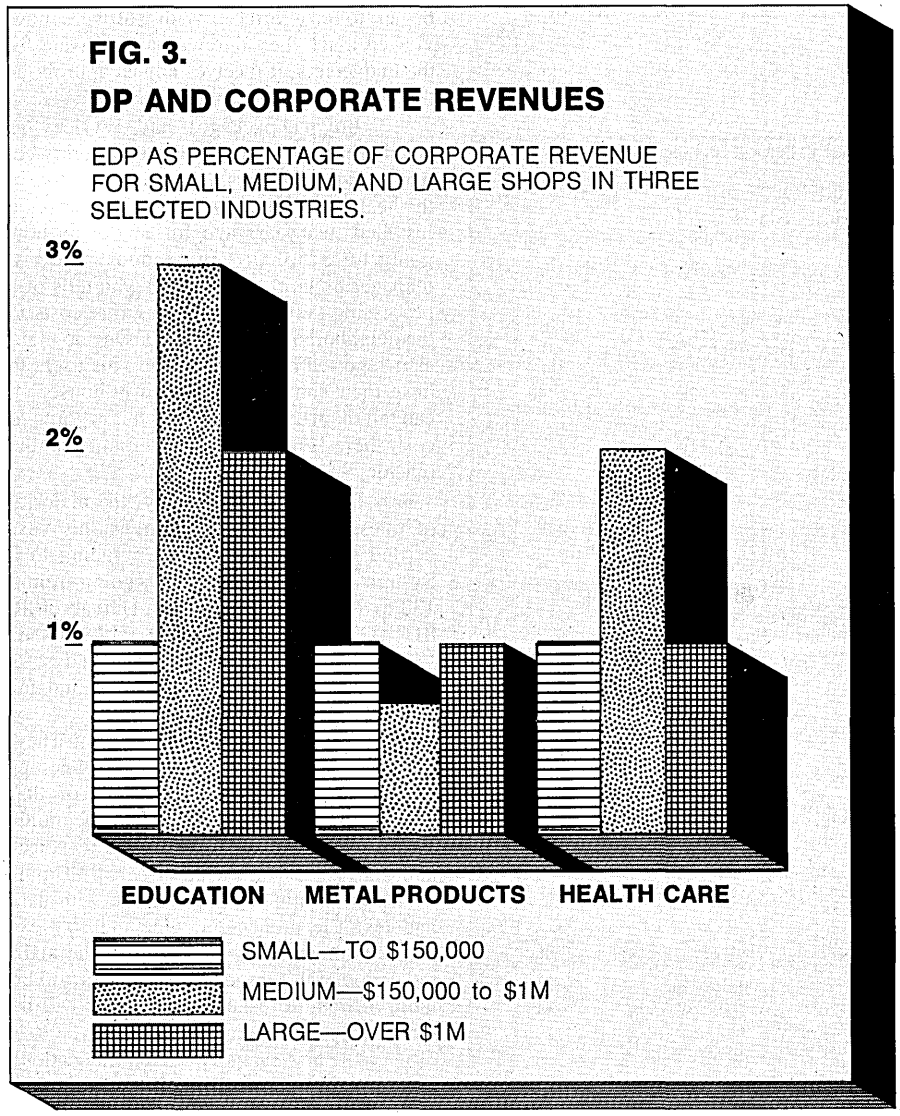
So, will corporate dp budgets take up more room in the company ledger over the next few years? No. The more-bang-for-the-buck principle will continue to free up hardware dollars that can be rechanneled into other dp budget areas. No one is slashing dp budgets, and no one is turning over saved dollars to anyone else's budget.

Still, the figures for 1980 clearly point out the reshifting of dp dollars. Breaking down expenditures category by category, central site processing remains the way the majority of companies do their dp business. While the move to remote sites is rumored, it

The more-bang-for-the-buck principle will continue to free up hardware dollars that can be rechanneled into other dp budget areas.

FIG. 3.
DP AND CORPORATE REVENUES

EDP AS PERCENTAGE OF CORPORATE REVENUE FOR SMALL, MEDIUM, AND LARGE SHOPS IN THREE SELECTED INDUSTRIES.



isn't evident in the budget reporting. One school of thought says the end-user is buying much of his own equipment, programs, and services, and therefore, those figures aren't appearing on budgets. Also, as much as distributed data processing may be considered the wave of the future, there is a slower process of acceptance than once predicted.

Word processing, another highly touted field, did not produce enough figures from this year's respondents to allow us to draw any conclusions or make any predictions.

HEALTH CARE FIELD GROWS

Looking at the specific industries, the field of health care deserves special mention. Its figures back up its designation as a high-growth industry—and it's also an accurate reflection on the incredible amount of paperwork involved with forms. The health care industry spends 44% of its allocations on hardware—usually data entry, 35% on salaries, and 7% on supplies. It appears that health care is in the same stage of dp that the insurance industry was several years ago—the "paper mill" stage, with very slow progress toward on-line processing.

And, while, remote local hardware locations remains in favor of central sites, two exceptions stand out: the insurance industry, especially those companies with large shops, in which 11% of the respondents said hardware was not at a central site, and small shops in the textile industry, where it was nearly 50-50 for local and remote.

The days of looking out the dp window and giving rough estimates are over. Data processing budgets have joined the big time, and will continue to become more complex. In the words of one East Coast dp executive, "Right now, all I'm trying to do is stay even in the game." ✻

HOW WE DID THIS SURVEY

The DATAMATION 1980 Budget Survey is based on a sample of DATAMATION's User Panel and dp managers selected by title from the magazine's domestic mailing list. A sample of senior dp executives in all industries was surveyed from mid-October through mid-November 1979.

The sample included virtually every known industrial classification. There were sufficient reponses to allow us to do comparisons in the following industries: furniture, manufacturing, construction, metal products, automotive, and government on the federal, state, and local levels. Industry groups were reported on only when there were sufficient numbers of respondees to permit us to draw valid conclusions while protecting the identities of the reporting organizations. This is the reason for the seeming omission of such major industrial groups as public utilities, or petrochemicals, or distributors; there just weren't enough responses.

Each returned questionnaire was examined before its results were included in these figures. Those that were incomplete, came in too late to be included, or had data that just didn't add up, were regrettably eliminated.

The organizations reporting were divided into three size classifications based on budget size:

Size	Budget Range	Typical Hardware
Small	Under $150,000	IBM S 3/10
Medium	$150,000 to $1 million	IBM 370/138
Large	Over $1 million	IBM 370/168

We have used IBM hardware as the standard size measurement because so many of the reporting installations are IBM shops.

Industrywise we did something different this year. Instead of including education and government as industries equal to say textiles or automotive, they are standing by themselves. Traditional industries, the academic world, and the offices of the President, governors, and mayors just don't operate under the same boundaries when it comes time to draw up the budget. Laid side by side, it's apparent one of the biggest differences is in the allocations for hardware and people. Industry pays bigger salaries, education goes heavy on the hardware, government has a higher number of purchased rather than leased machines. Salaries in the governmental field are lower and hardware is run longer. It wouldn't be too radical to say government is always a little behind in the paperwork.

Another unnecessary myth

Hughes views software as a science

History does not reveal what musician first called his style "jazz."

Nor what baseball player first prepared to hit by swinging three bats.

Nor what systems-engineering organization first recognized software as an essential ingredient of its product line.

But one that clearly has is Hughes.

Hughes Aircraft Company's management has made a major commitment to using the technology and discipline of software engineering in its systems design and development process.

Software here is an integral part of the system. Not an afterthought.

Recognition, commitment, investment

Hughes is investing millions of dollars a year in resources for software development and production. (With our four-billion-dollar backlog of more than 1,500 high-technology electronic projects to complete, we *need* to make that kind of investment!)

More important, our software engineering population — around 1,000 as recently as 1976 — has grown to more than 2,500. And is still growing. We'd like it to grow even faster.

Software specialists are a distinct and recognized element of the mainstream at Hughes. They are integrated in our engineering environment. But not swallowed up.

Software, not a sensor, is increasingly the key element in systems we are developing and delivering.

Our in-house software engineering capability is more and more often the key ingredient that keeps us ahead of competition.

We know that the software specialist is central to our scientific success and business growth at Hughes

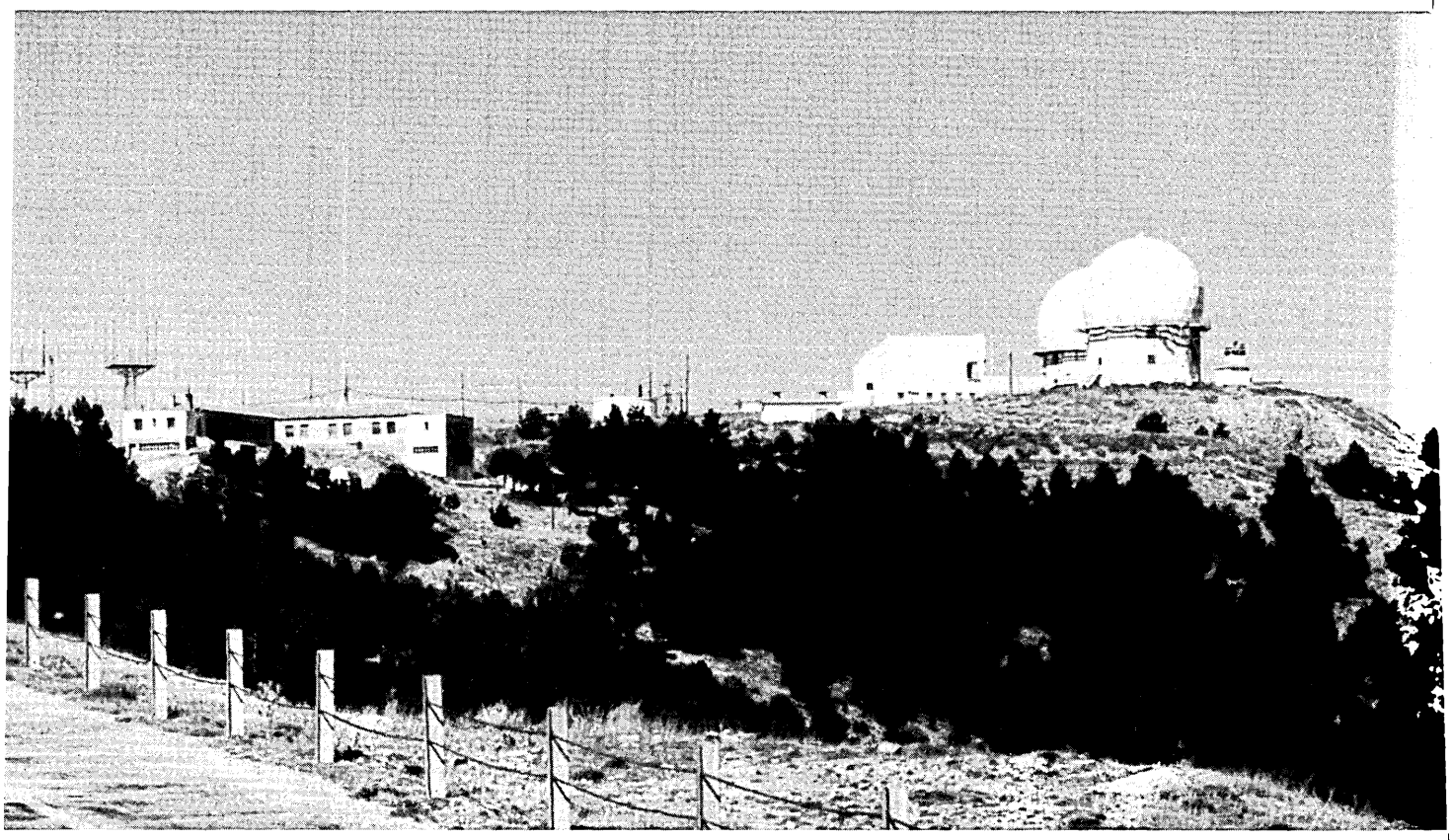
It's an interesting and rewarding place for a software specialist to work.

Come see.

Success breeds success in software at Hughes

As we repeatedly demonstrate capability in software engineering, we get more and more assignments invo ing software as the major component from concept through performance — in space, in the air, on or under the sea, on the battlefield, or in the corporate setting.

Meanwhile, our work attracts senior people with broa software experience and talent. And we are able to keep them happy because of the variety of our assign ments that use and stretch those individuals' abilities.



Hughes is offering secure and varied jobs in a dozen Southern California locations in Los Angeles, Orange, and San Diego Counties.

Hughes is hiring software specialists and other data-processing professionals, engineers, scientists, and technicians.

Hughes is looking for capable men and women with all kinds of experience:

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- Computer Design Development
- Computer System Development
- Digital Communications Design
- Digital Systems - Microprocessors
- Software Design Analysis
- Software Test

PROGRAMMING
- Business Management Systems
- CAD, CAM & CAT
- Communications
- Computer Systems
- Data Processing Analysis
- Information Management Systems
- Numerical Control
- Operating System & Network
- Real-Time Graphics
- Scientific
- Software Analysis, Development & Test
- Space Power Systems

. . . and Applications Programmers familiar with radar, signal processing, air defense, tracking, missiles, or satellites.

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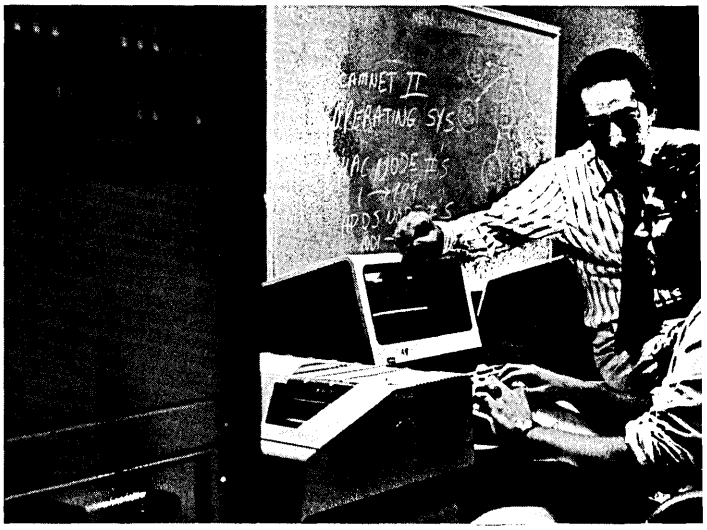
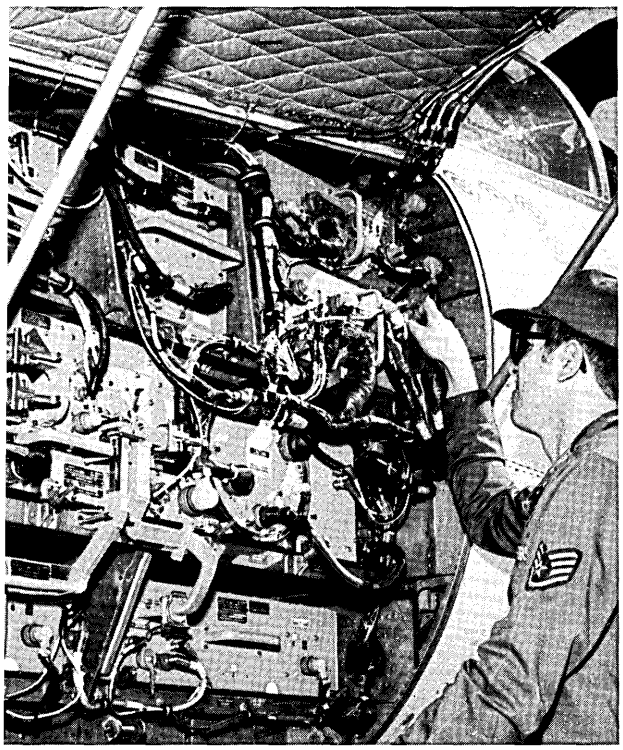
Massive data compression, interactive graphics, an integrated computer network, and 3 1/2 million computer instructions are components of the Hughes Large-Scale Real-Time Data-Processing System.





All-altitude, all-aspect radar for the F-15 fighter aircraft is the Hughes-developed AN/ APG-63 system of air-to-air detection, target acquisition, and tracking capability.

Now Hughes technology is increasing that capability still further with the addition of a programmable signal-processor on board, converting the radar from hard-wired to software programmable.

This digital modification is one example of the trend from analog to digital technology in many kinds of advanced electronic systems we create.

Combat Grande is the electronic air defense system Hughes developed for Spain. It integrates existing radars, such as those shown, into the automated systems with the use of radar data extractors.

More than 680,000 instructions were programmed into the system's computers. The entire nationwide network was completed on time and within budget, and the software has effectively supported intensive tests.

Earlier, Hughes created the NATO alliance's air defense system that reaches from Norway to Turkey. It is considered the largest and most complex electronic undertaking in Europe.

Every tool is close at hand

The amount of data-processing equipment available for our software specialists to use is formidable:

IBM 370-165's, 158's, 145, 115 . . .

Sigma 5, 8, and 9; DEC-10, 11-70, and 11-780's; Univac 6135; HP 3000; and too many minis to inventory . . .

Amdahl 470's, Hughes 5118M's and AN/UYK 40's, and more.

Our modern software-development environment provides simulation-modeling tools, special test-instrumentation tools, mature compiling systems for a variety of higher-order languages, tested specification languages, and state-of-the-art programming aids — all to help set the software specialist's creativity free.

Specialists in the overall

Software engineering at Hughes focuses on the development of embedded computer systems; i.e., systems in which the data-processing capability is determined by, and dedicated solely to, necessary functions of the system.

We define and design the total system: hardware (data processing, peripherals, sensors); software (operational application programs, support for built-in test equipment, fault-isolation diagnostics, system support, training and test-exercise programs); site facilities; operational plans and handbooks; training; and installation.

What does that all-round capability mean to the individual software engineer at Hughes? Total involvement. Participation alongside the systems engineer and hardware engineer in defining with the customer the system requirements. Top-down work on definition of software architecture to meet hardware and software requirements. Cooperation with the systems engineer and hardware engineer in bringing the system to operational acceptability.

Virtually every software specialist will have a choice of job opportunities in the 1980's. In some, you might seem to be a stepchild, or on a treadmill.

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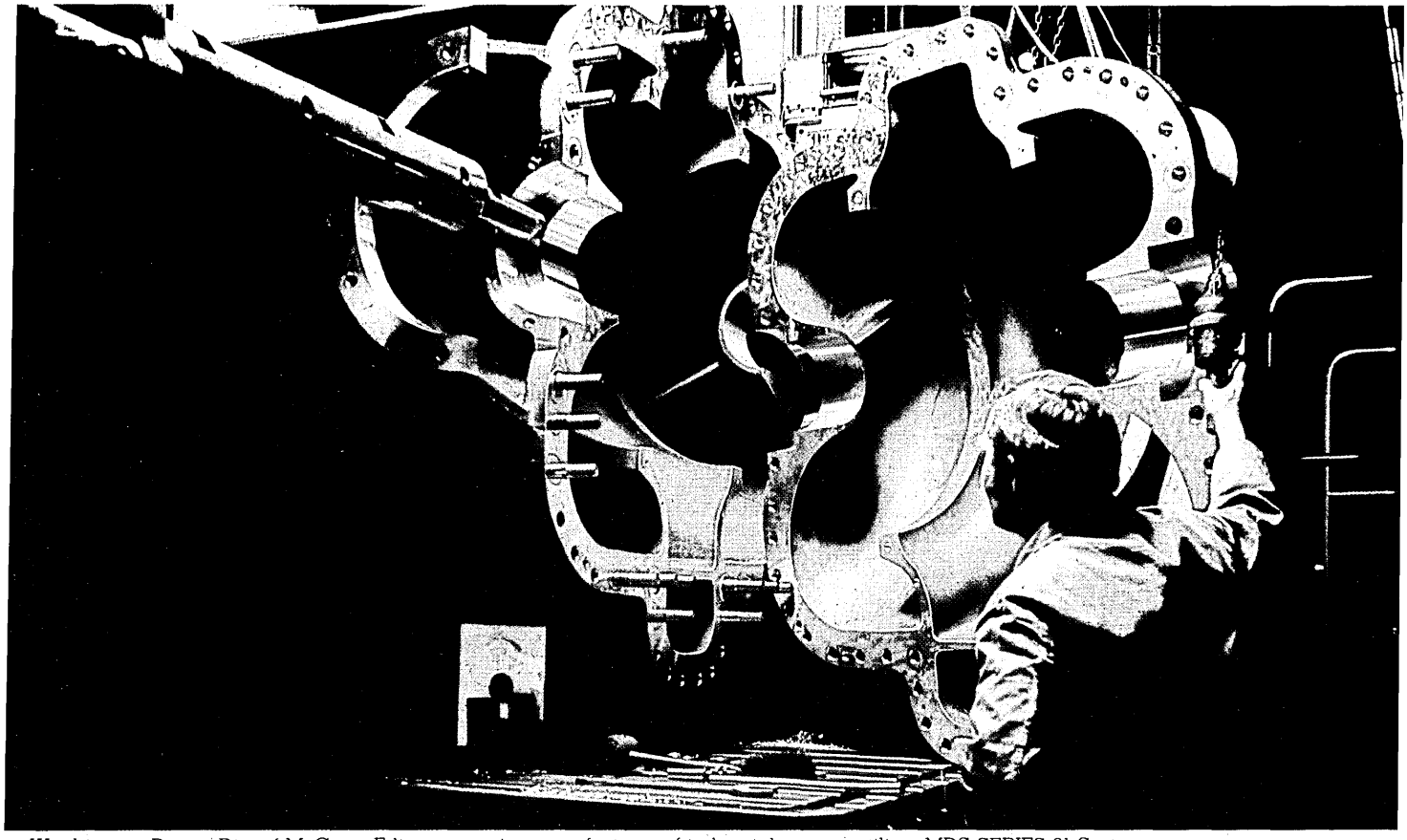
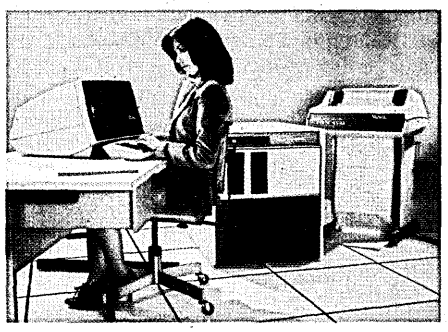


Worthington Pump, Div. of McGraw Edison, a major manufacturer of industrial pumps, utilizes MDS SERIES 21 Systems.

The Information Pump



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◀ CIRCLE 96 ON READER CARD

CIRCLE 97 ON READER CARD

To maintain production schedules and keep error rates low, managers are turning to team organization strategies and group review processes.

GROUP PROCESSES IN PROGRAMMING

by Ben Shneiderman

The first two decades of programming history gave us the image of the introverted, isolated programmer surrounded by stacks of output. Other workers have left the office, but our intense programmer, ignoring the absence of his colleagues, scribbles rapidly with a felt-tipped pen in hopes of eliminating the last bug before a 9 a.m. deadline.

Fortunately, this image is becoming a caricature. The lonely days of programming are giving way to community, interdependence, and stability. This passage is happening gradually—the settler groups are still resented by the pioneers who seek to preserve their freedom and independence. Personality studies of programmers still show that programmers' need for social interaction is significantly lower than for people in many other professions. The concept of the programmer as a "loner" has some validity, but it is changing.

Although some people mourn the passage of the days of explorers and pioneers, the benefits of stable civilization that depends on social interaction are attractive. Pioneers are necessary, but their productivity and reliability are erratic. As organizations become more dependent on computerized systems, production schedules cannot be violated, maintenance must be fast, and error rates must be low. To satisfy these needs, managers are turning to team organization strategies such as egoless democratic teams or chief programmer teams, and to group review processes such as structured walkthrough, peer ratings, and code inspections. Although individual accomplishments will always be important, the value of group processes is increasing.

Team organizations are long-term strategies for encouraging cooperation during major projects. Short-term team or group processes are designed to bring individuals together for specific tasks such as evaluating program designs or code. Group processes may be used in conjunction with or independently of team organizations. Like group therapy, group processes are designed to encourage cooperation, build interdependence, and help individuals overcome their anxieties.

Some social psychological research suggests that small groups encourage individuals to perform at higher levels than larger groups because they feel that other group members will recognize good work and criticize poor performance. However, learning may be hindered in small groups if anxiety and fear of failure become debilitating.

Experimentation on team organizations is difficult because the alleged benefits are difficult to measure and the time frame is long. Experimentation on group processes, however, is difficult but possible. The trend toward experimental testing, apparent in programming languages, data base query facilities, and interactive systems design, stems from the recognition that a designer's (or manager's) intuition can be and should be supported by experimental evidence.

The concept of peer review or peer rating, relatively new to dp, has proved to be useful in predicting an individual's performance and in evaluating products such as technical articles and books. Peer reviews are global predictions of performance and peer ratings are evaluations of a specific product quality.

Studies performed by the Defense Dept. concluded that peer reviews are more valid in predicting how individuals will fare in Officer Candidate School or in combat situations than are objective tests or supervisory evaluations. Possible reasons include

- the closer daily contact of peers
- people show their best side to superiors
- peer review provides a larger number of judgments than one evaluator's opinion

The peer rating process serves as a tool for programmer education, programming team communication, and programmer self-evaluation. Such a feedback technique is useful because we have poor software quality metrics.

PEER RATING STUDY

After a pilot study in 1977, three peer ratings were conducted during 1978 at the Defense Mapping Agency (DMAAC) in St. Louis; at General Electric (GE) in Arlington, Va.; and at the Bureau of the Census in Suitland, Md. In this work, done in collaboration with Nancy Anderson, a University of Maryland psychologist, assisted by Opal Reynolds, five professional programmers with similar background and experience each provided one program representing their best work. Notes indicating authorship were removed and copies were distributed to each participant, who rated four programs (one for each of the others). GE programmers provided FORTRAN IV and FORTRAN 77 samples, DMAAC programmers ASCII COBOL samples. GE and DMAAC samples ranged from 50 to 275 lines in length while Census samples ranged from 100 to 650 lines.

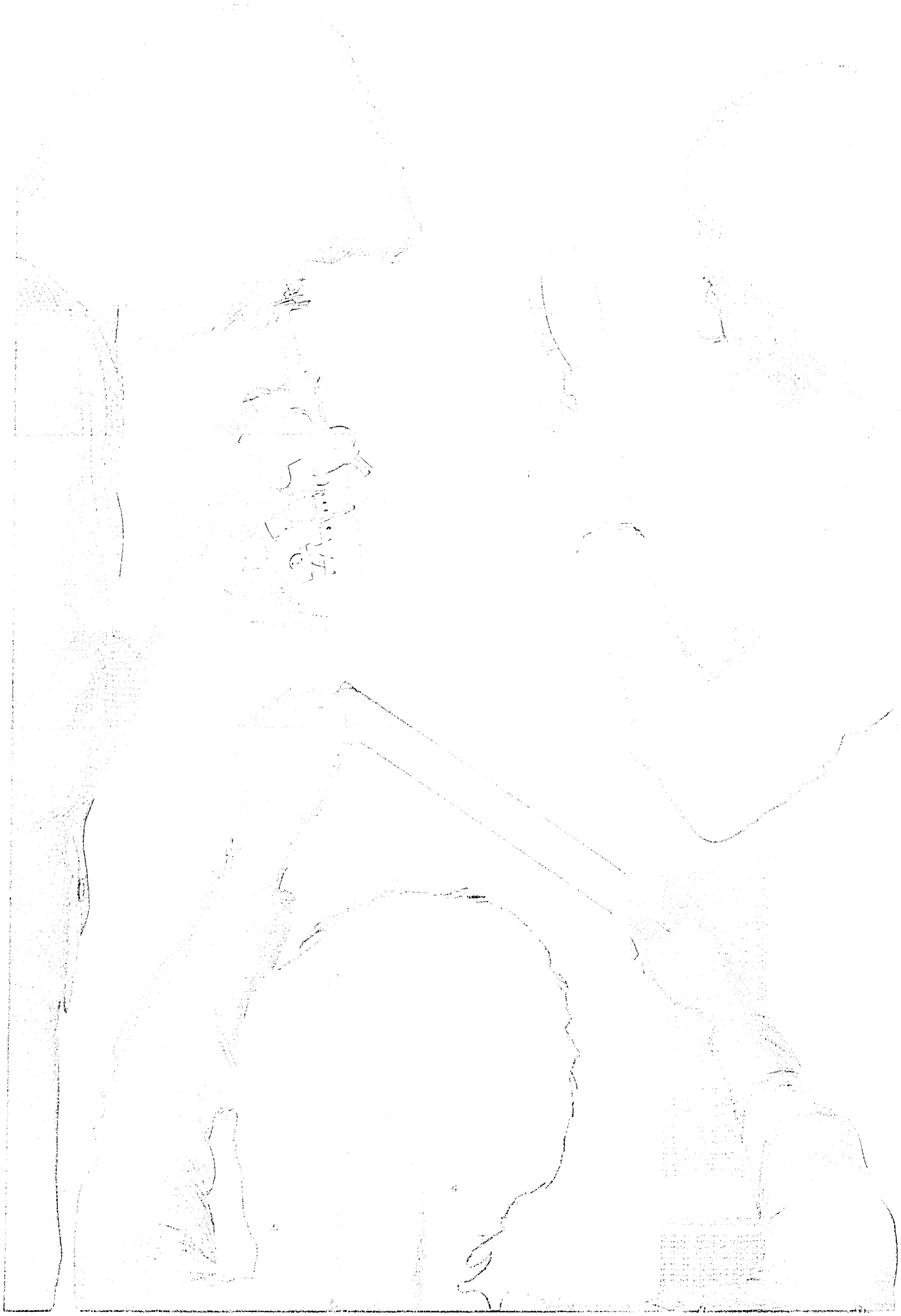
Each study was conducted in a well-lighted, comfortable conference room in an informal atmosphere. Distractions and interruptions were not allowed. Participants worked on one program during each of the four periods of 35 or 45 minutes. Raters who completed a program before the time elapsed were not permitted to go forward or backward and were encouraged to take a break. Participants were asked to work individually and not to discuss the programs during the study.

Thirteen subjective questions on program qualities on a 1 to 7 scale (Fig. 1) were asked for each program, and comments were written on plain sheets of paper. At the end of the fourth time period, participants completed the summary evaluation (Fig. 2).

To preserve anonymity, the administrator copied program comments onto separate sheets prior to distributing them to the author/programmers (approximately one hour after the review for Census and GE subjects). Each participant received two reports. One indicated how his or her program was rated by the other programmers and the second compared how each participant acted as a rater in relation to the others.

In over half of the 195 cases, on any simple question, at least three of the four raters gave the same rating or a rating that differed by one one point. In all other cases, at least two raters showed agreement. These encouraging results indicate that raters are fairly consistent in rating subjective questions. Ratings would probably be even more consistent if the meaning or intent of each question were

PHOTOGRAPH BY STEVE COOPER



The development process metrics provide dramatic evidence of the effectiveness of disciplined team procedures.

discussed prior to the review. Analysis of the difference in the highest and lowest ranking for a program by the four raters shows that in 55.4% of the cases there was a difference of no more than one point.

Of the 15 participants in the three field studies, 10 replied (by a rating of five or more on a scale of 1 to 7, where 7 was the "yes" rating) that they learned something during the peer review process. Twelve people said they would modify their programming behavior to produce good samples if they expected a peer rating semiannually. Eleven believed that peer ratings might improve programming in their organization. Verbal comments made by GE programmers regarding the merits and capabilities of FORTRAN 77 and FORTRAN IV, suggest that the process was educational.

The response to the question about preserving anonymity (nine participants gave ratings of three or less) indicates that, despite precautions, anonymity is a problem. Programmers who work together, who are familiar with the work done in a particular shop, or who assist peers with programs are able to identify the authors of code. Solutions include composing peer rating teams of people who do not work together.

These field trials suggest that peer ratings of programs are productive, enjoyable, and nonthreatening experiences. Such reviews can serve as educational tools and as incentives for programmers to produce higher quality code and submit for semiannual peer reviews. Long-term studies should be undertaken to verify if programmers change behavior when they anticipate peer ratings.

GROUP TESTING

Glenford J. Myers of IBM's System Research Institute conducted an intriguing experiment to validate the effectiveness of individual testing and group testing patterned after code inspections. Category A subjects tested a 63-statement PL/1 string manipulation program individually by using a terminal to execute programs against test cases generated after examining the program specifications. They did not have access to the program listing but could execute it against data files. Category B subjects were given the same environment plus the program listing. Category C subjects were organized into three-person teams and were asked to test the programs manually with the code inspection process. A questionnaire on PL/1 and code inspection experience was used to assign subjects to groups.

The results (Fig. 3) suggest that group testing is only modestly more effective than individual testing, although group testing does consume more time per error found. However, this is not to be taken as an indictment of group processes since the claimed benefits of groups include facilitation of

FIG. 1:
EVALUATION FORM FOR PEER RATING FIELD STUDIES

Evaluation Form **Program Number** ____ **Evaluator Number**

Please make any written comments you wish after each question or on a separate sheet.

	No			Neutral or Don't Know			Yes
1. Were reasonable variable names used?	1	2	3	4	5	6	7
2. Were sufficient and useful comments provided?	1	2	3	4	5	6	7
3. Were spaces and blank lines used properly to produce a program with a pleasing format?	1	2	3	4	5	6	7
4. Was the low-level logic of the program comprehensible?	1	2	3	4	5	6	7
5. Was the high-level design (for example, top-down or modular) apparent and reasonable?	1	2	3	4	5	6	7
6. Was the algorithm a good choice?	1	2	3	4	5	6	7
7. Was this program easy to comprehend overall?	1	2	3	4	5	6	7
8. Would it be easy for you to modify this program?	1	2	3	4	5	6	7
9. Is this program compiler-independent?	1	2	3	4	5	6	7
10. Is this program machine-independent?	1	2	3	4	5	6	7
11. Would you have been proud to have written this program?	1	2	3	4	5	6	7
12. Are the data structures used in a sensible way?	1	2	3	4	5	6	7
13. Would you find it hard to improve this program?	1	2	3	4	5	6	7

FIG. 2:
SUMMARY AND FINAL EVALUATION FORMS FOR PEER RATING FIELD STUDIES

Summary Evaluation **Evaluator Number** ____

Which program was of the highest quality? _____

Which program was of the lowest quality? _____

Which program was second highest in quality? _____

Final Evaluation

	No						Yes
Did you learn anything useful about programming style during the peer review process?	1	2	3	4	5	6	7
Do you think you would modify your programming behavior to produce good sample programs if you were told to expect a peer review every six months?	1	2	3	4	5	6	7
Do you think the peer review process may be effective in improving programming in your organization?	1	2	3	4	5	6	7
Do you think the administrators of the peer review have done their best to preserve your anonymity?	1	2	3	4	5	6	7

General comments about the peer review process and suggestions for improvement

FIG. 3:

RESULTS OF GROUP TESTING EXPERIMENT

	Individual + specs + terminal	Individual + specs + terminal + listing	Group Walkthrough + specs + listing
Number of subjects	16	16	9 (groups of 3 each)
Mean number of errors found	4.5	5.4	5.7
Variance	4.8	5.5	3.0
Range	1-7	2-9	3-9
Man-minutes per error	37	29	75

cooperation, education, and increased reliability. For these reasons, I believe managers would accept the increased cost of group testing even for the modest improvement.

A surprising result of the experiment was the wide variation in which of the 15 known errors the programmers found. Only three errors were found by more than 75% of the subjects. Of the remaining errors, no pattern was found that would indicate some were easy to find and others difficult. This suggests that individuals have radically differing debugging styles.

Myers carries out a hypothetical experiment based on his data and suggests that the best approach is to have two individuals test a program by first working separately to find errors and then pooling their results.

Group processes may be less productive in program testing than in evaluating designs—certainly different behavior is required for these different phases of program development. Defenders of group processes argue that the benefits include supportive feedback, increased desire to demonstrate competence before colleagues, development of trusting relationships and educational opportunities.

An important study was conducted by Victor Basili and Robert W. Reiter Jr. of the University of Maryland in which advanced undergraduates and graduate students, some with professional experience, were assigned to six three-person ad hoc teams and seven three-person disciplined teams; six subjects worked on their own. The ad hoc teams and the individuals could use whatever strategies they perferred while the disciplined teams used chief programmer organization strategies, top down design, a program design language, walkthroughs and code inspections. Each of the 19 software development units (the teams and individuals) designed and implemented a two-pass compiler for an ALGOL-like language requiring over 1,200 lines of code in SIMPL-T, a high-level structured programming language.

Each compilation and execution was automatically copied, thus minimizing interference with normal development processes. Some 130 objective programming metrics were automatically evaluated, focusing on the development process and final product.

The development process metrics provide dramatic evidence of the effectiveness of disciplined team procedures. The average number of computer job steps to complete the project for the disciplined teams was only 75.6, compared with 223.5 for the ad hoc teams and 185.5 for the individuals. Similarly, the average number of program changes, a indicator of the difficulty encountered during development and of the clutter in the programs, was 159.1 for the disciplined teams, compared to 522.7 for the ad hoc teams and 353.0 for the individuals. The superiority of the disciplined teams was at the 1% significance level.

For the final product metrics, the ad hoc teams had greater control flow complexity and had longer programs (1,676.5 lines of code on the average, compared with 1,275.3 for the disciplined teams and only 1,026.7 for the individuals). Metrics indicating data variable organization, modular structure, invocation patterns and inter-routine communication suggested better organizational strategies for the disciplined teams. Time spent on the progject was not monitored so it is hard to assess costs for the implementations.

This experiment makes a strong case for the disciplined team approach when compared with ad hoc teams. Just putting three people into a group does not make it a team—the participants must be trained in group processes and in coordinating their efforts, or the overhead will interfere with productive work. The large number of computer job steps and program changes for the ad hoc teams supports Brooks' aphorism that adding programmers to a late project only delays it further.

GROUP CODE REVIEWS

The effectiveness of group processes as an educational experience was demonstrated in an controlled experiment by Ronald S. Lemos of California State University, Los Angeles. Some 87 undergraduates in three sections of an introductory COBOL course were assigned to an experimental group while 128 undergraduates in four sections of the same course were assigned to the control group. The experimental group subjects brought program listings to class and were organized into three-person groups to review and write critiques of each other's programs. The control group subjects had lectures instead of a group process. The experimental group required significantly fewer runs (3.4 compared to 4.4, on the average) to complete homework assignments. On the final exam, program composition scores were significantly higher for the experimental group (136.2 compared with 108.8, on the average) and comprehension scores were substantially higher (117.1 compared with 84.5, on the average), but did not reach significant levels because of high variance in performance.

These four experiments provide valuable data about human performance in programming. Disciplined group processes are effective in reducing the number of runs necessary to complete a project by helping programmers find bugs and write better code. Code inspections, structured walkthroughs, peer reviews, group testing, and technical reviews apparently encourage cooperation, increase communication, support education, and reduce variation in performance. Group processes may consume a great deal of time, but they are worthwhile investments since they speed the development process, improve the final product, and help to develop a more harmonious work environment.

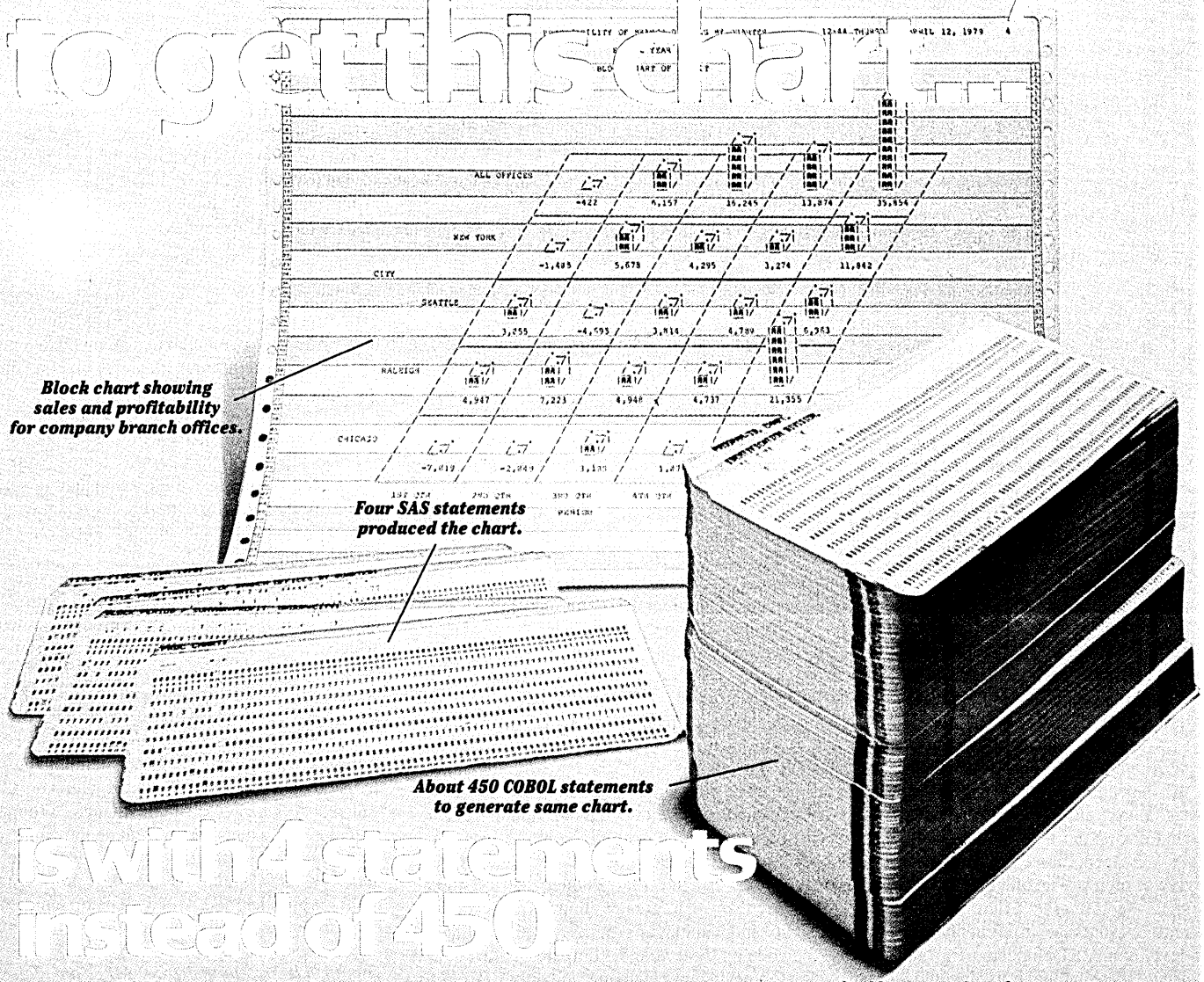
—

This article is adapted from Mr. Shneiderman's forthcoming book, Software Psychology: Human Factors in Computer and Information Systems *(Winthrop Publishers, Cambridge, Mass., January 1980).* ❋

BEN SHNEIDERMAN

Ben Shneiderman, an associate professor of computer science at the University of Maryland, has written five books and 50 technical articles on data base management, programming, and human factors engineering. He is on the editorial board of *Transactions on Database Systems*, was an ACM national lecturer, and is a frequent participant in conferences and in ski-lift lines.

The fastest way to get this chart



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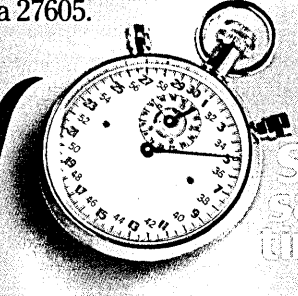

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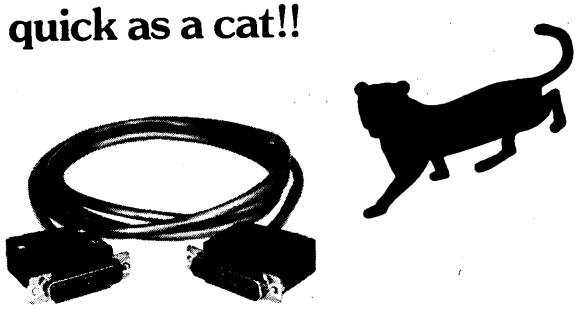

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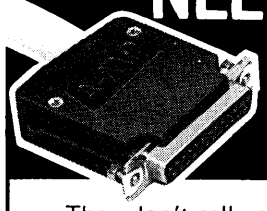

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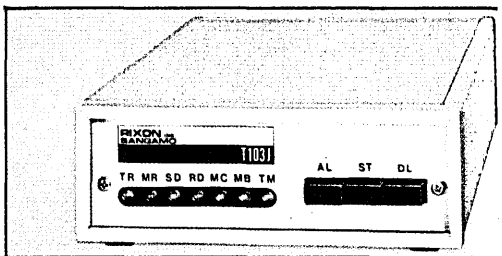

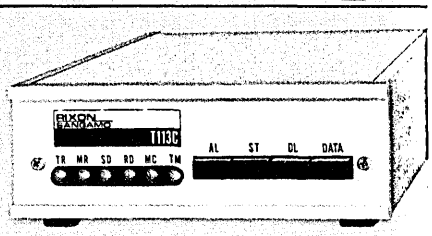

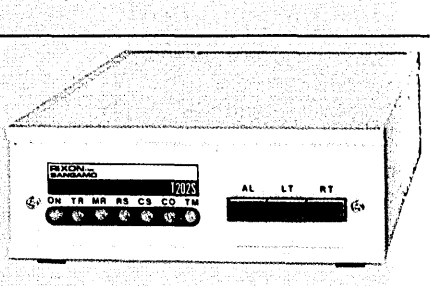

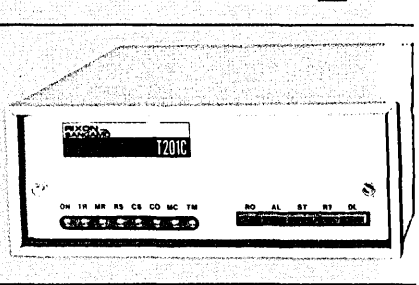

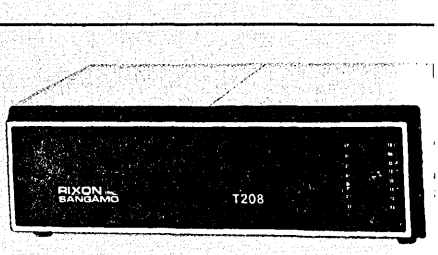

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CIRCLE 104 ON READER CARD

From consultant Bob Patrick's forthcoming Handbook, 15 excerpts that focus on the human factors of designing a distributed system.

A CHECKLIST FOR SYSTEM DESIGN

by Robert L. Patrick

This article is based on a book, Application Design Handbook for Distributed Systems, *by Bob Patrick, consultant and longtime* DATAMATION *advisor, which is scheduled for release by CBI Publishing Co., Inc., of Boston, in late February. The first chapter views distributed systems from the vantage point of the senior manager approving the project; it discusses economics, life-cycle costs, and technical factors affecting the financial break-even point.*

The second chapter takes the project manager's viewpoint and enumerates 95 separate activities that must be addressed during the development, installation, and operation of a distributed system. This checklist is organized by development phases and gives special attention to project management, business systems requirements, conversion, systems maintenance, and the operation of the system after development is over.

The bulk of the manual is devoted to the enumeration of 186 design hints. Each of the 186 items describes an idea and tells how it has been used successfully.

Patrick does not claim the coverage is exhaustive. He notes the rapidly developing state of the art in designing distributed systems, and plans to update this book in a few years to reflect improved design practices. The excerpts reflect primarily human factors aspects of distributed systems design; the book, however, covers distributed data, reliable systems, network operation and troubleshooting, standards, and several other major topics.

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43. *User Organization*. In addition to tuning the system design to the user's capabilities, sometimes the user's organization and the support organization also must be tuned so production operations and continuing service can be successfully conducted. When processing and data are distributed, responsibility is distributed. If user management is too busy, unwilling, or incapable of accepting the responsibility for system administration, service, security, training, and some of the responsibility for problem determination and recovery, then a distributed system is likely to be unsuccessful. Education, training, and user participation in the design are the best ways to avoid this problem.

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80. *Preliminary Operator's Manual*. After a preliminary design is prepared, surprising benefits result if the design team next produces an operator's manual. If the operators review the manual while the detail design is proceeding, you will receive feedback from your community of users which allows human factors considerations to be inserted into the design early. In addition to a system overview, the operator's manual should cover morning startup, routine processing, evening cleanup, abnormal cyclic processing, special runs, and recovery actions.

Most designers recognize two modes of man-machine interaction; namely, the infrequently used function, and the routine high volume activity. If separate sets of standards are devised to govern each type of dialog, then the protocols for all the infrequently used commands will be the same. While the high volume, frequent activities may be different, they too will share a (different) common protocol. The goal should be to allow infrequent activities to be successfully performed with a minimum of error, while frequent activities are fast and easy to do.

81. *Built-in Training Mode*. Preliminary design time is not too early for the designer to plan additional support and service functions that are relatively easy to include if considered early enough. For example, unless an installation is so huge that operator training can be delegated to a training team and conducted on a computer dedicated to that purpose, the training of replacement operators (or the retraining of operators transferred from section to section, and the retreading of trained operators who have been on leave or assigned elsewhere) suggests the system include a training mode that will allow operators to familiarize themselves with the system without damaging live data files. If the log-on sequence provides for a training mode and if message processing programs are conditioned by that mode, operators can log-on for practice and reference a sample file for training purposes.

Similarly, system exercises can be easily prepared if a terminal can be logged-on in a test mode. The terminal can use production program modules but have its outputs derived from, or its inputs compared to, a set of sample test files.

•

82. *Built-in Statistics*. If systems level workload statistics are desired, a designer should try to record total activity and the rate of that activity. For instance, a run-time parameter could control how often the activity statistics are sampled. If the parameter were set to one hour, then the counters would be reset to zero once each hour and activity would be accumulated over the set time period. At the end of each time period the totals could be optionally saved while they are being added to the previous totals. This of course would require two areas for storing activity statistics, one for the detail counts and one for the accumulated sums.

As a minimum, one might consider counting the number of transactions from each screen and counting the number of outbound messages returned to that screen. If one also counted disk accesses, messages to and from the communication lines, and lines

A good on-line system design couples the computer intimately to the workforce at the terminals.

printed, a good measure of overall activity would result.

If the lengths of the various processing queues were stored adjacent to these activity statistics, then a single command executed at the end of a preset time period could record the activity which transpired during that period and the lengths of the queues at the end of the period. In addition to being useful for reporting and planning purposes, this activity table would be useful whenever the system crashed, upon restart, and immediately prior to shutdown.

•

91. *Living with Error*. In a batch system we customarily abort the job step whenever an "uncorrectable" error occurs. By this means, human intervention is obtained for conditions that occur too infrequently to warrant programming. However, in a distributed on-line system, a new philosophy is required. At the risk of overstating the obvious, an on-line system should never abort. Therefore, some of those infrequently occurring circumstances must be accommodated by programming. The remainder must be recognized and set aside in some meaningful fashion so human intervention can be requested. However, while the person is solving that problem, the system should continue to process transactions not related to the troublesome case and must queue all transactions which are logically dependent upon the case being investigated.

In the rare case of a nonrecoverable system error, the system still cannot abort but must do an orderly shutdown or chaos will result. For instance, if log messages are being blocked in a buffer, a controlled shutdown will cause the buffer to be written onto the storage device. A long-running background application should be programmed so it will respond to a request for orderly shutdown and clear its queues, write end-of-file, and take a checkpoint so it can be restored without loss of the computing performed to date. This is particularly important if a background application was maintaining an on-line disk file, since backout of all changes made to the point of interruption and then rerun of the job from its beginning may be unreasonably slow tasks.

The complement situation occurs in a large network when a system or node is restarted. Status indicators must be checked to see if all applications were completed prior to the shutdown or whether some application must be restarted partially through its processing. Priorities in communication messages were briefly mentioned some pages earlier in this handbook. While some networks require priority in messages to synchronize clocks, perform problem diagnosis, or start beginning-of-day activities, a system which contains application programs that are sufficiently long running to require orderly shutdown and restart in times of emergency also requires message priority carried over into the application. Then the predecessor messages contained in the queues when the checkpoint was taken are processed before recently entered current transactions.

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93. *Trouble Indicators*. System operators have long used response time, at any level of transaction volume, as an indicator of a system's health. Thus, if terminal response time deviates significantly from the expected response time at a given level of transaction load, an alarm is sounded so the support staff can determine whether diagnostics are in order.

Another technique that is easier to implement (and is in some ways more informative) calls for threshold limit checks on all queues maintained by the application. These limit checks detect abnormal conditions and sound the alarm *before* the queue overflows or uncontrolled lockout occurs. The abnormal conditions are reported to the support center staff and processed by an abnormal condition module which is empowered to change priorities, shut off inputs, or take snapshots while the support staff is diagnosing the problem.

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97. *Terminal Blackout Time*. During a diagnosis or recovery process, the problem determination program sometimes seizes exclusive control over the data base. If the system is to be programmed so partial operation can be restored as soon as recovery is partly accomplished, then the diagnostic program should set a maximum lockout time parameter so it voluntarily relinquishes control to production modules periodically. Otherwise the terminal service on the restored portion of the system will suffer unnecessarily.

"Maximum blackout time" is the time period during which an operator's screen goes dark while the system is recovering. Each application and each environment differs in its tolerance for blackout. If natural recovery time for frequently occurring problems exceeds the user's blackout tolerance, then designers must seriously address problem determination/recovery activities.

In large batch systems a multistep job occasionally must be restarted at the beginning of the job, losing a few hours of processing time. While this may be the simplest type of recovery to program, it is usually unacceptable in an on-line environment. Thus special programs are required to assess the status of the data base, and special data base structures are required which contain sufficient redundancy to support this assessment. The entire file system must be designed so the file set can be partially locked, allowing production operation on the surviving members while the records in error are reconstructed. Thus the maximum time of total blackout is reduced even though the partial blackout may apply to some records for an extended period of time.

•

108. *Usage and Service*. For many years, the administrators of large host systems have configured to their average workload in an attempt to keep the systems fully occupied 24 hours a day. They have been encouraged to operate in this manner by auditors who were acutely aware of the cost of a central computer facility.

In contrast, on-line systems are traditionally configured for their peak loads. This guarantees that terminal response time will not suffer during periods of maximum activity, and as a corollary, leaves some unused capacity during their off-peak hours. Some designers resist attempts by financial managers to use this surplus capacity as it always results in queues, priorities, and complexity. Other designers attempt to manipulate the real world so the peaks are not so pronounced and the peak hour tends to approximate the average load. Sometimes a compromise is in order if configuring for the peak requires hardware or software that may not be available, or if the price difference between a configuration for the peak and an average configuration is drastically different.

If an attempt has been made to reduce the peak load, but if the remaining load still taxes the installed capacity, the designer can build a transaction dispatcher on the front of his application that appends a priority to each transaction upon receipt and queues it appropriately. Then the queues can be processsed in accordance with the available capacity, and the designer need not depend on special conditioned behavior by the workforce.

•

109. *Human Factors*. A good on-line system design couples the computer intimately to the workforce at the terminals. There are several systems aspects which promote that coupling. The following considerations are typical:

A. Some operator commands imply a secondary action; i.e., "if the number of persons taking a tour is changed, the price of the tour package must be recalculated." The application's command processor should be programmed so the secondary action is automatic unless canceled by the operator. To do otherwise would allow an untrained or inattentive operator to affect the integrity of the files.

B. Similarly, if the system is carrying on an interactive dialog with an operator and if the next information request is obvious, the computer should be programmed to present the next message voluntarily without

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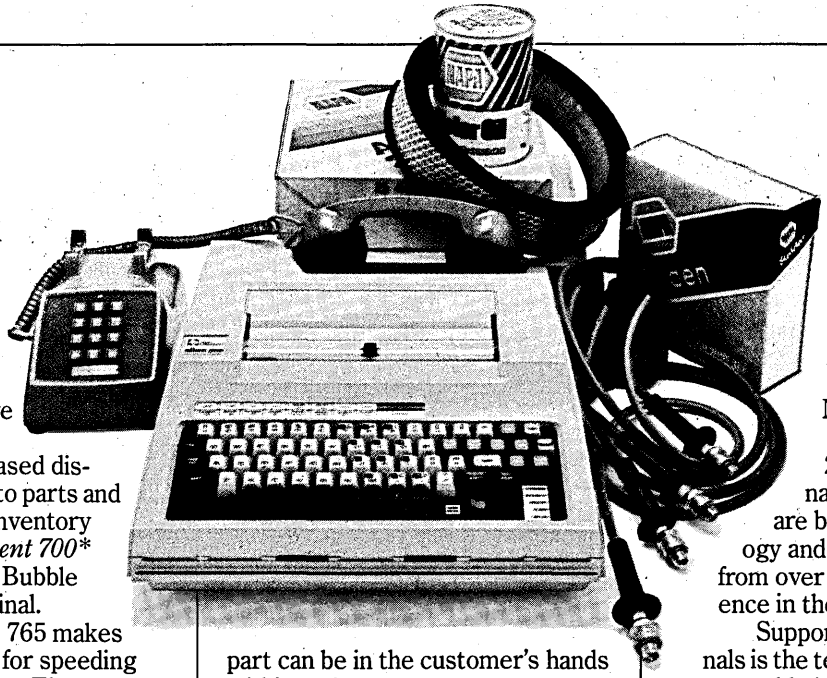

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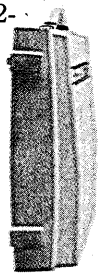

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CIRCLE 105 ON READER CARD

Companies with large systems should consider retraining employes who return from leave or are transferred to other units.

waiting for operator input.

C. Many systems contain a table of authorized users and their access privileges. Thus, at sign-on time, the operator's name is located in the table before access is given and if the name matches, the privileges allowed this operator are authorized.

D. Along the same line, extensive coding or heavy abbreviation in computer responses usually implies a need for increased operator training and a code book among the operator documentation to decode the abbreviations. Some designers code the responses heavily for the proficient operator and then implement a MORE command which causes the full text of the appropriate code book section to be printed out on-line whenever requested.

E. The administrative system surrounding the computer should be designed concurrently with the computer programs. If paper files are kept or human assistance is required to complete some function, a general rule dictates that the computer be programmed to make the human's job easier. This is true even when extensive computer programming is required. An example will illustrate this point: If the computer files are not in sequence on the same key that is used for references in the external physical world, sort the outputs from computer processing into real world sequence before printing or queueing for display.

F. If one of the primary purposes of an on-line system is to support on-line query, the designer should seriously consider allowing each authorized user to catalog search commands for repeated use. Thus a stock broker monitoring the performance of the market for a series of clients or the flight dispatcher monitoring the status of all departing planes, or a physician inquiring about certain patients, could enter queries into their private catalog. Some personal shorthand notation could then be used to invoke those queries and receive the computer's response.

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110. *Administrative Features.* A lean, unadorned, strictly functional network is hard to administer because the persons responsible for its administration cannot observe what is happening and may not even know all the principal players. Designers concerned about system administration should consider the following:

A. Establish one cell in each node to count errors. Then as each operator message is constructed, increment the cell and append it to the message.

B. If an application is designed so that all the message traffic between the application and the terminal operators goes through a single module, the stage is set for the construction of a useful debug tool. The module can log all traffic through it and append codes to each message log entry indicating which party (the computer or the person) originated the message, and which terminal-operator pair is involved in the dialog.

The system administrator should be able to request that the monitor ignore all the traffic and make no logs, select only the messages involving a specific person, select only the messages involving a single terminal, select all the messages involving a single loop or communications line, or record all of the system's interactive dialog regardless of source.

During debugging the monitor module can be set to capture information for debugging purposes, and after the system is in operation, the module can be reenabled any time a terminal or line proves troublesome.

C. If several processors are interconnected in a net, the computer console operators will benefit from a high priority, operator-to-operator, hard-copy communications mode.

D. Small systems are frequently installed with the minimum number of necessary hardware devices. If the only printer attached to a node goes down, the entire site can be impacted if clerical procedures are vitally dependent upon hard-copy output. Therefore, a good practice would call for a header on each print file containing the site identification, the report name, the number of pages in the report, the preprinted form number this report expects, the program producing the report, the date the report was produced, the security classification of the data in the report, and any instructions for special handling. This header should be printed as the first page of the report, since it uniquely identifies the report and provides instructions to the operator concerning the handling of the printed copy. If ever it becomes necessary to transmit the entire report to an adjacent node for remote printing, the report would be self-defining.

E. If data is distributed through a network, the replicated data bases must sometimes be synchronized. If the system cannot be shut down but if update transactions can be temporarily deferred, provide for a queue at each local node to capture update transactions against a data base that is in HOLD status. Further, program the inquiry processes to respect the HOLD status and to display a comment as part of an interactive query which says: "Data current to ————, may not contain latest information."

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117. *Human Factors Hints.* Experience also yields some hints to be used in the design of the man-machine dialog itself:

A. Keep date and time of last update in the data base. Display this information on screens and reports to identify currency of information presented.

B. When designing interactive commercial systems, segregate all transactions into uniform classes based on complexity and the terminal operator's tolerance for delay. Design the system internally to provide uniform response to each transaction class regardless of load.

C. Operating systems software should provide service priorities. Applications should be designed to place production keyboarding at the highest priority; with other man-machine dialogs next, telecommunications next to that, and electromechanical devices (such as printers) last. Then deterioration in print performance is an indication that saturation is occurring.

D. When inputting on a screen, request the data in the units most natural to the user, allowing the computer to perform the necessary conversion. Always display the units alongside the input variables.

E. For fill-in-blanks record creation, split the screen and set aside a small area for machine-man dialog. This allows the machine to initiate (or the operator to request) information messages without disturbing a partially completed screen.

F. Choose a consistent vocabulary and use it uniformly for operator prompts and crt-to-operator instructions. Words like "Avenue" and "Ave." should be treated as synonyms.

G. Punctuate or otherwise break long fields of numbers to improve readability: 213/871-4320 or 430-74-0447.

H. Establish a convention for handling missing data: .00 for dollar amounts, ... for alphabetic characters, - - for an alphabetic field.

I. When the computer displays a variable length list on crt, use a standard technique to indicate end-of-list.

J. When an error is detected in a small transaction, it is usually acceptable to reject the entire transaction. However, if the transaction is large or complex, allow rekeying of just the fields in error.

K. For applications with multiple crt screens, put a unique ID on each screen for reference purposes.

L. Consider adopting the following good protocol: any record to be modified must first be viewed.

M. Sometimes crt screens are used for data entry where the paper input data forms are not subject to change. If the input data forms cannot be changed, it is preferable to lay out the screen to correspond to the input data form, rather than asking an operator to extract fields randomly from the input data form for entry into some "optimum" screen design.

N. In prompted interactive dialogs, provide a fast path for highly skilled terminal operators.

O. Build a display option into the end

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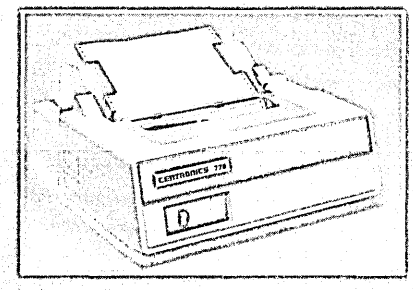

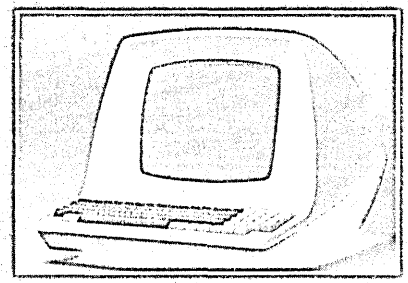

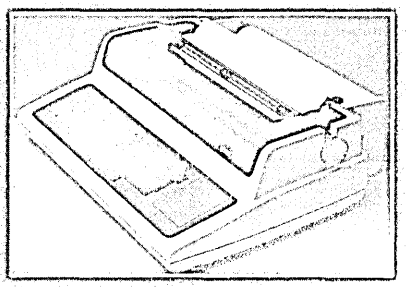

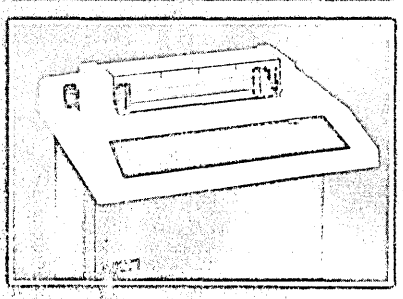

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CIRCLE 73 ON READER CARD

Although a system has sophisticated communications protocols, the main part of the conversion chore must be faced by the design team.

of message processing in a data capture application. Then if the operator becomes confused or distracted, he need merely request a display of the last transaction entered to regain his place in the sequence.

P. When presenting search results on crt screens, label every variable and give its units.

Q. In a big system give attention to the human factors of error/diagnostic message displays to avoid saturating the console operator with uncorrelated data.

•

136. *Specific Process Controls.* In addition to the global controls, some specifics deserve consideration:

A. If controls are planned from the start, the designer will consider:

1. Count of transactions from each screen.
2. Counts on populations in queues.
3. Counts on numbers of outbound messages to screens.
4. Counts on communication lines traffic.
5. Arithmetic totals for all like fields (dollar amounts).
6. Placement of all totals in a compact table so they can be readily formatted for display and used for problem determination and restart.

B. Every data set should have a header which dynamically records the time and date of the last update, the program performing the last update, and the number of items currently in the file.

Financial files should carry an extra date to indicate when the file was "closed" to additional input.

C. It is traditional in editing to build in special controls over big ticket, unusual occurrence, and catastrophe-if-wrong items.

D. If primary identifiers carry a check digit, if transactions are prenumbered at the source, or if prenumbered forms are used, the computer should check these descriptors upon input.

E. If programs are cataloged in several locations throughout the network, then each program should store a change level number. This number can be used to verify the applicability of future changes and to guide the troubleshooting process.

•

139. *Training Features.* When a lifecycle approach is taken to design, the attention given to several aspects of the system usually changes. One function frequently given increased attention is training. Many systems have been installed in which training was treated as a one-shot activity conducted at the time the system was implemented. Training courses are usually planned, definitive examples prepared, and coaches are provided during the initial system installation.

However, what happens when there is turnover in the workforce? What happens when a new site is added to the network? How are new features and enhancements introduced? What if there is movement in the user organization and whole activities are reassigned to personnel at a new location?

Usually ongoing training is left to the users themselves. Training materials are not mantained, examples become obsolete, and since test data sets are seldom retained, the new operator goes live from the beginning.

In small systems with low turnover this may be satisfactory. With large systems, training of new employees and retraining of existing employees as they return from leave or assignment or are transferred from unit to unit should be considered.

Previous items in this handbook have suggested that a few lines at the bottom of the screen be set aside, that some operator documentation be maintained on-line, and that users be provided with a HELP command so they can get information in context when it is needed. Other items have suggested that the users' skill level be maintained in the authorization table used at sign-on time and that this skill code be used to condition the system's response to the user. Heavy abbreviation should not be used in comments to unskilled users, while skilled users should still be able to use acronyms and codes to communicate with the machine and reduce keyboarding.

Another item has suggested the implementation of a training mode so trainees are restricted from the global system commands which could cause trouble, and the provision of special training data sets so inexperienced users can use production programs on test data without disturbing the main data base. Some additional thoughts along this line are as follows:

A. The training mode should be designed to keep track of the training, so the trainee may be provided with an evaluation of his efforts at the end of the session.

B. Some systems provide selection from command menus as a way to progress through a command hierarchy, and others prompt users in an interactive dialog when data is desired from an inexperienced user. Almost all users appreciate these features when they are initially introduced to a system, but find such interaction laborious after some proficiency is gained. Thus some systems have provided a fill-in-the-blanks mode for experienced users.

C. Some systems have provided special commands to allow a second terminal to be slaved to the first terminal so a coach may follow the interactive dialog of his pupil without disturbing the training session.

D. For complex systems which support interactive searching, a library of proven search commands if frequently maintained. Thus the experienced searcher need not rekey a lengthy search command every time he wishes to invoke it.

These libraries provide useful training information that suggests how the system should be used for certain purposes.

E. The designers of one distributed system provided the ability to downline load training material whenever the system was changed and enhanced. Then as each operator reviewed the training material, their operator IDs were appended to a list. These lists were remotely accessible, and this allowed the training administrators at the central site to determine how large a population of users had viewed the training material and hence, when the new features could be scheduled for production operation.

•

158. *Conversion Strategy.* People, files, and physical facilities must be converted before a new system can operate successfully. If people are scarce and the workload is heavy, spare time may not be available to devote to training. Thus temporary staff or overtime may be required to give the present staff enough relief so they can start to assimilate the new system.

If the current system is automated and if the goal is merely to migrate existing system functions outboard, file conversion chores may be minimized. However, if the data resides in manual files of if automated files lack key data elements or if the integrity of the existing automated system is not satisfactory, file conversion tasks can vary from significant to formidable.

If the user occupies a crowded space or if there is equipment already installed that occupies crowded space, there may not be enough room to install new equipment. Further, the installation of new equipment and its cabling usually requires some disruption to the current operation. Depending on the company and the current situation, getting a few hundred square feet near stable power in a benign environment, with good access to overhead or underfloor cable runs, may be a time-consuming political chore.

If a system exists and if that system is vital to the daily operation of the work unit, the management may not allow an entirely new replacement system to be brought in and installed in a single series of events. Despite the experience of others, they may not trust the equipment, the software, the development team, or the schedules.

If this is the case, then an installation strategy requiring complete cutover in a short period of time may be unacceptable. The basic design may need rework so a system can be installed in increments and still provide useful function between the installation intervals. This will allow managers of previously unautomated functions to phase the introduc-

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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Reality® by Microdata

CIRCLE 107 ON READER CARD

People, files, and physical facilities must be converted before a new system can operate successfully.

tion of the system into their operations and stretch out the time for user training and systems assimilation.

Although you may be installing a system which has sophisticated communications protocols, can emulate the terminal system you are replacing, and has hardware and software designed for easy installation, the main part of the conversion chore remains to be faced by the design team. How much change can the user tolerate, how fast can he absorb increments of change, how does the system operate between those intervals, how many versions of the documentation and how many training short courses will be required? Can all of this be accomplished so any one set of changes can be backed out and the previous stable operation restored in the event serious trouble is encountered?

In addition, very big systems will tax the ability of the development project to install them. Even with the most ornate preparations, several hundred processors will be a chore to install. Even if the programming were perfectly done, obtaining communication circuits, resolving problems with physical facilities, and training a thousand or more people is a formidable undertaking. Therefore practical considerations dictate that multiple simultaneous installations be deferred until a few pilot installations have been established, load tests have been performed, training materials have been revised, and an articulated installation plan has been prepared. This may result in a carefully phased cutover extending from one to two years with oversize HELP groups being required to support the varying levels of user skill and systems maturity until all systems are installed and settle down.

•

182. *Post-Installation Audit.* The proper scheduling of the post-installation audit depends on the complexity of the system and the skills of the operational staff. While the operational crew is still learning at a rapid rate, things will not be routine. After a normal routine is established and each person has had an opportunity to use the training he received, and all major flaws (if any) have been corrected, the site administrator should request an operational audit.

A knowledgeable, independent, objective person should lead the audit. Ideally, this person would have had no part in the design, nor be responsible for any of the operation. The proper audit team would consist of one of the designers, one of the programmers, and a senior member of the operations staff. The goals of the project should be reviewed and each of the functions provided should be evaluated.

Each post-installation audit should conclude with an audit report. The contents of this report should cover the features planned versus the features delivered, the original schedule versus the final schedule, the original development cost estimate versus the actual cost incurred, and conclude with an enumeration of the flaws that still require correction. If the requirements changed during the development process or if the live environment and its staff differed from the planned environment, or if the project was reestimated and rescheduled one or more times during the development period, these matters should be covered in an appendix.

The purpose of a post-installation audit is to learn from your strengths so they can be repeated and to document your mistakes so they can be avoided. Some development organizations are not self-confident enough to stand a critical review and evaluation (even if it is conducted objectively by an independent party). In these cases, dispense with the post-installation audit as it is likely to be counterproductive. ✲

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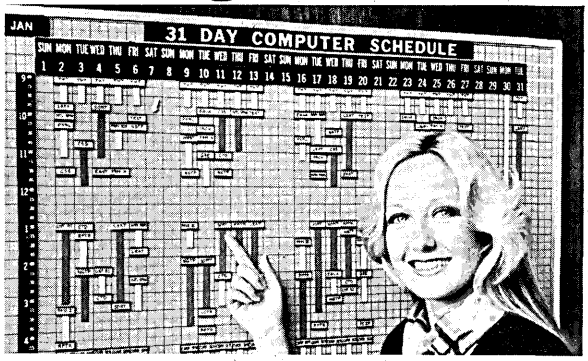

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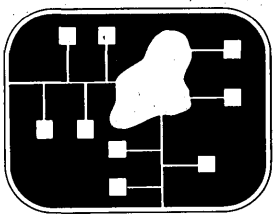

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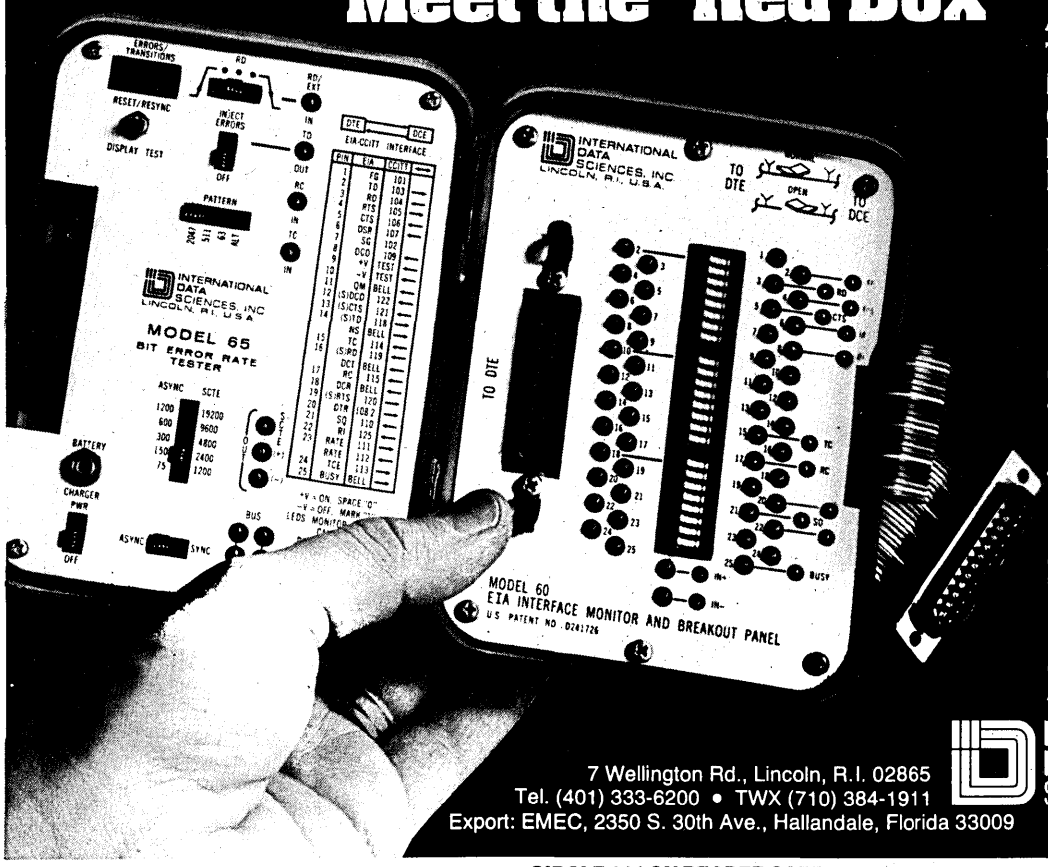

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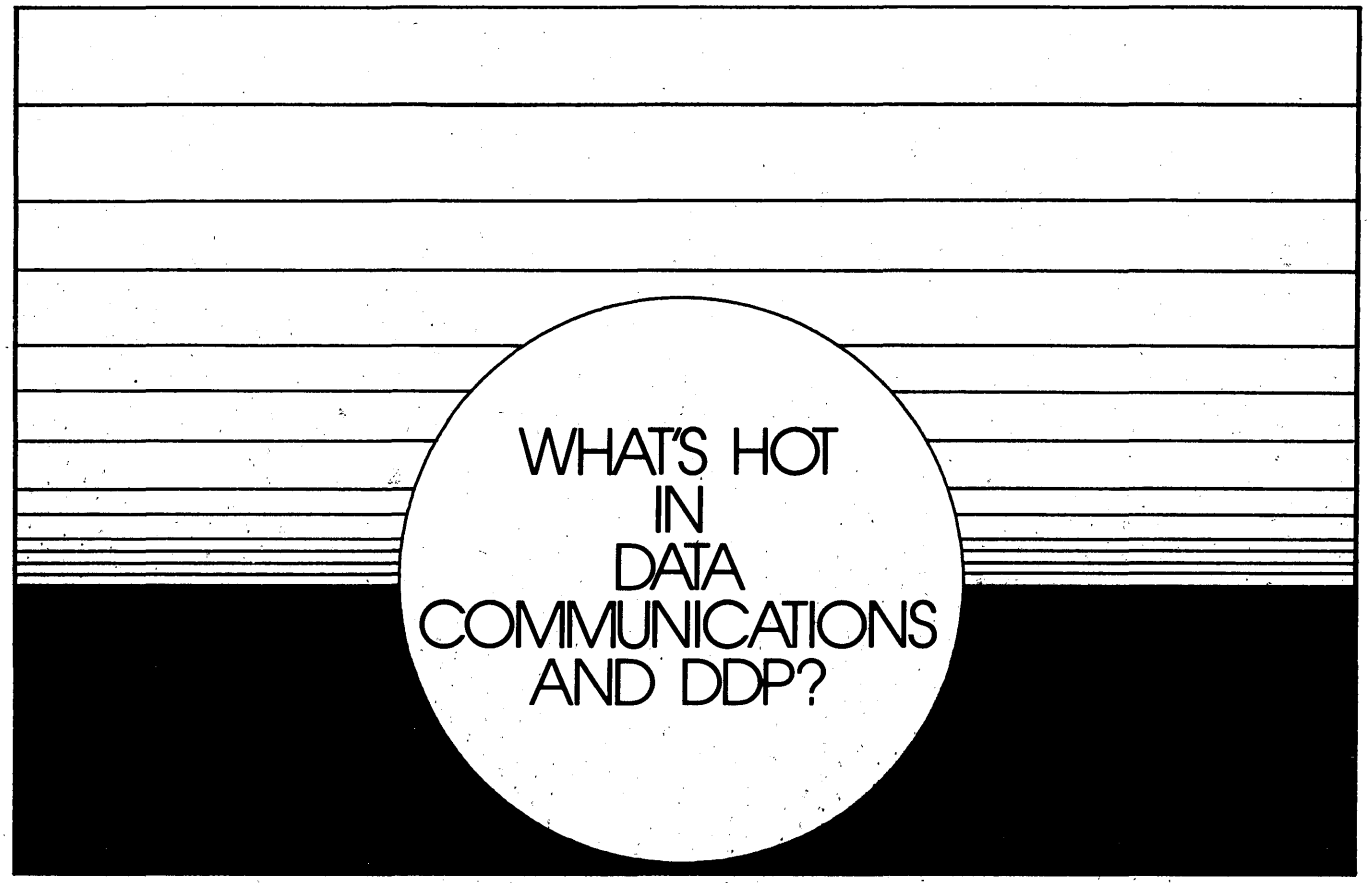

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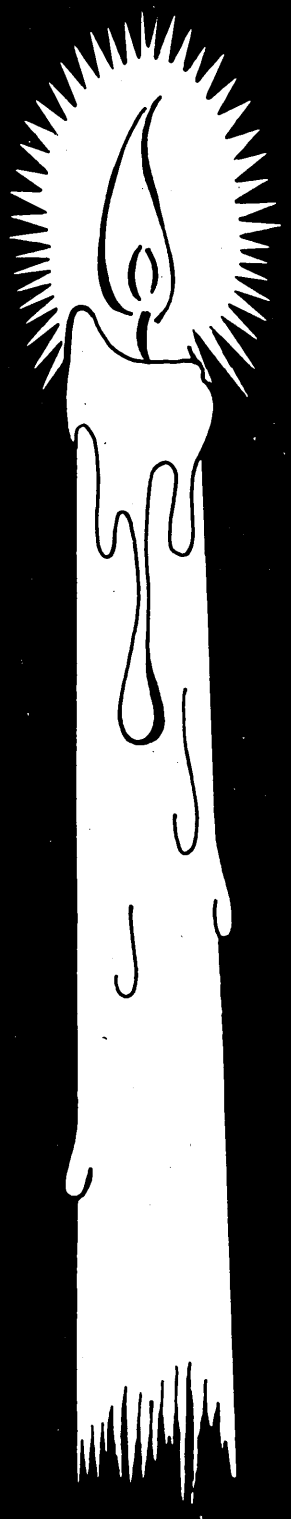

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The buzzwords of the past are examined; many are found to have no future.

BUZZWORDS REVISITED

by Werner L. Frank

New ideas are often christened with catchy names in order to promote research and developmental support. A great name or a new acronym can do wonders for sales literature and trade journal articles and can possibly influence buyers to join the bandwagon. Now, on the threshhold of the '80s, we have decided to review the buzzwords of the past, and categorize them by levels of realization (Tables I and II).

Most of the failures in Software Development, shown in columns A and B (Table I) relate to Programming Languages. The hunger for better implementation tools suggested by these buzzwords has not been fulfilled. Nothing today suggests possible breakthroughs in these directions, and we reluctantly put these ambitions to rest. Also, despite vast efforts by research organizations and the commercial world, COBOL and FORTRAN and their derivatives (PL/I, BASIC, etc.) remain the Higher Order Languages. Of all the efforts to promote Problem Oriented Language, only one, APT, used in numerical control systems, can be considered a success.

Automatic Programming fell into disuse in the '60s and is now an archaic term. Soon thereafter, the Universal Computer Oriented Language (UNCOL) failed, despite initial optimism.

A second attempt at universality was the International Algebraic Language (IAL). This would have supplanted FORTRAN and ALGOL as "algebraic" or scientific programming languages. IAL activity died quietly.

Decision Tables looked good in the late '50s and early '60s, but where can you find these techniques in use today?

With the failure of UNCOL and IAL, attention turned to brute force methods to achieve machine-to-machine transportability. These efforts did not gather much support or generate results.

The most surprising fall from poularity has been the sacred Flow Chart. In the '60s and early '70s, good programming demanded flow charts as the basis for design and documentation. Applied Data Research, Inc., today is a leading software vendor because of early success with AUTOFLOW, an automatic flow chart system. Now, flow charts have been replaced by other documentation techniques, and sales of AUTOFLOW have dropped to less than 50 a year from a high of 300.

Other organizational techniques to increase code production included Program Generator, Modular Programming, On-Line Programming, and Nonprocedural Languages. The Program Generator, unless embodied in the new Application Generator, has disappeared completely. The remaining terms are still popular, but where are the results? There is no convincing proof that On-Line Programming is more cost effective than conventional approaches.

The Systems and Organization classification has the clear failures of Automated Display Systems, Associative Memories, Content Addressable Memories, Hierarchical Storage, Polymorphic Systems, and Self-Organizing Systems. The early '60s heard fanfare about fully automated displays to produce real-time, large screen color display from computer-generated information. While a lot of money was spent on systems such as Iconorama and Eidiphor, the usefulness of the technique seemed questionable and the crt terminal took over. Color displays are comparatively rare even today. Only at the end of 1979 did IBM announce color for its crt terminal product line.

Associative and Content Addressable Memories are still being researched. Software techniques and low-cost semiconductor memories have largely replaced the hardware effort and relational data base concepts may be the eventual substitution.

Hierarchical Storage was the ability to automatically "trickle" data from low-speed, slow access to high-speed, fast access storage as a function of need and frequency of use. Where are these systems?

GRACEFUL AND BEAUTIFUL

The Polymorphic System was a multicomputer system of many parallel, non-homogenous cpus and peripherals with electronic switching between modules. The approach was an overkill plunge into today's IBM Attached Processor concept or Tandem's "nonstop" computer.

Another popular term in the early '70s was "Graceful Degradation." The words were beautiful, but we now prefer "Startup" and "Recovery Procedures." Presumably these techniques are not graceful.

And what about Project Evaluation and Review Techniques (PERT) and Critical Path Method (CPM)? These project planning and computer monitoring systems, the rage of the '60s, were required by government procurements for use in project management. PERT charts abounded in every proposal and subsequent operations report. Eventually, however, PERT and CPM charts soon degenerated to simple milestone schedules and Gantt charts.

A favorite term of the '60s, suggesting a new generation of software production and capacity, was Firmware. Today, the word is an unpopular way to describe hardware-related means of writing and executing computer code as "microcoded instruction executed in a controlled access memory, and as "locked up" code executed in read-only memories.

Another phrase looking for a home is Facility Management. This was an important movement when it seemed that corporations would turn over their facilities, personnel, and problems to third-party professionals. How many new Facility Management contracts are now signed each year? The concept seems virtually dead, although it will never completely disappear.

The Sole Category C survivors are in communications, where two major systems concepts have dominated the '70s: Value-Added Networks and Packet Switching. Both have commercial presence, and it's only a matter of time until wide dissemination occurs.

Under Application, we find Management Information Systems. MIS was to be the strategic and decision-making aspect of dp-support systems as contrasted with tactical or operational-oriented applications. Language Translation was highly motivated by federal government and political and intelligence needs, but the technological breakthrough never came to automate this process economically.

Also very close to falling into disuse

TABLE I. CURRENT STATUS OF OLD BUZZWORDS

	CATEGORY		
CLASSIFICATION	**A. "Insignificant impact, unproven, has practically disappeared"**	**B. "Low profile, not yet significant, may still make it"**	**C. "Prospects look good, not yet fully accepted or respectable"**
Software Development	Higher Order Language Automatic Programming Universal Computer Oriented Language Implicit Programming International Algebraic Language Software Transportability	Problem Oriented Language Decision Tables Flow Chart Program Generator	Modular Programming On-Line Programimng Nonprocedural Languages Software Products
Systems/Organizations	Automated Display Systems Associative Memory Content Addressable Memory Hierarchical Storage Polymorphic Systems Self-Organizing Systems Graceful Degradation Integrated Data Base PERT/CPM	Multicomputers Automated Resource Allocation Self-Diagnostic Systems Parallel Computing Firmware Facility Management	Value Added Network Packet Switching
Application	Management Information Systems Language Translation	Automatic Abstracting Computer Assisted Instruction Pattern Recognition Automated Factory Artificial Intelligence Medical Diagnosis	Source Data Entry Word Processing

are Automatic Abstracting, Computer Assisted Instruction, and Pattern Recognition. Computer Assisted Instruction, CAI, was to be a pivotal application. Hopes were high for upgrading the learning process. CAI struggles along now with little economic impact, although due to the microprocessors in electronic educational toys, CAI could be a sleeping giant. Pattern Recognition as a discipline has not led to a specific product. If it exists at all, it is relegated to the research laboratory setting.

Three applications—Automated Factory, Artificial Intelligence, and Medical Diagnosis—are still kicking, but their labels are archaic. The Automated Factory is progressing nicely, and a vast untapped potential has become available as a result of microprocessors. Artificial potential has made progress, and more is expected. Rather than achieving human-like behavior from machines, however, emphasis is on the production of specialized systems performing a specific job Early researchers thought modern medicine would be highly computer-dependent in diagnosis. This simply is an idea whose time has not come. Instead, medicine has made unusual, unpredictable advances in applying microelectronics to diagnostic systems and patient monitoring devices.

Source Data Entry and Word Processing were highly touted applications during the last 10 years and have now reached levels of acceptability and commercial visability. Source Data Entry springs from the fundamental premise that data should be handled only once, preferably at its origin.

The introduction of microelectronics and specialized, handheld devices will increase the opportunity for automated data capture. Word processing is a specialized aspect of source data entry, and soon, few medium-sized offices will be without at least one computer-based text-handling device.

PROMISING IDEAS FOR SOFTWARE

In the years ahead, our strongest needs are going to be productivity enhancements in software development. Table II suggests a plethora of ideas that show promise.

People are still waiting for Advanced Languages. Prior lack of success in breaking out of COBOL and FORTRAN seems not to have lessened enthusiasm. Application developers are desperately seeking a superior mode of expressing problem solutions that will enhance implementation productivity. The major current efforts are in PASCAL and in the Department of Defense (see DATAMATION, July 1979, p. 142).

Many people have recognized Procedural Languages have limitations for enhancing the production of software. Attention has turned to enhancing productivity through organizational methods such as Structured Programming, Top—Down Programming, Egoless Programming, and Chief Programmer Organization. Unfortunately, these efforts are temporary diversions from long-term benefits, just as the flow chart and modular programming were thought to be aids in facilitating improvements in the programming process.

Three varying approaches are systems-oriented methods for implementing a computer-based application. First, there is Design Technology, the techniques and methods for describing the nature of the application and its required functionality which purports to better and more accurately achieve a functional design that reflects the user's requirements. A primary objective of such systems is to describe fully what needs to be implemented with appropriate external and internal consistency checks to avoid potential defects in the ultimate system. Successful Design Technology should define the consequential point before errors or defects can be propagated and thereby minimize the cost of maintenance during the life cycle of the system. There is every reason to hope for substantial improvements in Design Technology, although none seem to have taken hold.

A second direction is User Development Systems. These are nonprocedural approaches to express a user's application requirement that employ a simple comprehensive method for a computer program, typically a transaction system, to be generated automatically. Few if any such systems are available today. IBM, for example, has begun to emphasize this capability by introducing "application enabling" systems. At this point, the systems are geared to the profes-

The hunger for better implementation tools suggested by buzzwords has not been fulfilled.

TABLE II. FUTURE STATUS OF THE NEW BUZZWORDS

	CATEGORY		
CLASSIFICATION	**A. "Insignificant impact, unproven, has practically disappeared"**	**B. "Low profile, not yet significant, may still make it"**	**C. "Prospects look good, not yet fully accepted or respectable"**
Software Development	Advanced Languages Structured Programming	Design Technology User Development Systems Application Generator	Data Dictionary Implementation Systems Transaction Development System Programmer's Workbench
Systems/Organization	Robustness, Forgiving User Oriented, Friendly Data-as-a-Resource Data Base Administrator Personal Computer Compatible Systems	Software Engineering System Security Home Computer Voice Recognition Distributed Data Base	Distributed Processing Relational Data Bases User Workstation Transaction Processing
Applications	Electronic Files Paperless Office Office of the Future Teleconferencing Total Information System	Automated Office Electronic Funds Transfer Videotex Systems Robotics	Electronic Mail Query Systems

sional programmer rather than the casual user. It is probably not achievable for the "user" in the near future.

In *Data Processing in 1980-1985*,* the Application Generator, the third approach, is mentioned as the software vehicle with the most promise for the mid-'80s. At present, a primitive example of an Application Generator may be the application software on the IBM System/34. It is not clear, however, how this Application Generator concept can be moved toward production of complex, transaction systems and achieve individualized results. The concept will probably slide into disuse.

LITTLE HOPE FOR THREE

The Systems and Organization classification begins with some comments on three buzzwords in the "little hope" category: Robustness, Forgiving; User Oriented, Friendly; and Data-as-a-Resource.

In all three cases, imagery suggests more than the words say. The first two concepts evoke the idea of computer-based systems that favor the end user and are convenient during operation of the system. No doubt we will achieve these objectives in the '80s, but it will be done by the competitive offerings of different vendors in the marketplace, not by labels alone.

*Dolotta, T.A., et al, John Wiley & Sons, New York, 1976.

Possession of data is important. Data, however, is useless until transformed into information. Data-as-a-Resource will find an early grave.

A few other popular terms seem temporal. These are Data Base Administrator and Personal Computer. In the former case, the suggestion of a single individual or even group as czar of all data for an organization is farfetched in a large, complex organization. The Personal Computer conjures up a symbiosis that will not occur. A secretary's typewriter is not viewed as a personal item; why should a computer be? The name will go away and will be replaced by such terms as "terminal" or "workstation."

The subject of compatible systems is of current concern because of the impact of IBM plug-compatible mainframes. Compatible systems exist because of the need for continued extension of hardware life cycles to take advantage of the vast existing body of software. In the long run, hardware compatible systems will disappear and will be replaced by software compatible systems.

Category B is a mixed bag ranging from engineering capability to hardware disciplines. While there is no doubt the production of software requires a disciplined foundation if we are to succeed in adequately predicting and fulfilling software project forecasts, there is no engineering discipline that can be imposed, so that programming can move from its current art form to a more scientific basis; I do not see much promise for Software Engineering.

System Security is another concept in search of realization. Aside from some hardware protection techniques and some software coding schemes, we are far from achieving what can be termed a "secure system."

Unlike the Personal Computer, the Home Computer carries more promise. It is likely there will be a computer in most new homes by the end of the '80s, built into the construction and wiring and interfaced to all electrical and communication items.

Voice Recognition's initial applications will be limited primarily to promotional and highly specialized applications, and wide utilization is questionable.

With two terms, Distributed Data Base and Distributed Processing, there is a difference; the difference is in distribution of computing power, application decoupling, and the division of data among dispersed dp units. We do not envision dispersal of data; rather, we view dispersed computing as two modes of operation: decoupled functions for a specific application operating in a disjointed system,and pre- and post-execution of portions of an applicaion for which the data base is centralized and from which data subsets are derived as needed.

Relational Data Bases is another popular term. We are swinging from hierarchically structured data bases to relational. It is expected the relational approach will dominate the dp scene in the next decade.

It is only a matter of time until wide dissemination of Value-Added Networks and Packet Switching takes place.

USER WORK-STATION The concept of the User Workstation has arrived. We have been driven to it as a result of the development of computer hierarchies. The User Workstation has been accelerated by the development of electronically based office systems to provide user assistance. If the User Workstation becomes the dominant tool for employing computers in the future, then Transaction Processing will be the dominant mode of using the system. The User Workstation will have a screen and all activity will be geared to the interactive dialogue between the human and the formatted displays. This does not mean the batch system will go away; it will be interfaced through workstations and transaction processing systems.

The last classification is Applications. We pronounce bleak prospects for Electronic Files, the Paperless Office, and the Office of the Future. These notions imply radical changes in office operation and management. While we do not ignore vast potential for improving the productivity of white collar workers, we cannot accept that severe changes will occur.

Teleconferencing is another office concept for which we do not hold much promise.

And finally, a death sentence for Total Information Systems as a meaningless phrase, a catch-all for nothing.

Electronic Funds Transfer is operating in limited areas now, and will continue to move into the business world in the next decade. We are cautious, however; it may be another 10 years before the majority of people will accept these ideas.

Videotext Systems are making their European appearance and will touch American society in the next few years. However, it remains to be seen whether a large scale, viable business can develop along these lines.

Finally, there is Robotics, the current popularization of artificial intelligence, from which we expect additional developments in specialized functions where a robot can perform a well-defined task.

Electronic Mail will become an economical alternative to present communications in the increasing need for rapid delivery of information.

The Query System consists of a variety of inquiry and interrogation systems played against existing data bases. The language or syntax of such systems varies from stylized English to structured, nonprocedural techniques. As data bases develop in the '80s containing more and more resident information, readymade Query Systems will become more useful to end users who need selective pieces of the data base or have ad hoc information requirements. *

WERNER L. FRANK

Mr. Frank is executive vice president and a director of Informatics, Inc. He has a BS in mathematics from Illinois Institute of Technology and an MS in mathematics from the University of Illinois. He has published over 20 papers in numerical analysis and general data processing subjects concerned with on-line systems and software development.

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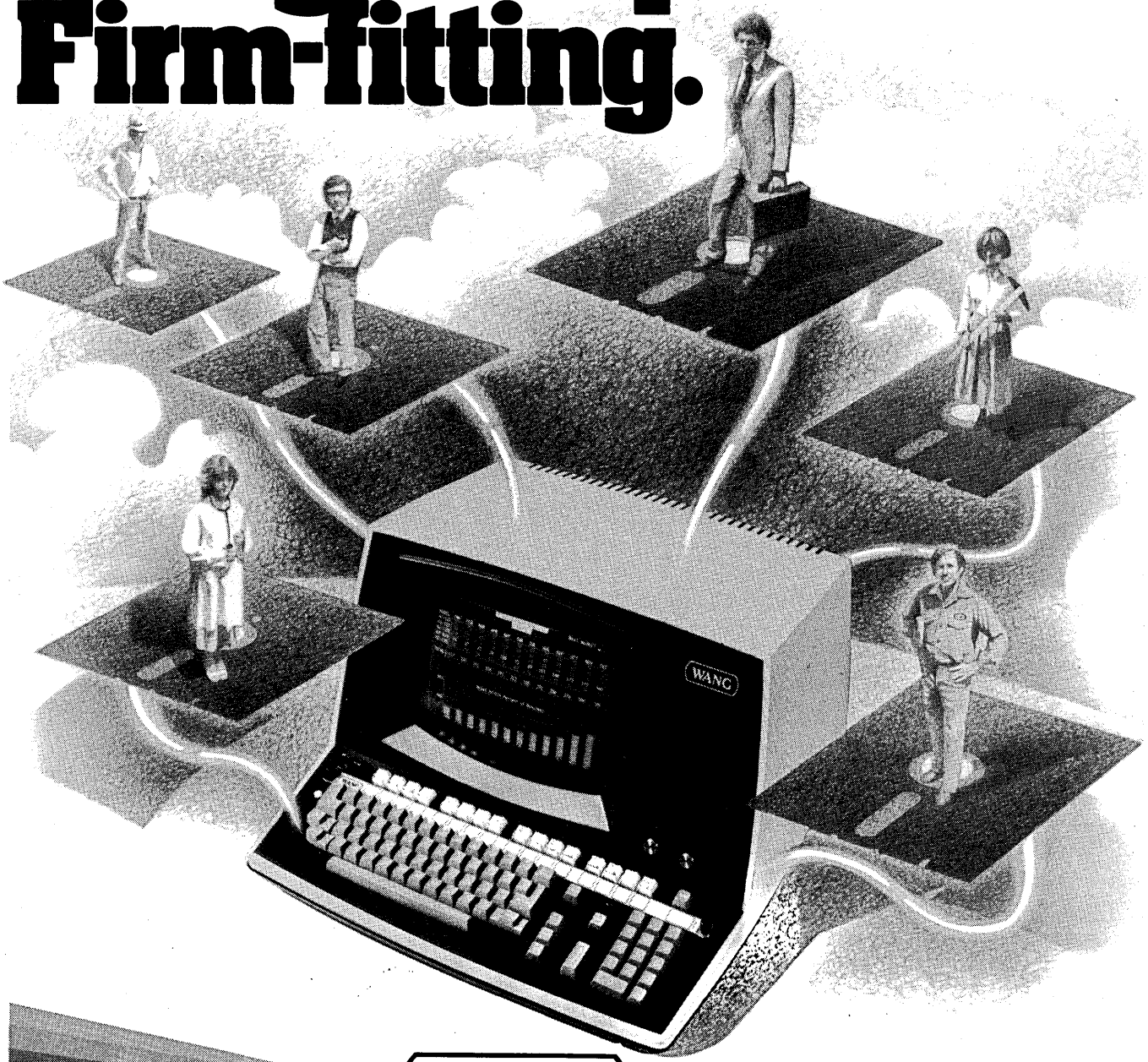

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CIRCLE 161 ON READER CARD

HARDWARE

OFF-LINE

"It is not likely that the prices will decrease," said John J. McDonald; "the bottom has already been reached." McDonald, president of Casio, Inc. (the calculator maker) described the future of the desktop calculator market to members of the Office Methods and Equipment Association in mid-November. Instead of further price erosion, McDonald sees additional features being incorporated in desktop calculators selling at today's prices. These features include speech and music generation, and timekeeping functions.

"Robots will multiply," predicts International Research Development, the Connecticut market research firm. After a decade and a half of "slow and painful" growth, the market for industrial robots is about to explode. With an eye on refined capabilities in the robots developed in the next 10 or 20 years, IRD says, "Someday robots will be used to assemble other robots, thus in a sense endowing robots with reproductive capacity."

Old Sturbridge Village, a historical center in Sturbridge, Mass., is using a Basic Four System 730 to handle its business offices functions. In addition to accounting functions, the system will help administer membership and fund raising services.

IBM's General Systems Div. has lowered memory prices by roughly a third for Series/1 4955s, System/3 Models 8, 12, and 15, and System 34. System/3 models 12 and 15 cpus had purchase price reductions of up to 15%, and prices on some unspecified System/34 models fell up to 23%.

MODEM

About two years ago, this vendor introduced a 1,200bps central-site modem capable of automatically selecting its operating mode to be compatible with Bell 212 or 103 modems, or with the vendor's VA3400. The new VA3450 modems bring this three-way compatibility out into the field. The VA3450 series consists of six switched network originate/answer modems, and an originate or answer version for leased line applications. The six models for use over the switched network are registered for direct connect under Part 68 of the FCC Rules.

The vendor feels the 3450s satisfy "every conventional originate/answer application for switched network full duplex data transmission from zero to 1,200bps." Three-way compatibility is provided by the VA3451, which can communicate with 212A, 103, and VA3400 modems; the VA3452 and VA3453 provide two-way compatibility—both are compatible with the VA3400. The 3452 also talks with 212As, and the 3453 can work with 103s. Each of these three are offered for connection to the phone system through programmable data jacks, or through voice jacks and programmable data jacks. Prices start at $900 for the 3451, $850 for the 3452, and $825 for the 3453. RACAL-VADIC, Sunnyvale, Calif.

FOR DATA CIRCLE 300 ON READER CARD

MINICOMPUTER

The PDP-11/44 brings more power for fewer dollars to the middle of the PDP-11 product line. It provides the 11/70 instruction set, 8KB of cache, and main memory sizes ranging from 256KB to 1MB. Performance is said

to be twice that of an 11/34, while the price is about 20% higher. The 11/44 has a microprocessor controlled ASCII console interface and provisions for remote diagnostics. Options include a floating point processor and a commercial instruction set processor. Four operating systems are supported: RSX-11M, RSX-11M-Plus, RSTS/E, and CTS-500. The 11/44 is sold as a separate processor, as a system, and as the Datasystem 540. The cpu alone sells for $23,900. Systems comprise processor, dual TU58 DECtape II drives, a DECwriter III terminal, and a choice of mass storage peripherals; system prices range from $44,900 to $97,400. Prices for Datasystem 540s begins at $54,000 for a 256KB system with two 10MB disks and the CTS-500 operating system. Volume deliveries are to begin in June. DIGITAL EQUIPMENT CORP., Maynard, Mass.

FOR DATA CIRCLE 301 ON READER CARD

MULTIPLEXOR

The DE-4 multiplexor concentrates data from up to four asynchronous lines onto one synchronous (or, optionally, asynchronous) line operating at speeds of up to 19.2 Kbps. Terminal attributes, including speeds at 9600bps, parity, and word lengths, are individually selectable for each of the four input lines. Buffering allows the aggregate input data rate to exceed the output rate temporarily. The DE-4 uses RS232 interfaces. It sells for $1,500. COMPRE COMM, INC., Champaign, Ill.

FOR DATA CIRCLE 303 ON READER CARD

TERMINAL

The TM25 Microterminal is intended to provide oems with an alternative to crts. The Microterminal can be used where the full capabilities of a crt (screen capacity and alphanumeric keyboard, in particular) aren't called for. The 8.5″ × 4.5″ × 0.6″ TM25 has a weatherproof front panel protecting its 8 digit LED display, seven function indicators, and hexadecimal or numeric keyboard with seven function keys. The buffered terminal works with serial ASCII data and can communicate at distances of up to one mile via an RS232 or 20mA current loop interface at speeds of 100bps or 300bps. Prices range from $249 per unit to $159 in 249 unit quantities. BURR-BROWN, Tucson, Ariz.

FOR DATA CIRCLE 304 ON READER CARD

FIBER OPTICS EVALUATION KIT

For those wishing to investigate fiber optics, this vendor offers a $99 evaluation kit, dubbed "The Link." The kit includes a fiber optic infrared source, integrated detector/preamplifier, and a one-meter fiber optic glass cable, terminated with matching AMP connectors. Data sheets and technical information also are provided. MOTOROLA SEMICONDUCTOR PRODUCTS, INC., Phoenix, Ariz.

FOR DATA CIRCLE 308 ON READER CARD

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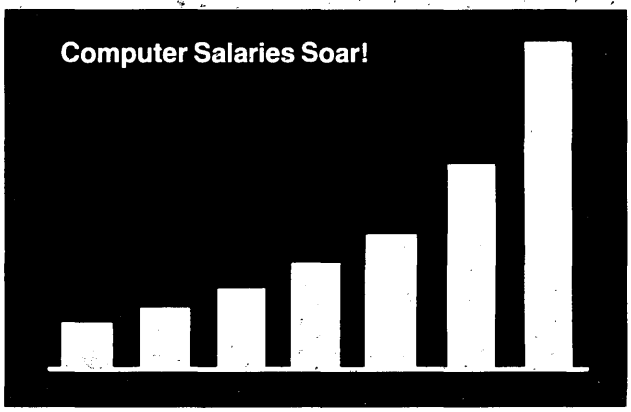

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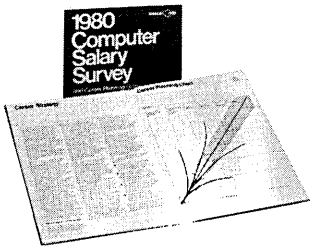

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CIRCLE 116 ON READER CARD

HARDWARE

CO-AX MODEM

Have an application calling for high-speed serial data transmission over limited distances, perhaps through noisy environments? This vendor's model 30-0078 moves asynchronous data over coaxial cables (over distances of up to 50,000 feet) at data rates ranging from DC to 2Mbps. It uses FSK modulation at high carrier frequencies; filtering helps reject EMI and RFI interference often found in industrial environments. Bit error rates are said to be typically less than one in 10^{12}. Using T-connectors, several devices can be multidropped from a line. The modem operates in half-duplex mode; full-duplex operation requires two co-ax links. Packaged on a 2-inch by 4½-inch printed circuit board, the model 30-0078 modem sells for $240 in quantities of 100. COMPUTROL CORP., Ridgefield, Conn.

FOR DATA CIRCLE 309 ON READER CARD

DISKETTES

This magnetics manufacturer has developed a line of double-sided single and double density 5¼-inch flexible diskettes. Offered in either hard or soft (16 and 10) sectored formats, the 5¼-inch FlexyDisks have unformatted capacities of 250KB (single density) and 500KB (double density) at 48 tracks per inch. The diskettes are certified 100% error free in both single and double density modes. The 5¼-inch FlexyDisks list at $6 apiece. BASF SYSTEMS, Computer and Business Products Dept., Bedford, Mass.

FOR DATA CIRCLE 310 ON READER CARD

COMPUTER

This vendor's 3200 series of 32-bit machines, which debuted earlier this year, has a new, larger member, the 3240. Available with memory sizes ranging from 256KB to 16MB, the 3240 retains compatibility with

HARDWARE SPOTLIGHT

DISTRIBUTION SYSTEM

The Route Commander extends the utility of this vendor's existing portable data entry terminals in the distribution and delivery operations of companies. In essence, Route Commander weds a handheld 101XL data entry terminal with a portable printer; options include two-way communications, auxiliary battery packs, chargers, and a real-time clock. In its basic version, the Route Commander is packaged in an attache case with 26-column impact printer and batteries; there's a cradle containing the 101XL, and room for an acoustic coupler within the case. Under firmware control, the Route Commander collects inventory information as the delivery truck is loaded. The driver can then have a load sheet printed. As deliveries are made, the driver enters them into the handheld 101XL; he then has the Route Commander print a receipt. The Route Commander handles quantity price extensions, taxes, etc. At the end of the route, the system speeds check-in by

producing a load summary (showing beginning inventory, sales en route, and remaining stock on the truck) and a cash report. The vendor says the savings accrued in time savings at the start and end of each route, combined with eliminating arithmetic errors when calculating sales, can pay for the basic Route Commander in about seven months. The basic Route Commander, packaged in an attache case, sells for $2,695. NORAND CORP., Cedar Rapids, Iowa.

FOR DATA CIRCLE 316 ON READER CARD

the vendor's earlier 32-bit machines; it runs the OS/32 operating system (licensed separately for $5,000 for a single cpu). Under OS/32 users can run the Multi-Terminal Monitor, allowing up to 32 concurrent users to program in any mix of languages chosen from FORTRAN VII, COBOL, RPG II, BASIC, CORAL 66, CAL, and CAL Macro (the last two are error checking and correcting that corrects all single-bit errors and detects all double-bit and most multiple-bit errors. An 8KB four-way-associative cache speeds memory accesses, to provide an effective memory access time of 250nsec.

A multiplexor bus and from one to four DMA buses provide I/O. Slow and medium speed devices connect the multiplexor bus, while tapes, disks, and other high speed devices use the DMA buses. The DMA buses run on 10Mbps each. The 3240 supports up to 1,023 devices on four priority interrupt levels. A floating point processor is available for speeding single- and double-precision floating point operations. The 3240's power subsystem, on which two patents are said to be pending, provides noise immunity, overvoltage and overcurrent protection, and brownout protection. Battery backup also is offered. A single 256KB 3240 processor carries an oem price of $76,500. A configured system with an oem quantity one price of $125,550, includes a 512KB processor, floating point processor, writable control store, model 550 crt, 75ips tape drive, 80MB disk, and battery backup. Memory sells for $8,000 per 256KB; the vendor has priced 1MB of memory at $19,900 if it is included in the initial order for the cpu. PERKIN-ELMER, Computer Systems Div., Oceanport, N.J.

FOR DATA CIRCLE 313 ON READER CARD

MODEM

An FCC-approved direct connect modem, the AJ 245 can be attached to the phone system via a modular jack or DAA. Compatible with Bell 103/113 type modems, the 245 operates in full duplex mode at asynchronous speeds ranging to 450bps. A dual terminal interface is provided, allowing use with RS232 or 20mA current loop terminals. In lots of 50, the AJ sells for $192; lease plans and additional quantity discounts are available. ANDERSON JACOBSON, INC., San Jose, Calif.

FOR DATA CIRCLE 306 ON READER CARD

DISK BACKUP

The HCD-75 cartridge drive and a 10,000 bpi data cartridge, the DC600HC, will be offered next summer by 3M as a solution to the problem of inadequate tape backup for such fixed disk drives as the 8-in. and 14-in. Winchester devices. Inadequate backup currently is a major customer concern in using these disks. The data cartridge system will provide 75 megabytes of user data storage, although total tape capacity is 144 MB, and it has an information transfer rate of up to 4 MB per second. Two Motorola microprocessors, the 6803 and 6800, are used for tape drive control, diagnostic self-test, and error detection during the data read functions. A microprocessor-controlled servo mechanism in the drive positions the ceramic head to address one of 16 tracks across the quarter-inch tape.

Data is written or read in what 3M calls a "serpentine" mode (alternate forward and reverse directions as track assignments change) to eliminate timewasting rewinds. The 4 MB per second transfer rate is achieved when data is unloaded into an integrated buffer storage system. In the "streaming" mode, with continuously running tape, an average rate of 20 Kbps is claimed. The system also can use direct memory access, routing data directly to computer memory without tying up control circuitry. Evaluation devices will be made available early in 1980 to oems from a pilot production line, with full production scheduled for early spring. Drives list at $2,150 ($1,050 for additional drives). Cartridges list for $30. Discount of from 35% to 40% will be offered to oem's. 3M, Mincom Div., St. Paul, Minn.

FOR DATA CIRCLE 315 ON READER CARD

SOFTWARE AND SERVICES

UPDATES

The Bank of Tokyo, Ltd. has launched its Tohnet System linking the bank's worldwide offices to master nodes in New York, London, and Tokyo. Tohnet uses packet switched communications to link offices over privately leased lines; satellite communications link New York, London, and Tokyo. Each of the three master nodes uses PDP-11/45s. In Tokyo, a large-scale Facom M-190 also is connected to the network.

Digital Equipment Corp. and Bolt Beranek and Newman are taking on a cooperative marketing effort to sell BBN's RS/1 scientific software. BBN's Computer Systems Div. and DEC's Laboratory Data Products Group will market the package, which runs on PDP-11s, MINCs, and VAX-11/780s.

GTE Telenet Communications Corp., has installed a packet-switching exchange in San Juan, Puerto Rico, for ITT Diversified Services. ITT will use the exchange to extend its public data communications services between the island and the mainland.

Network Analysis Corp. has extended the graphics capabilities of its Grinder and Mind data network design and analysis software to include support for Tektronix graphics terminals. Previously, the graphics system worked only with terminals from Imlac.

Information Processing Inc. shipped the 500th copy of its BLIS/COBOL system to The Cleveland Press in Cleveland, Ohio.

COBOL

Designed to run on any PDP-11 or LSI-11 with at least 56KB of memory, this vendor's COBOL-Plus compiler and run-time system implements most ANS 74 Level 2 language features. Included are level 66, 77, and 88 data items, complex conditional expressions, COMPUTE, PERFORM VARYING, and MOVE CORRESPONDING statements, and the OCCURS DEPENDING ON clause. Programs larger than available real memory are automatically segmented into virtual memory segments which are swapped on a least-recently-used basis; run-time routines for OPEN-CLOSE, I/O, and ISAM are managed in this fashion. Interactive screen handling is possible with positional ACCEPT and DISPLAY statements. Sequential, relative, and indexed-sequential files are supported, with recorder locking to synchronize accesses to shared files. COBOL-Plus can run under RT-11 or this vendor's TSX operating system. A single-user COBOL-Plus package licenses for $2,000. A multi-user version, with the TSX system, goes for $3,000. S & H COMPUTER SYSTEMS, INC., Nashville, Tenn.

FOR DATA CIRCLE 324 ON READER CARD

GRAPHICS SLIDES

The developers of the DISSPLA and TELL-A-GRAF graphics software systems now offer a 35mm slide preparation service. Users create their displays either on their in-house system or one of the 18 time-sharing services that offer the graphics packages. After previewing and modifying their displays, users generate a mag tape of the final graphics images. This tape is sent to a processing center in Minneapolis, where, within 48 hours, the slides are produced on a Dicomed D48 color microfilm recorder. The fee ranges from $10 to $18 per slide, depending on quantity; the is a 10 slide minimum per order. INTEGRATED SOFTWARE SYSTEMS CORP., San Diego, Calif.

FOR DATA CIRCLE 323 ON READER CARD

SOFTWARE SPOTLIGHT

NETWORKING

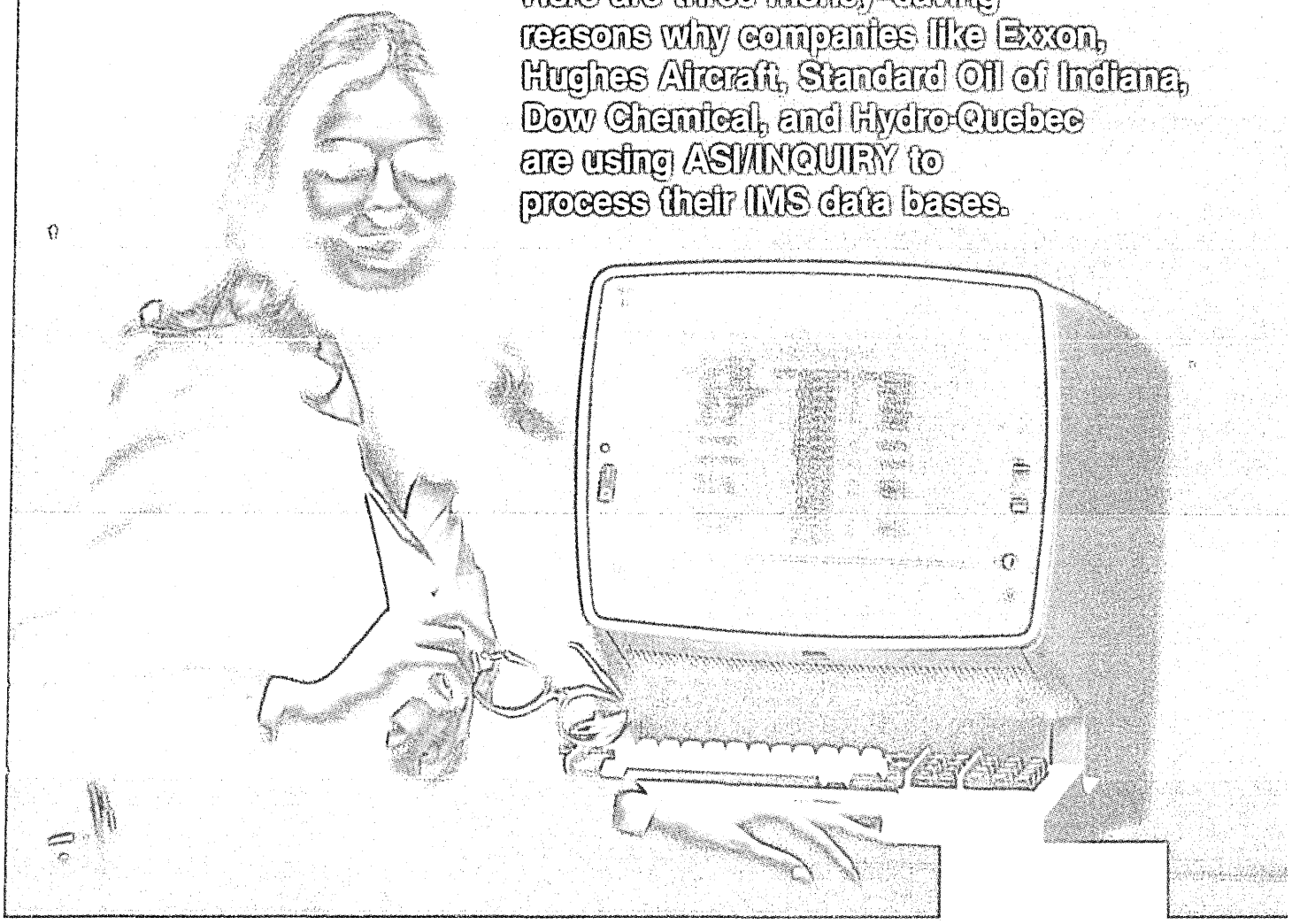
Another mini-maker has joined the ranks of vendors offering networking software that provides transparent access to remote systems and resources. This vendor's approach certainly seems sound. With an eye towards worldwide compatibility, the vendor chose to implement its Xodiac network management system (for Eclipse processors running AOS) using the CCITT Recommendation X.25 packet-switching protocol. Defined in three layers, X.25 specifies a physical (RS-232) link between systems, a link control layer (the software interface to the physical link), and a connection layer where messages are segmented into packets and logical connections are maintained between systems. The vendor has, for some time, offered these three layers comprising X.25 for users running RDOS on either Eclipse or Nova processors.

But it's a fourth layer of software, dubbed the "functional layer," that provides users of one Xodiac AOS system with transparent access to remote Xodiac AOS systems. This functional layer is an extension to AOS comprising two "agents": the Resource Management Agent (RMA) and the Virtual Terminal Agent (VTA). Each agent consists of a "using agent" on the user's host and a corresponding "serving agent" on the remote system. The RMA gives users transparent access to remote files, devices, and processes, while the VTA gives users a logical connection to program processes on a remote system, be they user programs, AOS utilities, or the Command Line Interpreter (CLI). Once a user has established a logical connection to the remote system, the user's terminal appears to be directly connected to the remote system.

AOS X.25 runs on any AOS-based Eclipse with at least 256KB of memory, and a communications subsystem including an SLM-2 synchronous line multiplexor with a Data Control Unit (DCU/200) or the Multiprocessor Communications Adaptor (MCA). Three packet-switched communications carriers—Telenet in the U.S., Datapac in Canada, and Transpac in France—have reportedly certified the vendor's compliance with X.25. For the first copy of AOS X.25 a user pays $1,500, and $1,100 for subsequent copies for use on remote systems. The functional layer, including AOS VTA and AOS RMA, goes for $7,000 on the first system and $3,000 for additional systems. To make use of the functional layer, each system must have at least 512KB of memory (and, of course, AOS X.25 software). DATA GENERAL CORP., Westboro, Mass. ✲

FOR DATA CIRCLE 320 ON READER CARD

Here are three money-saving reasons why companies like Exxon, Hughes Aircraft, Standard Oil of Indiana, Dow Chemical, and Hydro-Quebec are using ASI/INQUIRY to process their IMS data bases.



1. ASI/INQUIRY Is Easy To Learn and Easy To Use.

Because inquiries are stated in simple English, nonprogrammers can learn to use ASI/INQUIRY quickly. DL/1 structures are completely transparent to the user. You need not understand the complexities of multipathing or multiple data base access. Comprehensive diagnostic messages simplify error correction. ASI/INQUIRY automatically displays data in the appropriate format—horizontal, vertical, or overflow. Or you can specify any desired screen format. Repetitively executed queries can be saved in an on-line catalog. New release 5 features include the ability to defer query execution to batch and a powerful user exit facility.

2. ASI/INQUIRY Assures Faster Access and Response Time.

ASI/INQUIRY lets you access your DL/1 data bases through IMS or TSO faster and more efficiently. That's because it eliminates need to write and debug those highly procedural programs usually required to access data bases. ASI/INQUIRY operates as an IMS message processing program executed from any IMS DB/DC-supported terminal. Execution priority is dynamically controlled through automatic program message switching. High initial priority assignment assures fast response. Priority is then automatically adjusted to the rate that to-be-displayed data is encountered, which optimizes *load leveling* of IMS DB/DC resources.

3. ASI/INQUIRY Provides Complete Security.

Built-in safeguards protect data at the system, terminal, and data base levels. Data base administrators define the data bases users can access, their passwords, and the terminals from which individual data bases can be accessed.

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CIRCLE 121 ON READER CARD

SOURCE DATA

FROM DITS TO BITS: A PERSONAL HISTORY OF THE COMPUTER INDUSTRY
by Herman Lukoff

Herman Lukoff died on Sept. 24, 1979 from the leukemia he had battled for 12 years. He was 56 and had been in the computer business since June 1943. Herman Lukoff was an engineer. He built things that worked, discarded things that didn't work. No higher tribute can be paid to any engineer than that contained in J. Presper Eckert's Introduction to this book ". . . if Herman could not get it to work satisfactorily in the laboratory, nobody could." Before his death, Lukoff completed this highly personalized set of recollections.

Lukoff was a Philadelphia boy. Almost by accident he attended the Moore School and became enmeshed in the ENIAC project even before he graduated. After ENIAC, he moved on to BINAC, the UNIVAC I and II, and finally LARC, for which he served as chief engineer. In the proess he knew and worked with all the true pioneers. The pages of this book are studded with such names as Eckert, Mauchley, Grace Hopper, Bill Norris, George Cogar, Ken Olsen, Ted Bonn, Dick Merwin, Ike Auerbach, and Sid Fernbach.

What really glows through these pages is Lukoff's dedication to getting the job done right. Perhaps this stemmed from his background in building amateur radio equipment from junked sets he had salvaged. Using a heated screwdriver as a soldering iron is highly educational. So too is using a piece of wire instead of an oscilloscope. Such experiences teach engineering the hard way. Academic theories as to why an approach will work become little more than reinforcement for what has already been learned, sometimes painfully, at the workbench.

Time mercifully blurs some of the memories. Such bitter fights as Williams tubes versus mercury delay lines now seem to have been purely technical (Lukoff was on the right side of that one). In fact there were strong personalities involved and this ought not be forgotten. Those interested in Univac's eternal split personality, St. Paul versus Philadelphia, will have to read between the lines of Lukoff's book. The answers are present but much of the invective was removed. This is not to say that the book is a bland pudding. Lukoff had strong opinions he did not hesitate to express on such matters as the constant Univac reorganizations, the shelving of John Mauchly, the merger of the Eckert-Mauchly operation into Remington Rand and the acquisition of ERA.

Among the more important technical issues Lukoff comments upon is the famous Honeywell versus Sperry Univac law suit that overturned the ENIAC patent in spite of all evidence to the contrary. When he wrote, Lukoff was still puzzled over the peculiarities of a legal system that attempts to rewrite technical history without really understanding the issues. How running a test program and allowing the press to stare at some flashing lights represents public disclosure must remain a mystery to non-lawyers.

Another major theme in the Lukoff manuscript is the missed opportunities that are so much a part of Univac's history. What would have resulted had H.L. Strauss, the president of American Totalizer, not been killed in a plane crash? What might have happened if Remington Rand understood the silliness of its forced separation of engineering from manufacturing? What could have been the market impact of serious efforts to sell the then highly advanced LARC system to commercial buyers? How many more great ideas would have sprung from Pres Eckert if his intellectual sparring partner, Frazer Welsh, had not been killed in yet another plane crash? The list of near misses is seemingly endless. If the Department of Justice and Judge Edelstein ever read this book, all their neat theories about how IBM secured its grasp on the computer industry would be shattered. IBM did not win domination, Univac lost it!

This is truly a personal history in an old-fashioned way. The author comes across as a three-dimensional person, not a cardboard cut-out. There was tragedy as well as triumph in both his personal and professional life. Childhood wasn't easy, financially or psychologically. Honors gained in later years do not fully compensate for growing up as an overweight nonathlete in a marginal neighborhood, for rejection from the college of his choice, or for having to struggle through college competing against better-prepared peers.

Lukoff's professional accomplishments have been recognized in his IEEE Fellowship, Watson and McDowell award citations. They were important but what seems more critical today is the professional approach he took toward managing large scale, pioneering projects. LARC may be of little interest to today's computer engineers. But, could today's Silicon Valley whiz kids deal with the primitive surface barrier transistors of 1955 with no two components producing the same performance? Very few of today's engineers seem to fully understand Pres Eckert's stubborn stand on internal error checking. When you are dealing with dubious discrete elements, it isn't out of line to allocate 30% of all the circuits to checking. What if this trend had continued?

It is nearly impossible to summarize 30 years of work in one manuscript. Lukoff naturally concentrated on the early years, when one person could have a hand in every phase of design, development, implementation, testing and installation. This gave that individual a broad view of the problems that today's engineers often lack. Without the formal title, Lukoff actually served as customer engineering manager on UNIVAC I, serial number 1 (for the Bureau of the Census). He knew all about those phone calls at 3 a.m.

The salvage job that Lukoff and his team did on the UNIVAC II has been documented elsewhere. Lukoff's remarks on the effort are almost more interesting for what he didn't say than for what he wrote. If Bill Norris ever retires from CDC and writes his memoirs, perhaps we will hear more about the basic design that Lukoff inherited.

The LARC story is especially interesting because Lukoff and his crew virtually rewrote the book to get it to work up to the specifications. A special vote of thanks is owed to the user installation, University of California Radiation Laboratory, (now Livermore Laboratories), for its refusal to back away from performance requirements even though it meant late delivery. Lukoff's remarks about how far one can safely push the existing technology should be read and reread by those who dream of breakthroughs. First expressed by Lukoff in *Were Early Giant Computers a Success?* (DATAMATION, April 1969), his thoughts are still valid.

He firmly believed that: (1) you don't do advanced development on fixed price contracts, and (2) you had better not get yourself beyond the "knee" in the tech-

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nology curve. Demanding 100:1 improvements for a fixed price and on a preset timetable just doesn't work.

Lukoff knew what he had been through and didn't seem to be very regretful that the era of machine code, tubes, and hand-wiring were over. He may have been nostalgic but apparently never allowed it to interfere with his ability to assimilate new technology as it emerged. Indeed, right at the end of this book is Lukoff's note that he intended to integrate his microcomputer into his amateur radio station. The idea was to be able to display incoming morse code character on the crt in English. That doesn't sound like a man who was ready to turn the clock back.

While this is Lukoff's story, it also is the history of the Univac operation. There are parts that read like an indictment of Univac's stewardship of the Eckert-Mauchly dreams. So be it, the facts speak for themselves. Industrial historians can sort this out in the next century.

Too large a part of this industry believes computers were invented in April 1964. It would be highly educational for these newcomers to find out what it was like in the 1944-1964 era, before System/360. Some of the hasty judgments of why things are the way that they are could be avoided. How often must it be said that "those who do not read history are doomed to repeat the same mistakes?"

Today's industrial and corporate climate will not nurture very many Herman Lukoffs. Without a PhD he wouldn't get near an R&D laboratory. It is no longer enough to be an engineer, to want to get things right.

Herman Lukoff left behind a shining tribute to the profession of engineering that reflects directly back on its author. This book is a handbook on how to manage complex, innovative, state-of-the-art projects that stretch the imagination.

This book was written not by one of today's faceless corporate memo writers but by a man who had sat at a bench and built, tested, discarded, and rebuilt. He always remained faintly amused by the notion that a multimillion dollar machine could be turned into a babbling idiot by the failure of a 10¢ component. He never forgot what level of sweat was required to get from design to production. Those who see computers as mere figures on a balance sheet, investments to be amortized or assets to be depreciated would do well to study what it takes to create one from undesigned technology using yet to be invented methodologies. Herman Lukoff could have told them. His book lays it out clearly for those who take the time to read. Robotics Press, Portland, Ore. (1979, 219 pp., $12.95).

—Philip H. Dorn

SOFTWARE ENGINEERING by Randall W. Jenson and Charles C. Tonies

The authors, quoting J. L. Bauer, define software engineering as "the establishment and use of sound engineering principles in order to obtain economically software that is reliable and works on real machines." Software engineering addresses the entire software life cycle: requirements definition, design, implementation, testing, operation, maintenance, and, most important, the management of the entire process. This ambitious book attempts to cover all these topics and more. It is a major contribution to software literature.

The book begins with an overview of project management fundamentals. The various stages in the life cycle of a software project are described in the context of a large-scale system development project. The need for management of the transition from stage to stage is explained in detail. The authors introduce the concept of entropy to explain the losses that occur as the project progresses from stage to stage. This concept turns out to be a very useful explanatory tool. Also useful is the discussion of the Department of Defense procurement cycle, a model for large-scale system design and development.

The longest chapter in the book covers requirement definitions, systems design, and software design. For each of these stages, the authors discuss various structuring techniques that make the process manageable. The emphasis is on systematic structured design. The next chapter covers the topic of structured programming, focusing on stepwise refinement. This emphasis, however, results in a number of excellent structuring devices being neglected, such as coroutines and semaphores. The use of high-order languages for structured programming is covered, as are various procedures and techniques.

There is also a chapter explaining verification and validation, which covers not just software testing but the whole process of assuring software does what it was designed to do and that it meets customer needs.

The vast range of material covered includes discussion of available software techniques for supporting security and privacy objectives, a most interesting chapter on legal aspects of software development, and a proposal for a software engineering education. While the book may be the best available on this broad subject, it fails to be what it should be precisely because the authors fail to follow some of their own criteria for a good design: clarity, usability, and cohesiveness. The long chapter on design is poorly structured and difficult to follow. A number of useful design tools are presented, but the reader must work at discovering their relationship to each other, relative importance, and applicability.

Another shortcoming is that the discussion on software design focuses exclusively on program-dominated rather than data-dominated systems. While working in an integrated data base environment requires another set of design strategies and techniques, these are just as important for the reader to see.

Beyond these major problems, there are a number of minor but annoying flaws. In the early chapters, the authors have the maddening habit of referencing footnotes buried elsewhere in the text. The subject index is inadequate.

A book of this size and scope, written by obviously knowledgeable and capable authors, should have been better. However, until a better attempt is made, *Software Engineering* is highly recommended. Prentice-Hall (1979, 580 pp., $27.50).

—William Stallings

REPORTS AND REFERENCES

INTELLIGENT COPIERS/PRINTERS

The market, technology, and user needs for and perceptions of the developing intelligent copier/printer are discussed in a new report from Creative Strategies. The optical disk is mentioned as a potential future output medium, and predicted to eventually replace computer output microfilm. Another new technology briefly discussed is the semiconductor laser. Company profiles are given of AM International, Burroughs Corp, DEC, Exxon Enterprises, IBM, 3M, Wang Labs, Xerox Corp., Data Products Corp., Documation, Centronics Data Computer Corp., Eastman Kodak, Canon Inc., Konishiroku Photo Industry, Minolta Corp., NEC Information Systems, and Toshiba America Inc. The 91-page report sells for $995. Other recent reports from CSI include "Dictation Systems in the Automated Office," a $1,250 volume; and "Floppy Disks and Low-Cost Winchesters," at $895. Creative Strategies Int., 4340 Stevens Creek Blvd., Suite 275, San Jose, CA 95129, (408) 249-7550.

PERIODICALS

SALES MAGAZINE

A monthly magazine devoted to computer salespeople has been introduced. *CMO,* for Computer Marketing Opportunities, features interviews with notable marketers; a summary of short news items from the publisher's *Computer Marketing Newsletter,* a dress-for-success advice column by John Molloy which is nicely written and includes questions on subjects other than fashion, such as how a resume's looks affect interview decisions; and a variety of light features. The magazine has controlled circulation (distributed without charge to those in the field). *CMO,* MV Publishing, Inc., 1000 Quail, Suite 120, Newport Beach, CA 92660 (714) 752-0271.

The Marketplace...

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Jean Bodnarchuk
Programmer/Analyst
informatics inc

"Even though the company I'm working with has pretty sophisticated systems, my Mark IV experience makes me the person everyone comes to first. I'm the only Informatics person in the group. I get a lot of respect for that connection because when Informatics sends you out on a project, you really know what you're doing.

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READERS' FORUM

THE INCREDIBLE SHRINKING DECADE

The decade just ending marks the end of the third decade in which computers have been commercially available. It has been a quiet decade in terms of significant advances and breakthroughs; one could even argue that we have gone more than 10 years since the last big new idea emerged.

Well, it all depends on your point of view. Listen to Fred Brooks, the author of *The Mythical Man-Month:*

> I certainly would not characterize the '70s as the Stable Seventies. I'd almost call them the Sizzling Seventies. I find the microprocessor revolution to have as much fizz and excitement as the original computer development in the '40s and early '50s. Indeed, I am continually amazed how much of it is exactly the *same* excitements—the same lessons being learned the hard way by an entirely new cast.
>
> Even so, something truly phenomenal has happened to the computer game in this decade. The American computer industry shipped *8 million* computers last year! A machine fully equivalent to the 701 cpu and memory now costs less than one-hundredth as much!
>
> The second event I consider of fundamental importance in this decade is the development of software engineering as a discipline distinct from computer science, and indeed, from programming. It seems to me that the emergence of software engineering parallels closely, with a 60-year lag, the emergence of chemical engineering as a discipline distinct from chemistry.

Frank Wagner, senior vice president of Informatics, points out that "the significant thing about the '70s was the appearance of clear evidence that the ills of the central processor are terminal." It is his contention (and his batting average on long-range predictions is quite high) that by the year 2000 at the latest everyone will have to acknowledge that we must operate on a structured computing basis: from the bottom up, one job, one man, on one computer dedicated to that job. The only remaining task is to figure out how to communicate up and down the structure.

There will be no sharing of jobs on a central processor. The rise of the minicomputer was the first sign. These machines are dedicated; when they are busy, they have no overhead and hit high percentages of useful work, as opposed to OS systems in which 60% to 85% of the cycles do no useful work. Actually, for the minis, up to 100% of the cycles may be doing useful work, but only when the machine is occupied with its task—there may be long periods of idleness.

A TIME OF SETTLING IN

For established installations, the decade was a period of getting the house in order, of settling in to do the necessary jobs. Richard Nolan, writing in the *Harvard Business Review*,* marks four stages of growth of the typical edp installation:

1. Cost-reducing accounting applications (e.g., payroll); "bread and butter" jobs; strictly overhead, with no charge-back
2. Functional area applications (e.g., inventory, budgeting)
3. Control applications (e.g., scheduling, purchasing)
4. Data base applications (e.g., on-line conversions)

Richard Canning, editor and publisher of *Edp Analyzer*, makes these comments:

> Dick Nolan's four stages of edp growth do contain an element of truth. It seems to me that the '60s might be considered to be the second stage, taking the field as a whole—the proliferation stage. And the '70s might fit the third stage reasonably well—the control stage. At least in the data processing use of computers, I think the '70s were the time that most users decided to get their programming methods, data definitions, etc., under control. Centralization (in order to achieve this control) was the thing to do.
>
> Now, as we are about to enter the '80s, processing power and data storage are being moved back out toward the end users —but often under rules and standards set up centrally.

USERS CONFIDENT

In all those users who have passed Nolan's second stage, one senses a feeling of quiet pride in their installations. It was not too long ago that you could shake up an installation manager by asking him one of two questions: "Why do you have so many tape drives?" or "How do you manage with so few tape drives?" But no longer; today's manager knows why he has the number of tape drives he has, and he's quite sure that the number is not wrong by more than half a drive. In other words, he feels confident that he has the right equipment for the jobs assigned to him and that the equipment is being used efficiently.

We have not yet reached the stage where upper management will ask questions like "How much should it have cost?" or "How long should it have run?" This probably means that there is still an aura around computers which prevents outsiders from questioning the activities of the in-group. It is astonishing that this should be so, inasmuch as computing is the one high technology subject on which everyone is an expert. Prof. John Motil at California State Univ., Northridge, explains the apparent contradiction this way:

1. One can experience instant success (albeit at a very low level) in computing. A person in a shopping mall, attracted to the

*Cyrus F. Gibson and Richard L. Nolan, "Managing the Four Stages of Edp Growth," *Harvard Business Review*, January/February 1974.

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FORUM

Radio Shack computer display, can be led into writing a successful six-line BASIC program that actually runs, in a matter of minutes.

2. Only in computing can one be the judge of his own work. The 12-year-old can say "I wrote a chess program" and mean it. His program plays only on a 6 × 6 board, leaves out frills like bishops and knights, has its pieces wander off the board, and tends to move into check—but the kid is a computer expert to his friends and, above all, to his parents.

THE AWESOME MICRO

By all odds, the outstanding event of the '70s was the emergence of the microprocessor, leading to the microcomputer.

The personal computing explosion is about three years old, but it has already spawned some 14 general monthly journals, plus at least 15 more that are devoted to a specific machine (11 for the TRS-80 alone).

Most of the quarter-million personal machines are devoted to hobby uses, but a fair number are bought and used as small business computers. Thus, a significant revolution is going on right under the noses of IBM, Univac, and Honeywell.

Let's examine what other progress there has been during the decade. Take the area of artificial intelligence, which is now in its 22nd year. How are we doing? The game-playing branch of that discipline can demonstrate results: chess programs are getting better and have extended to microprocessors and hence to large numbers of people. Pattern recognition is beginning to show positive results. Music composition is, so far, pathetic; the music that has been generated just doesn't have the correct sparkle, except perhaps in esoteric bypaths like chamber music. Generalized problem solving has simply died; perhaps the notion was too ambitious. And the big plum—natural language translation—still eludes all effort. We have yet to see the first sentence of idiomatic language A translated into idiomatic language B *and back* by machine (which is what human translators do routinely with ease).

Also in the name of progress, we finally seem to be getting a handle on some basic metrics, like programmer productivity and computer system power. At least, there is now a directed and systematic effort toward finding methodologies of measurement.

PARADIGMS MARK PROGRESS

Just as a people or culture can be known by the metaphors they use, so a discipline can be known by its paradigms—the "frameworks for thinking." Dr. Richard Hamming, one of our industry's great scientists, observes that the changes in our paradigms mark our progress in the computing art. "These changes in the way we think about computing are the important events, not the construction of a faster machine, nor the availability of bigger, faster, cheaper computer chips, etc. The engineering may force the change, but it is neither the paradigm itself nor the new view of the field. It seems to me that in computer science we began with the idea that machines could compute numerical solutions for a wide range of problems that had stopped us before. I date the beginning of this paradigm 1945-48."

Then, around 1952, according to Dr. Hamming, we began to observe computers as symbol processors rather than number crunchers. "At a somewhat later date which I cannot pin down precisely, the concept of algorithm began to penetrate the whole field. We then saw computer science as the art of constructing algorithms to do processes . . . and processes on data as being central to computer science.

"It seems to me that we are now at another stage of changing our paradigm," Dr. Hamming observes. "We are beginning to understand that the heart of computer science is the concept of programs whose operating domain is other programs. Again, this is not a new thing. A FORTRAN compiler has other programs as its input. It is not easy in principle to sharply distinguish between data and programs, but it is usually reasonably easy to understand the difference in practice. For a FORTRAN compiler, much of the task is to find out the structure of the program it is compiling."

FORUM

Dr. Hamming is both optimistic and pessimistic about this past decade. "There is now so wide a choice that 'the best' is too expensive to locate and test. We tend to settle for a 'good' solution and get on with the job; this is a sign of maturity. The desire to do the best often blocks doing even a good job." In another context, he observes, "Word processing is getting off the ground; computers are getting into the hands of secretaries. Authors, and especially frustrated authors, will now produce more and more books with less and less that is new or worth the storage space. God help us!"

Fred Gruenberger
Northridge, California

MANUSCRIPT FOUND IN A TAPE CANISTER

Once upon a midnight dreary, while I pondered, weak and
weary,
Over a quaint and curious program written long before,
While I nodded nearly sleeping, suddenly I heard a beeping
From my console; bugs a-creeping, creeping in the system core.
'Twas some misstroke I had entered, errant thumbstroke not
well centered,
Just a typo, nothing more.

Ah, distinctly I remember, it was in the bleak December,
When each dying disk pack member's fate was listed on the
door.
Eagerly I wished the morrow. Hopefully I'd seek to borrow
Program guides to ease my sorrow, from the dump piled on the
floor.
For my small glich had created endless loops of cosines, fated
To be rooted evermore.

Deep into my console peering, long I sat there wondering,
fearing,
Doubting, dreaming dreams all mortal programmers had dreamt
before,
That some subroutine, much needed, had my core space just
exceeded,
And was therefore rudely weeded, banished from the system
core,
Exiled to where none can forage, software limbo: federal
storage.
There to languish evermore.

Had this ghastly curse befell me? Cpu time now would tell me.
Missing code could very well be anywhere. I must explore.
LIB.FORTRAN, LIB.CARDECK, even secret LIB.STARTREK,
All these DSNS I queried. To the last they came up poor.
One last hope, a final member: biorhythms for November,
Only this and nothing more.

But I knew there was insurance for my toil and hard endurance.
Nervously I sought assurance, hopefully I did implore,
Day and hour, nay, every second, when the grand machine had
reckoned
I had backed up all my labors safe within the system core.
For eons it did cogitate, then printed out that fateful date.
Quoth the console, "Nevermore."

—John A. Kogut
New Carollton, Maryland

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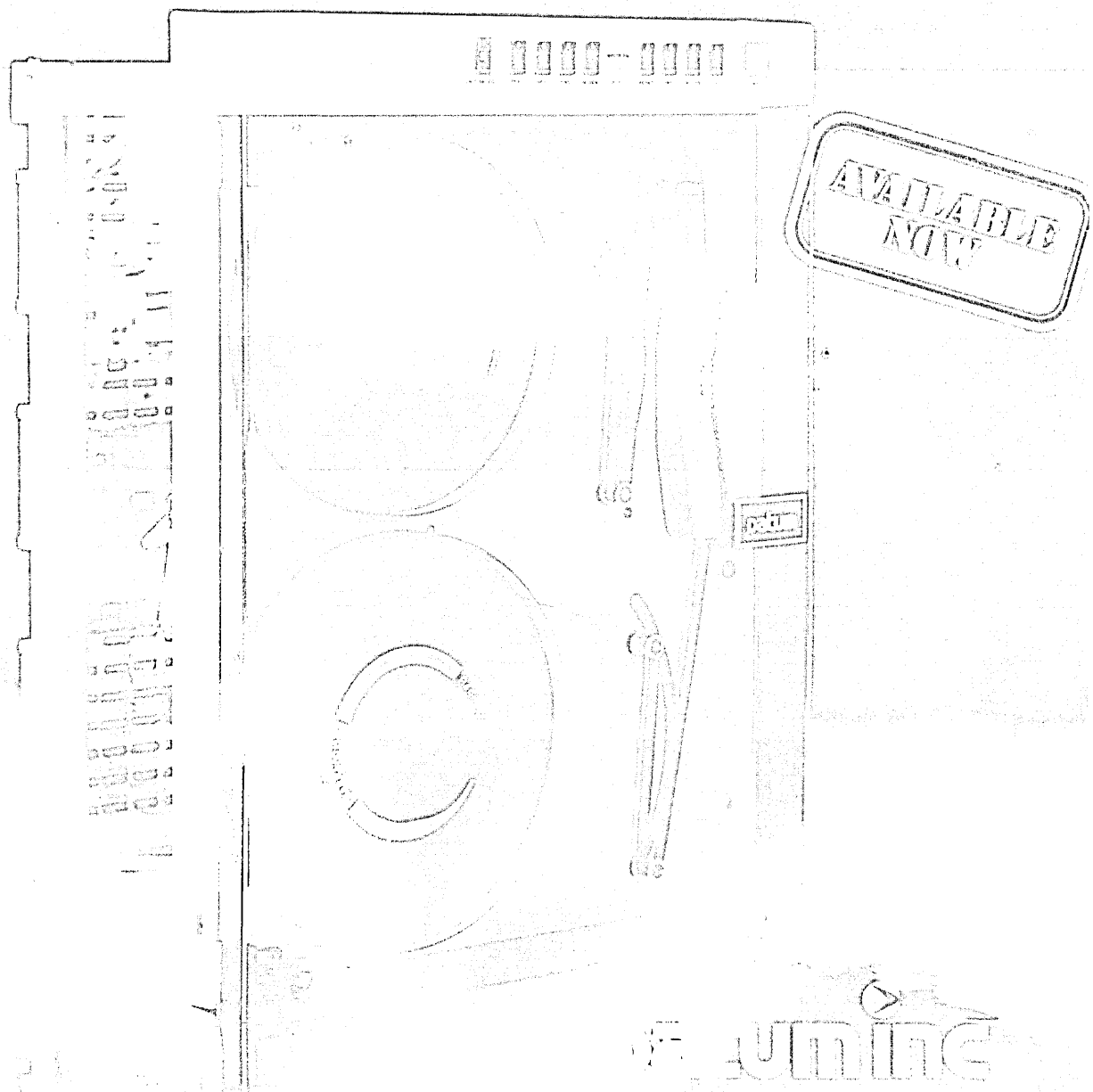
You won't need an external test box with the D-45i. Initialization, and skew verify alignment are among the functions microprocessor controlled self-test diagnostics.

An embedded Dual Density formatter controls up to four tape transports.

Every aspect of the intelligent D-45i's design and engineering makes its contribution in superior performance and reliability when reading and writing IBM/ANSI-compatible, ½" magnetic tape. Featured are 7-track, NRZI and PE formats, dual-format capability for 9-track. Phase Encoded density is 1600 BPI, while densities of 800, 556 and 200 BPI are available in NRZI.

And Datum's patented tape-path geometry provides the D-45i with IBM tape-path geometry, ceramic tape cleaners, photoelectric write-error detection, low-inertia capstan drive and digital write-current control.

Find out more about the real thing, the tape transport that thinks for itself. Call or write your local Datum representative or Datum Inc., 1363 South State College Boulevard, Anaheim, California 92806, (714) 533-5333.



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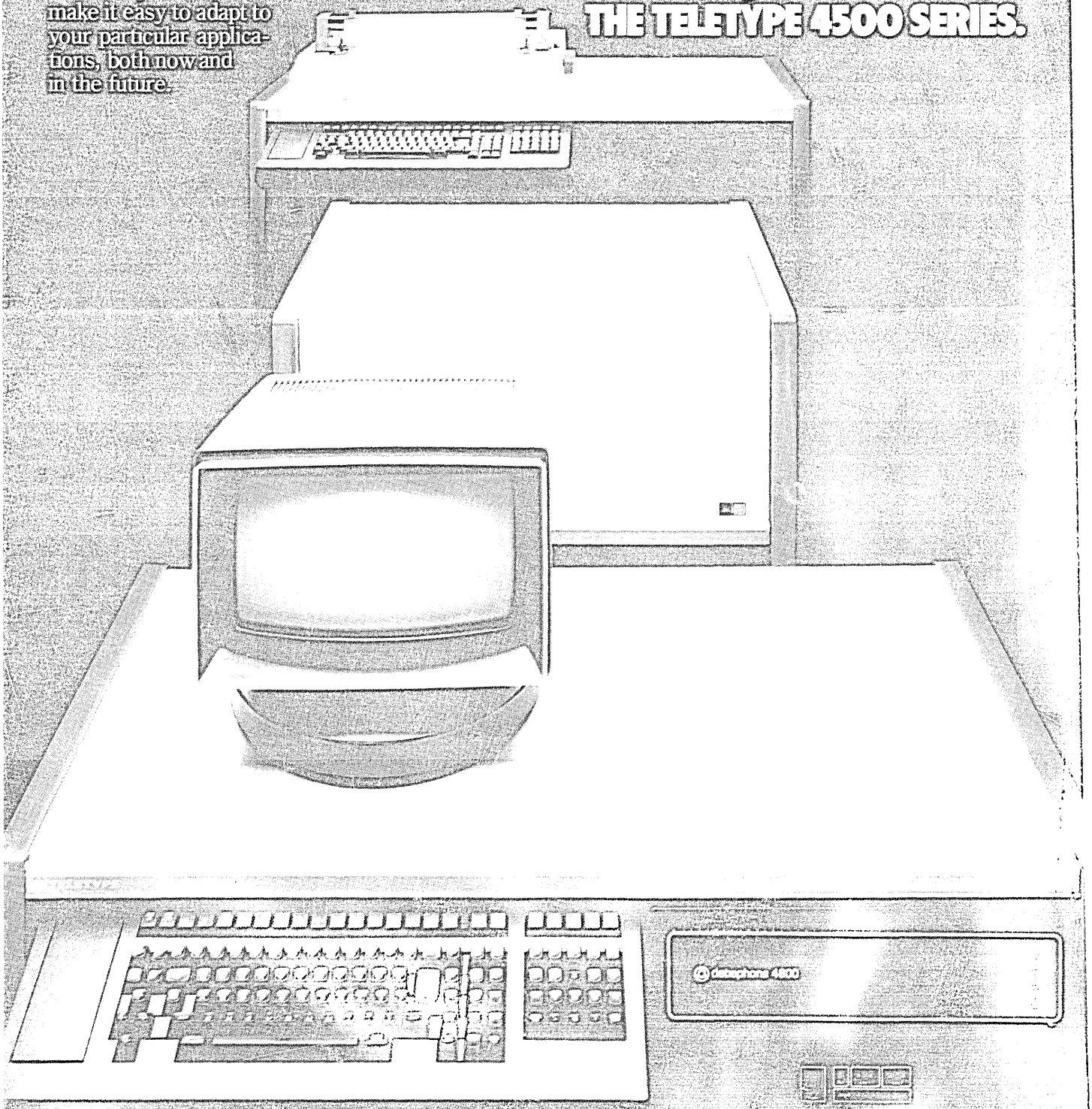

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CIRCLE 3 ON READER CARD