DATAMATION® 78
February
3.00
USA

NETWORK SYSTEMS ARCHITECTURES

Also: Data Communications Interface '78, changes in dp, computer output microfilm, and vector computers . . .

World Travelers

Kennedy tape recording equipment—it's the finest in the world, and that's why it's in use around the world. Kennedy recorders are monitoring and recording airport traffic and arrivals in Holland; solar activity to determine the Earth's weather, in Switzerland; gasoline usage at stations in Sweden; banking systems for up-dating payments and billing in Japan; computerized feed lots in India; utility power distribution to industry in England and telephone usage analysis, toll ticketing, message switching control and automatic program load for virtually every country with a telephone service.

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Asynchronous tape drives, vacuum column tape drives and a complete line of cartridge recorders are available for any application.

To service Kennedy products, there is a European service center and parts depot to handle factory warranties, repairs and parts stocking. If you're an OEM doing business in Europe, that's something to think about.

Kennedy tape products—they're the finest in the world. If you're thinking international, think

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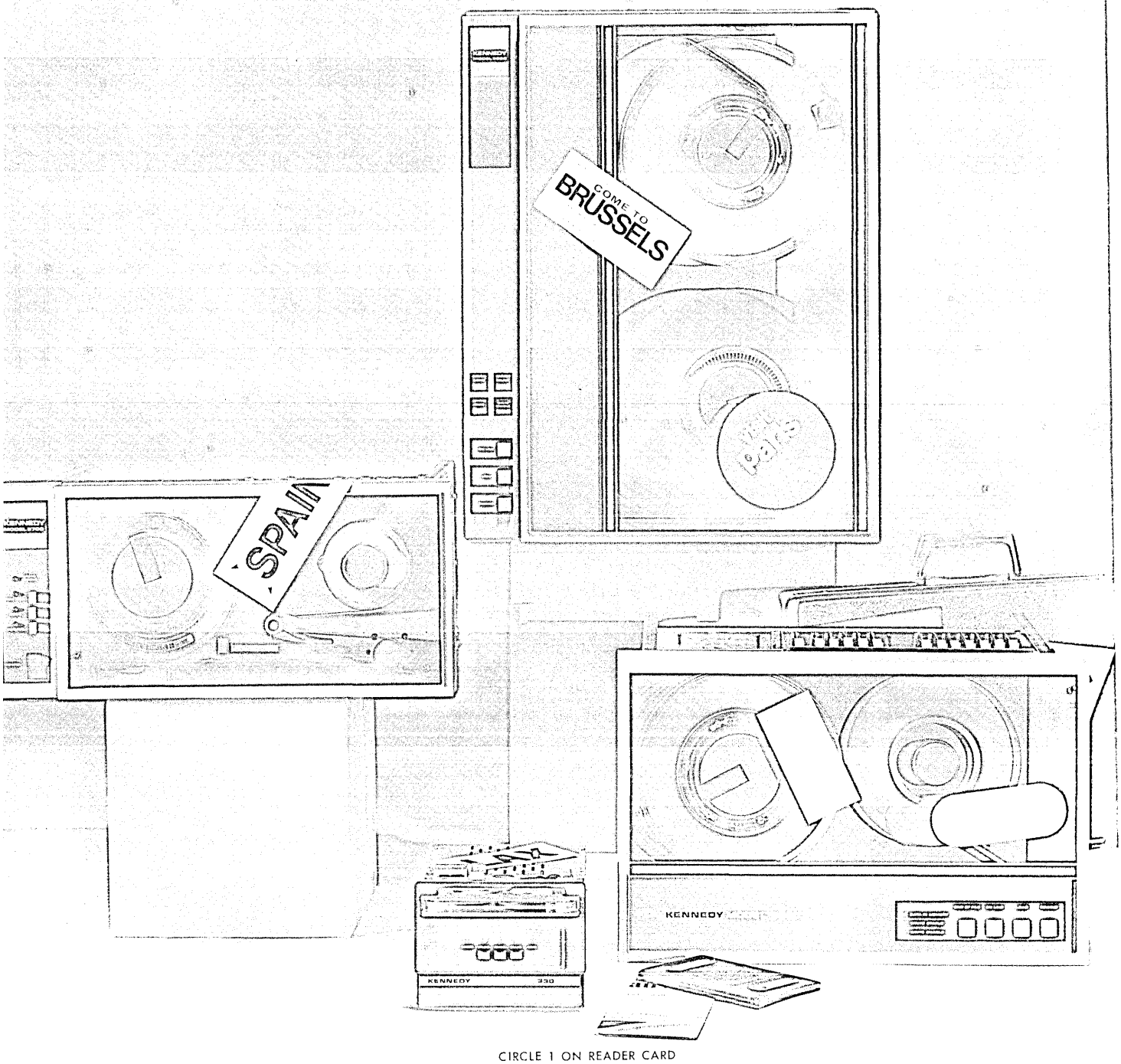
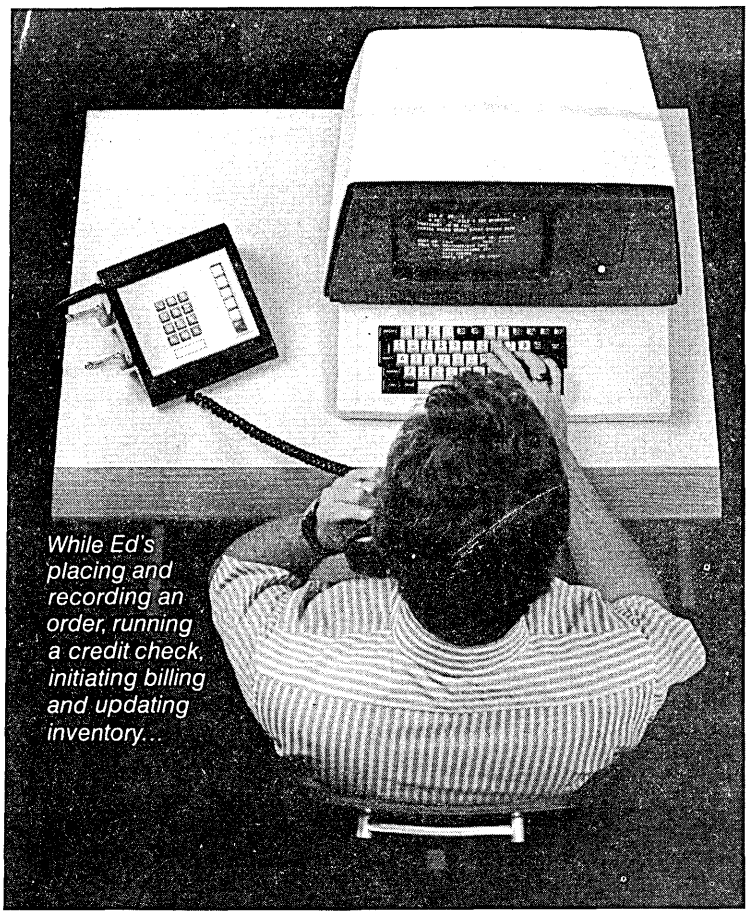
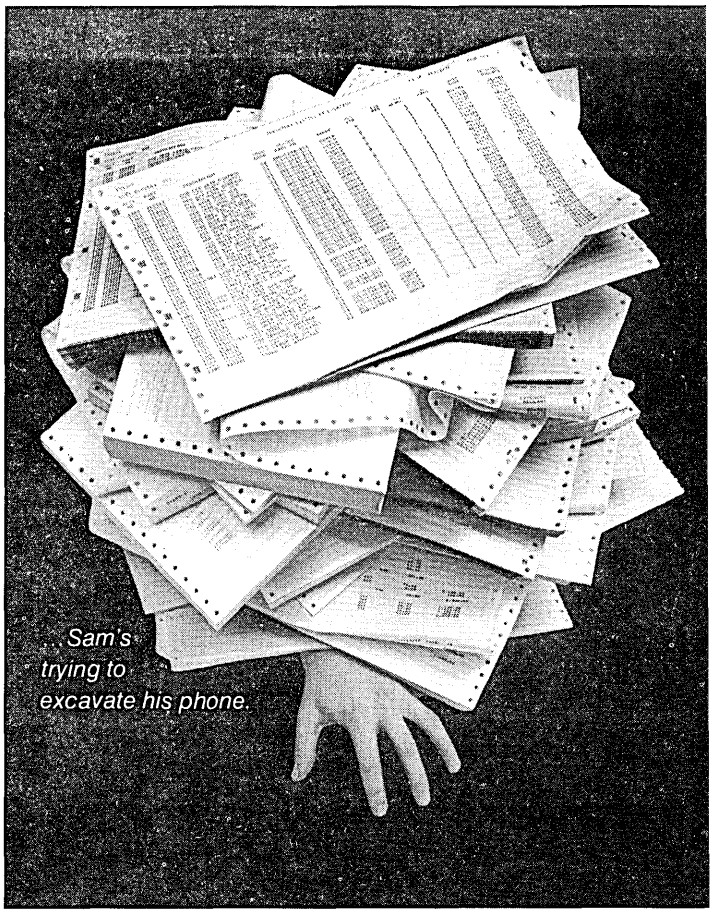


CIRCLE 1 ON READER CARD

With XL40 Distributed Processing, your people will be doing business...





...while your competition's doing paperwork.

The XL40 Distributed Processing System delivers decision-making data fast to the people in your company who need it most. So they can be making decisions—while the competition's still sorting through yesterday's printout.

Faster, more accurate information management.
Accuracy and speed increase—and costs decrease—when information is managed by the people who know it best. That's why the XL40 distributes data processing power to source departments.

Staff personnel—not computer specialists—operate the system, using centrally provided programs. They're familiar with the data they're handling, so they make fewer mistakes. And if corrections have to be made, they have all the source data they need—usually right in the same room.

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Ready for business.
The XL40 was designed for simplicity and reliability. Getting the system up and running is fast and easy. The XL40's professional education program will train operators—even Harry on the loading dock—in no time. And the XL40's modular hardware and flexible, COBOL-based software enable your staff to go right to work once the system is installed.

Built and backed by Pertec Computer Corporation.
The XL40 is manufactured, marketed and supported by PCC, the world's leading independent producer of computer peripherals, distributed processing and data entry systems, and microcomputers.

Call us today for more information on the XL40. We'll send you a brochure that explains the system in detail. Or we'll be happy to arrange a demonstration.

PCC PERTEC COMPUTER CORPORATION

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System 4100 Statistical Multiplexer

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The System 4100 can reduce your communication costs and provide reliable data transmission for all your terminals, both asynchronous and synchronous.

Network reliability is further secured by the use of state-of-the-art microprocessors and LSI technology.

Network control and management are provided via the operator control panel and display, thereby reducing costly downtime for network reconfiguration. System 4100—clearly, the intelligent answer.

Nationwide Maintenance

An additional plus—now nationwide maintenance service is available for Western Union Information Systems data communications equipment from more than 100 service centers.

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CIRCLE 6 ON READER CARD

DATAMATION 78®

VOLUME 24 NUMBER 2 This issue 139,837 copies FEBRUARY 1978

FEATURES

NEWS IN PERSPECTIVE

DEPARTMENTS

About the cover
The network systems architectures are upon us—redoubtable structures, uniquely labeled, full of explosive surprises. Design by Barbara Benson.

DATAMATION

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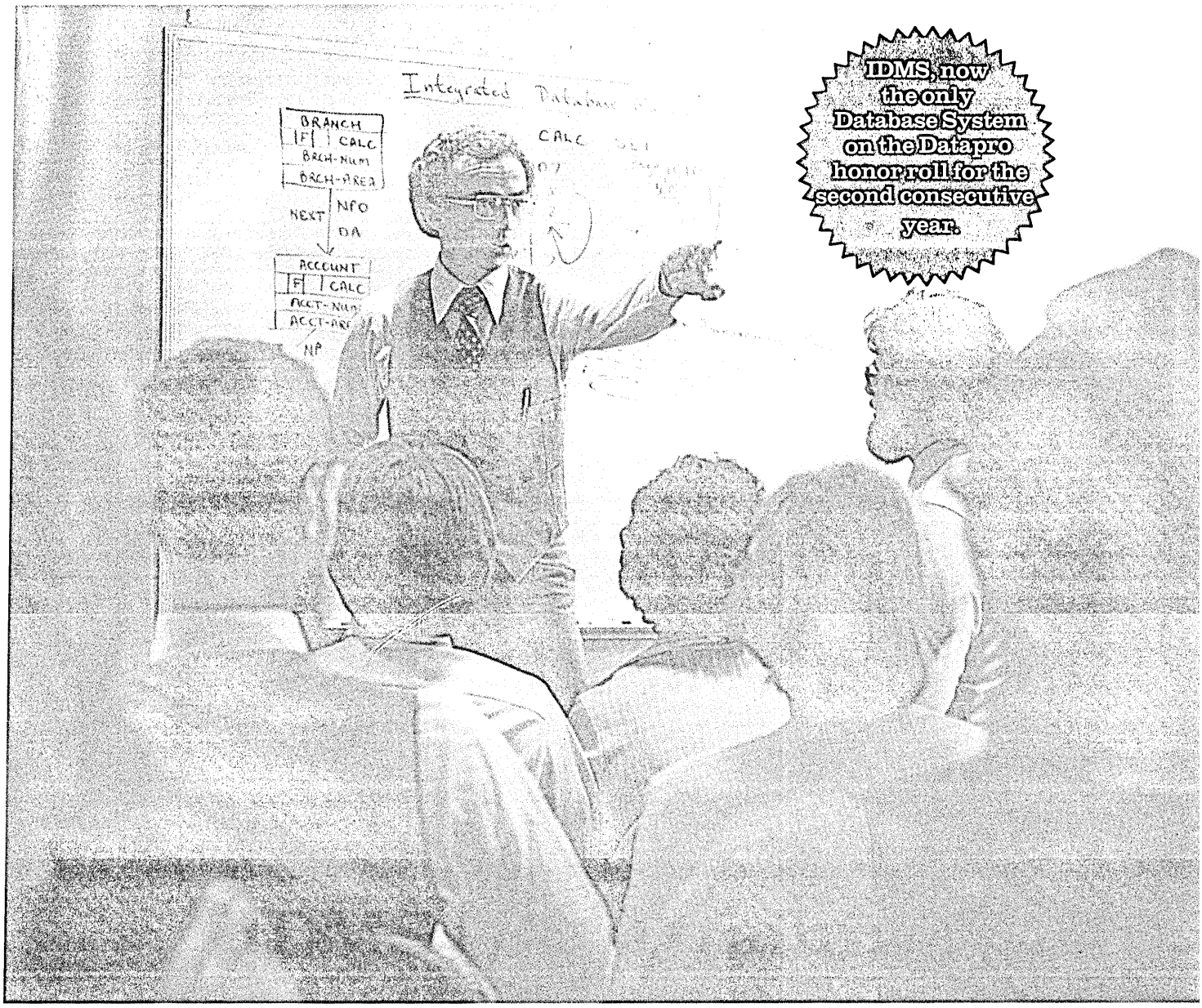

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*say users in Datapro study... and dozens of customer letters

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How did we get to be #1 in Training? Here's what some of our customers say:

"...the IDMS database course presented by Mr. Dave Ireland was probably the most comprehensive and valuable course our group has received in quite some time."

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"The splendid class...has allowed an increased level of effectiveness in the use of (IDMS)." "You did an outstanding job and received rave reviews."

If you'd like to learn more about the Cullinane Training Program, and IDMS in general, just complete the attached coupon, or give us a call.

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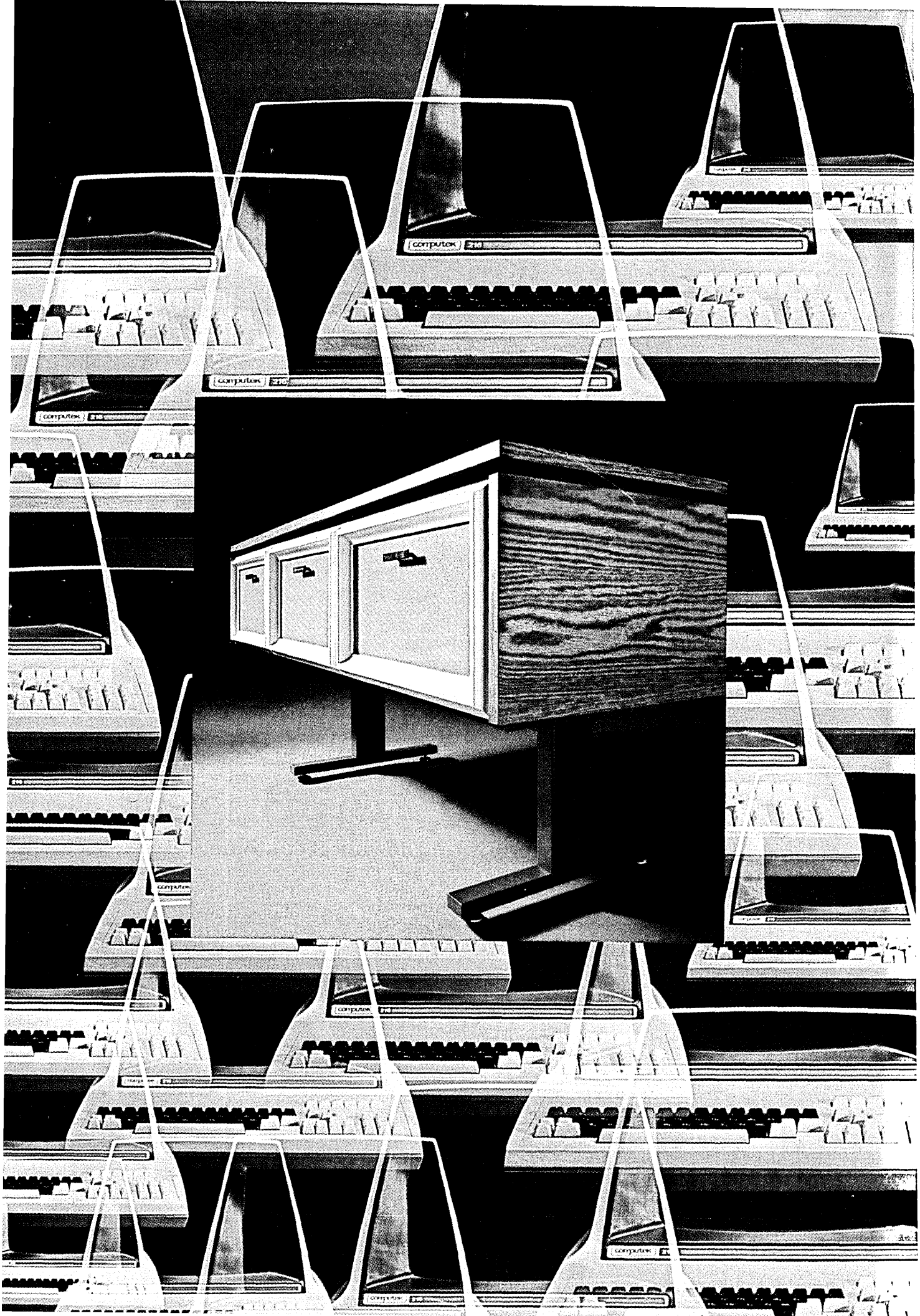
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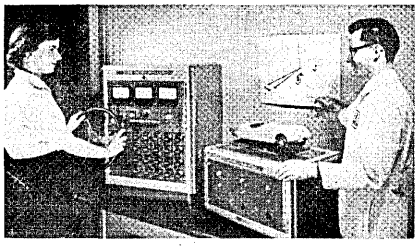
CIRCLE 18 ON READER CARD

Looking Back in DATAMATION®

January/February 1958

Twenty years ago, the topics were the same, but their execution decidedly different: *Computer-aided design* was highlighted by a GM simulation based on an "electronic analogue computer" (but note that the model being studied was a Jaguar, not a Chevy).

Office automation appeared in a prescient quote from Edwin Moran: "Automation is coming as rapidly to



the office and to the credit department as to the production end of the business . . . we cannot presently ignore it with the mistaken thought that it is 15 or 20 years hence."

People: A one-line announcement mentioned G. E. Jones' move to Manager of Marketing & Service in IBM's DP Div. He received better coverage later when he became president of the division.

February 1968

The prospects of the major league computer firms were evaluated for "Computing's '68 season" IBM (As with the Yankees of old, the cry continues, "Break 'em up"); Univac ("front office has halted the slide of this famous old team"); RCA ("Wait'll next decade"); Honeywell ("First division finish assured"); Control Data ("Strong head man, weak coaching staff, lousy bench"); General Electric ("Near-fatal lineup decisions wrecked '66 and '67"); Burroughs ("Solid, dull"); NCR ("best of the bush leaguers"); and SDS ("content to make money in second division"). How much change in ten years? Three of nine gave up the game.

Other hot items: the 360/65 MP had just been announced, a model 85 was rumored, users weren't too sure about the 800bpi tape standard yet, and an estimated 80% of new computer time was being spent on 2nd-generation emulations. LSI had made it possible to store 200 bits/chip, but one author speculated that LSI's biggest contribution would be in "the development of small systems that heretofore were economically or physically impractical." Looks like he was right. ❋

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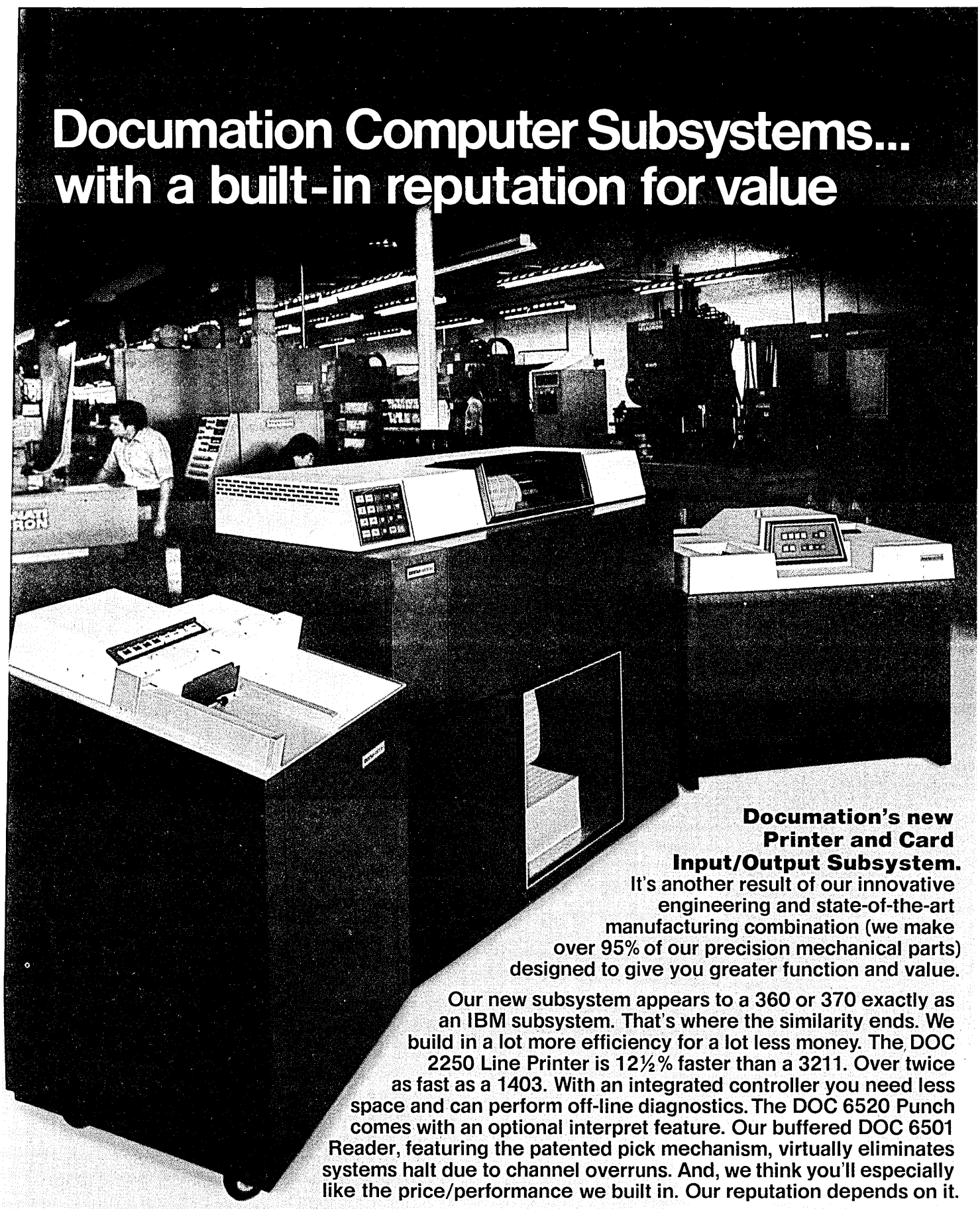

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CIRCLE 26 ON READER CARD

Now there are small Sperry Univac

Systems builders, rejoice!

Now you can stop wishing you could put a Sperry Univac Mini in your product. And actually do it.

For we are happy to announce that Varian Data Machines just became Sperry Univac Mini-Computer Operations. And now there's a whole family of Sperry Univac minicomputers for your system.

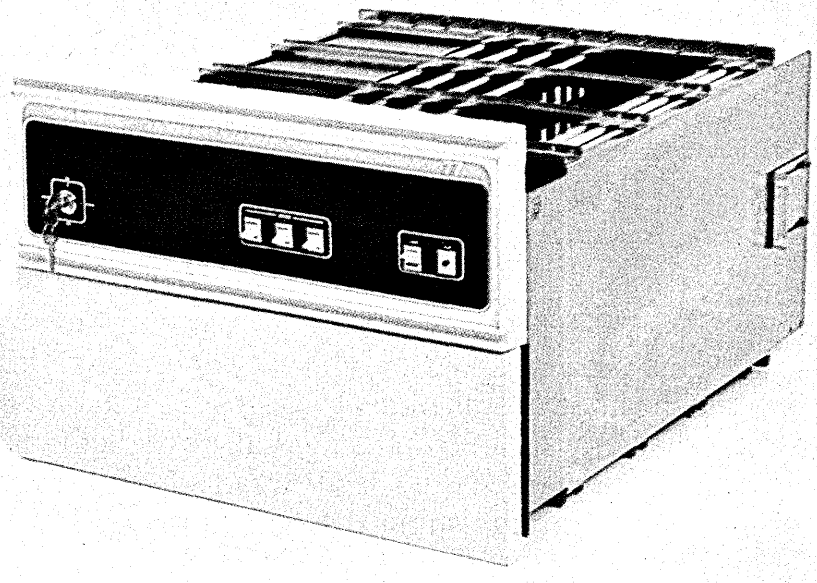
Consider our V77-400.

On top of all its standard big machine features, there's an incredibly flexible dual port memory. With up to 256K /16-bit words of 660ns MOS memory in a single, standard chassis.

An optional Writable Control Store lets you expand the V77-400's instruction set to further improve the speed of programming and program execution.

Now you can buy the entire V-77 family with complete confidence that the strength, experience, and dollars of Sperry Univac are there to back you up.

If you're currently building Varian Data



computers to complete your big ideas.

Machines into your products, fear not. Sperry Univac will not abandon you. In fact, we'll continue to support and enhance Varian's product line as if it had always been our own.

We'll also bring you peripherals and support products that were unavailable until now.

Write to us at Sperry Univac Mini-Computer Operations, 2722 Michelson Drive, Irvine, California 92713. Or call (714) 833-2400.

Ask about the new Sperry Univac Minis.

This could be the start of something big.

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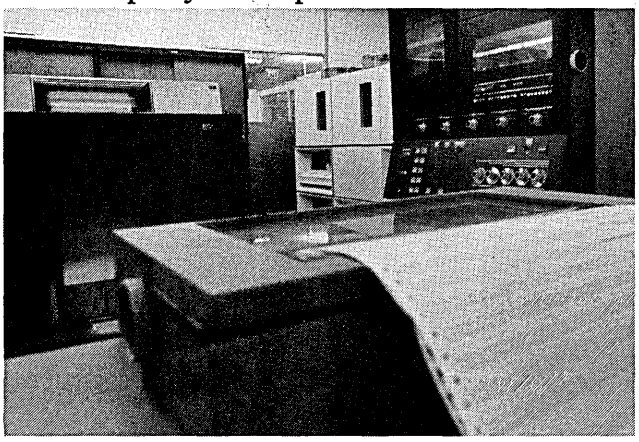
HOW THE FENWAL FIRE SUPPRESSION SYSTEM IN THIS AUTOMOTIVE COMPANY PAID FOR ITSELF IN ONLY 2 WEEKS.

At 9:03 on a Wednesday night, an electrical malfunction caused overheating, and smoke began rising in the west end of this company's computer room.



At 9:06, while the fire was still in the smoldering stage, the Fenwal Fire Supression System automatically sensed this smoke and discharged its extinguishing agent (Halon 1301).

By 9:30 that same night, the smoke had cleared, employees had arrived and with the appropriate Fire Department clearance entered the computer room. Traces of Halon were present but there was no discomfort.

Close examination of the problem area revealed scorched and discolored internal wiring. Some relays would have to be replaced. But no other damage had occurred.

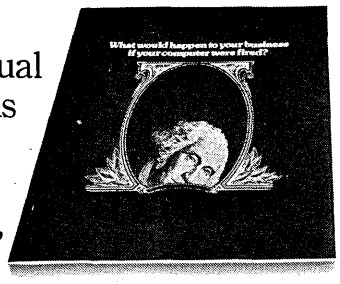
Even though the fire was inside the consoles, at the farthest point from the Fenwal discharge nozzles, the flames were snuffed out *dry* and major damage or personnel injury was completely averted.

At 10:45 P.M. the Fenwal distributor who had installed the modular suppression system was called. By 5:30 A.M. it was re-charged and back in service.

This protection system had been installed just two weeks prior to the true incident described above.

It actually made the difference between a few hours of downtime and several weeks of expensive business interruption. The kind of interruption from which some businesses never really recover.

Fenwal has designed and installed more of these Fire Suppression Systems than any other manufacturer. And we make a full line of thermal, smoke and ultraviolet Detection Devices and Control Panels.



We have visual proof our Systems work in a variety of environments. Send for our film, "The Fireaters." Or for a copy of our booklet on fire suppression. Write Fenwal Incorporated, Ashland, Mass. 01721. A division of Walter Kidde & Co., Inc., or call (617) 881-2000.

For installation and around-the-clock service, see our local distributors listed in the Yellow Pages under "Fire Protection."

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Nobody in the world has more experience in fire and explosion protection systems.

Introducing Micro-2 from Digital Systems

You might find or put together another computer system with the same capability as Digital Systems' new Micro-2. But it would probably cost you a lot more than $5,000. At $4,995 the Micro-2 is a completely assembled, compact, high-performance microcomputer system with Shugart dual-drive, double density floppy disks. Its single computer board includes a Z-80 CPU, 32K of RAM, four RS-232 serial interfaces, 16 bits of parallel I/O, and a real-time clock. And on the same board you have the option of 64K of RAM.

The single-disk controller board uses either the standard IBM 3740 format or a double density format of 571K bytes per diskette. Optional double-sided drives increase storage to 2.8 Megabytes. And since the controller can support another two drives, the storage capacity of the Micro-2 can be increased even more.

The simple bus and two-board design of the Micro-2 means greater inherent system reliability. A short cable interconnects the computer and controller boards, providing a high-speed DMA interface. On the computer board there's access to the internal bus connector and a wire-wrap area for custom logic.

With the Micro-2, you get the comprehensive CP/M disk operating system, disk BASIC, and complete hardware diagnostics. (For the past three years CP/M has been field-proven in other Digital Systems' hardware.) What's more, extensive accounting software packages and high-level languages, such as CBASIC and FORTRAN, are available.

So if you're interested in a low-cost, high performance microcomputer system, you can begin and end with the Micro-2. Write or call us today about the new Micro-2 or our other disk-based systems. OEM and dealer discounts are available.

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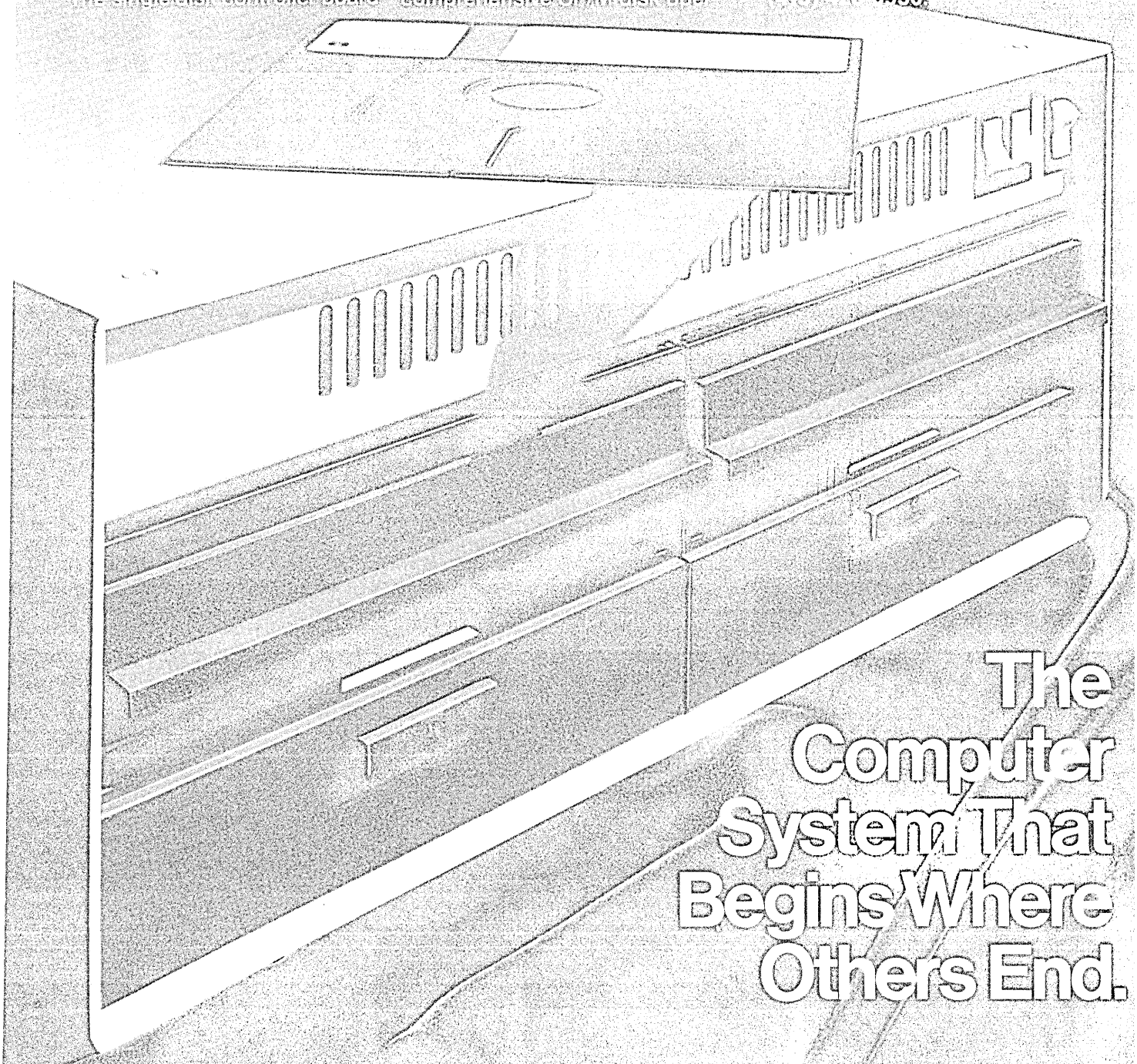

The Computer System That Begins Where Others End.

CIRCLE 40 ON READER CARD

Wrong competitive evaluation!

5-year penalty!

Buy a competitive network control system right now and you can set your company back 5 years. Wait for Intertel's new Network Control System, and you'll get a design created and built with more field experience than everyone else combined.

At Interface '78 in Las Vegas, Intertel will introduce a new Network Control System that will meet the on-line needs of *any* large system. Minute-to-minute needs. Designed to integrate *immediately* with your present network. And without any penalty when you upgrade.

Be prepared for the network challenges of the 80's with the only third generation control system. It's the choice that puts a wider range of features in your hands than any other competitive system. And it's compatible with our NCS4000—the proven standard in Network Control.

The fact is, Intertel has already *installed* over 160 systems. A record that speaks more and more for itself. It should. After all, we're:

#1 in Network Control.

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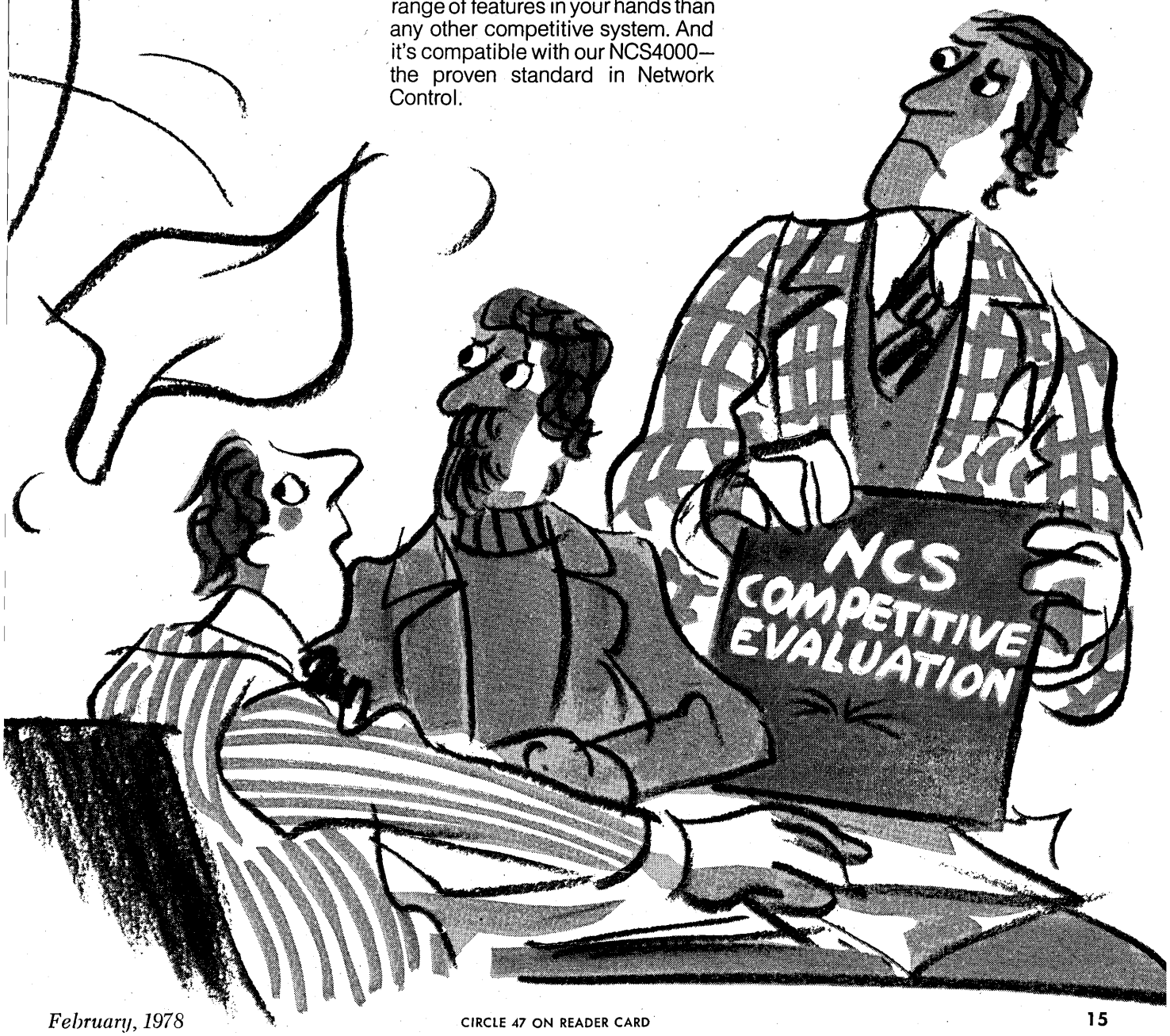

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The Data General CS/40 Commercial Systems. They speed up program development using ANSI '74 COBOL and unique screen handling extensions. And these interactive small business systems can be enhanced without redesigning original programs. So CS/40 systems keep saving you time and money.

CS/40 systems, with multiple interactive terminals, put data processing power right in the hands of the people who need it. When they need it.

CS/40 systems won't interrupt your growth. Adding hardware such as larger discs or more terminals, or changing to other models, need not affect application design structure or programming.

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LOOK AHEAD

EARLY DELIVERY FOR A PREMIUM

A major computer user says at least one leasing firm has offered mid-1978 delivery of an IBM 3033 if the buyer is desperate enough to pay a $200,000 premium. But a Wall Street analyst who closely follows the computer business says he can't figure out why so many users are indicating they will buy rather than lease 303X systems. (A survey by Gruman-Cowan says 75% of the orders are for purchase only.) He says the cost of maintenance has jumped so much that the ratio of purchase to fixed term lease makes leasing a better deal: a four megabyte 3033 has a 57.9:1 ratio while the equivalent 168 is 53:1 when maintenance is included. "IBM maintenance is so high because it includes two plumbers and a lake," says a wag. Investment tax credit is no incentive to purchase since IBM also passes it on to the user in long-term leases.

FIVE PRODUCTS IN FIVE YEARS

IBM will come out with five major product introductions between now and 1982, speculates Drexel Burnham Lambert analyst Harry Edelson. Coming up: E-Series or System 4, a performance substitute for the 370/115-2 and 125-2 computers and possibly a replacement for System/3; Orbit Trinity, due in the first quarter of 1978, a terminal-oriented mini system to be marketed by DPD in competition with GSD's Series 1; System 36 and 38, due this summer and possibly the first IBM commercial products with bubble memory; H-Series, due fourth quarter 1979 and perhaps the long-awaited fourth generation machine but more likely a mid-life kicker for the 3033 with improved ECL logic and 32K or 64K bit memory; Sierra, fourth generation machine due in 1981 or 1982 with significant new technology including new, easier to use programming and COM, facsimile, word processing, and satellite communications terminals.

AT&T PREPARING BDN ANNOUNCEMENT IN SIX MONTHS

Those anxiously awaiting AT&T's official announcement of its highly touted Bell Data Network may not have to wait too much longer. The communications giant has tentatively targeted June 19 as the announcement date. But sources close to Bell speculate that there may be some slippage in the announcement due to training, tariffs, and other regulatory hang-ups such as the Federal Communications Commission's Computer Inquiry II. AT&T, the sources claimed, is also wary of the Justice Dept. which could nail the company if it preannounced the service long before it could deliver.

However, despite these obstacles it's clear that Ma Bell is gearing up for a major BDN announcement, probably within the next six months. Sources believe the service initially will be offered on a gradual piecemeal basis, possibly tailored to specific industries. To ready its marketing and sales crew, the company has been tracking down outside communications experts to help company trainers who will coach Bell System employees. The initial training program is expected to begin in May and eventually will involve every account executive in the 23 Bell operating companies.

LOOK AHEAD

BELL'S BDN TOO LATE FOR WESTERN ELECTRIC

AT&T may have thought it had a captive customer for its aborning Bell Data Network in its supply subsidiary, Western Electric, but it was dead wrong. It spite of repeated AT&T pleas to wait for BDN, Western is going ahead with plans to build its own internal network based on independent communications processors (supplied by Computer Communications Inc., of Torrance, Calif.) that will front-end a mixture of IBM and Digital Equipment Corp. hosts. The system is going up in one of the company's consolidated data centers, with plans to expand it to the other two later.

FED PLANS PAYMENTS MECHANISM CHANGES

The Federal Reserve Bank has some new proposals for the national payments system it said would "encourage private development of competitive payments services and to encourage broader use of electronic funds transfers (EFT)." The Fed seeks comment by Feb. 28 on a proposal to provide a nationwide service for clearing-houses (ACH's) and to make its net settlements services available to member banks on their reserve accounts possible via wire transfers on Bankwire. Under the planned connection of ACH's, an institution would give the Fed electronic instructions over its communications system, collect the amount from the originating depository, and pay it to the recipient depository which would credit or debit the customer.

THREE FOR SIEMENS

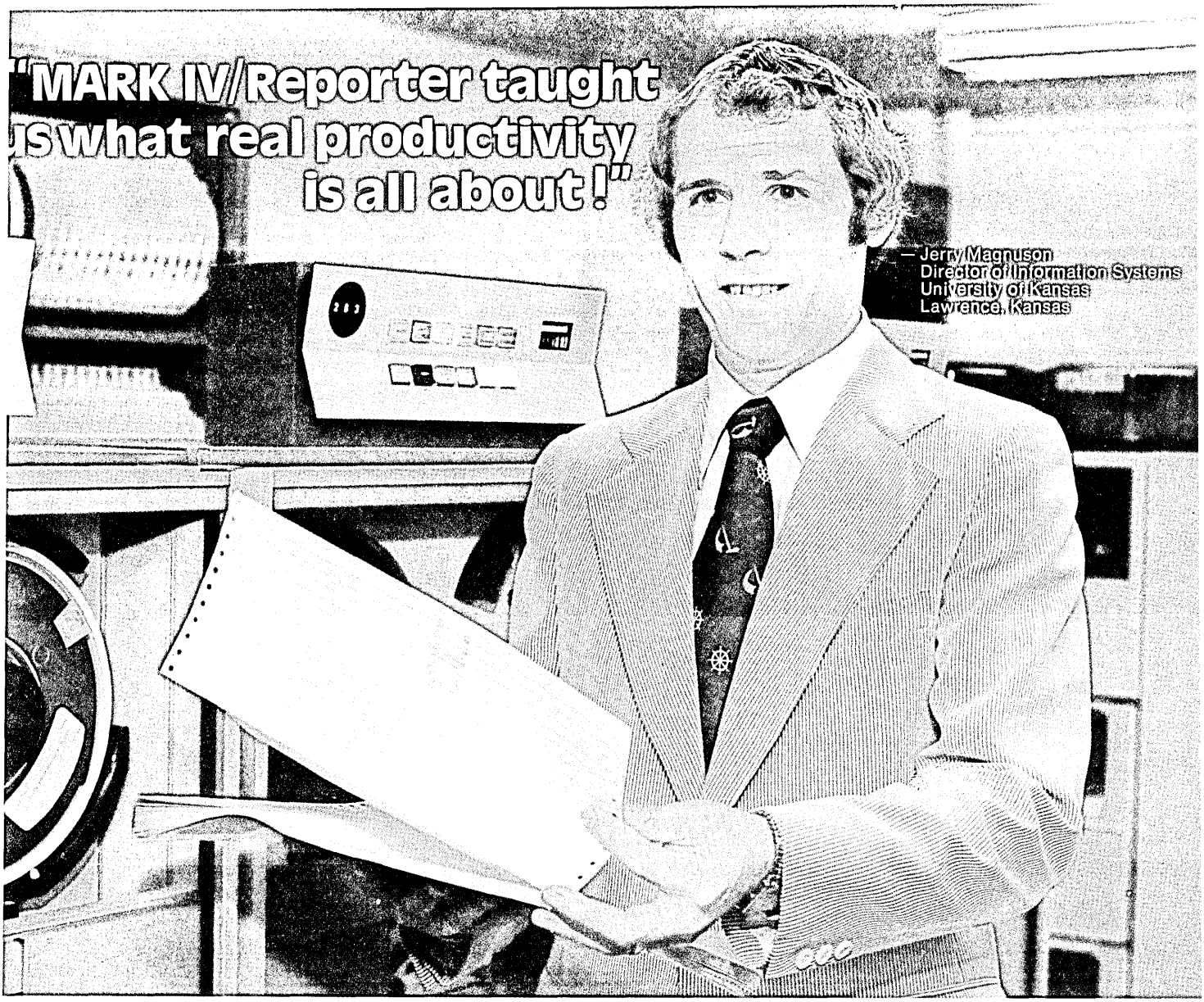
Three Phoenix Co., Phoenix, Ariz., outgrowth of the old Wabash Computer Corp., is manufacutring disc test equipment formerly manufactured by a major competitor, Siemens A.G. Siemens is distributing both its and Three Phoenix' equipment in the U.S. on a non-exclusive basis. Don Oglesby, president of Three Phoenix, said the company's own capacity in disc test equipment is sold out through mid-year. The deal with Siemens gives Three Phoenix a marketing capability it hasn't had since it was formed in 1973. "Before it was just myself," said Oglesby.

STORAGE FOR MINIS AND MICROS

A fast-growing Minneapolis company is poised to attack the low-priced data storage market with a 32 megabyte Carousel Tape System. National Computer Systems, Inc., whose revenues last year more than doubled to $27 million, has formed an oem sales force and named some international distributors to sell the system which consists of up to 16 quarter-inch DC 300A data cartridges made by Minnesota Mining and Manufacturing Co. (3M). Each cartridge, mounted in carousel form on the drive, has a recording density of 1,600 bpi and yields a transfer rate of 8,000 characters per second.

Aimed at the mini and microcomputer market where low-priced storage is considered subordinate to the availability of a large data storage medium (February 1977, p.170), the carousel is being offered to oem customers with an RS232 interface, and eventually interfaces for Data General's Nova mini and the DEC LSI/11 will be offered. Next, the company in the fourth quarter of this year will offer interfaces to IBM's Series 1 minicomputer.

(Continued on page 206)



"We purchased a General Ledger accounting system from a major vendor. After investigating, we found that we were going to have to drastically change the Cobol programs in order to generate all the required reports.

"Rather than this, we concluded that it would be far better to start from scratch and use MARK IV/Reporter for the 75 to 100 daily, weekly, monthly and year-end accounting reports that we produce. We made the right decision. If we had tried to modify the Cobol report writer that came with the system, it would have taken us at least two months longer to complete the project.

"MARK IV/Reporter was installed on our 370/145 within a few hours. The four people who attended a basic MARK IV/Reporter class were using it comfortably within a week. We also have a competent Cobol programmer who took the MARK IV® manuals home and read them over a weekend. He started using MARK IV/Reporter the next Monday morning.

"It runs very efficiently and it's helped increase the productivity of our systems and programming staff. With the confidence we've gained in MARK IV/Reporter we can commit to new projects now that would have been impossible before. We'll be using it for 50% of our new work, which includes a new student records information system. MARK IV/Reporter will be a key part of this new system. "As for Informatics Support, our staff here is very impressed; their people have been extremely competent and the systems engineering support has been excellent."

WHAT IS MARK IV/REPORTER? MARK IV/Reporter is an information processing system which handles all reporting requirements for existing file and/or data base systems. Although extremely flexible and powerful, the system allows non-programmers to produce error-free reports in a fraction of the time required with conventional programming methods. MARK IV/Reporter can be installed and implemented in the U.S. and Canada for as little as $306.00 a month. MARK IV/Reporter is upward-compatible to MARK IV whose 1,300 installations worldwide make it one of the most successful software products of all time.

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The acquisition of Mark IV was made possible by a grant of the University of Kansas Endowment Association. Mr. Magnuson oversees administrative DP activities for the Lawrence campus. The views expressed are those of Director Jerry Magnuson and not necessarily those of the University of Kansas.

CIRCLE 17 ON READER CARD

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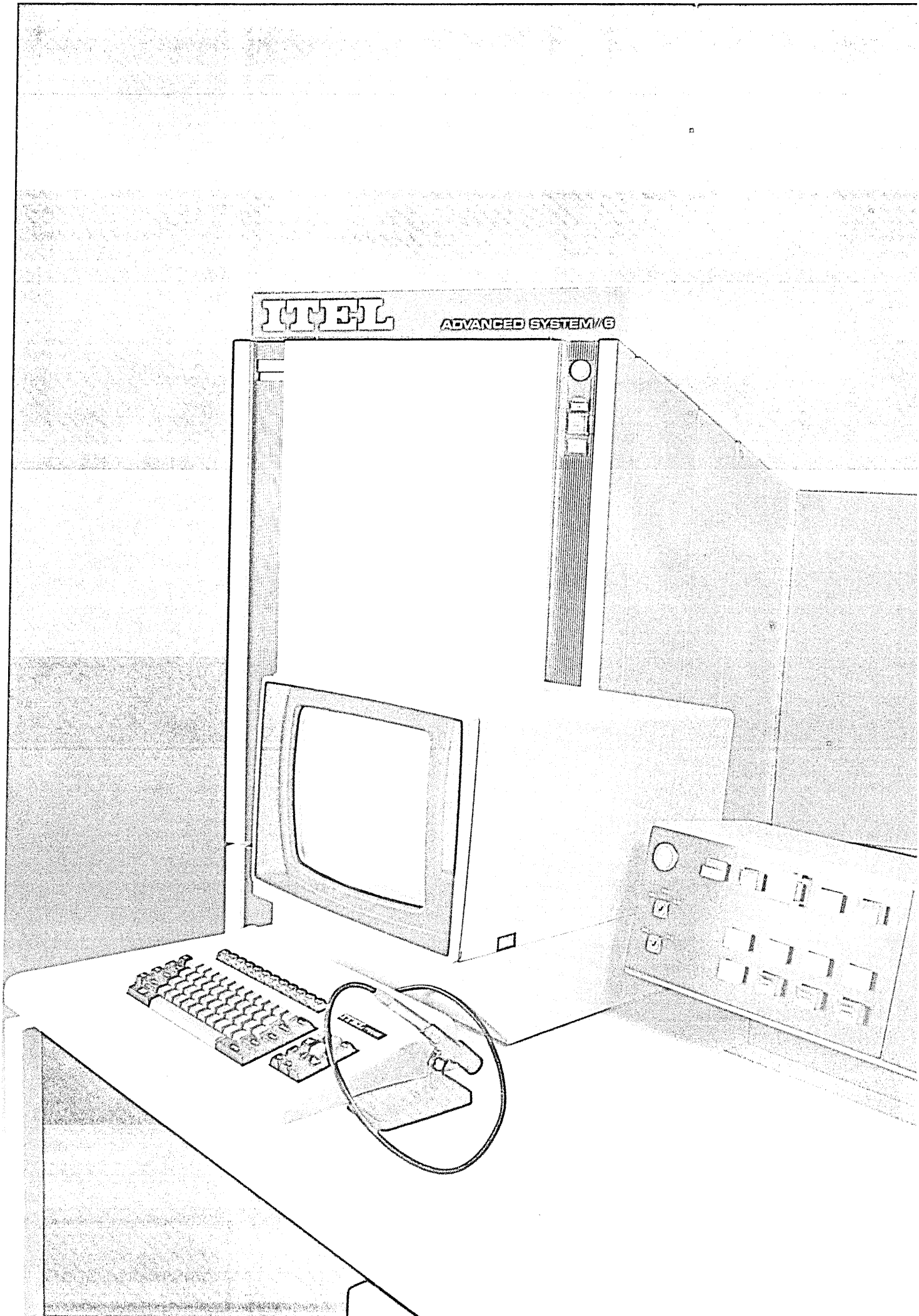
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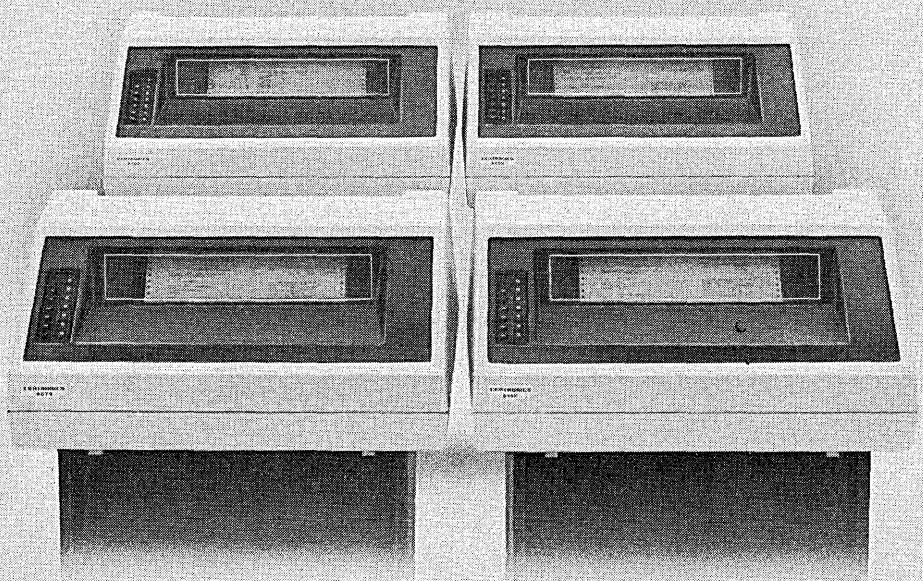

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letters

Keep Basic basic

The article "Structured BASIC Is Alive and Well in Denmark" (Forum, December, p. 243) was well written and seems to be a progressive step toward more comprehensible programming languages. There is one aspect mentioned, however, that I would like to comment on.

One major consideration in "expanding" a language is that while it may have been at one time a concisely defined set of grammatical formulas, the "expansion" sometimes causes unnecessary grammatical constructs to appear. These redundant constructs may be left in the language simply for reasons of "compatibility" with previous versions of the language or to ease the frustration of the programmer required to learn the new constructs.

Mr. Christensen mentioned adding three such constructs to his language, COMAL:

FOR . . . NEXT
REPEAT . . . UNTIL
WHILE . . . ENDWHILE

although each is only a different form of the more basic control structure LOOP . . . ENDLOOP (and thus we could do with one structure instead of three).

In any event, a requirement for any language is parsimony—the need for one and only one method of producing identical results. The parsimony aspect of languages must be followed in BASIC since its primary design is for novice programmers in schools and other nontechnical users.

JOHN M. ROJEWSKI
Programmer/Analyst
Farmer's Mutual Insurance
Lincoln, Nebraska

Misreading the readings

The December issue featured many pages of software package ratings ("User Ratings of Software Packages," p. 117). I assume that many, many hours and dollars were invested in the compiling and publication of those ratings, and all for naught!

Any rating that reports that 51 installations are using IBM's System/3 RPG and that 44 are using IBM's System/3 Sort has got to be the most distrusted information since the "I am not a crook" speech.

Yes, I read your disclaimer on page 119, but after all, why waste your time, money and space on something as meaningless as this survey? I'm sure many people would welcome the same investment if applied to additional articles of general interest.

RAY A. HAHN
Manager, MIS
Marshburn Farms
Norwalk, California

Whoa. Slow down. You've misread the numbers. The December feature did not report that 51 installations are using IBM's System/3 RPG. It reported how 51 installations rated that RPG. The reason we gave you the number in the first place was so you could judge how much confidence to have in the rating; and the reason we included the disclaimer was to remind you of that. True, a consensus of 51 installations is not Gospel, but it's far from meaningless to those who know how to use it.

Two cheers . . .

I believe Mr. Peters and Mr. Tripp (in "Comparing Software Design Methodologies," November, p. 89) are probably not aware of the fact that a variation of the Warnier methodology is becoming increasingly popular in the United States. This Structured Systems Design (SSD) approach was pioneered by Ken Orr of Langston, Kitch and Associates in Topeka, Kansas. It has upstaged other structured methodologies formerly in use at several major corporations and government agencies.

The authors suggested that the Warnier methodology is ". . . well suited to problems involving one module or only a few modules, and where the data are tree structured." This may be true of the limited material presented in the one Warnier book translated into English, but it is certainly not true of either Mr. Warnier's or Mr. Orr's complete methodologies.

The Warnier approach has been used for years in France to develop some very complex systems, among them a scheduling system for a data center. Closer to home, the State of Washington has developed a CICS/ADABAS on-line criminal justice system in record time using the Warnier-Orr approach (hardly your one or two module system). Also, the State of Nevada programmer/analysts completely designed, programmed and implemented a statewide payroll system using the Warnier-Orr approach. These are only a few of the many successful complex systems applications of these methods.

CHARLES H. FINLEY, JR.
President
Finley & Associates
Los Angeles, California

The authors respond: We are always pleased to hear of successful software development projects. However, software design methodology is only one of several factors that play a role in successes. The Warnier-Orr approach was not unknown to us. We had read an article about it, but more definitive information (in the form of a book by Orr) was not available at the time we wrote our article.

You may have misunderstood our intentions. The point we tried to make was simply that a given method would be easier to use on some problems than on others. No implication regarding success or failure was intended.

This does raise an important higher-level issue regarding the state of the art in software design. As an example, in mathematics, specific tests can be applied to a system of ordinary differential equations. The results of these tests will identify the means by which the equations can be solved. In contrast, in software there is currently no method of formalizing problems which uniquely represents a class of problems such that all members of that class can be solved via a specific technique. Perhaps this will be possible at some future time when problems are stated in a more disciplined, precise manner. About the only test currently available is the application of a technique and evaluation of the resulting system. For the time being, we must tolerate using our own favorite method on all the software problems we encounter.

. . . for Warnier

Training support for the "Warnier Methodology" or "Logical Construction of Programs" mentioned in "Comparing Software Design Methodologies" is also given as a two-week course by the education department of Honeywell Bull AG in Eschborn, Germany and by various other CII-Honeywell Bull affiliates in Europe.

We think it is a good, field-proven methodology, not only because Mr. Warnier is a Honeywell Bull engineer but also because we know LCP users who have applied it successfully for years.

WILHELM TAUREL
System Engineer
Honeywell Bull AG
Düsseldorf, Germany

And one for Structured Design

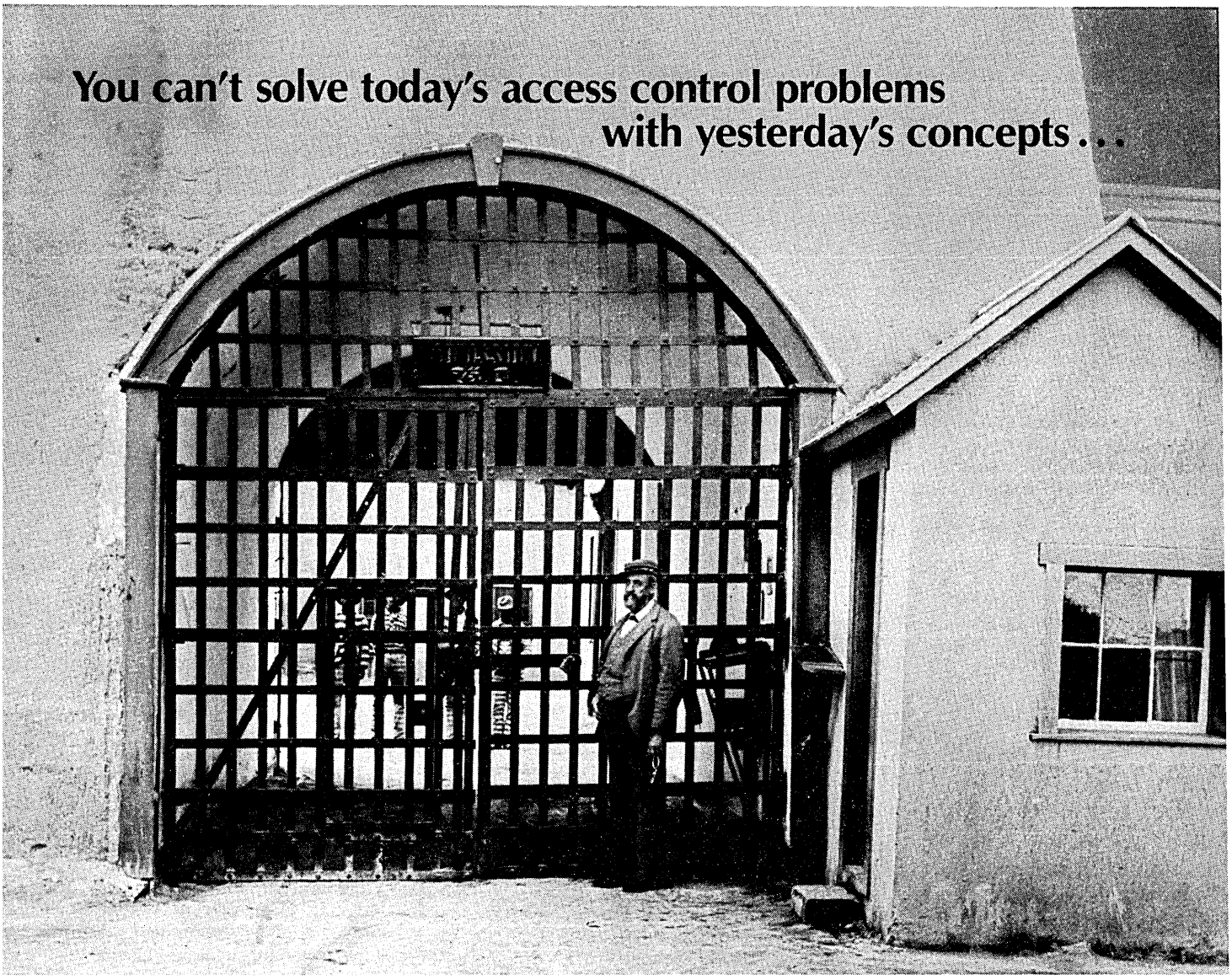
It was interesting to read the article in your November issue comparing the software design methodologies developed by our company and various other software experts.

Your readers may have some trouble tracking down the reference to a paper by Stevens, Myers, and Constantine. The paper was actually titled "Structured Design," not "Structural Design." And it was not published by our company, but rather in the May 1974 issue of the *IBM Systems Journal*.

We would, of course, be happy to take on the *IBM Systems Journal* as a subsidiary of our organization, but I'm

(Continued on page 26)

You can't solve today's access control problems with yesterday's concepts...



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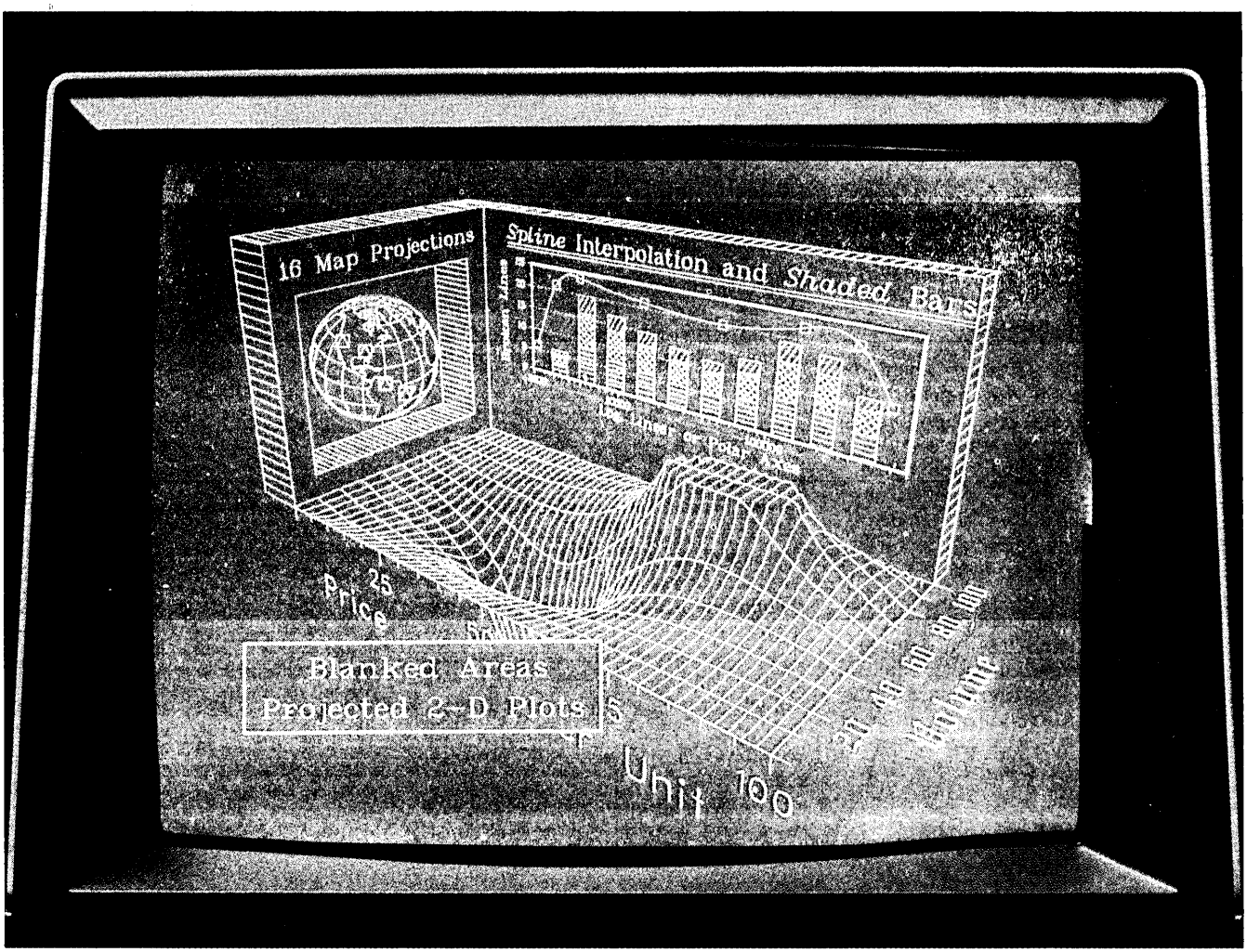

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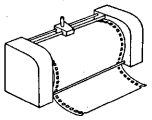

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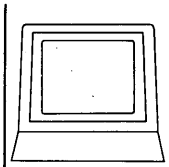

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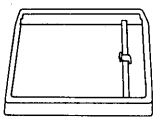

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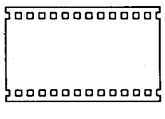

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letters

(Continued from page 23)

not sure IBM would go along with the idea.

EDWARD YOURDON
Chairman
Yourdon inc.
New York, New York

But have Pride, instead

Because I'm a solid advocate of some methodologies for software design, I read with interest the November article by Peters and Tripp. Alas, they failed to include PRIDE (Profitable Information by Design), marketed by M. Bryce and Associates of Cincinnati.

I agree with the authors that none of their five methodologies satisfactorily address the "whole problem." As an experienced PRIDE user, we recommend this beautifully simple solution for the preparation of not only superior designs, but superior end products.

STEPHEN F. NOYCE
Information Systems and
DP Manager
State of Idaho Transportation Dept.
Boise, Idaho

The (r)evolution of OCR

I enjoyed Dan Bowers's nostalgic romp through the generations of edp hardware in your 20th anniversary issue ("The Rough Road to Today's Technology," September, p. 69), but must take violent exception to his statement that optical character recognition has ". . . yet to surpass the widespread usefulness of (its) brother, magnetic ink character reading."

Magnetic ink character reading is used by one industry, commercial banking. It is a technology developed in the late 1950s, to solve the check processing problem—which it did—but it is extremely limited. . . .

OCR is used by public utilities, insurance companies, retail stores, oil companies, publishing houses, manufacturers, all levels of government, and, yes, many commercial banks which also have MICR equipment.

I have nothing against MICR equipment, but I don't like to see a statement such as Mr. Bowers made go unchallenged in a magazine with DATAMATION's stature. MICR does not have the "widespread usefulness" of OCR and never will have.

WILLIAM J. MULDOWNEY
Cinnaminson, New Jersey

Mr. Bowers responds: I am pleased that reader Muldowney rises to the defense of OCR, which certainly needs defending, although I would have preferred that his exceptions be motivated by reason rather than violence. For many years I have publicly held the view that we need and will have a revolution in data entry; I urge Mr. Muldowney and those in the OCR trade to lead this revolution and to fulfill the promises OCR has been making for 20 years. MICR is entrenched in the banks, and OMR is taking over the supermarkets. OCR is no doubt the inevitable and universal answer in the long run, but I'm not sure I'll live to see that day.

Turnabout reviewing

We take exception to two points in Mr. Patrick's review of our report to the National Bureau of Standards on the use of non-unique identifiers for accessing personal data files (October, p. 41).

First, Mr. Patrick has incorrectly assumed that Operating Systems, Inc. received a small business grant from NBS to carry out this work. In fact, OSI responded to RFP 5-35928PR which was announced May 21, 1975 in the *Commerce Business Daily*. The wording of this announcement was as follows: "Report on the efficiency and error tolerance of using *names and other non-unique identifying characteristics as a means of identifying individuals in files of personnel information.*"

This was an open competition with no special provisions for small businesses. On the basis of this competitive bid, OSI was awarded a small ($19,660) contract. Mr. Patrick's incorrect statements about the manner in which the award was made have prompted phone calls from an investigative reporter with a local television station who was concerned about possible misuse of government funds, and from private individuals seeking access to the easy money. Thus it seems essential to set the record straight.

Second, Mr. Patrick has strongly implied that we were not competent to perform the work. His criticism of the report can be summarized as follows:

- The report does not include a study of the algorithms used by circulation departments of major magazines.
- The study "lacked creativity (and this, in turn, causes me to suspect its credibility)." The only specific indication of lack of creativity cited by Mr. Patrick was failure to consider telephone number and zip code . . .

The first criticism related partly to his misunderstanding of the goal of the report: it is *NOT* a complete review of all currently used algorithms. Instead, we concentrated on the most difficult case where there is no guarantee that the file has been constantly maintained and where accuracy of identification is of great importance.

We disagree with the general criticism that the report lacks creativity. We also consider creativity to be a strange criterion for credibility.

Finally, the inclusion of telephone number and/or zip code as identifiers does not strike us as a particularly creative solution.

The final criticism is most curious of all: considerable space in the report is given to a discussion of data quality. At the risk of employing the same methods as he, we cannot help suggesting that Mr. Patrick did not bother to read the entire report.

GWENDOLYN B. MOORE
Senior Staff Analyst
Operating Systems, Inc.
Woodland Hills, California

Mr. Patrick replies: After reading Ms. Moore's letter, I re-reviewed the NBS Special Publication (500-2) that resulted from her work. I found that the foreword, the abstract, and the introduction did a fine job of presenting the problem. The discussion of state-of-the-art retrieval techniques was weak, and the whole dissertation rapidly gravitated toward a statistical treatment and a specific approach to only part of the problem. Thus the first 72 pages of prose and references are somewhat valuable, while the last 121 pages of computer printout are only of academic interest.

I commend NBS for seeking a definitive paper which would describe techniques for identifying individuals without the use of a Social Security number. I congratulate OSI for successfully winning the competition and receiving a study **contract.** I apologize to the barristers among the Datamation magazine readership who make a distinction between a contract with vague deliverables, i.e., a report, and a grant which says "take my money and do your best."

However, I would like to borrow a fleece from Senator Proxmire. I don't think they structured the problem, their literature search was shallow, and they did not address all the important aspects of the problem. I don't think the results exhausted the subject or were worth $20,000 of tax money.

Testing: system vs. design

I would like to thank DATAMATION for publishing Laura L. Scharer's article "Improving System Testing Techniques" (September, p. 115). Testing long has been neglected in our field, and yet, as she pointed out, it is the only practical means of product quality control available.

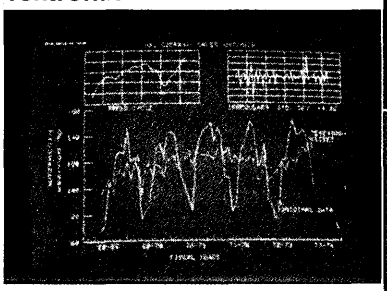
However, Mrs. Scharer has overlooked one critical consideration for testing in a business systems environment, that of the user's expectations of a system. She states that ". . . planning for the system test will commence as soon as detailed design and program specifications have been approved." Unfortunately, this is too late a stage to begin test planning.

In fact, it appears she advocates testing with respect to the design of the

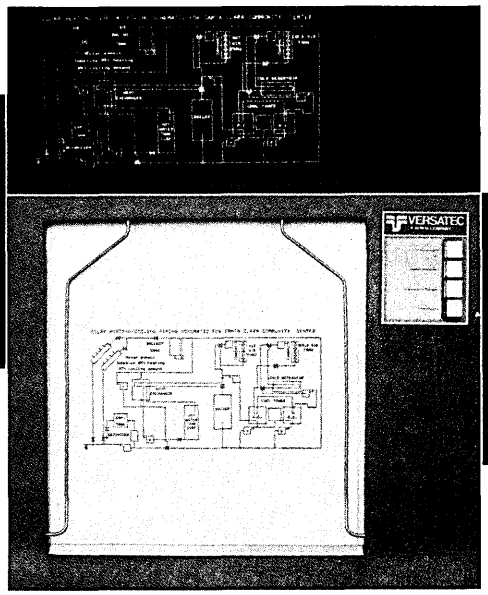
(Continued on page 228)

Which display has Versatec hard copy?

Tektronix



Hewlett-Packard



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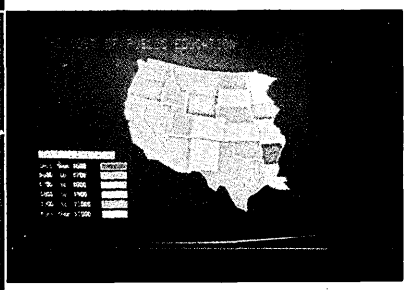

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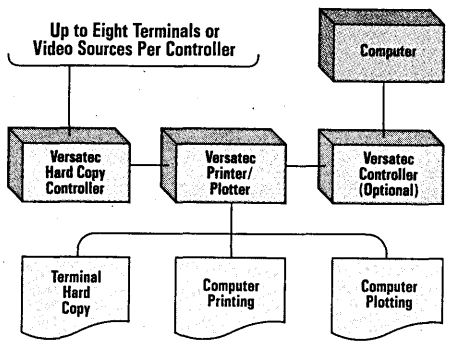
Get a permanent record. Give yourself more time to study graphics and images without tying up your terminal. Strengthen your next report with key visuals. Improve analysis, monitoring or design.

Get the best copy quality at the lowest copy cost. No fade. No deterioration. True archival quality for 2¢ a copy. That's less than one-fourth the cost of dry silver paper.



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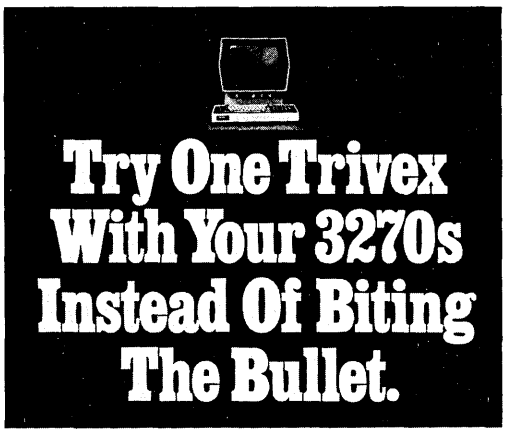

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DP Dialogue

Notes and observations from IBM that may prove of interest to data processing professionals

Computer-based manufacturing systems help Boeing build commercial aircraft like these giant 747's. IBM's TPNS lets Boeing test such online programs under realistically simulated conditions.

BCS 'Test Flies' Online Systems with TPNS

"Putting any part of a critical computer system online without thorough testing—under every likely and unlikely condition—would be like test flying an airliner with passengers aboard."

The analogy comes naturally to Jerry Kotulan. As manager of technology for Boeing Computer Services, Inc. (BCS), Seattle, Kotulan has a complex of six IBM Model 168's in his charge. One of the most critical applications in the center is the On-Line Planning (OLP) System, which supports manufacturing operations in the Boeing Commercial Airplane Company through 330 in-plant terminals.

"IBM's Teleprocessing Network Simulator (TPNS) lets us test a system under realistic operating conditions, including heavy terminal traffic," he says. "The simulator incorporates 'scripts' of typical user transactions and exercises all of the network support software as well as the system logic.

"There's a lot more to testing a large online system than just validating the logic," Kotulan points out. "How well does it work with a full load of terminal transactions? Where does response time fall off? At 300 users? At 350? TPNS gives us accurate measurements of such performance variables directly, without involving the terminal network at all."

Today the mainstream of the work of several hundred manufacturing engineers is on the OLP system; it controls tool planning and shop order release for 470,000 airplane parts. It is part of a developing family of manufacturing applications that will include an Order Location System to track work through the shop and a Parts Inventory Control System. This entire group of programs, Kotulan explains, will run under the Information Management System/Virtual Storage (IMS/VS).

"To use TPNS, we write a few test transactions, which are enough to exercise every system function. Then TPNS acts as an application program 'driver,' using these inputs to generate message traffic. We can ask it to generate any desired transaction load profile, to bring out hidden logic problems and obtain detailed measurements of performance under load," Kotulan says.

"When we make a maintenance change or enhancement, it must be done fast and be 'transparent'—unnoticeable—to the user. New systems must be correct at startup and stay that way. TPNS helps us meet that reliability standard."

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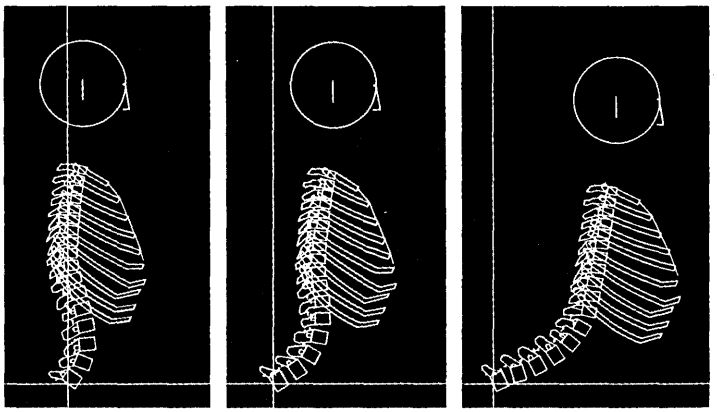
Simulated Spine Hastens Injury Research



The effect of a 30-mph automobile crash on the human trunk is shown by these drawings derived from a computer. A normal spine is at left; the center and right views show its position 20 and 40 milliseconds after impact.

This insight into the complex mechanics of the backbone was made possible by a mathematical model of the spine, developed on an IBM System/370 Model 158 at the Chicago Circle campus of the University of Illinois, sponsored in part by the Aerospace Medical Research Laboratory. Engineers at the university are studying the effects of injuries and disease on the back.

The potential benefit is far-reaching, since eight million people in the U.S. suffer from back problems, and half a million currently wear braces.

"We don't know much about that sophisticated structure we call the spine," says Dr. Albert B. Schultz, professor of mechanical engineering. "We're working with orthopedic surgeons to learn more, in the hope of preventing and treating back problems."

"Because we can apply engineering principles to the skeletal system," adds Dr. Ted B. Belytschko, professor of structural engineering, "we can sometimes determine in a few days responses to treatment which would take years to find by observing results of therapy."

In one experiment, the computer simulates the force applied to the spine by a therapeutic brace. "This helps show us the effectiveness of different modes of treatment," Dr. Schultz notes. "In treating lateral curvature of the spine, or scoliosis, the model has told us that applying pressure from the side will often be more effective than a stretching force."

By means of the computer model, engineers in the university group have predicted the effect of a hip-to-neck brace in a number of patients. The actual results of treatment supported the predictions in 80 percent of the cases.

Each year an additional 400,000 American workers incur back injuries; Dr. Schultz and his colleagues expect the computer model to help analyze their causes. The results will be available as guidance to therapists, orthopedists and industrial safety programs.

Farsighted Financial Planning at American Optical

"Eighty percent of our major investment decisions, that's five a day, are evaluated for internal rate of return. On the average, our actual performance is within 10 percent of what we predict."

Marvin M. Eisner, chief financial officer, American Optical Corporation, is talking about a computer-based financial simulation model. It uses the IBM Planning System Generator II (PSG II/VS), which is run on the company's System 370/Model 158 and uses a program language oriented to financial planners.

American Optical Corporation, a subsidiary of the Warner-Lambert Company, is the world's largest manufacturer of optical products. Inherent in the business are a wide range of investment opportunities that have vastly different conditions. For example, a line of designer eyeglass frames may have a short selling life and high promotional expenses. A new microscope, however, may incur costly research and development, but have a long selling life.

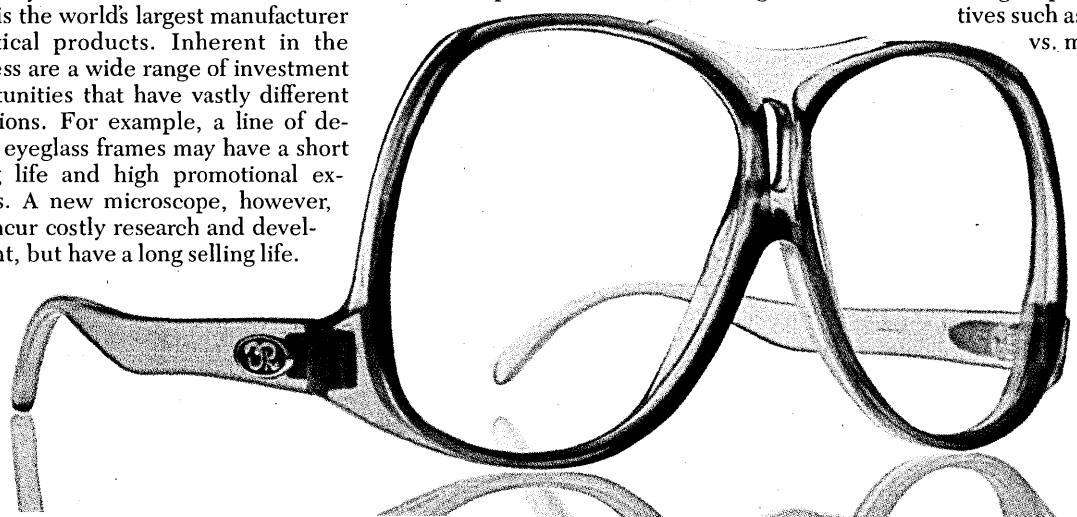
"We need information that is timely and relevant," says Eisner. "But we take a farsighted look at investment horizons of 10 years, so we apply discounting to the time value of money.

"R & D is one of our more uncertain investment opportunities. In order to evaluate R & D project feasibility, we work backwards from a desired rate of return, which we call a hurdle, and through a series of iterations determine the maximum allowable capital expenditure."

"To do this, we created a program called Capital Simulation, which gives us a series of project income statements and cash flow reports," says Wayne Krautkramer, manager of financial analysis, optical products division. "Each one reflects a different set of assumptions of capital and its relationship to variables for which we have estimates, such as direct cost, market penetration and selling price."

Fifty percent of financial modeling at American Optical evaluates capital expenditures, such as new investments in plant and equipment. New ventures and improved products cover 35 percent. The remaining 15 percent is on alternatives such as buy vs. lease, buy vs. make and budgeting functions.

"We've seen a positive behavioral change in the corporation as a result of using the modeling," Eisner reports.



Fast Answers to Tough Energy Questions

"Suppose the government made major changes in national energy policy," speculates Prof. John J. Donovan of MIT. "What would be the economic impact on each region of the U.S.? How would the economy change if the fuel supply were to be altered? If prices were to change? What effective actions can be taken by homeowners, industry and public policymakers?"

To help provide prompt answers to such questions, the Generalized Management Information System (GMIS) was jointly developed by IBM, MIT Sloan School of Management and the MIT Energy Laboratory. IBM provided staff support and the use of a System/370 Model 158 at its Cambridge Scientific Center. GMIS has been used to analyze conservation strategy in, for example, the consumption of energy for residential heating across the United States. And it has been used to produce programs and a data base for energy policy analysis in New England. Called the New England Energy Management Information System (NEEMIS), this application was developed through a collaborative effort among MIT, the New England Regional Commission (a Federal-New England states partnership) and IBM.

What can the homeowner do? According to Donovan, an associate professor at the Sloan School: "An econometric model shows that, for a homeowner in the Northeast or upper Midwest, a thermostat setting of 65 degrees (daytime) and 55 at night—or 63 around the clock—will save 15 percent of his energy costs.

"Other computer models produced using GMIS suggest measures for commercial buildings. For some institutions in the Boston area, these models identified ways to reduce energy costs by 40 percent (of which 20 percent required no capital improvements).

"To answer questions like these," he continues, "the Energy Laboratory has collected data and computer programs from government research, professional and technical groups, and university research efforts. A user can scan the data base interactively to locate and define the needed data and select a suitable modeling system.

Most homeowners today want to keep warm without wasting energy. At MIT, computer simulation has shown that a 24-hour thermostat setting of 63 degrees saves as much fuel as a night setting of 55 degrees.

"GMIS is a universal bridge to this diverse collection of data: Whatever type of analysis is to be used—a simulation or a regression analysis, for instance—GMIS provides the interface between the required language and the data."

Users with terminals in their offices are now working out solutions interactively. Using programs created under GMIS, engineers in the government of the state of Maine are conducting studies to determine the best use of the money available for energy conservation.

GMIS data has helped the New England region avert a proposed oil tariff by demonstrating its negative economic effects there.

"Sound public and private policymaking and resource management require prompt, accurate information on many such issues," Donovan says. "GMIS is designed expressly as a tool to provide that information."

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3. IMS/VS Data Base Structure Mapping (IMSMAP/VS) produces maps and reports on a line printer describing an IMS/VS data base.

For more information on these and other IBM software products, contact your local IBM branch office or write to the Editor of DP Dialogue at the address on the right.

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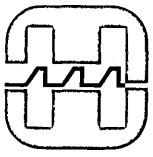

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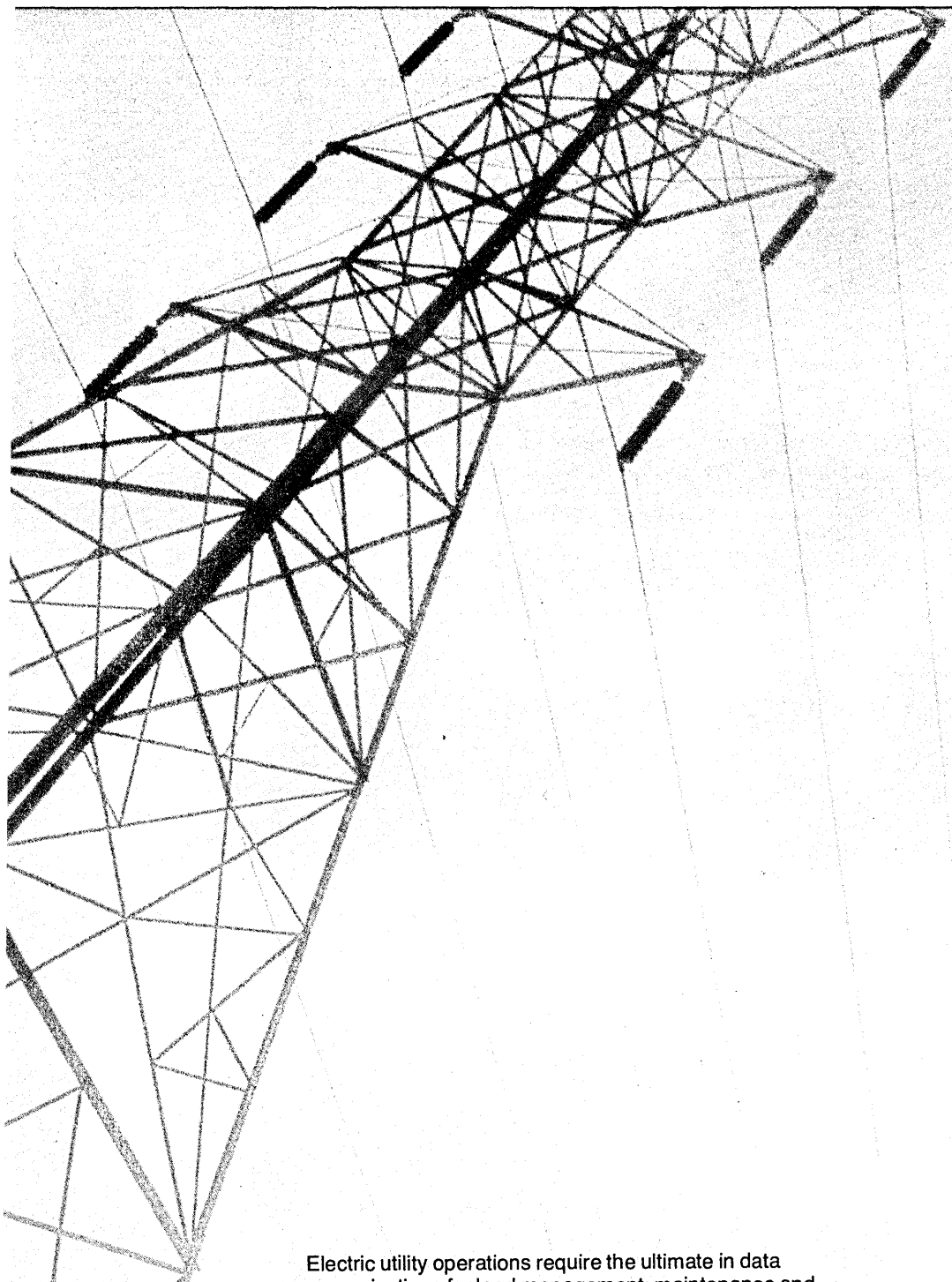

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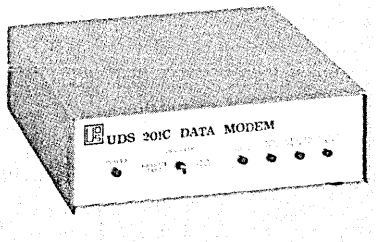

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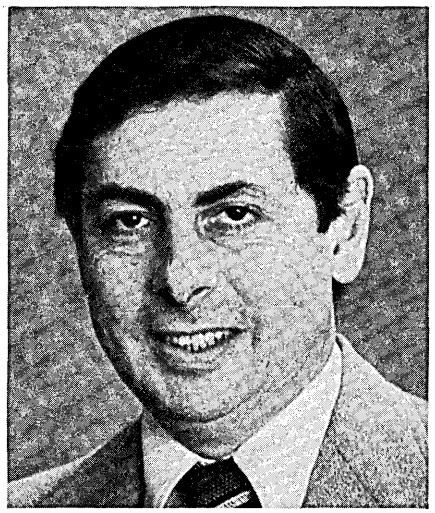
Goldstein: "No Monopolists Here"

Bernard Goldstein has spent all of his adult life in the computer services industry, an industry about which he always has been optimistic.

By 1985, said the newly appointed senior vice president of Tymshare, Inc., "we will see as many as a dozen firms whose revenues exceed $250 million or $300 million. They will share about 50 percent of the industry's total revenues. There still will be room for the small local companies and those with arcane specialities. The computer services industry will not produce a monopolist as the hardware side did. No one firm will dominate."



BERNARD GOLDSTEIN
"where ignorance could survive"

Looking ahead is a big part of Goldstein's job at Tymshare where he has responsibility for "strategic planning. This means stepping away from the one- and two-year time frame and looking out three years and beyond for long range opportunities." Prior to the recent promotion, Goldstein was vice president for corporate development in charge of acquisition and merger activities. His new position includes continuing direction of the acquisitions activity

Goldstein does not believe IBM will reenter the services business, a business it left in 1973 when it sold its Service Bureau Corp. to Control Data as part of an antitrust settlement. IBM agreed as part of the settlement that it wouldn't compete in services for six years which will be up next year. "I know I'm in the minority in my opinion," Goldstein said. "A lot of the incense burners think otherwise."

"They're (IBM) not well enough equipped," Goldstein said. "Take for example, the most generic of computer services, payroll. The biggest in payroll is ADP (Automatic Data Processing) and it only brings in $75 million a year. IBM got out of the time-clock business because it was only bringing in $50 million a year. They've got bigger fish to fry."

While sure that IBM won't come back to computer services "in the traditional way," Goldstein feels that "some aspects of their communications services will have sub-features that resemble data processing."

Goldstein settled on data processing services as his industry when he was released from the Navy in 1957. "I was too neurotic to go to work for anybody else and the computer services industry looked like one in which ignorance could survive. It was the right place for my inexperience and my premature entrepreneurial urge."

With two associates he formed a services company, Computech, Inc., in 1957. Computech was acquired by Control Data in 1964 and Goldstein became New York district director for CDC. He left CDC to co-found United Data Centers, Inc. of New York City and became part of Tymshare when the Cupertino, Calif. headquartered firm acquired United Data Centers in 1974. Goldstein is based in Tymshare's Darien, Conn. office.

A native of New York City, Goldstein was a finance major at the Univ. of Pennsylvania's Wharton School and at Columbia University's graduate school of business.

He has been a vocal spokesman for the computer services industry in his 20-plus years in it and served for two years as president of the Association of Data Processing Services Organizations (ADAPSO) in 1971 and '72. Currently he is ADAPSO's vice president for unfair competitive activity. "The banks and the government are the bad guys," he says of that job.

Goldstein cited among other reasons for selecting computer services as his industry, the fact that "I didn't know anything but nobody else knew any more." He said he's never regreted his decision. "The industry and my peers have been good to me."

Chips Impact Product Planning

Microprocessors are finding homes in unusual places. Consumer products such as tv sets and audio cassette decks are examples. But they are also going into such mundane products as gasoline pumps and esoteric things like torpedo controllers. The technology represented by those little processor chips is a boon to manufacturers of all sorts of electronic products.

But it has an even more profound implication for the management of those companies, says James T. Chao. The microprocessor and the LSI technology behind it, he says, are changing not only the way products are designed and manufactured but also the way they are marketed. Chao adds that manufacturers are being forced to restudy their markets and restage their product planning and strategy activities in order to determine where their value-added function is to be. All this because their competitors may be buying their microprocessor chips from the same supplier.

Chao, who a year ago became director of Computer and Electronic Technologies at the Bendix Research Laboratories in Southfield, Mich., speaks from a background of many years in the industry. He was in on the early design of the Burroughs B5000 and the Bendix Computer G-20 mainframes before forming his own company, Information Technology Inc. There he designed and developed small machines before they came to be called minicomputers. His ITI 4900 made its debut a few months before Digital Equipment Corp. introduced the PDP-8.

Born in Peking and reared in Taiwan, Chao got his BS and MS degrees in electrical engineering from the Univ. of Southern California in the late 1950s. In pursuit of a Ph.D., he moved to northern California to enroll at Stanford. He helped finance his education with a part time job at Data Technology Corp., a newly formed instrumentation company in Palo Alto, where he applied digital techniques in coming up with analog function generators and frequency synthesizers. It was this work that led him to think there was a need for small computers.

The Air Force at that time was using analog computers to perform flight simulations. Mainframers such as IBM, CDC, and GE proposed the use of large-scale digital computers. "But," says Chao, "I showed them that if they had lots of small, dedicated computers to do the job it would be much more efficient than a large-scale machine." Chao's ITI was selected to supply those minicomputers ("That term hadn't even been coined at that time").

His first machine had an instruction

people

set almost identical with DEC's PDP-11, which was not to debut until some ten years later. Chao's machine was designed to sell for about $30K. He delivered 15 machines to the Air Force. For the first five years of the company's short life, sales and earnings almost doubled each year. But overexpansion and the recession of the early '70s did the firm in.

In the period that followed, Chao went around the world twice to complete consulting assignments on international technology transfer for the State Dept. and on the development of electronic industries for the World Bank. His travels took him to the major electronics firms in Europe and Japan and to semiconductor assembly plants in Southeast Asia. But it was a stint at the Stanford Research Institute that opened his eyes to the marvels of market research and product strategy and planning.

With this experience under his belt, Chao has the job now of getting Bendix, which has some 50 operating divisions, to apply the latest LSI technologies to the company's products. They range from automotive applications to mobile homes to aerospace and industrial electronics.

"We have no interest in designing a computer," he says. "But computers will be imbedded into the product line, almost all the products. This applies to the entire electronics industry," he adds, and not just to his employer. He says the Fortune 100 industrial companies, whether they know it or not, are facing the same thing.

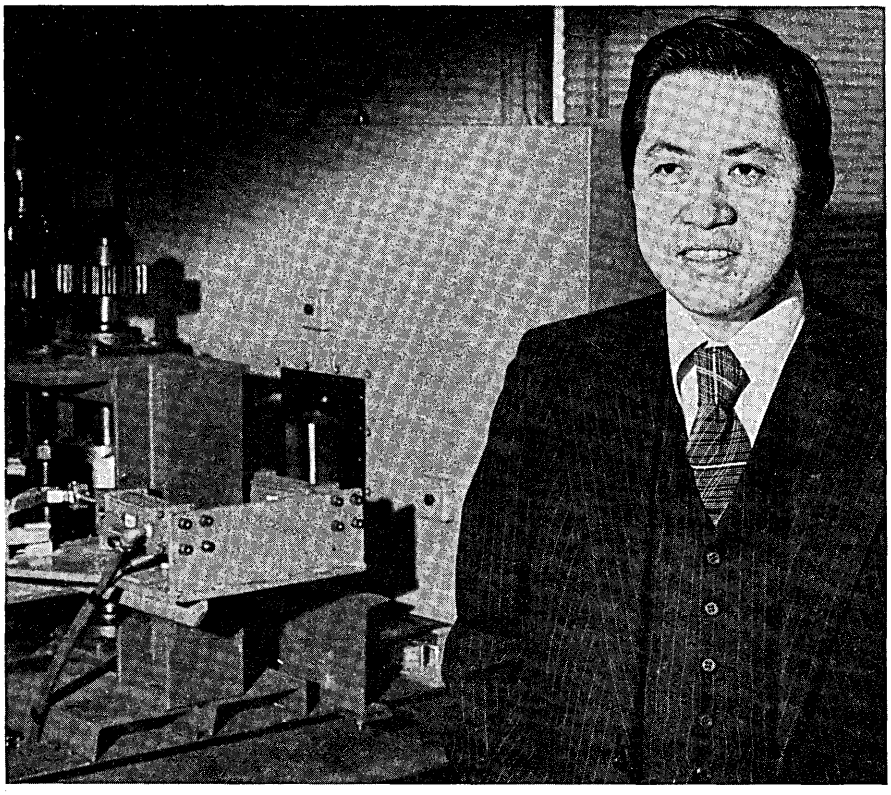
These companies, he believes, must develop the skills necessary to apply to their operations and products the technologies of microelectronics, software, and systems architecture. Chao places a premium on the latter, something not understood yet by industrial firms. "Just like 20 or 30 years ago in the computer industry," he explains, "we went through exactly the same thing. We didn't understand what that really meant. But that's one of the most important parts."

"Almost every company becomes a computer company," he says.

Speaking of the pervasiveness" of semiconductors, he notes that an engineering manager at an electronics manufacturing firm formerly managed people engaged in circuit design, in packaging, and drafting. But this is changing. "In the old days we had engineering drawings. Now the engineering drawing consists of nothing but a lot of lines of code."

In product test, there were technicians handling a probe and using an oscilloscope. Their efficiency depended on their ability to trace and isolate problems. "But we no longer have that luxury. . . How fast can a technician move his probe? Now we can go to 100,000 points a second. No technician can move that fast." That's test automation, again computer-controlled.

"Basic knowledge of the whole computer technology," says Chao, "is becoming the most fundamental part of any electronics company." He sees these developments posing both a serious challenge to these manufacturers and "on the other hand, for people who recognize the dramatic change and capitalize on it, it's an enormous opportunity."



JAMES T. CHAO
"Every company becomes a computer company."

In New Posts

GARY E. LIEBL joined Microdata Corp., Irvine, Calif., as president of Microdata International and senior vice president, Microdata Corp. He had been with Columbia Pacific Resources, Inc. as corporate vice president in charge of AzurData, a computer terminal manufacturing subsidiary. . . RICHARD E. DOOLEY was elected senior vice president of Colonial Penn Group, Inc. He joined the company in Sept. 1977 as president of Colonial Penn Group Data Corp., a subsidiary. . . . JANET KRALICEK was promoted to the newly created position of manager, quality assurance for Boole & Babbage, Inc., Sunnyvale, Calif. . .. DARRELL R. MAY was named manager of the Management Information Services Div. for Allendale Insurance, Johnston, R. I. . . . HERBERT M. SCHENE, vice president, Canada/Latin America in NCR Corp.'s International Data Processing Group for the past two years, was named vice president Far East/Australasia. . . STEVEN H. PUTHUFF was appointed vice president, engineering, for Memorex Corp. . . . ALAN C. MELKERSON is the new president and chief executive officer of Gandalf Data, Inc., Wheeling, Ill. manufacturer of high performance data communications equipment. . . FRANK BIAMONTE was appointed general manager of STC Systems, Paramus, N. J. subsidiary of Storage Technology Corp. . . . JOHN J. WOOLDRIDGE was named senior director of engineering for the Satellite Communications product area of California Microwave, Inc., Sunnyvale, Calif. . . .

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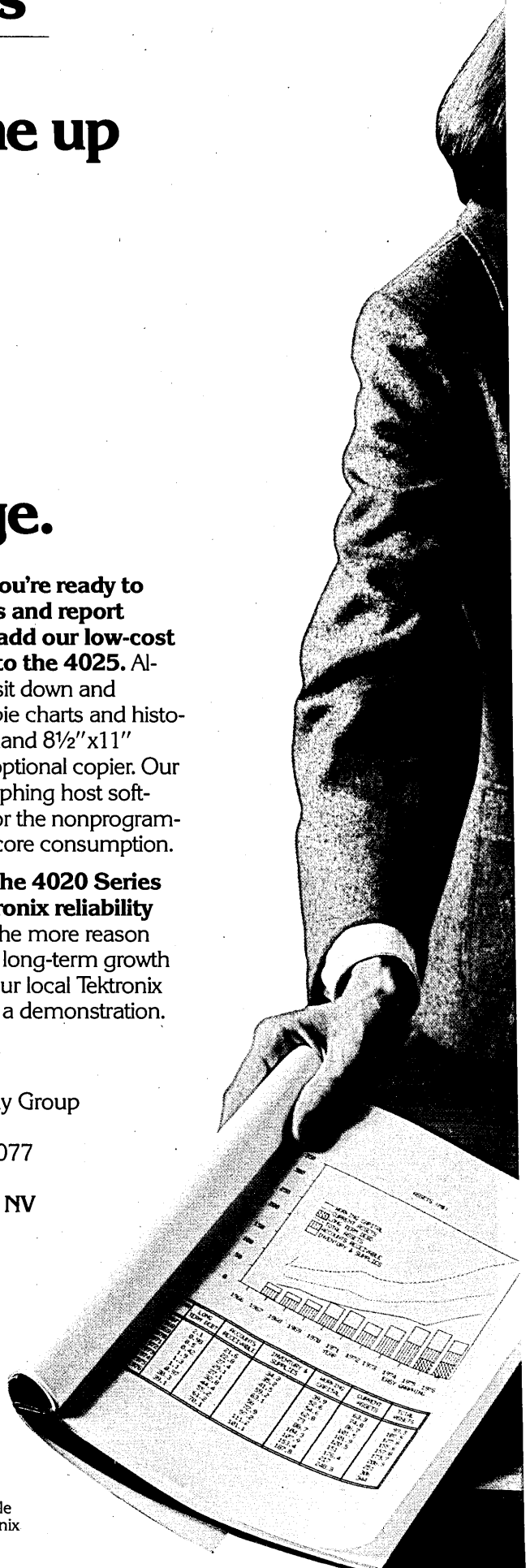

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calendar

FEBRUARY

ACM Computer Science Conference, Feb. 21-23, and **SIGSCE meeting, Feb. 23-24,** Detroit. The sixth annual computer science employment register and book displays featuring current texts on subjects in the field of computers and information sciences will highlight this three day conference. State-of-the-art papers and submitted reports on current research by students, faculty, and researchers will be offered, and there will be an instructional equipment display and the finals of the ACM National Student Computer Programming Contest. Registration fees for the conference are: $25, member; $30, nonmember; $10, student. The SIGSCE technical symposium on computer science education immediately follows the conference. Registration fees for the symposium are: $20, member; $35, nonmember; $10, student. Contact: Dr. Seymour Wolfson, Computer Science Section, Wayne State Univ., Detroit, Mich. 48202 (313) 577-2477.

Compcon 78 Spring, Feb. 27-March 2, San Francisco. With the theme "Computer Technology: Status, Limits, Alternatives," sessions for this conference will include discussions of distributed processing and computing, microprogramming techniques, microprocessor developments, architecture, operating systems, universal cross software, and high order languages. The technical sessions will focus on hardware, software, and applications, and a one-day tutorial on Feb. 27, "Limitations and Alternatives in Future Silicon LSI Technology" will be offered. There also will be sessions on large-scale scientific computation, LSI testing, simulation, economic modeling, and office systems word processing. New for this meeting is a series of special exhibits on personal computing, which carries an individual registration fee of $5. Registration fees for the tutorial only are: $60, member; $75, nonmember; $30, student member. For the Tutorial and Compcon both, fees are: $120, member; $150, nonmember; $45, student member. For Compcon only, fees are: $60, member; $75, nonmember; $15, student member. Contact: A. J. Stripeika, Lawrence Livermore Laboratory, P.O. Box 808 L-151, Livermore, Calif. 94550.

Computer and Communications Industry Assn. Washington Caucus, Feb. 28-March 1, Washington, D.C. Guest speakers at this year's caucus will include Sen. Edward M. Kennedy, Sen. Ernest Hollings, Assistant Attorney General John Schenefield, and Director of the Federal Trade Commission's Bureau of Competition Allen Dougherty. The program will be structured to provide a dialogue with these policy-makers on such topics as capital formation and tax policy, antitrust enforcement and reform, international trade opportunities and barriers, national telecommunications policy, federal procurement policy, practice and organization, and the state of the nation's economy. Contact: CCIA, 1500 Wilson Blvd., Arlington, Va. 22209 (703) 524-1360.

MARCH

2nd West Coast Computer Faire, March 3-5, San Jose, Calif. Nearly 100 papers will be presented at this conference and exposition devoted to home and hobby computing. Such topics as the legal aspects of personal computing, computer networking for the general public, personal computers and education, speech recognition, and speech synthesis with personal computers will be addressed. Approximately 190 manufacturers will exhibit at the Faire. Registration for all exhibits and presentations for the full three days will be under $10. Contact: The Computer Faire, P.O. Box 1579, Palo Alto, Calif. 94302 (415) 851-7664.

Data Communications Interface 78, March 6-9, Las Vegas. More than 175 exhibitors will display their products and services, and 70 program sessions will be offered at this annual show on computers and communications. Program topics will include the Datacomm School designed for newcomers to the data communications field and for executives needing an introduction and overview of data communications. Each of the school's sessions will stress the basics for decision-making rather than the technical aspects of the methods and products used. Other conference sessions will discuss Privacy: A Worldwide Datacomm Conflict; Hardware Highlights; Software Strategies; Getting into Packet Services; Net Workshops; Datacomm Management; and Technology Forum for the Future. Five comprehensive sessions will specifically address software issues. Registration for the full four-day conference and exposition is $95. The one-day registration fee is $60. Group discounts are available. Contact: Data Communications Interface '78, 160 Speen St., Framingham, Mass. 01701 (617) 879-4502; (800) 225-4620 (outside Massachusetts).

3rd International Conference on Computers and Design, March 14-16, Brighton Metropole, Sussex, U.K. This year's program will include 70 papers on the areas of computer applications in building design, civil and structural engineering, manufacturing, and NC in the formal sessions, and about 15 less formal tutorial papers. Emphasis will be on the practical use of the various techniques of computer science in CAD, including graphics and data bases. Registration is £90 + £7.20 VAT for the three days, or £45 + £3.60 VAT for a single day. Contact: CAD 78, IPC Science and Technology Press Ltd., 32 High St., Guildford, Surrey, England GU1 3 EW.

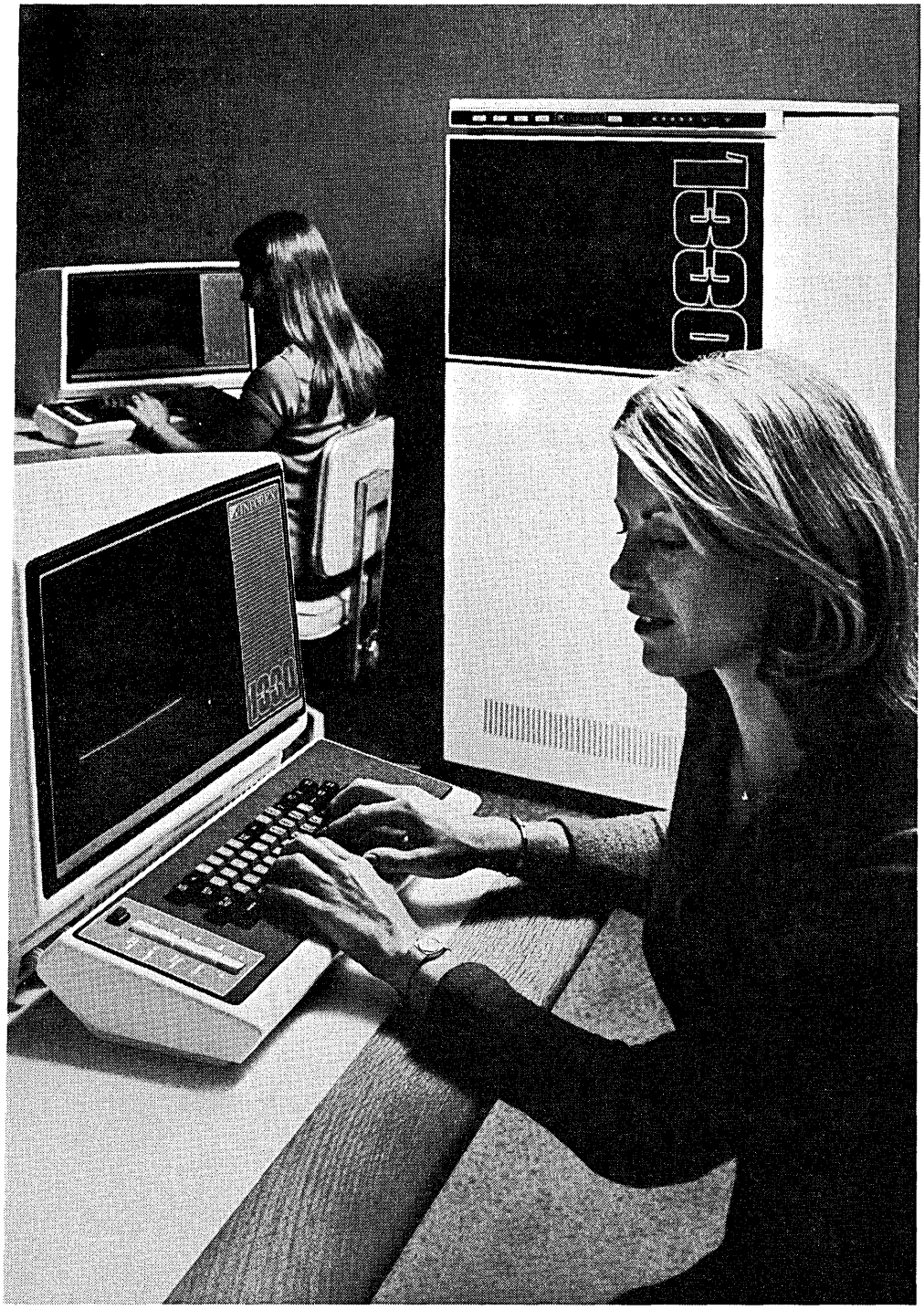
ON THE AGENDA

DPMA COMtec National Conference, Feb. 27-March 3, San Francisco. Contact: Jack Abbott, Cetec Corp., 290 Fischer Ave., Costa Mesa, Calif. 92626 (714) 545-7676.

Federal ADP Users Group Conference on Zero Base Budgeting, March 13-14, Washington, D.C. Contact: U.S. Professional Development Institute, 719 N. Belgrade Rd., Silver Spring, Md. 20902 (301) 649-1177.

Printemps Informatique, March 14-17, Paris. Contact: Peter Ryan, U.S. Dept. of Commerce, Domestic & International Business Administration, Washington, D.C. 20230 (202) 377-2849.

11th Annual Simulation Symposium, March 15-17, Tampa, Fla. Contact: Annual Simulation Symposium, P.O. Box 22621, Tampa, Fla. 33622.



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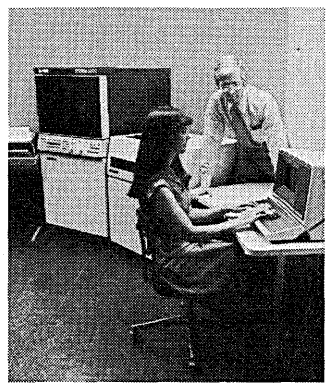

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CIRCLE 25 ON READER CARD

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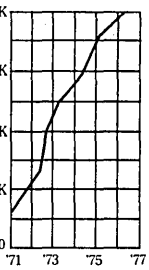

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calendar

The Oregon Report on Computing, March 20-22, Portland, Ore. Contact: T. G. Lewis, Computer Science Dept., Oregon State Univ., Corvallis, Ore. 97311 (503) 754-3273.
Data Entry Management Assn. Regional Meeting, March 30-31, Washington, D.C. Contact: Data Entry Management Assn., 16E Weavers' Hill, Greenwich, Conn. 06830 (203) 531-4036.

APRIL

8th Annual Symposium on Automatic Imagery and Pattern Recognition, April 3-4, *Gaithersberg, Md. Contact: Electronic Industries Assn., 2001 Eye St. N.W., Washington, D.C. 20006 (202)457-4981.*

5th Annual Symposium on Computer Architecture, April 3-5, *Palo Alto, Calif. Contact: IEEE Computer Society, P.O. Box 639, Silver Spring, Md. 20901 (301)439-7007.*

Communications '78, April 4-7, *Birmingham, England. Contact: Tony Davies Communications, c/o P.D. Bishop, 8 Coningsley Rd., South Croydon, Surrey, CR2 6QP, England.*

8th Conference on Computer Audit, Control, and Security, April 10-13, *New York City. Contact: Institute of Internal Auditors, 249 Maitland Ave., Altamonte Springs, Fla. 32701 (305)830-7600.*

ADAPSO 49th Annual Management Conference, April 12-14, *Phoenix. Contact: ADAPSO, 210 Summit Ave., Montvale, N.J. 07645 (201)391-0930.*

Workshop on Pattern Recognition and Artificial Intelligence, April 12-14, *Princeton, N.J. Contact: Prof. Y.T. Chien, Dept. of Computer Science, Univ. of Connecticut, Storrs, Conn. 06268*

National Information Conference and Exposition, April 17-19, *Washington, D.C. Contact: Information Industry Assn., 4720 Montgomery Lane #904, Bethesda, Md. 20014 (301)654-4150.*

Mini/Microcomputer Conference and Exposition, April 18-20, *Philadelphia. Contact: Bob Rankin, Mini/Micro '78, 5528 La Palma Ave., Anaheim, Calif. 92807. (714)528-2400.*

Hannover Fair, April 19-27, *Hannover Messe, W. Germany. Contact: Helga Meixner, Schenkers International Forwarders, 1 World Trade Center #1867, New York, N.Y. 10048 (212)432-3000.*

Percomp '78, April 28-30, *Long Beach, Calif. Contact: Percomp '78, 1833 E. 17th St., Santa Ana, Calif. 92701 (714) 973-0880.*

MAY

Micrographics '78, May 9-12, *Boston. Contact: National Micrographics Assn., 8728 Colesville Rd., Silver Spring, Md. 20910 (301)587-8444.*

Eurocomp '78, May 9-12, *London. Contact: On- Line Conferences, Cleveland Rd., Uxbridge UB8 2DD, England.*

Edp '78, May 9-15, *Milan, Italy. Contact: Tommy Thomas, U.S. Dept. of Commerce, Washington, D.C. 20230 (202) 377-4508.*

International Conference on Software Engineering, May 10-12, *Atlanta. Contact: IEEE Computer Society, P.O. Box 639, Silver Spring, Md. 20901 (301)439-7007.*

Assn. for Educational Data Systems Conference, May 15-19, *Atlanta. Contact: Dr. James E. Eisele, Office of Computing Activities, Univ. of Georgia, Athens, Ga. 30602.*

7th ASIS Mid-Year Meeting, May 22-24, *Houston. Contact: ASIS Headquarters, 1155 16th St. N.W., Washington, D.C. 20036 (202) 659-3644.*

JUNE

Isratech '78, June 4-8, *Jerusalem, Israel. Contact: Government of Israel Investment Authority, 641 Lexington Ave., New York, N.Y. 10022 (212)486-8538.*

National Computer Conference (NCC), June 5-8, *Anaheim, Calif. Contact: AFIPS, 210 Summit Ave., Montvale, N.J. 07645 (201)391-9810.*

4th Annual Symposium and Exhibition: MIMI '78, June 12-15, *Zurich, Switzerland. Contact: Secretariat, MIMI '78, Interconvention, c/o Swissair Postfach, 8058 Zurich, Switzerland.*

Computers in Banking, June 13-15, *Zurich, Switzerland. Contact: Secretariat, Computers in Banking, Interconvention, c/o Swissair Postfach, CH-8058 Zurich, Switzerland.*

Design Automation Conference, June 19-21, *Las Vegas. Contact: IEEE Computer Society, P.O. Box 639, Silver Spring, Md. 20901 (301)439-7007.*

FTC-8, June 21-23, *Toulouse, France. Contact: Jean Claude Rault, DIB-Thomson CSF, 33 rue de Vouille, 75015 Paris, France.*

Syntopicon VI, June 21-23, *Washington, D.C. Contact: IWP Assn., Attn: Lorraine Lear, AMS Bldg., Maryland Rd., Willow Grove, Pa. 19090 (215)657-3220.*

JULY

Summer Computer Simulation Conference, July 24-26, *Newport Beach, Calif. Contact: 1978 Summer Computer Simulation Conference, P.O. Box 2228, La Jolla, Calif. 92038.*

AUGUST

ACM Sigmini Symposium on Small Systems, Aug. 2-3, *New York City. Contact: ACM, 1133 Ave. of the Americas, New York, N.Y. 10036 (212)265-6300.*

Jerusalem Conference on Information Technology, Aug. 6-9, *Jerusalem, Israel. Contact: Anthony Ralston, SUNY-Buffalo, 4226 Ridge Lea Rd., Amherst, N.Y. 14226.*

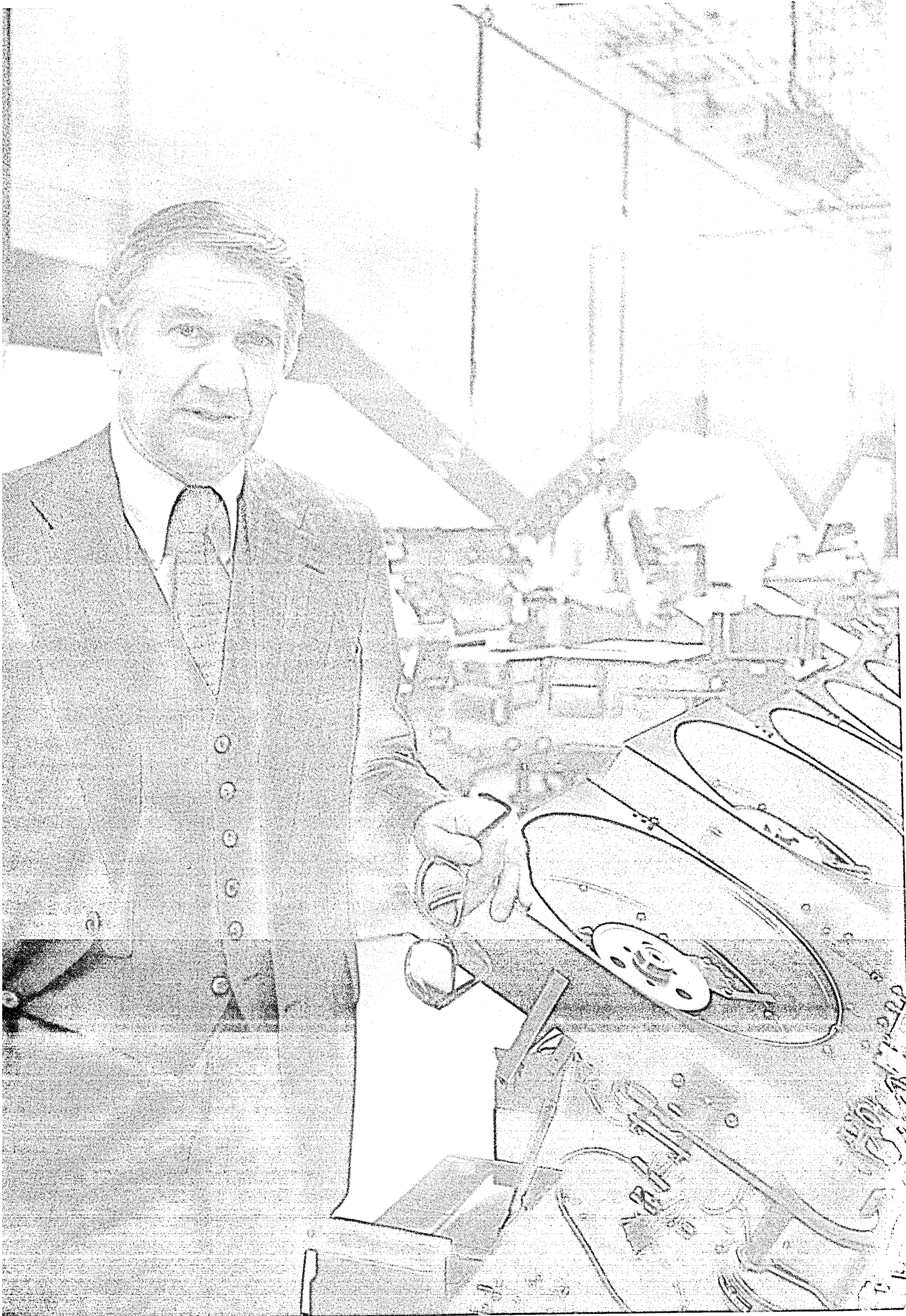
Conference on Computer Graphics and Interactive Techniques, Aug. 23-25, *Atlanta. Contact: ACM, 1133 Ave. of the Americas, New York, N.Y. 10036 (212)265-6300*

Compstat 1978: Symposium on Computational Statistics, Aug. 21-25, *Leiden, The Netherlands. Contact: Centraal Reken Instituut, Univ. of Leiden, Wassenaarseweg 80, Leiden, The Netherlands.*

8th Australian Computer Conference, Aug. 28-Sept. 1, *Canberra City, Australia. Contact: Australian Computer Society, Box 448, Canberra City A.C.T. 2601, Australia.*

SEPTEMBER

Southeast Asia Regional Computer Conference, Sept. 4-8, *Manila, Philippines. Contact: Philippine Computer Society, MCC P.O. Box 950, Makati Commercial Center, Metro Manila, Philippines.* ❋



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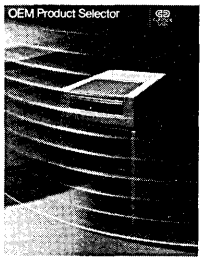

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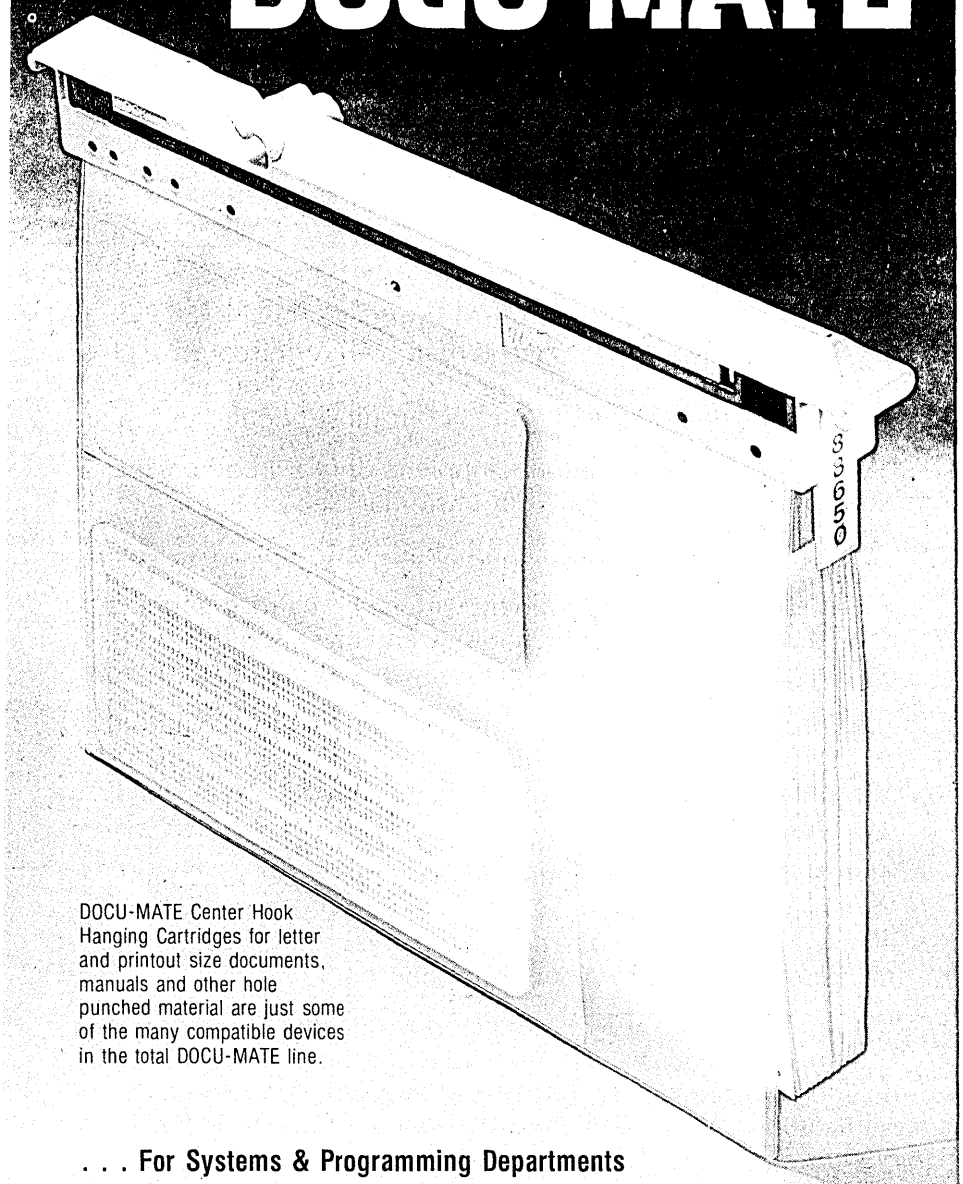

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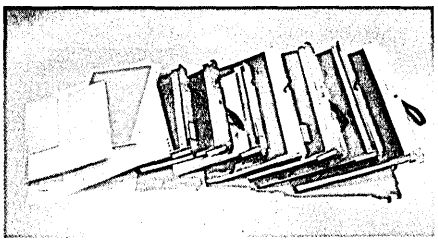

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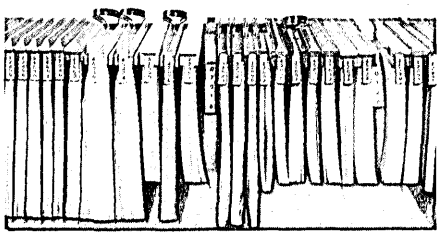

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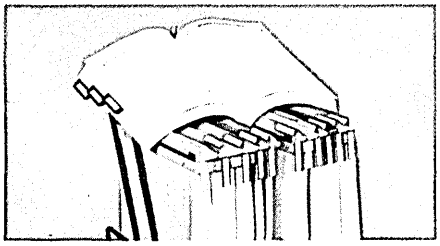

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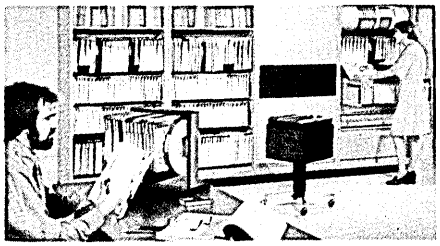

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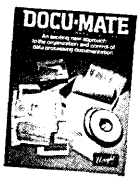

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CIRCLE 15 ON READER CARD

source data

SOURCE DATA provides information on books, courses, references, reports, periodicals, and vendor publications.

books

Structured Systems Development

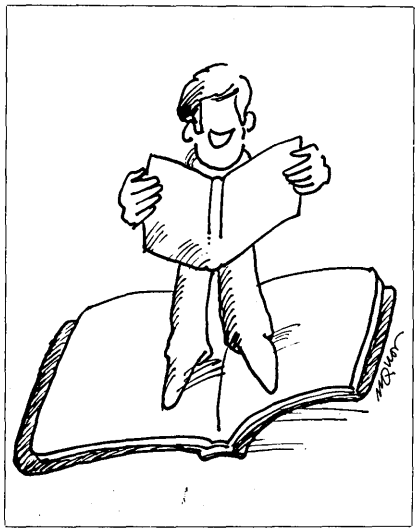
by Kenneth T. Orr
Yourdon Press, 1133 Ave. of the Americas, New York, N.Y. 10036 (1977)
192 pp. $17.00

Here is a book to rouse feelings of ambivalence. It does an excellent job of promoting Warnier diagrams, thereby adding a valuable technique to the system developer's tools, but does nothing spectacular for system development itself. It is not a long book and is easily read. I was able to read it on a trip to Oklahoma City and return, and found its message presented in a straightforward and interesting fashion.

In the book, Kenneth Orr makes some interesting extensions of Warnier diagrams and shows how the diagrams may be applied to system analysis, system and program design, data base, and output format descriptions, and a variety of other applications. In the process he covers the relative merits of flowcharts, HIPO diagrams, formal documentation, Nassi-Schneiderman charts, and Yourdon-Constantine structure diagrams. In each instance, Orr finds the Warnier diagrams more compact, clearer, and more informative. Nevertheless, he leaves room for the application of these other techniques and even shows how they may complement one another and be combined into more powerful tools. It is obvious that Orr has given his area considerable thought and has evolved a powerful tool.

On the other hand, Orr writes as if functional and structural decomposition were the whole of system analysis. No mention is made of trade-offs, testing methods, or evaluations of alternative designs. (However, the possibility of alternative solutions is included.) Further, although the existence of environmental factors is mentioned, no real attention is paid to the often tedious task of exact definition of interfaces that often is the system analyst's lot. The establishment of system objectives and the derivation of information requirements is mentioned in passing, but largely in terms of showing the flexibility of Warnier diagrams in adapting to changes and adapting to the uncertainties of the customer's grasp of his problem.

On the design side, Orr dismisses the theoretical work of Myers, Constantine, and Yourdon with a word—he doesn't believe in it—but adopts the notion of simple control structures and the forward flow of processing quite wholeheartedly.



Technically, Orr shows the equivalence of Warnier diagrams, hierarchy charts, flowcharts, and Nassi-Schneiderman charts. He also shows the facility of the Warnier diagrams in overcoming some of the shortcomings of the other techniques. I thought him a bit unfair in his critique of HIPO diagrams (although I do agree that they tend to be verbose and difficult to maintain), since he showed a functional complexity of a "module" that good modularity would not permit. He does suggest some reasonable extensions to HIPO's in terms of depicting the handling of data files.

Another interesting extension was the substitution of a Nassi-Schneiderman diagram for the process box of the HIPO. Orr apparently likes the Nassi-Schneiderman more than flowcharts of HIPO's, but points out the speed with which internal complexity drives them into microscopic box size. Both HIPO's and Nassi-Schneiderman are difficult and costly to maintain for a system of any size, while Warnier diagrams are relatively easily changed.

Orr also points out that while structured design languages are adequate for communication among professional data processors, they are nearly as obtuse as any other programming language to customers. However, Orr does present a fragment of an SDL of his own—fragmentary in that only limited block structuring and no data structures are included.

As one can see, while the emphasis is upon the application of Warnier diagrams to analysis, design, and testing of data processing systems, Orr does touch a lot of other bases. In short, while hardly a profound book, it could serve as an opener on the way to real improvement in structured analysis and design.

—N. E. Willmorth

Dr. Willmorth has been employed at System Development Corp. since 1955 on a variety of projects, and is professionally active both locally and nationally. He has served as chairman of L. A. SIGPLAN and is a member of the ACM Committee on Self-Assessment Testing and the AFIPS committees on job descriptions for programmers and systems analysts.

BOOK BRIEFS . . .

Realization of Data Protection in Health Information Systems

edited by G. Griesser
North-Holland Publishing Co.
Elsevier North-Holland Inc., distributors
52 Vanderbilt Avenue
New York, N.Y. 10017
214 pp.

The IFIP Working Conference on Realization of Data Protection in Health Information Systems was held in Kiel, the Netherlands, in 1976. This book is a collection of the accepted conference papers, which were compiled and distributed before the meeting so that the conference could be a comprehensive discussion of the issues. Papers were either based on personal experience in the field or on technical aspects. Some titles of papers are: "Experience with the Swedish Data Act," "Data Protection by Software Techniques with Special Regard to Problems Created by Multiuser Access," "Data Protection by Hardware Precautions with Special Regard to Distributed Hardware and ID Cards." Most of the papers include charts and references.

Also included are the text of the discussion sessions at the conference, one each on software, hardware and "orgware," and one on the interdependencies between these areas; and summary and conclusions by the authors of the book, who were members of the conference committee. ❋

(Continued on page 56)

Introducing a true heavy-duty 120 cps teleprinter.

Our new EDT 1232 is equipped with a 1,024 character buffer which permits an effective throughput of 120 characters per second.

Our built-in buffering capability virtually eliminates the need for carriage return and line feed "fill" characters.

The EDT 1232 gives you fully formed, upper and lowercase characters instead of a series of dots. So you get high print quality, time after time. Even with multiple-part forms.

Expanded carriage.

It also offers versatile form handling. Multiple-part forms can be vertically front-loaded. Or, forms can be loaded from the rear.

With its expanded carriage, the EDT 1232 has 132 print positions per line, which makes it ideal for your computer-generated reports.

The EDT 1232 was designed to operate on a continuous 12-hour-per-day duty cycle to meet your data communication needs.

Its continuous ribbon-loop cartridge is easy to replace and the re-inking unit on the EDT 1232 can extend ribbon-life up to 100 million characters.

Multiple configurations.

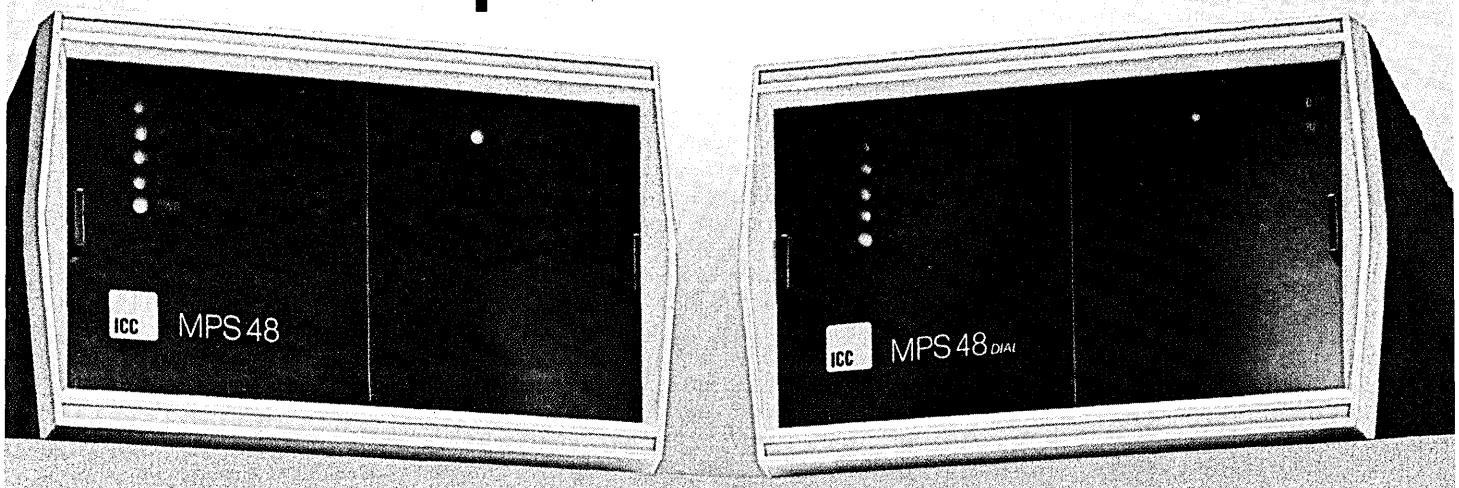
To meet your systems needs, we're offering the EDT 1232 in a variety of configurations. It is available as a keyboard send/receive (KSR) teleprinter, shown above, as a KSR with magnetic tape cassette buffer or as a Receive-Only with our Video 100.

Like all of our terminals, the EDT 1232 is supported by our nationwide Termicare® service.

For more information, call Bob Roth toll-free 800-631-7050. (In New Jersey, 201-529-1170).

western union data services

These modems transmit at least 108 bits of data while other 4800 bps modems are still trying to equalize the line.



Data communication stops every time a modem switches between sending and receiving. That's normal. But since this switching often occurs more than once a second, the length of this "turnaround time" is very significant to the user.
That's where our MPS 48 modems offer a special advantage.
Equalization time is only 26 milliseconds—about half that of conventional modems.
So, while other 4800 bps modems are waiting for a Clear to Send signal, the MPS 48 transmits at least 108 bits of information.
With this ultra-fast turnaround time, you get maximum data throughput, even over poor quality lines.

There are 10 more advantages described in our new 16-page booklet. We'll gladly send you a copy.

Racal-Milgo™ — the new name for ICC

Racal-Milgo, Inc., 8600 N.W. 41st Street, Miami, Florida 33166, Telephone (305) 592-8600
In Europe: Racal-Milgo Limited, Reading, Berks, England

member of IDCMA

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source data

(Continued from page 53)

reports & references

Software Guide

This guide provides owners of medium to large-scale general purpose computers with the information needed to select the right combination of data base/data communications software to best meet their needs, the publisher reports. The annual publication also provides guidelines for the implementation of a distributed processing system, and the information needed to move to an on-line data base/data communications system.

The three sections of the guide discuss the areas of data base management, data communications control, and information storage and retrieval. Each section contains a tutorial covering the basic concepts of the topic and a description and evaluation of each product. Price: $59. AUERBACH PUBLISHERS, INC., 6560 N. Park Dr., Pennsauken, N.J. 08109.

Bubble Domain Memories

This report is said to analyze the technology and the probable market trends for bubble domain products for the next five years. Applications for the memories are discussed, as well as competitive technologies and the industry participants. Sample chapter headings include: history, industry structure, the technology, the total market for bubble memories, markets by application and price/performance trends, and competition within the bubble domain. Price: $950. VENTURE DEVELOPMENTAL CORP., 1 Washington St., Wellesley, Mass. 02181.

Performance Evaluator

The purpose of this 250-page report is to provide a reference manual for the selection of a minicomputer or microcomputer. *Mini/Micro Computer Performance Evaluation* is divided into six sections: introduction, executive summary, comparative specifications, comparative architecture, comparative KIPS (instructions/second), and computer selection for specific applications. Sixty computers representing 10 semiconductor manufacturers and 10 minicomputer manufacturers are analyzed and categorized (20 minis and 40 micros). The report is said to be specifically written for product planners, evaluators, market researchers, and corporate engineers responsible for purchase recommendations, but also would be of interest to suppliers of mini/microcomputers who need to evaluate the performance of their products against competition. Price: $995, first copy; $195, additional copies. SMALL BUSINESS SYSTEMS, 4320 Stevens Creek Blvd., San Jose, Calif. 05129.

Quality Assurance

For the past several years, a separate organization at Grumman's Data Center has been responsible for the implementation of a quality assurance program. This department is said to have developed and refined techniques to assure a level of quality and control to enable achievement of low operating and system maintenance costs. Among other activities, design reviews, audit reports, standards development, and the transition to development are described in this 39-page report. The facility handles both internal aerospace work and an outside group of users. It operates two IBM 370/168s, an IBM 360/65, and other equipment. The report concludes that the QA group has provided constructive criticism and recommendations for applications implementation, systems software, and hardware configuration management. Highlights include: organization, a quality assurance (QA) overview, deliverables for QA, QA activities, standards, and types of audits. There also is a section on questions and answers, 15 tables and figures, and a bibliography. Price: $25. FAIM TECHNICAL PRODUCTS INC., Box 1013, Melville, N.Y. 11746.

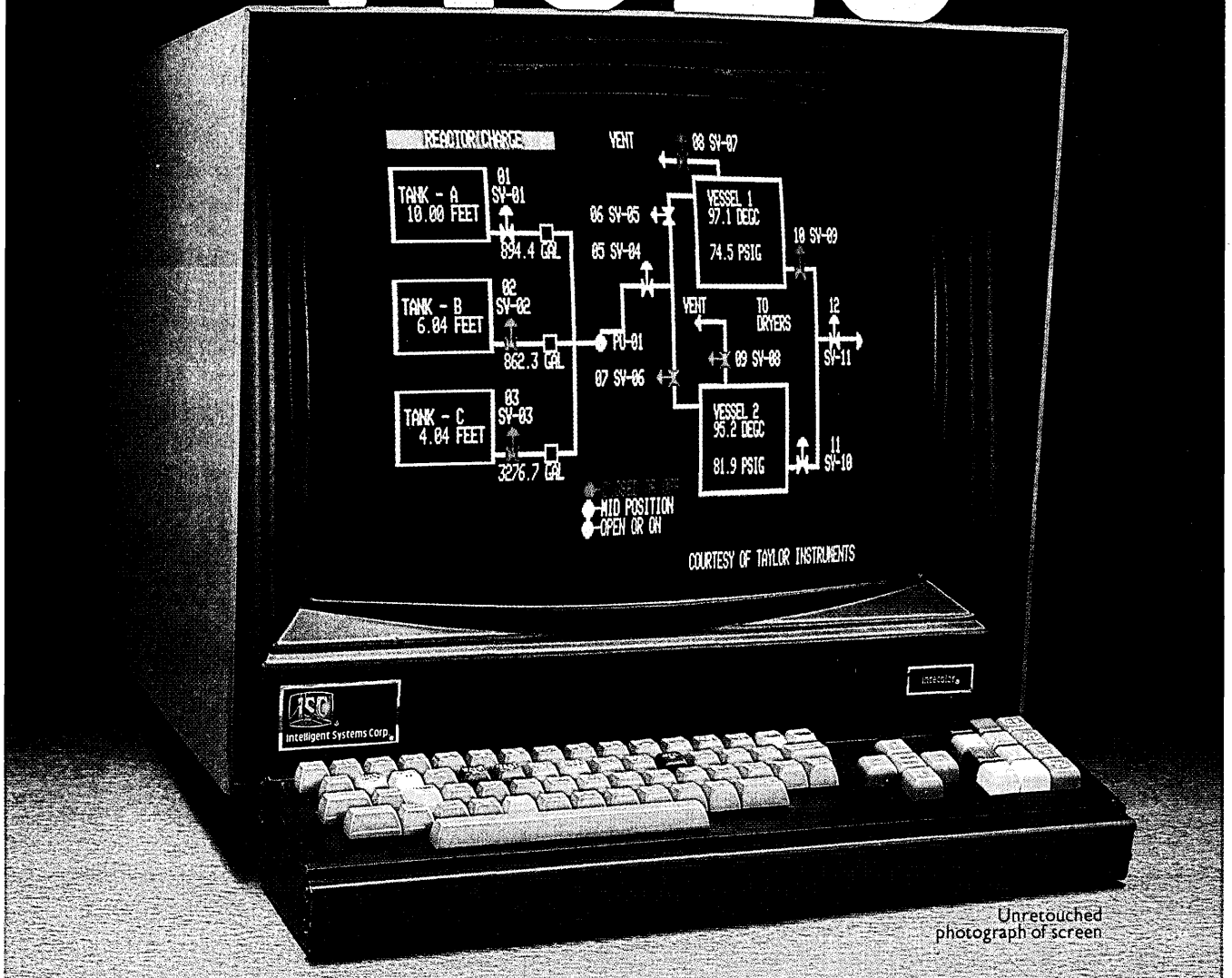
DD/DS Portfolio

Users are aided in their selection of data dictionary/directory systems by this new portfolio, *Criteria for the Selection of Data Dictionary/Directory Systems*, designed to help them compare, evaluate, and select a commercial DD/DS. Administrators and managers of MIS are provided with uniform, objective, comprehensive criteria for evaluating and comparing packaged software systems, and the information will enable them to eliminate their dependence on more subjective methods, the publisher says. Price: $10. AUERBACH PUBLISHERS INC., 6560 N. Park Dr., Pennsauken, N.J. 08109.

Security/Privacy Lectures on Tape

Three lectures on techniques for security and privacy in computer systems recently have been released. The three tapes, available individually or as a series, are: "Authentication Methods in Computer Systems," which outlines methods for verifying the identities of users, terminals, and systems. "Author-

$1925



Unretouched photograph of screen

There isn't a process control system in the industry that our Intecolor 8001G can't improve, because color communicates faster. Bailey Meter, Taylor Instruments, Dow Chemical, International Paper, ACCO Bristol, PPG Industries come from a long list of industry leaders who have integrated our Intecolor 8001 color data terminal into their systems—sophisticated systems that demand critical control. Now we can bring you the Intecolor 8001G, the same precision terminal with a special color graphics package as a standard feature, at considerable savings over the separate option cost. Look at some of the advanced Intecolor 8001G features:

- Expanded hardware and software graphics
- 48 lines by 80 characters with two different character heights
- Eight foreground colors, plus eight background colors for additional definition
- Character and line insert and delete
- Page roll-up
- 64 Standard Instrument Society of America characters
- Plotting capability on a 160 by 192 matrix
- Expanded keyboard with cursor and color controls
- 19" display

A 25" unit with the same standard features is available at slightly extra cost.

We guarantee delivery of your Intecolor 8001G evaluation unit for $1,925* (cash-with-order) within 30 days or your money back. The same $1,925 price goes for orders of 100 units or more. Get the jump on your competition without outspending your competition. Get the Intecolor 8001G.

Intelligent Systems Corp.®
5965 Peachtree Corners East
Norcross, Georgia 30071
Telephone 404-449-5961 TWX 810-766-1581

Color communicates faster.

*U.S. domestic price.

source data

ization in Logging in Computer Systems" deals with ways of determining if a user is entitled to access to a source, and shows both the security and non-security uses of a log. "Modern Data Encryption Techniques" explores ciphering techniques that may enhance security, and discusses several types of encryption software and hardware. Price per tape: $35, one day's use, ¾" videotape only; $450, purchase, any tape format. The three tapes as a series are available for $1,000. FILM/VIDEO SALES MANAGER, Univ. of California Extension Media Center, Berkeley, Calif. 94720.

vendor literature

Manufacturing Management

A 12-page black and white brochure describes this vendor's manufacturing management package, which is designed for first time users although it is popular with medium to large concerns. Included are descriptions of the package's bill of materials processor, integrated inventory control, order analysis, automatic min/max, inventory analysis, and job costing. The illustrated booklet includes a system flow chart and a discussion of the vendor's philosophy of providing a complete hardware and software solution for manufacturing managers. WANG LABORATORIES, INC., Lowell, Mass.
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Single Board Computer

The MSC 8001, a Z80-based, multibus-compatible single board computer is the topic of a 16-page color brochure. Instead of relying on color photographs (of which there are only two), the authors of the brochure use outlines of the computer's sole circuit board, overlayed with vivid colors, to draw attention to the various features being discussed. These features include the Z80 microprocessor, memory, I/O (both serial and parallel), interrupts, DMA transfers, and power back-up. Configuration options and software also are discussed. Tables cover features and specifications, connectors, physical characteristics, and environmental data. MONOLITHIC SYSTEMS CORP., Englewood, Colo.
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Facsimile

A three-color capabilities brochure and two four-color data sheets provide information on this vendor's sub-minute facsimile transceiver. The capabilities section explains that the transceiver uses data compression to attain its high speed of operation. Support capabilities, including diagnosing problems using the vendor's regional monitoring system, systems planning, and after-the-sale-support, are discussed. Of the two data sheets, one describes the model 100 high speed facsimile system and the other covers options and accessories for the system. RAPIFAX CORP., Fairfield, N.J.
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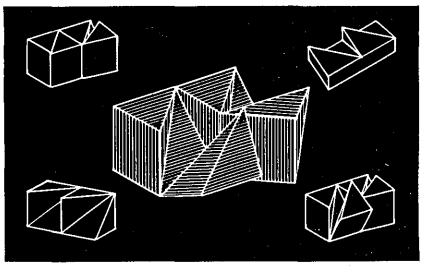
Design System

A set of four illustrated applications notes describe various uses for this vendor's minicomputer-based IDI 150 drafting and design system. "Three Dimensional Design with Dynamic Simulation" contains discussions of dynamic simulation, projected views, design editing, a manufacturing interface for users of CAD/CAM systems. Engineering drawings, cross section, line styles, and plotter output are covered in the application description entitled "Mechanical drafting and design." Operations over attributes, including viewing, description, modification, and sorting,



are among the topics of "Attribute Structure Function." For users with printed circuit layout and design applications, a fourth application note covers layout, layering, bill of materials, fabrication and assembly drawings, and automatic generation of NC tapes. INFORMATION DISPLAYS INC., Elmsford, N.Y.
FOR COPY CIRCLE 206 ON READER CARD

Digital Tester

This vendor describes its model 851 digital tester (as well as the reasons leading to its development) in a 12-page, four-color booklet. In one photo of the 22-function instrument its controls, inputs, and indicators are identified and briefly explained. Postage-paid post cards are included for requesting additional information.
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In addition to the descriptive booklet, the vendor also offers an applications information packet, consisting of a data sheet, 13 technique briefs, and five application notes. Technique briefs explain various tester functions. The application notes cover documenting service procedures for a terminal, preventive maintenance on a tape drive, installing a disc drive, troubleshooting a microprocessor system, and servicing data communications devices. TEKTRONIX, INC., Beaverton, Ore.
FOR COPY CIRCLE 205 ON READER CARD

Workstations

Workstations and cabinetry—ranging from small terminal workstations to peripheral pedestals to RETMA racks—make up this vendor's Deskware product line, the topic of a six-page, four-color brochure. A configuration table provides information on device compatibility and Deskware dimensions. Color samples, similar to the ones provided in paint stores, show the variety of colors available for work surfaces and side panels, MINICOMPUTER SYSTEMS, INC., Anaheim, Calif.
FOR COPY CIRCLE 207 ON READER CARD

Office Supplies

A mail-order vendor of office supplies, this firm has prepared a 64-page catalog. Magnetic media (floppies, cards, and cassettes), paper tape, and calculators, are scattered among the file folders, paper clips, and desks described in the catalog. GINNS, Richmond, Virginia.
FOR COPY CIRCLE 208 ON READER CARD

Printers

The DP-1000 40-column printer family for use with mini and microcomputer applications is described in this four-page, four-color brochure. Each of the four members of the family are described, and a section entitled "general specifications" covers character format, data format, data storage, EIA and current input interfacing, and double width characters. Paper, column format, input power, enclosure dimensions, controls and indicators, rear panel connections, and options also are discussed under the heading of general specifications. An orthogonal projection of the unit's enclosure also is provided. ANADEX, Chatsworth, Calif.
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Cassette Tape

Five series of cassette tapes are described in this six-page, two-color brochure. The various series are intended for applications ranging from word processing to collection and storage of irreplaceable (or nearly irreplaceable) data. For each series, intended applications are described, and descriptions are given of its shell, corner rollers, slip sheets, and pressure pad. A specification table provides physical characteristics and magnetic properties of the tape, as well as environmental requirements, dimensions, operating characteristics, and performance of the cassette. INFORMATION TERMINALS CORP., Sunnyvale. Calif.
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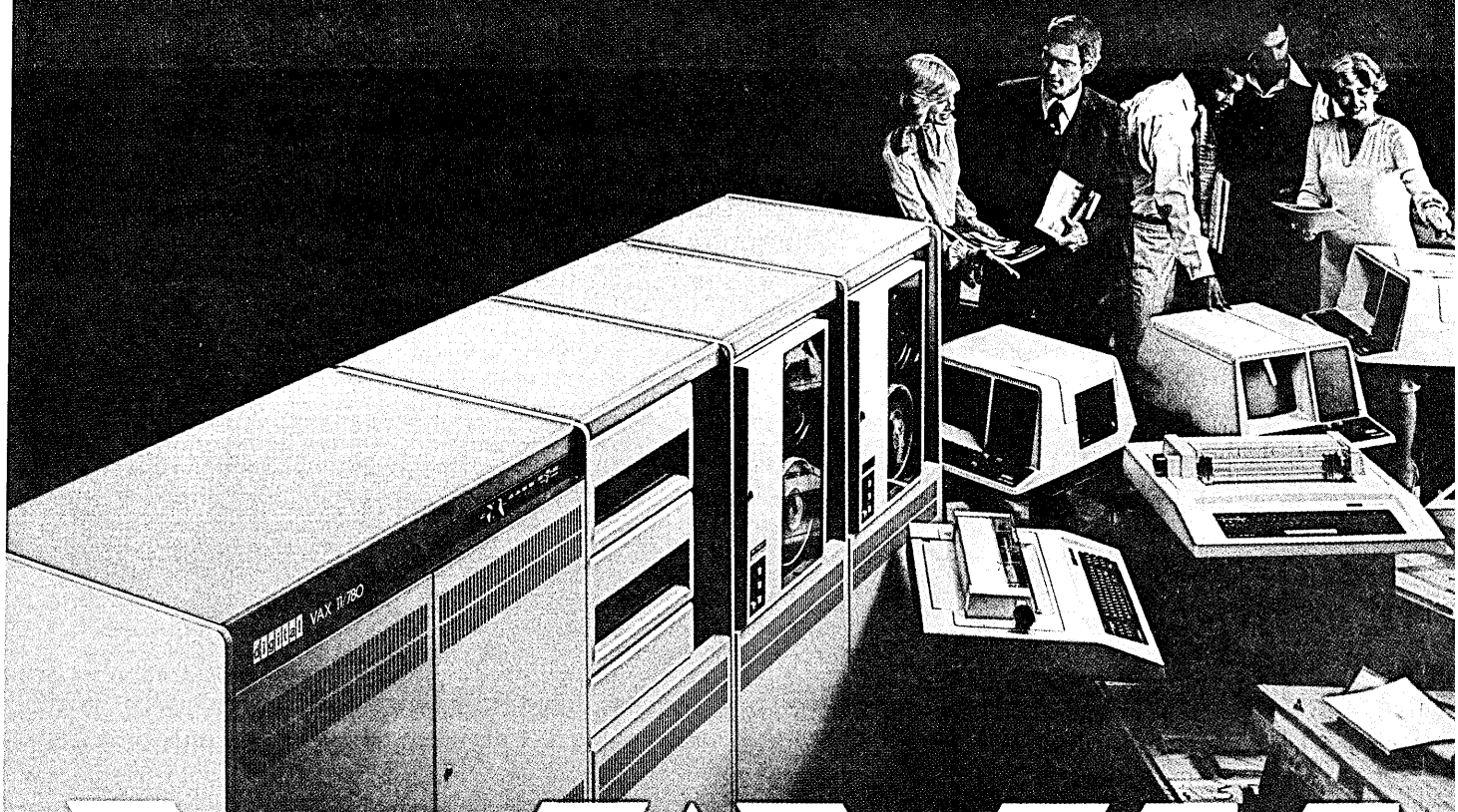
(Continued on page 65)

Digital introduces



VAX 11 780

Interactive VAX-11/780: A new computer system with exceptional performance...

VAX-11/780™ is a new, virtual memory, multi-user, multi-language, multi-programming, interactive computer system with extensive batch and real time response capabilities.

It is the product of many man-years of effort layered on top of more experience and more success with interactive computers than that of any other company in the world.

Digital believes the VAX-11/780 is a landmark computer system. It believes the VAX-11/780 is the beginning – of new definitions, new standards, new expectations.

Take performance. Throughput. Quantity and quality of useful work.

VAX-11/780 will take essentially *any* size program. It has a 32-bit word length, 2 million bytes of physical memory, and more than 4 *billion* bytes of virtual addressing space.

It will operate on that program quickly. Its big cache memory yields an effective cycle time of 290 nanoseconds. With its optional floating point accelerator, it performs double precision floating point 64-bit addition in 1.4 microseconds.

It will move the data with exceptional speed. Its synchronous backplane interconnect, which is its main control and data path, has a bandwidth of 13.3 megabytes per second. And it checks for parity and errors on each 200 nanosecond cycle for data integrity.

And it even makes the programming efficient. Its new, powerful instruction set is a model of efficient code generation. A FORTRAN DO loop, for example, is one instruction. Calls to subroutines, and returns to the main programs combine up to 15 operations into just one instruction. And for time-critical applications, one instruction will store and another will restore the contents of all general-purpose registers simultaneously.

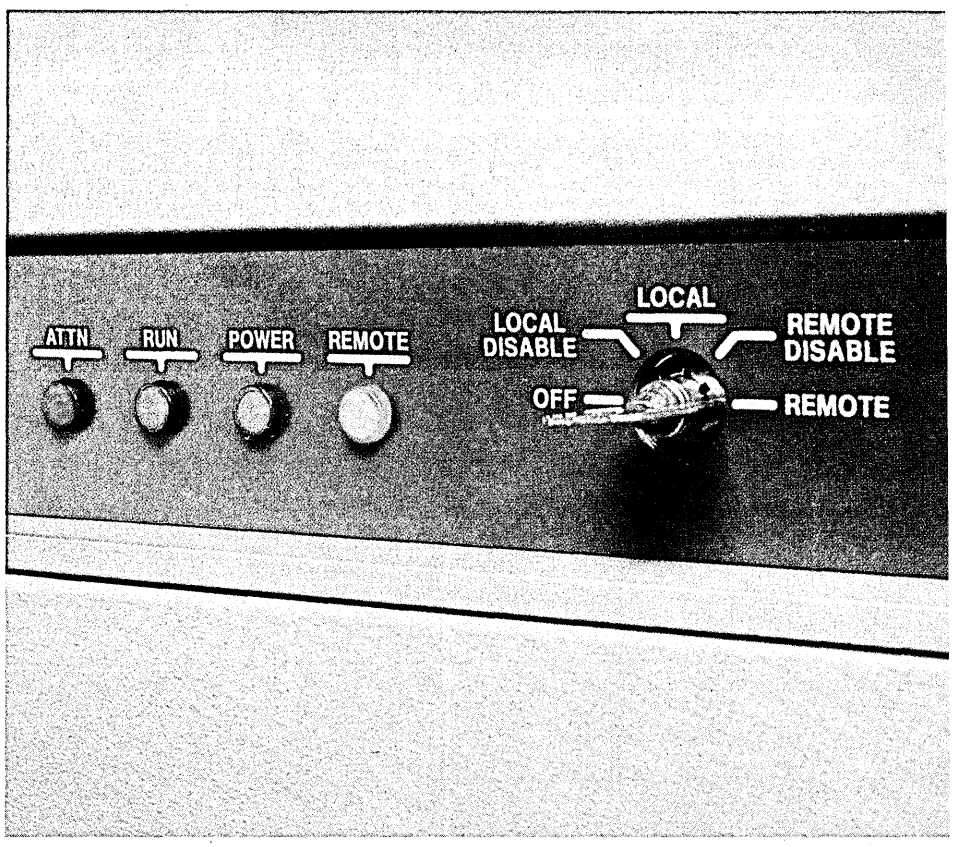
digital
VAX11
780

...unmatched reliability, availability, maintainability...

By design, the interactive VAX-11/780 is the most reliable, available, and maintainable computer system of its general class that has ever been built. It is another standard against which others must be measured.

Reliability, availability, and maintainability features are found in the hardware architecture, the software architecture, the individual component and board designs, and in the cabinetry – all supported by new and improved diagnostic aids.

Objective: keep the system running. If it fails, find the fault quickly, fix it, get the machine up and running again. Protect that data.



Four hierarchical access modes protect the system information. A diagnostic console contains an LSI-11 microcomputer. Automatic consistency and error checking detect abnormal instruction uses or illegal arithmetic conditions. Integral fault detection and maintenance features detect errors on memory, on disks, keep a history of recent bus activity, detect hung machine conditions, and allow automatic restart recovery.

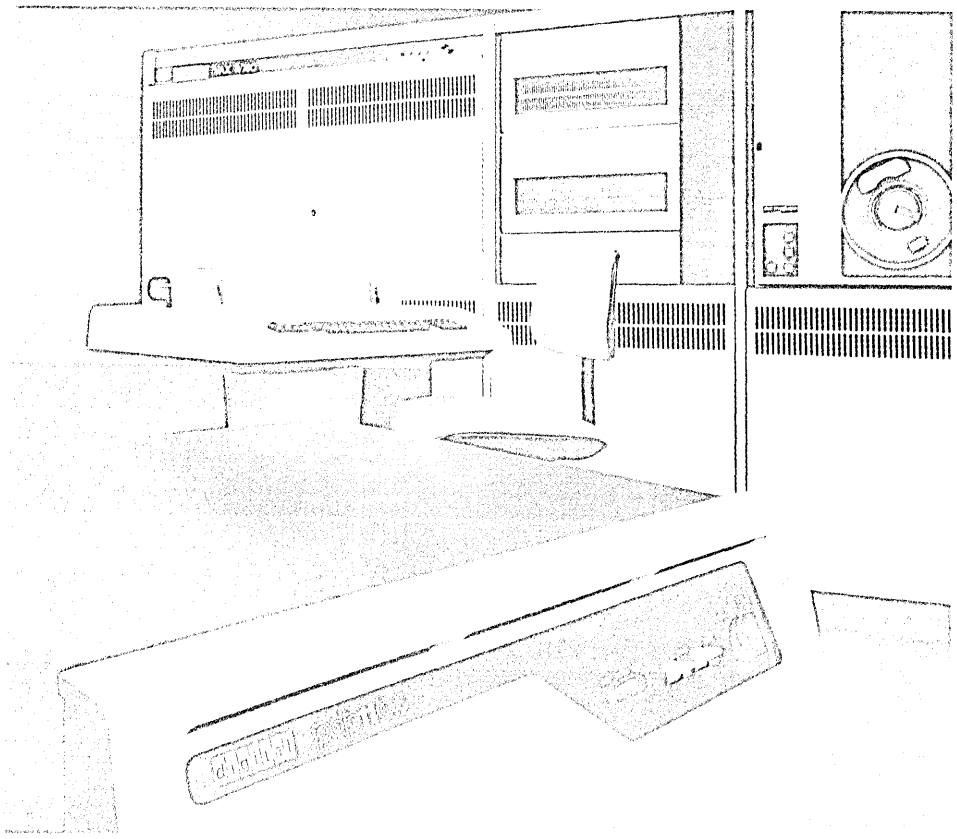
Parity checking for the integrity of the data is performed on the synchronous backplane interconnect, the MASSBUS and UNIBUS adaptors, memory cache, address translation buffer, microcode, and writable diagnostic control store. There are fault tolerance features. There are remote diagnosis capabilities. There are system verification test packages. There are functional and fault isolation diagnostics.

There are operating system consistency checks, redundant recording of critical information, uniform exception handling, on-line error logging, unattended automatic restart capabilities.

There are power loss, temperature and air flow sensors, cabling located away from the modules, a modular power supply with malfunction indicators...

digital
VAX11
780

...compatible with 50,000 PDP-11s already installed.



The VAX-11/780 is an all new 32-bit, virtual memory computer system with 243 basic instructions and a single, all-purpose operating system.

Yet...

DCL is the command language used on the PDP-11 with IAS and RT-11 operating systems. MCR is the command language used with RSX-11M and RSX-11D. Both DCL and MCR command languages are implemented on the VAX-11/780. The on-disk structure is the same one used by RSX-11M and IAS. The file access methods are the same as for RSTS/E, IAS, and RSX-11M.

Both VAX-11/780 and the PDP-11 implement the same FORTRAN IV-PLUS, BASIC-PLUS-2, and COBOL languages with the FORTRAN generating native 32-bit code on the VAX-11/780. Users who have programmed in any of these languages have no additional learning.

In addition to its 32-bit native mode instruction set, the VAX-11/780 can concurrently execute the complete PDP-11 instruction set (with the exception of privileged and floating point instructions) in its "compatibility" mode. Both modes are built into the firmware and logic of the processor.

An Applications Migration Executive allows non-privileged programs written for the RSX-11M system to execute on the VAX-11/780 with little or no modification.

VAX-11/780 can be used as a host development system for RSX-11M and RSX-11S operating systems running on PDP-11s. All but the final debugging can be developed on the more powerful VAX-11/780.

VAX-11/780 and the PDP-11 both use a UNIBUS for connecting to peripherals. VAX-11/780 and the PDP-11/70 both have integrated MASSBUS adapters for interfacing high speed peripherals.

For those hundreds of thousands of persons who have worked with, and who know, the PDP-11 family, the new VAX-11/780 will be the simplest new system to learn. For those who need more throughput than a PDP-11 can offer, the VAX-11/780 offers easy migration, and great compatibility.

DIGITAL
VAX 11/780

Major Features of the VAX-11/780 system

CPU 32-bit word length • Can directly address 4 billion bytes of virtual memory • User program can be up to 32 million bytes • Powerful instruction set includes integral floating point and context switching instructions • Instruction set supports 9 fundamental addressing modes with single instructions simulating entire high level language constructs • 8K byte write-through memory cache results in effective 290 nsec memory access time • Supports state-of-the-art paging memory management with 4 hierarchical protection modes each with read-write access control • 16 32-bit general-purpose registers • 32 interrupt priority levels, 16 for hardware and 16 for software • 2 standard clocks, programmable real-time and time-of-year with battery backup for automatic system restart operations • 12K bytes of writable diagnostic control store.

The Console Subsystem Intelligent microcomputer LSI-11 with 16K bytes of read-write memory and 8K bytes of ROM, floppy disk, and terminal • Optional port for remote diagnostics • Fast diagnosis, both remote and local, simplified bootstrapping, improved distribution of software updates.

Main Memory Subsystem ECC MOS memory built using 4K MOS RAM chips • Memory controller includes request buffer, increasing system throughput, eliminating most need for interleaving • Minimum memory configuration 128K bytes – maximum up to 1 million bytes per controller, two controllers allowed per system, for total of 2 million bytes physical memory.

Input/Output Subsystems Synchronous Backplane Interconnect (SBI) is main control and data transfer path. SBI capable of aggregate throughput rate of 13.3 million bytes per second • Error and parity checking every cycle for data integrity • SBI protocol uses 30 bits for address, allows both 32-bit plus parity and 64-bit plus parity data transfers • UNIBUS connected to SBI permits interfacing of general-purpose peripherals and user devices • Buffered UNIBUS adapter pathway between UNIBUS and SBI has throughput of 1.5 million bytes per second • MASSBUS connects to SBI via buffered adapter, permits interfacing high performance mass storage peripherals with parity checking • MASSBUS adapter throughput rate is 2 million bytes per second • Four MASSBUS adapters permitted per system.

Software System Designed for many applications including scientific, time-critical, computational, data processing, batch, general-purpose timesharing • Process-oriented paging for execution of programs larger than physical memory, transparently to the programmer • Memory management facilities controlled by user – can lock pages into working set, never to be paged out, or lock into physical memory, never to be swapped out • Sharing and protection at page level (512 bytes) • Four hierarchical access modes • Interprocess communication through files, shared address space, or mailboxes • System management facilities • DIGITAL command language and MCR command language provided • File and record management facility includes sequential and relative file organization, sequential and random record access • Supports Files-11 on disk structure level 2 • Program development capability includes an editor, language processors, symbolic debugger • Support provided for FORTRAN IV-PLUS/VAX and MACRO/VAX in native 32-bit mode, COBOL-11 (V3) and BASIC-PLUS-2 (V1) in compatibility mode • Scheduler is priority-ordered, round-robin/time-slicing, event driven • 32 levels of software process priority for fast scheduling • Networking capabilities are supported through DECnet for process-to-process, file access and transfer, and down-line loading • Batch facilities include job control, multi-stream, spooled input and output, operator control, conditional command branching and accounting • Command procedures are supported by command languages.

PDP-11 Compatibility Provides system-wide compatibility supporting execution of the PDP-11 instruction set (with exception of privileged and floating point instructions) in compatibility mode • Applications Migration Executive allows RSX-11M/S non-privileged tasks to run with minimal or no modification • Host Development Package allows creation and testing of RSX-11M tasks • Same data format • Same source-level programs • High level languages • Files-11 on disk structure, level 1 • RMS file access methods including ISAM • DIGITAL Command Language and the RSX-11 MCR command language.

Reliability, Availability, Maintainability Remote diagnostics by means of integrated diagnostic console permits diagnostics, examination of memory locations from remote terminal • Automatic on-line error logging • Automatic restart capabilities after power failure or fatal software error • Users continue to use system with failed hardware components • Consistency and error checking detects abnormal instruction uses or illegal arithmetic conditions • Improved packaging and cabinetry increase hardware reliability and ease of maintenance • On-line diagnostics available and run under operating system.

digital

VAX 11 780

Digital Equipment Corporation
146 Main St., Maynard, MA 01754
Attention: Communication Services NR-2/2

I want to know more about Digital's VAX-11/780:

☐ send me your colorful, new VAX-11/780 brochure.

☐ send me your detailed System Summary.

☐ please have a Digital sales representative call me.

Name_____

Title_____

Company_____

Address_____

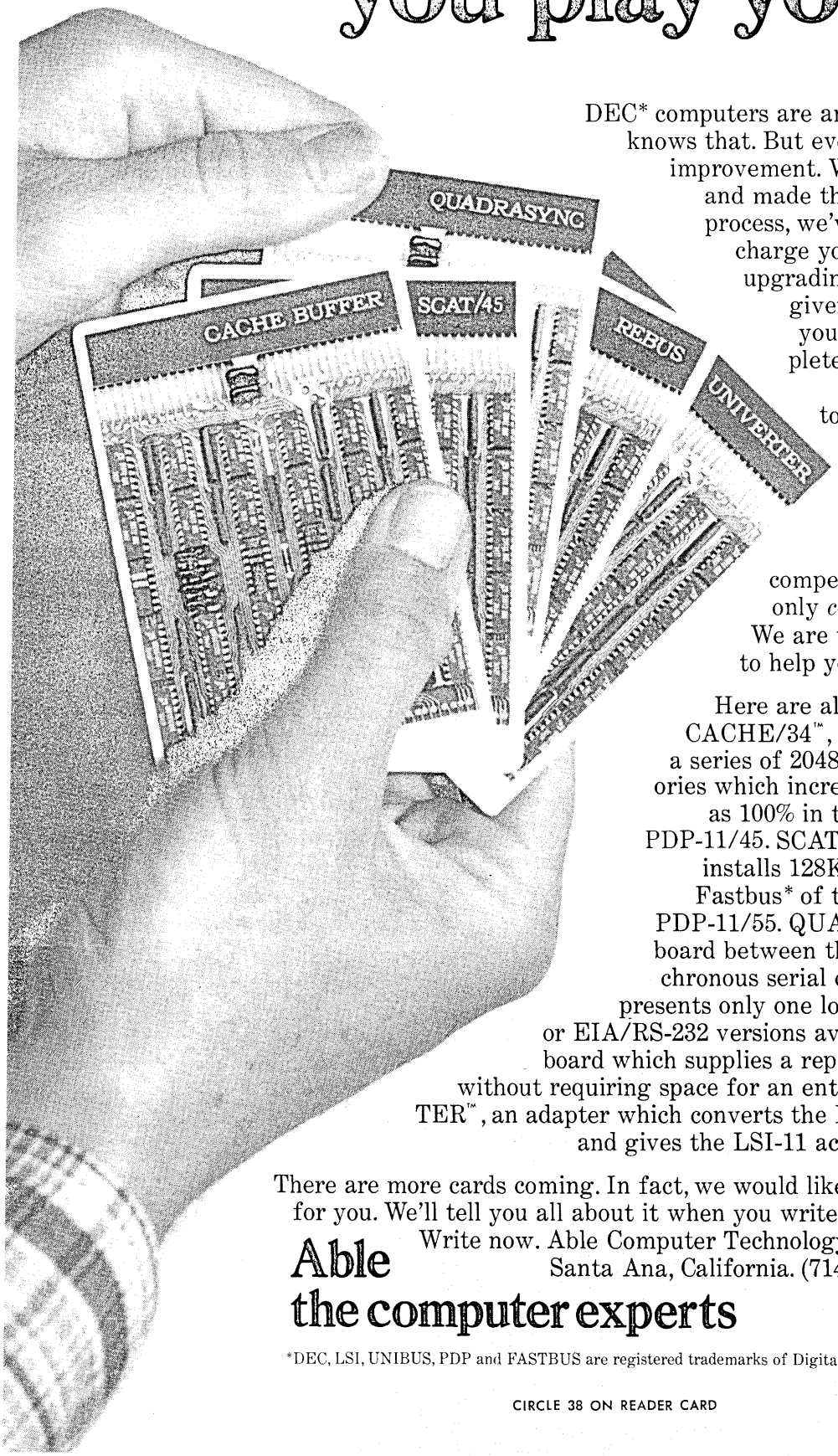
City_____

State_____ Zip_____

Telephone_____

CIRCLE 19 ON READER CARD

PDP-11 users, let the computer experts help you play your hand



DEC* computers are among the best ever. Everybody knows that. But even with DEC there is room for improvement. We took advantage of that fact and made the best ever even better. In the process, we've given you a chance to supercharge your present PDP-11* instead of upgrading to the next computer. We've given you more time and improved your cash flow with the most complete line of sophisticated computer enhancements on the market today. They are available off the shelf. They are priced competitively. They install in minutes. They provide immediate results. And, in every instance, they outperform the competition. They should. We are the only *computer* people in the business. We are the only people really qualified to help you play out your hand and win.

Here are all the cards in our present deck: CACHE/34™, CACHE/40™ and CACHE/45™, a series of 2048-byte single-board buffer memories which increase processing speeds as much as 100% in the PDP-11/34, PDP-11/40 and PDP-11/45. SCAT/45™, an add-in memory which installs 128K of high-speed memory on the Fastbus* of the PDP-11/45, PDP-11/50 and PDP-11/55. QUADRASYNC™, a quad interface board between the PDP-11 Unibus* and 4 asynchronous serial communication channels which presents only one load to the Unibus. Current loop or EIA/RS-232 versions available. REBUS™, a dual-width board which supplies a repeating function for the Unibus without requiring space for an entire system unit. And UNIVERTER™, an adapter which converts the LSI* bus to a Unibus structure and gives the LSI-11 access to a megabyte of memory.

There are more cards coming. In fact, we would like to build something especially for you. We'll tell you all about it when you write for details on our present line. Write now. Able Computer Technology, Inc., 1616 South Lyon Street, Santa Ana, California. (714) 547-6236. TWX 910-595-1729.

Able
the computer experts

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CIRCLE 38 ON READER CARD

source data

(Continued from page 58)

Signal Processing
A six-page brochure compares general purpose array processing, real time array processing, and real time signal processing. The discussion centers around this vendor's SPS-61 and SPS-81 programmable digital signal processors. Software, applications, and reliability and maintainability are covered. Block diagrams show typical systems, including stand alone systems and those coupled to a host computer. Multiprocessor systems also are examined, as is systems architecture. Timing information, both for instructions and FFT's, also are provided, SIGNAL PROCESSING SYSTEMS, INC., Waltham, Mass.
FOR COPY CIRCLE 211 ON READER CARD

Data Comm System
The Telecontroller Data Communications System is described in this 12-page brochure. Sections include a four-color photograph showing system components, a diagram of a typical configuration integrating terminals, TWX and Telex machines and a central computer, and a listing of system features. Various applications are described. Six reports available from the Telecontroller are described, and two of these are supplemented with sample output. The company, a wholly owned subsidiary of Plantronics, Inc., is described, along with other Plantronics companies. ACTION COMMUNICATION SYSTEMS, INC., Dallas, Texas.
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360/370 Software
A 12-page brochure describes this vendor's software packages for document file management on IBM mainframes running OS, VS, or MVS. Features and applications of packages for interactive document retrieval, interactive text editing, and automatic indexing are described, as is a terminal monitor. ASPEN SYSTEMS CORP., Germantown, Maryland.
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Modem
"Ten reasons why 4800 bps users are switching to the MPS 48" provides 10 comparisons between the Bell 208 data set and this vendor's MPS 48 modems. Pricing, turnaround, flexibility, and diagnostics are among the comparisons. Illustrated with graphs, diagrams, and photographs, the booklet also discusses network management capabilities and dial backup. A postage-paid post card is included for readers wishing to receive more information. RACAL-MILGO, INC., Miami, Fla.
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Equipment Rental
Telecommunications test equipment, and microcomputer development and test equipment are listed in two eight-page catalogs available from this rental company. The telecommunications catalog covers equipment for carrier, data handling, protocol, and general purpose uses. The microcomputer catalog includes equipment manufactured by Intel, Tektronix, Biomation, DEC, Hewlett-Packard, iCom, Texas Instruments, Remex, Biomation, and Beehive. ELECTRO RENT, Burbank, Calif.
FOR COPY CIRCLE 217 ON READER CARD

Safety Supplies
A 72-page catalog describes a variety of health and safety items. The catalog includes equipment which may be purchased or rented. Many of the items described are intended to aid in compliance with OSHA regulations. Signs, first aid kits, fire extinguishers, and ear plugs are included in the catalog. The vendor also includes a description of the lab services available from its Analytical Services Laboratory. INTEREX CORP., Natick, Mass.
FOR COPY CIRCLE 218 ON READER CARD

Cassette Data Storage
Digital cassette tape recorders and related equipment are described in the 1978 catalog from this manufacturer. The catalog, which includes a price list, covers low power recorders for data logging, OEM incremental transports, and ANSI-compatible high speed continuous transports, among other products. The illustrated 16-page booklet includes block diagrams and timing sequences. Accessories, supplies, and cassettes also are listed. MEMODYNE CORP., Newton Upper Falls, Mass.
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periodicals

Administrative Systems Monthly
Impact: Information Technology is a new publication, the first issue of which will be released this month. It has been designed to aid administrators in integrating their systems, and will emphasize the integration of information resources in a systems approach to administration. Experts from fields such as dp, word processing, and records management will act as editorial advisors, and specialty areas such as workflow/workspace design, records management, telecommunications, and human resources development, and how they relate to each other, will be examined. The initial issue will include

(Continued on page 68)

DIGISAT puts your computer in touch... via satellite

The new, all-digital system for medium- and high-speed computer communications, via satellite. It's DIGISAT from COMSAT.

DIGISAT can lower your costs, simplify maintenance and improve reliability for international data transmission. Existing modems are used. No special changes in terrestrial lines are needed.

DIGISAT provides digital satellite circuits at speeds of 2400, 4800, and 9600 bits per second at significant cost savings. COMSAT also provides international 50 kb/s channels to meet the requirements of larger users.

DIGISAT will put computers and data terminals in touch the world over... via satellite through earth stations in more than 80 countries with terrestrial interconnections to almost everywhere.

Ask us about putting your computer in touch.

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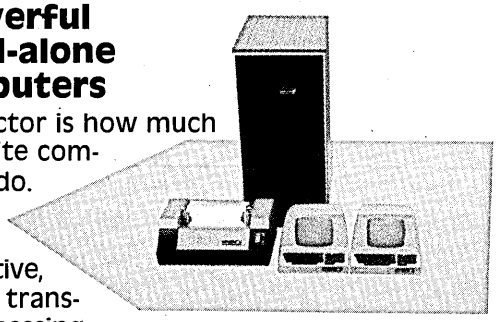
COMMUNICATIONS SATELLITE CORPORATION
SALES AND BUSINESS DEVELOPMENT DIVISION
950 L'ENFANT PLAZA, SW WASHINGTON, D.C. 20024
PHONE: (202) 554-6224

Introducing Basic/Four distributed data processing.

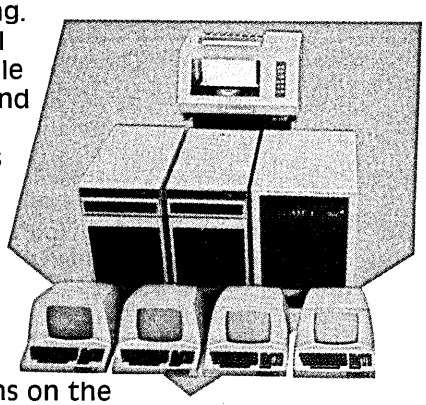
Right system, right price!

The right system should make each remote location an independent data processing center. That's what Basic/Four® computers do. And at the right price. Because there's a model to meet the exact needs of each location.

Powerful stand-alone computers



The key factor is how much each satellite computer can do. Basic/Four computers are interactive, for instant transaction processing. Each is powerful enough to handle all accounting and payroll for each location, plus its specialized function–manufacturing, distribution, warehousing, whatever.

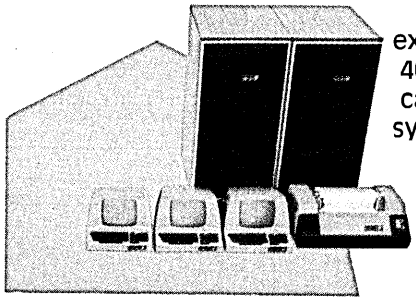


No more costly time-drains on the host computer. No more waiting for processing.

Easy to install, program, use

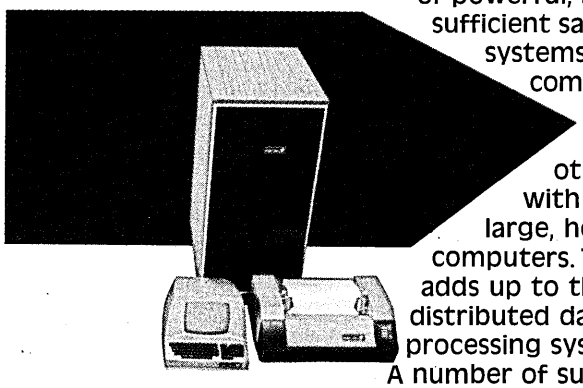
The data processing needs of your remote locations are like those of an independent business. And that's our specialty!

We offer proven software packages, with special application modules that are easily adapted to your particular needs. The language is BUSINESS BASIC, so programming is a snap. So is operation: we can teach a clerk to run a system in less than a day.



After 6 years experience, with some 4000 installations, we can put in Basic/Four systems fast.

We talk to IBM all the time



Our tie-in capability means your network of powerful, self-sufficient satellite systems can communicate with each other, and with most large, host computers. That adds up to the ideal distributed data processing system. A number of such Basic/Four systems are up and running in the U.S. and abroad.

For full information, call our nearest office. Or write: Basic/Four Corporation, P.O. Box C-11921, Santa Ana, CA 92711

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Albuquerque * Anchorage * Atlanta * Baltimore/Washington * Birmingham * Boise * Boston * Buffalo * Charlotte * Chattanooga * Chicago * Cincinnati * Cleveland * Dallas * Denver * Detroit * Fresno * Grand Rapids * Hartford * Honolulu * Houston * Kansas City * Indianapolis * Las Vegas * Los Angeles * Lubbock * Madison * Memphis * Miami * Milwaukee * Minn./St. Paul * Nashville * New Jersey * New Orleans * New York * Orange County * Philadelphia * Phoenix/Tucson * Pittsburgh * Portland * Richmond * Sacramento * Salt Lake City * San Antonio * San Diego * San Francisco * San Juan * Seattle/Tacoma * St. Louis * Syracuse *
Basic/Four Systems are also marketed in more than 30 foreign countries.

source data

(Continued from page 65)

articles entitled, "Designing Tomorrow's Office," "Minicomputers Fight It Out in Court," "Records in the Total Systems Office," and "Word Processing, the Foundation of the Future." A one year subscription to the newsletter costs $30. ADMINISTRATIVE MANAGEMENT SOCIETY, Maryland Rd., Willow Grove, Pa. 19090.

Telecommunications Analysis

The purpose of *Telecommunications Analysis and Research* is to identify the most promising market positions, analyze the effects of specific company strategies on the market, and to size subsegments as to market share, market growth, and competitive reaction. Each of the six bimonthly studies will cover three areas: a look at the meaning of events and market shifts in telecommunications; original market research and quantitative market research done at the communications user level; and an examination of which specific products will succeed in the marketplace—an evaluation of specific strategies of companies within the market, and an analysis of their product options and market tactics. An examination of what regulatory changes will mean to the marketplace also will be included. Price: $400/year. THE YANKEE GROUP, Harvard Square, P.O. Box 43, Cambridge, Mass. 02138.

PUG Newsletter

The *Pascal Newsletter* is the official, informal publication of the Pascal User's Group. Produced quarterly, it is designed to promote the use of the programming language through articles and notices concerning Pascal philosophy, the use of the language as a teaching tool, uses at different computer installations, portable program exchange, meetings, and new publications. Proposed extensions to Standard Pascal for users of a given implementation also will be aired. Miscellaneous features include bibliographies, questionnaires, and membership lists. Membership in the user's group is $4/year, and includes the four issues of the newsletter. PASCAL USER'S GROUP, c/o Andy Mickel, University Computer Center, 227 Exp Engr, Univ. of Minnesota, Minneapolis, Minn. 55455.

courses

Datapro Seminars

Datapro Research is offering a series of nine courses to be held over the next several months. The program includes 58 seminar presentations to be held in New York, Washington, D.C., Chicago, San Francisco, and Philadelphia. The courses are: "Data Communications: An Introduction to Concepts and Systems," to be held in San Francisco, March 29-31; New York, Feb. 1-3; Washington, Feb. 15-17 and April 10-12; Chicago, March 1-3; and Philadelphia, March 15-17. "Data Communications: Advanced Concepts and Systems" will be offered March 20-21 in Washington; April 3-4 in San Francisco; and April 17-18 in New York. "Effective Computer Operations Management" will be offered in New York, March 27-29; in Washington, March 20-22; in Chicago, April 5-7; in San Francisco, March 1-3 and April 12-14; and in Philadelphia, March 6-8.

"Computer Performance Measurement: Tools and Techniques for Increased System Productivity" will be offered in San Francisco March 1-3; in Chicago March 13-15; in Washington March 27-29; and in New York on April 17-19. "Data Base Management Systems: General Concepts and Planning Guidelines" will be offered in San Francisco, March 29-31; New York, April 3-5; Chicago, April 12-14; Washington, April 17-19; and Philadelphia, March 15-17.

"Minicomputers and Microcomputers: Selection and Usage Guidelines" will be offered Feb. 23-24 and April 13-14 in San Francisco; March 6-7 in Washington; and March 30-31 in New York. "Word Processing: Guidelines for Planning, Design, and Implementation" will be offered in New York March 1-3 and April 19-21; Chicago March 29-31; Washington March 20-22; and in San Francisco, April 5-7. "Structured Problem Solving: Bringing Productivity Improvements to EDP" will be conducted in San Francisco, March 8-9; Washington, March 20-21; and in Chicago, April 20-21. "Data Processing: An Introduction to Concepts and Systems" will be offered in New York, Feb. 27-March 1; Washington, March 15-17; Chicago, March 20-22; and in Philadelphia, April 5-7.

The seminar enrollment fee is $425 to subscribers; $475 for nonsubscribers. Group and advance registration discounts are offered. DATAPRO RESEARCH CORP., 1805 Underwood Blvd., Delran, N.J. 08075. ❋

How do you know if your system is really doing the job?

We'll tell you. With PLAN IV and PLAN IV:MVS, program products for system management from Capex Corporation.

If you're operating an IBM OS, OS/VS, or MVS system, PLAN IV and PLAN IV:MVS will let you know where you've been, where you stand now, where you're going next. You'll get the information vital for making informed decisions quickly. In clearly understandable form. With as much depth and detail (or as little) as you demand.

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PLAN IV and PLAN IV:MVS provide the information needed for all levels of decision making. Whether you're concerned about turnaround and response time, balancing system resources and load, tuning system performance, scheduling, IPS tuning, or capacity planning, PLAN IV and PLAN IV:MVS provide the information you need. You get immediate access to key information, presented in a concise, highly readable format, without smothering in extraneous detail. Yet when you need comprehensive information to support detailed analysis or problem solving, that too is available.

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PLAN IV and PLAN IV:MVS apply proven management techniques to DP: *Management by Exception.* Nobody likes to wade through stacks of reports. PLAN IV and PLAN IV:MVS pinpoint what you need to know first, what you need to know most. They automatically spotlight bottlenecks and significant changes. You identify problem areas quickly, get to work on them immediately. *Information in Perspective.* You can make immediate comparisons between shifts, with last month, last year, see where you're doing better... or doing worse.

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Both PLAN IV and PLAN IV:MVS utilize data from facilities already built into your system (SMF, RMF or MF/1) to efficiently gather information about overall system operation. They bring information about past and present performance into focus, providing the perspective you need to manage your system now and plan intelligently for the future.

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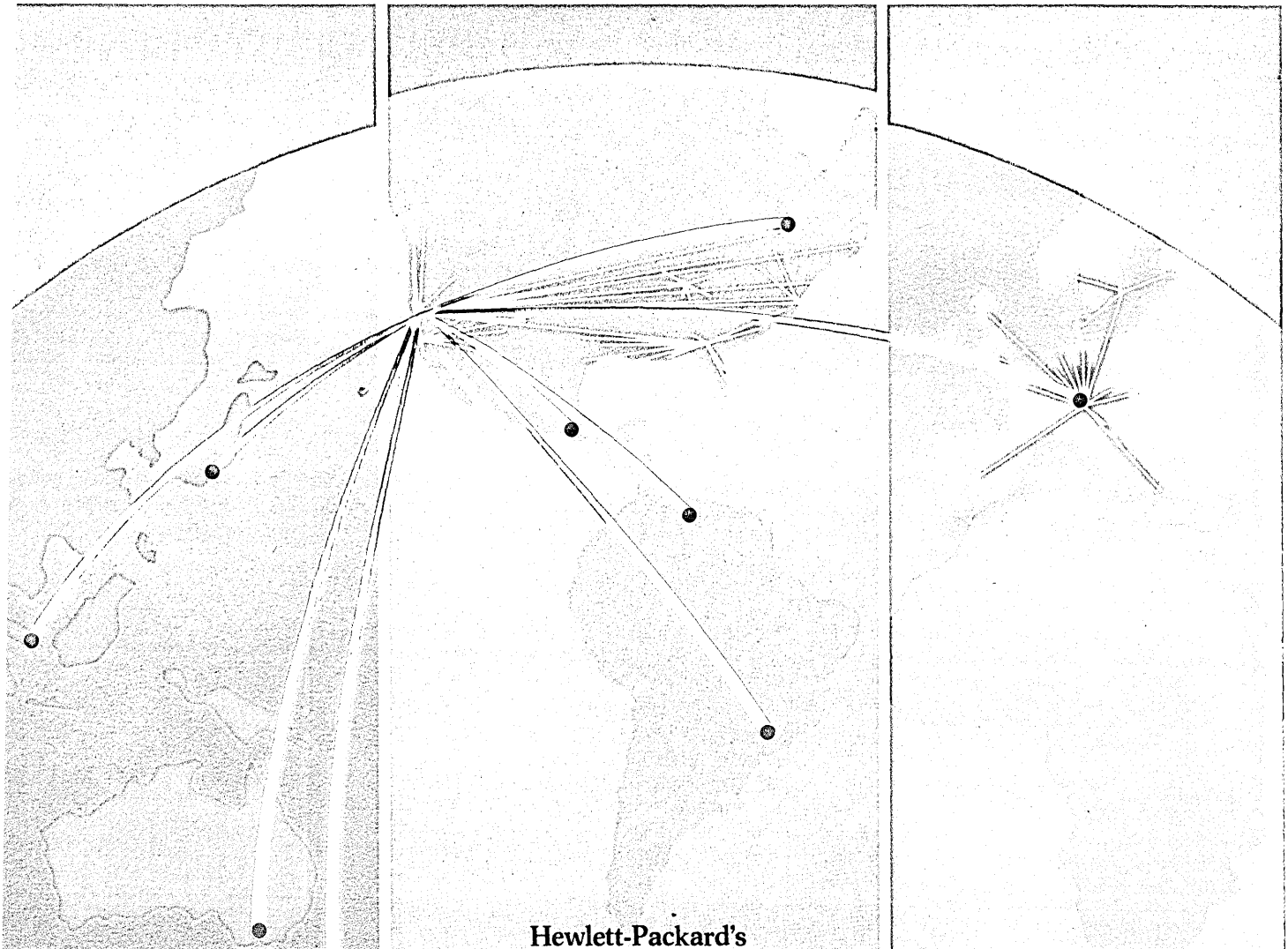
System: ☐ MFT ☐ MVT ☐ VS1 ☐ SVS ☐ MVS

How can you tell if distributed

Look at the job it's done for us.



Hewlett-Packard's Distributed Systems Network

With two major factories in Malaysia (more than 3000 people), we cut down on communications costs by linking the Penang plant with our Singapore facility. Here data is consolidated for transmission to the U.S. Accounting, payroll and inventory is handled locally by HP computers. A similar situation exists in Japan, with the plant in Hachiogi connected with our main sales office in Tokyo. In Australia and New Zealand, HP sales offices are equipped for both local data processing and long distance communications.

Most North American manufacturing plants and regional offices have HP 3000s to handle their local data processing needs, reducing the burden on the company's central computers. Major offices are linked with HP headquarters in Palo Alto by computerized communications systems. These are powerful enough to give the smaller sales offices plenty of EDP capability for such things as order processing and maintaining customer files.

In Brazil, our Campinas manufacturing plant is linked by computer to the main office in Sao Paulo. This in turn communicates with headquarters in California. Sales offices in Venezuela and Mexico have communications systems with sufficient computer power to handle local accounting and inventory management.

Most data from Europe is funneled through our European headquarters in Geneva. Data from sales offices is generally "queued" in the Geneva computers, waiting for the twice daily call from the U.S. All three manufacturing facilities in France, Germany and Scotland also use HP computers for accounting, order processing, management information and the like.

rocessing will work for you?

At Hewlett-Packard, we began distributing the computer workload around our factories in 1967. Then, in 1971, we instituted a worldwide systems network that has helped us grow to $1.36 billion in shipments, with 42 percent of our business in computational products.

Today we make 4000 different products at 40 divisions around the world and have offices in 65 countries. This rapid financial and geographical expansion in a highly technical field made the distribution of our data processing an absolute necessity.

We began with the basics.

Small systems went to work in our factories, automating the testing of circuit boards and, later, hand-held calculators. The next step was linking these minicomputers with other factory systems so they could relay data and programs. The obvious need then was to tie these computers into an information network so that key managers could make decisions based on accurate, up-to-the-minute data.

As we continued to grow, we connected our widespread sales offices with the factories. Today we have 130 high-speed communications systems in 94 locations, sending compressed data via satellite and phone lines. About 12 million words a day come into our California headquarters. Yet the cost is phenomenally low. For example, we can send a ten thousand word message to Toronto in one minute for 85 cents. On a teleprinter, it would take 16 hours and cost $800.

We need a system that can change. So do you.

One major reason our distributed processing approach works so well for us is the same reason it will work for you. It's extremely flexible.

You don't have to choose between a star network, or a circle, or a string. Our way, you can have any or all of them. And you can hook up an HP network for as little as $5,000. You won't have to throw out your old equipment, either. Some non-HP computers and peripherals are still carrying a share of our workload. There's no reason why your present systems can't do the same for you.

The keystone of our system is the HP 3000, a powerful general business system. It communicates with the HP 1000, a computer generally dedicated to design, test and control applications in the factory. (Both can also link directly with an IBM mainframe.)

Most long-distance communications between sales office and corporate headquarters are handled by the HP 2026, which can also take care of on-site editing. This keeps information (much of it off-loaded from the central computer) on-hand for local use, shrinking the amount of unusable data funneled to headquarters.

We've just introduced new software for the HP 3000 that makes it an even more powerful management information tool. You can, for instance, sit down at your computer in New York and use all the processing power and data base of your Los Angeles computer—or any other HP 3000 in your network. Software is also available to tie HP 1000 systems together in a plant-wide information sharing network. So you can find out exactly what's going on in your business—from the ground up.

Protecting the biggest investment of all.

Programming—that's where you really spend money. We know that from experience, too. We spent hundreds of man-years developing the operating software for the HP 3000. So we're just as interested in protecting that enormous investment as you are. We do it by designing our new systems to use existing software. They'll run your programs faster and more efficiently. Otherwise, you'll hardly notice the difference.

There's not much point in building good computers unless the peripherals are just as good. That's why we make our own printers, video terminals, disc and tape drives, and data entry devices.

If any part of the system does need servicing, we can fix it. With so many Hewlett-Packard offices around, we can respond quickly when you call.

The moral of our story.

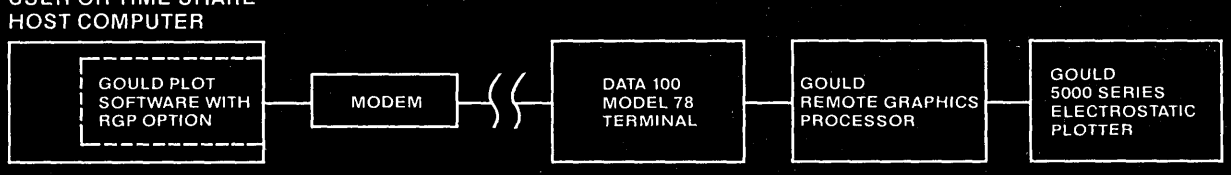
It's simply this. If you need to distribute your computer workload across oceans or in your plant, you don't have to go out on a limb. The Hewlett-Packard system has a bright future as well as a pretty impressive past. You can find out all about it by calling your local Hewlett-Packard office listed in the White Pages. Or write to Doug Chance, Hewlett-Packard, Dept. 416, 11000 Wolfe Road, Cupertino CA 95014. We'll send you information on Hewlett-Packard Distributed Processing. It could make a big difference in your company's planning.

HEWLETT hp PACKARD

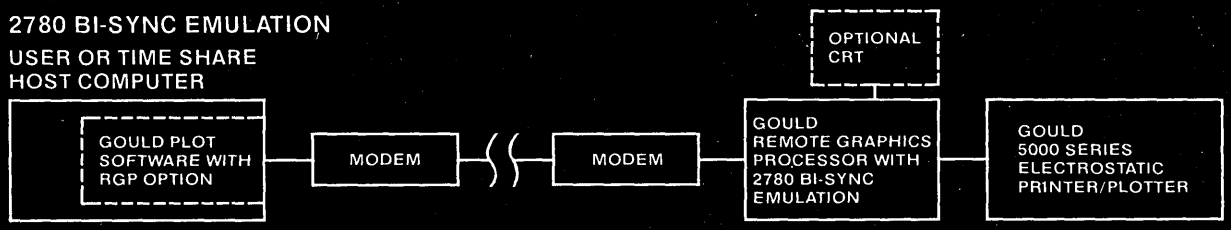
CSG801HP28

NOW GOULD GIVES YOU THREE REMOTE GRAPHICS CAPABILITIES.

RJE/RBT CONFIGURATION



2780 BI-SYNC EMULATION



Talk about versatility. That's what you get with Gould's Remote Graphics Processor teamed with their Electrostatic Printer/Plotter.

You can use them with your Data 100 Model 78. Or as a 2780 emulator. Or in a time share mode with either.

The RGP accepts serial input data from your RJE or RBT terminal (RS232C protocol) for plotting. The 2780 bi-synch emulator connects directly to a modem and operates stand-along for plotting and printing. Both versions can be used with a time share service bureau at a nominal extra cost.

The Gould RGP is a microprocessor based, intelligent interface which performs character decoding and decompression of highly encoded raster data transmitted by your mainframe or handled by your standard spooling software. The 2780 emulator performs appropriate handshake and error checking routines.

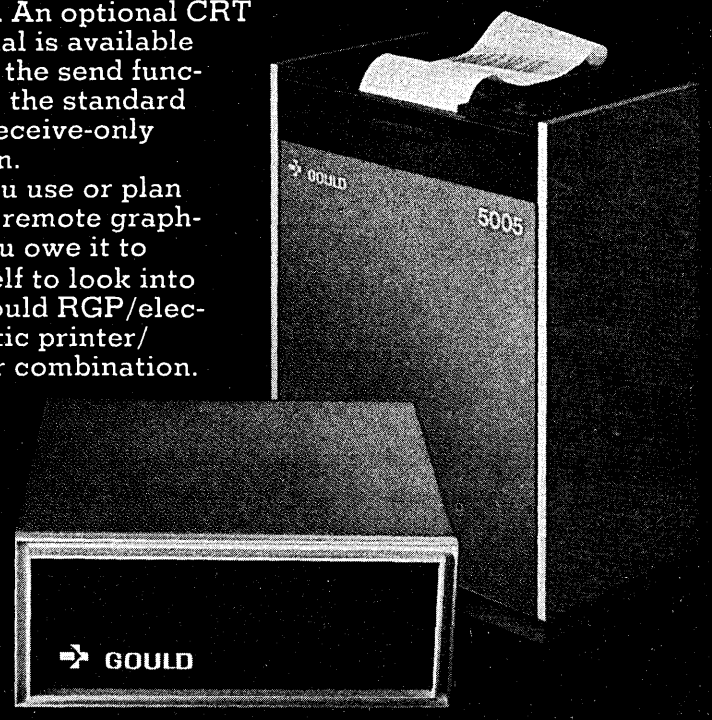
Gould software is available for IBM 360/370 series, Univac 1100 series and Control Data 6000, 7000 or Cyber 70 Series mainframes.

Paper speed is a function of baud rate and the complexity of the plot, and ranges from 0.04 to 1.0 in/sec. An optional CRT terminal is available to add the send function to the standard 2780 receive-only version.

If you use or plan to use remote graphics, you owe it to yourself to look into the Gould RGP/electrostatic printer/plotter combination.

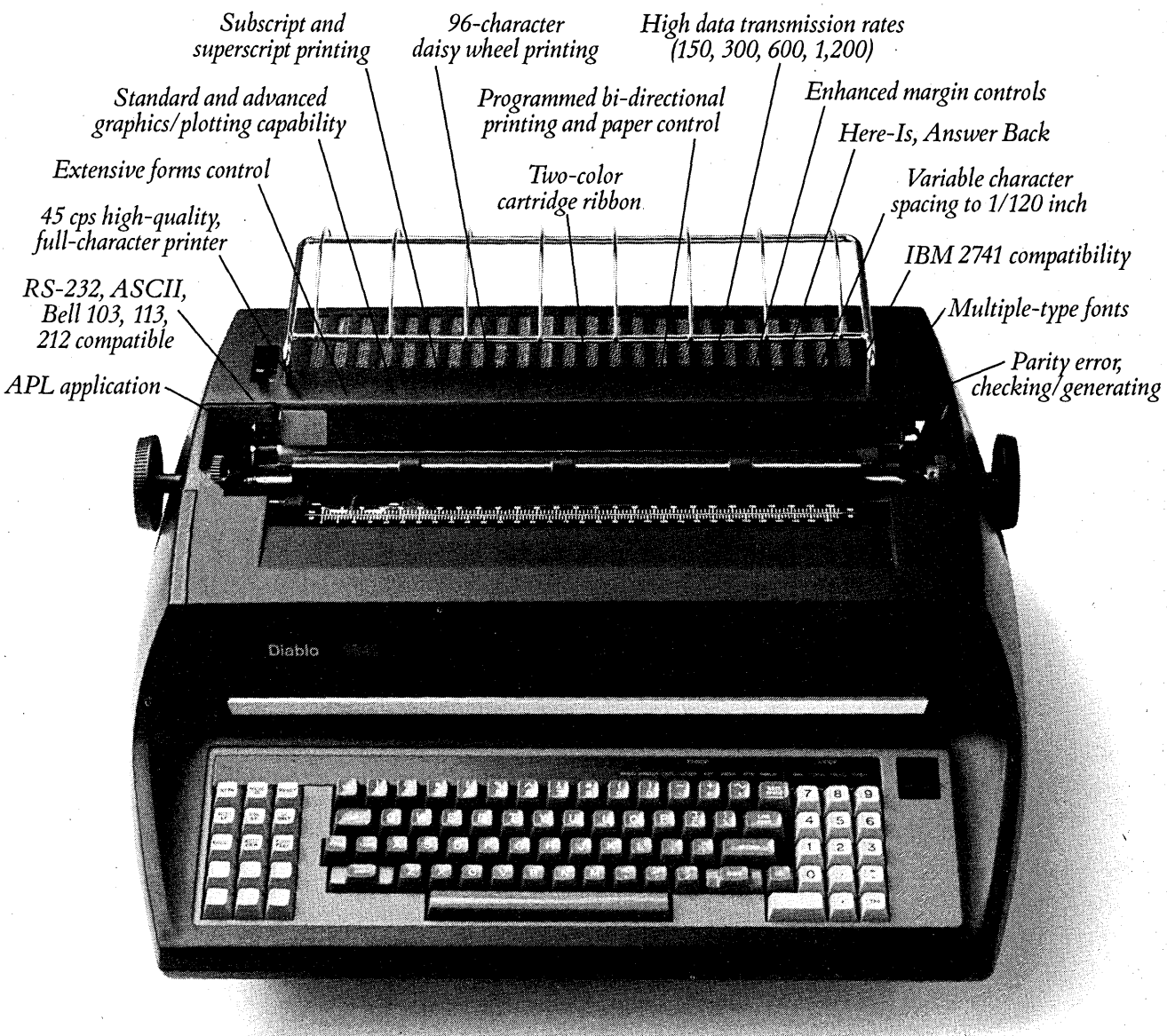
For more information, contact Gould, Instruments Division, 3631 Perkins Ave., Cleveland, OH 44114. Phone: (216) 361-3315.

For brochure call toll free (800) 325-6400. ext. 77. In Missouri: (800) 342-6600.



GOULD

You can't judge this Diablo terminal by its cover.



The new Diablo 1641 is what you make it. Because you choose the exact combination of features to fit your particular needs. To find out more, call Joan Gruenbaum at (408) 733-2300, or write her at 545 Oakmead Parkway, Sunnyvale, CA 94082.
When you get a Diablo terminal you also get Xerox quality, reliability, and availability.
So you see, there's a lot more to the 1641 than meets the eye.

Diablo Systems

XEROX

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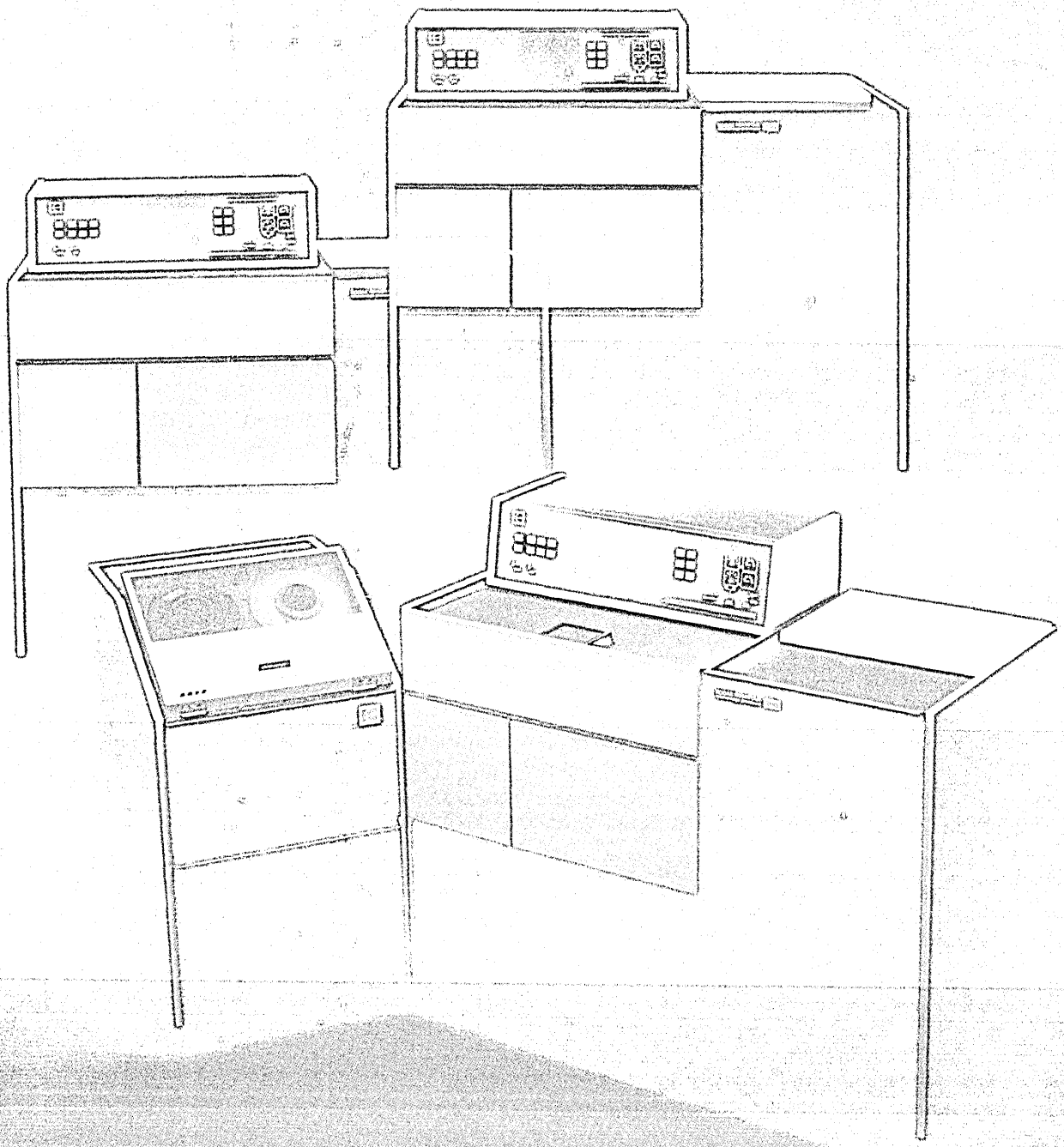
To Os
To Os

Take your choice: on-line or off-line.



3 dry, convenient, laser printers, from Kodak.

For the detailed story, write Eastman Kodak Company,
Business Systems Markets Div., Dept. DP854M, Rochester, NY 14650.

KODAK KOMSTAR MicroImage Processors

Editor's Readout

John L. Kirkley, Editor

Just What Is A Baud Anyway? And Why Is It Spelled Funny?

One of the more popular attractions at the annual Data Communications Interface show (previewed in this issue, page 86) is what insiders call "ding dong school." This two-day seminar, dealing with the basics of data communications, is well attended.

No wonder. The computer industry is already a tangled maze of technologies, arcane jargon, and obscure disciplines liberally seasoned with economic, political and social complications. And now, added to all of this, is data communications, a snarl of nested complexities in its own right.

At the discrete hardware level, things look relatively familiar: terminals, cpu's, front-ends . . . even the modem has become a familiar device. But from this point on it's all uphill. Before even considering launching out onto the dangerous seas of network architecture and software, the data processing professional has to master a whole new technical vocabulary. After a time, he'll find that many of the seemingly exotic data communications terms are identical to dp concepts that he's known for years—only the names have been changed. ("Is this a plot by a handful of datacom consultants to protect their turf?" we recently heard one dp'er mumble darkly.)

Once he's somewhat at ease with bauds, access methods, multidrops, and all that, he may wish to consider configuring a modest network. That's when, to his chagrin, he finds that the terminals he wishes to purchase are not only incompatible with the computers distributed throughout his company, but he can't even access different applications in the same computer.

All of which leads to the next level of complexity: the wonderful world of protocols and standards (or lack thereof). There are interface standards, link control protocol standards, packet level protocol standards and applications level protocol standards, to name but a few. And none of these are really standards in the true sense of the word, not even the venerable RS232 physical circuit protocol. There has been no universal agreement among the players who make up the next rung in our complexity ladder, the manufacturers and world standards bodies.

In this issue we tried making apples and apples comparisons between the network architectures of three major U.S. vendors. It didn't work. Although there are similarities, there is no real compatibility.

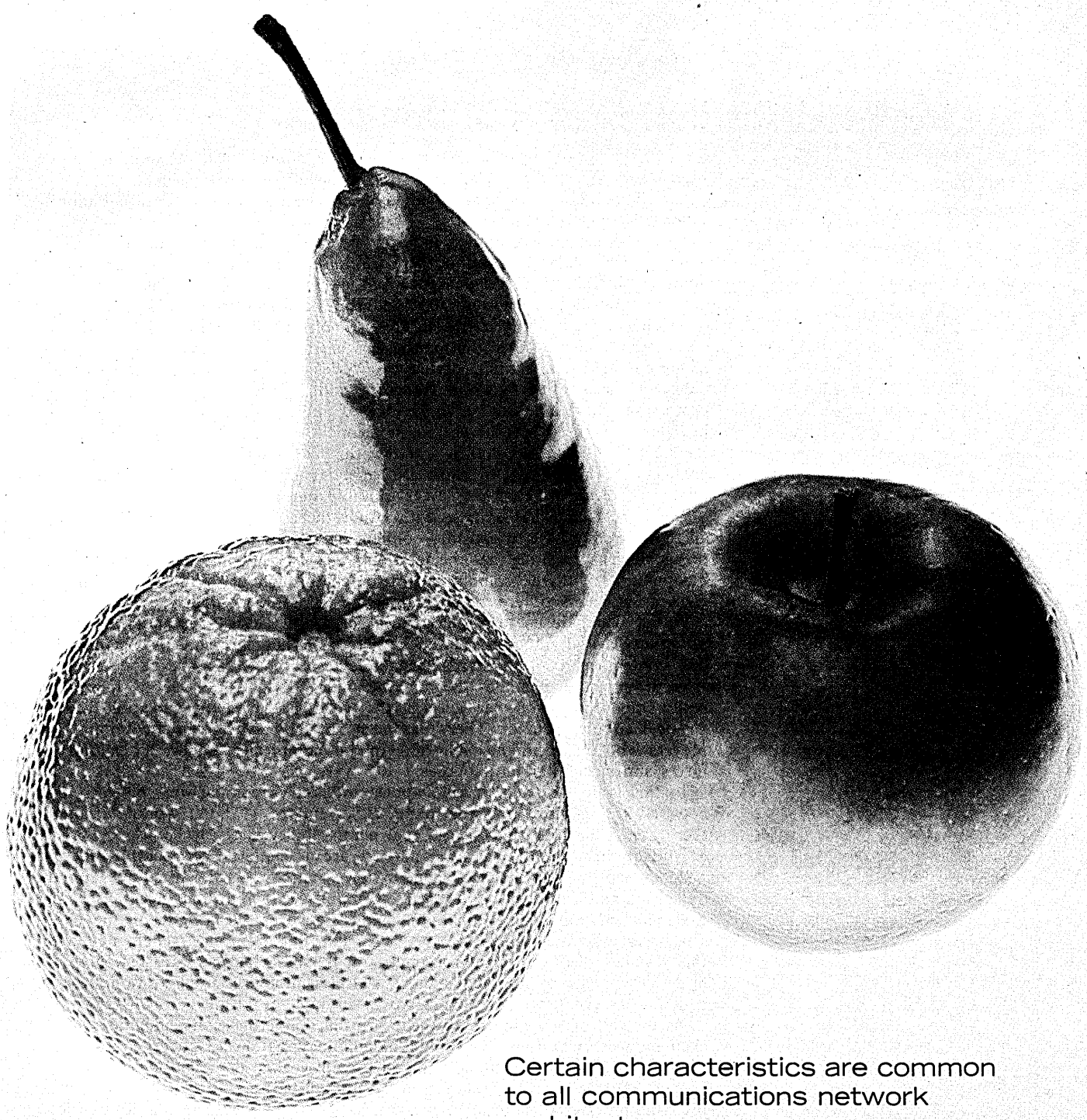
And at the international level matters are no better. For example, there's X.25, a packet level protocol standard proposed by CCITT (the International Telegraph and Telephone Consultative Committee). Even though X.25 is being designed and implemented on homogenous networks like Telenet in the U.S., TRANSPAC in France, and DATAPAC in Canada, not everyone is enchanted with this standard. Louis Pouzin for one, a man who wields an insistent and influential voice in international standards circles, prefers the datagram approach which gives the user more control over his network traffic.

At the top of our complexity heap are the ponderous and chauvinistic governmental machinations of the high technology nations. Concerned that the free flow of data over national boundaries will weaken their national sovereignty, many European countries are setting up data barriers at their borders, often invoking the sacred name of privacy. The net result could be a serious blow to international communications and commerce.

So there you have it—a small sampling of data communications' wheels within wheels. Faced with this labryinth, the faint of heart may be all too tempted to search for a simple "ultimate answer" and turn to Mother Bell saying "Yes, we believe . . . your system is indeed the solution."

But there are many positive aspects to this compounding of complexities. The marriage of computers and communications is still in its early stages. It's much too soon to cast data communications into rigid formats that play into the hands of a few powerful firms or nations.

Better that things bubble and boil for a while, even if it does mean another semester or two at ding dong school for all of us. ❁



Certain characteristics are common to all communications network architectures.
Unfortunately, that doesn't make them directly comparable.

PHOTO: BOB REED: JOAN LESSER/ETCETERA

Comparing Network Architectures

by Ralph G. Berglund, Contributing Editor

The era of computer network architectures is upon us. And who knows? Perhaps even the era of computer networks is near. But one thing is clear: between now, when the architectures are being announced, and that time in the future when we know how to use them efficiently, there will be a great deal of frustration.

No small part of that frustration will come from the fact that each vendor announcing a network architecture divides the computer communications realm up a little differently, and attaches his own set of labels to the resulting pieces.

Some time ago, DATAMATION *started out to clear up some of the confusion by inviting major vendors to supply comparably organized descriptions of their architectures for publication. We had hoped to lay them side by side and discover which labels were equivalent and how one communications philosophy mapped into another. It didn't work.*

Several vendors complied, and their contributions provided the basis for the discussion which follows. We will see, unfortunately, that those hoped-for mappings cannot be made, that exact equivalents are extremely rare, and that even basic terms like "end user" are interpreted differently by the vendors whose philosophies are outlined.

O

The development of data communications capabilities by the systems suppliers proceeded in the past without any master plan. In particular, the development of terminals and communications software proceeded independently in different application areas, with timing determined by the maturing of users' needs.

In the absence of a master plan, terminals were developed with more emphasis on application than on a standard communications interface.

End users aren't always people. They are always sources or sinks for data.

The same was true of communications software. Different networks for different applications demanded different telecommunications access methods. Worse, supporting multiple applications on a single machine demanded multiple networks and access methods. For example, a multipoint private line network might be established for data base I/O while conventional dial-up facilities were employed for remote batch or time-sharing on the same cpu. Multiple networks also were the "solution" when it was necessary to access two or more hosts from the same remote site.

This multiple network approach resulted in excessive operating costs and inefficient utilization of host processors. For many users, the excessive costs forced deferring new applications or restraining existing ones. For others, the gains from computing were less than they might have been.

The concept of distributing processing added fuel to the flames. When data communications were more or less limited to a remote site-central site flow, only minimal networking features were required. Having multiple hosts, or even multiple intelligent processors, in a net compounds all the earlier data communications problems.

It is in recognition, then, of network inefficiencies and of the potential advantages of distributed processing that computer suppliers have begun thinking in terms of comprehensive communications-oriented product and system development plans—the computer network architectures.

The suppliers each went off in their own direction, but the nature of the

problem constrained them all to meet certain common objectives:

- To enable terminals for different functions to be connected to the same network;
- to enable multiple host systems or other intelligent devices to be connected to that same network;
- to make the network transparent to the end user and application programmer;
- to better manage change in any of the network's elements.

And because they have some common objectives, the network architecture also have some common characteristics.

Commonalities: a short section

One characteristic common to the computer network architectures is that of having three levels of connection within the network. Fig. 1 illustrates the three levels. The first or most basic level is that of the link between two nodes. This link could be a single communication line interconnecting two devices. Or it might be a multi-dropped line managed by a communications front end, a remote concentrator, or even an intelligent controller. In any event it is the particular communication facility that electrically interconnects two or more physical network entities. The connection at this link level is usually implemented via one of the high level data link controls: SDLC in IBM's SNA; UDLC for Sperry Univac's DCA; and DLC in NCR's DNA.

> The ability of IBM's ACF to take over the domain of a failed host moots the issue of host dependency.

The second level of connection within the network is that between originating node and destination node, and is referred to as the path level. This is a logical connection or set of routing rules to move data from the input node to the target node. The physical path may be constant during communication or it may vary dynamically, depending on the architecture. As a reference point, the communications standard called X.25, the procedure for interfacing public packet networks, applies to the path level of network connection. It employs a manner of logically identifying a destination in the network which some intelligence within the network translates into a physical address.

One communicates with an entry node on the public packet network at the link level, and includes instructions so that the network can act at the path level. The communication then emerges at an appropriate exit node on the network and proceeds to its destination via a link level connection.

The third level of connection is that between paired end users. These aren't always people. On the other hand, they are always sources or sinks for data. One of the paired end users will usually be a person at a keyboard, but it might be a card reader, printer, punch, or crt screen. The other member of the pair often will be an application program receiving input from and/or sending output to the first. However, both could be application programs. An application executing in an intelligent controller may communicate with an application program in a host machine to retrieve exception data not present in its own storage, for example; in such a case, both end users are programs.

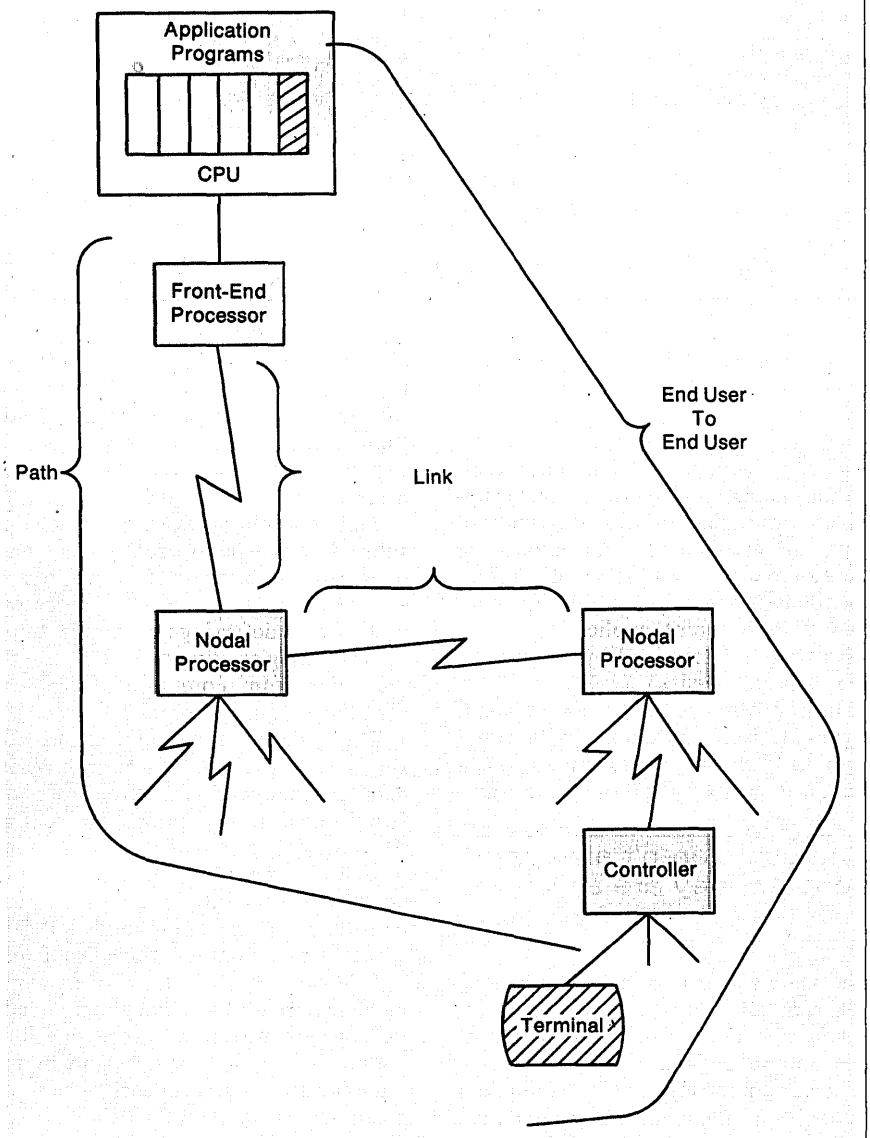


Fig. 1. Three levels of interconnection are common to all networking: the link connection between any two nodes, the logical path connection between the originating node and destination node, and the "end user" to "end user" connection.

Layering

A second characteristic common to the architectures is that of a layered structure in each network node or node "environment," where the environment includes a communications processor and an attached terminal. The "application layer" is concerned with end user functions and can be an application program or an I/O device such as a terminal. The second or "function management" layer provides device-specific transformations from the characteristics of the sender to the needs of the receiver. This layer is key to networking, providing as it does the translating functions between different I/O device characteristics and the basic, simple I/O characteristics of the

application programs. This level would manage the end user-to-end user connection. Finally, the transmission subsystem layer is concerned with the routing and movement of data between origins and destinations. This layer manages the path and link level connections.

The idea of layering is to insulate functions from each other, and to establish standard interfaces between functions. Hence, a function at one level (say, an application program) need not worry about the peculiarities of another layer (such as the transmission layer). A second advantage of layering is that changes can be made in one layer without concern for their effect on another. For example, a wholly different link control mechanism, perhaps for a new kind of public data network, can be readily accommodated in the transmission layer alone. Layering is the key to orderly, evolutionary system growth.

A short history

Now that we've examined networking in general, the objectives and features, and certain common denominators, we are as prepared as we can be to examine highlights of the three formal, networking architectures announced by the mainframers.

IBM, traditionally somewhat reactive in advancing communications, took the initiative in the industry by announcing its Systems Network Architecture (SNA) in September of 1974. In November of 1976 the company introduced its Advanced Communication Function extension to SNA in order to provide, appropriately, for networking multiple host systems.

Also in November 1976, Sperry Univac introduced its Distributed Communications Architecture (DCA). NCR joined the fray in June of last year with the announcement of its Distributed Network Architecture (DNA).

Among the other traditional mainframe suppliers, Burroughs seems to be moving toward having a functionally comparable architecture. Burroughs has not announced a formal structure, however, and seems to be emphasizing product and function more than plan. Control Data has defined computer network needs and objectives, but has publicly disclosed little of a formal structure. Honeywell has not announced any formal architecture but has been emphasizing achieving typical network characteristics and objectives through its so-called "distributed systems environment."

In view of these developments, and in view of related ones from the minicomputer suppliers, notably Digital Equipment and Hewlett-Packard, the ideas and functions of networking are beginning to move into commercial practice.

IBM's SNA

From a product point of view, IBM's Systems Network Architecture, SNA (see Fig. 2), is comprised of four components. First would be the family of terminals designed for different functions, but also for a common line control procedure. Included, for example, would be the 3790 programmable terminal system, the 3600 finance communication system, the 3770 batch terminal system, etc.

The common line control procedure, the second component, is SDLC, Synchronous Data Link Control.

The third component is NCP, the Network Control Program in the 370X front end. This represents largely an off-loading of some communications management from the host into the front end. Moved functions include polling, addressing, message accumulation, error detection and correction.

Finally, the fourth component is either VTAM (Virtual Telecommunications Access Method) or TCAM (Telecommunications Access Method). Either of these can manage the flow of information between application programs and terminals, performing much of the remainder of the communications management functions not performed by NCP. They also insulate any control programs "above" them, such as CICS, TSO or IMS, from changes in the network configuration. The control programs, in turn, insulate application

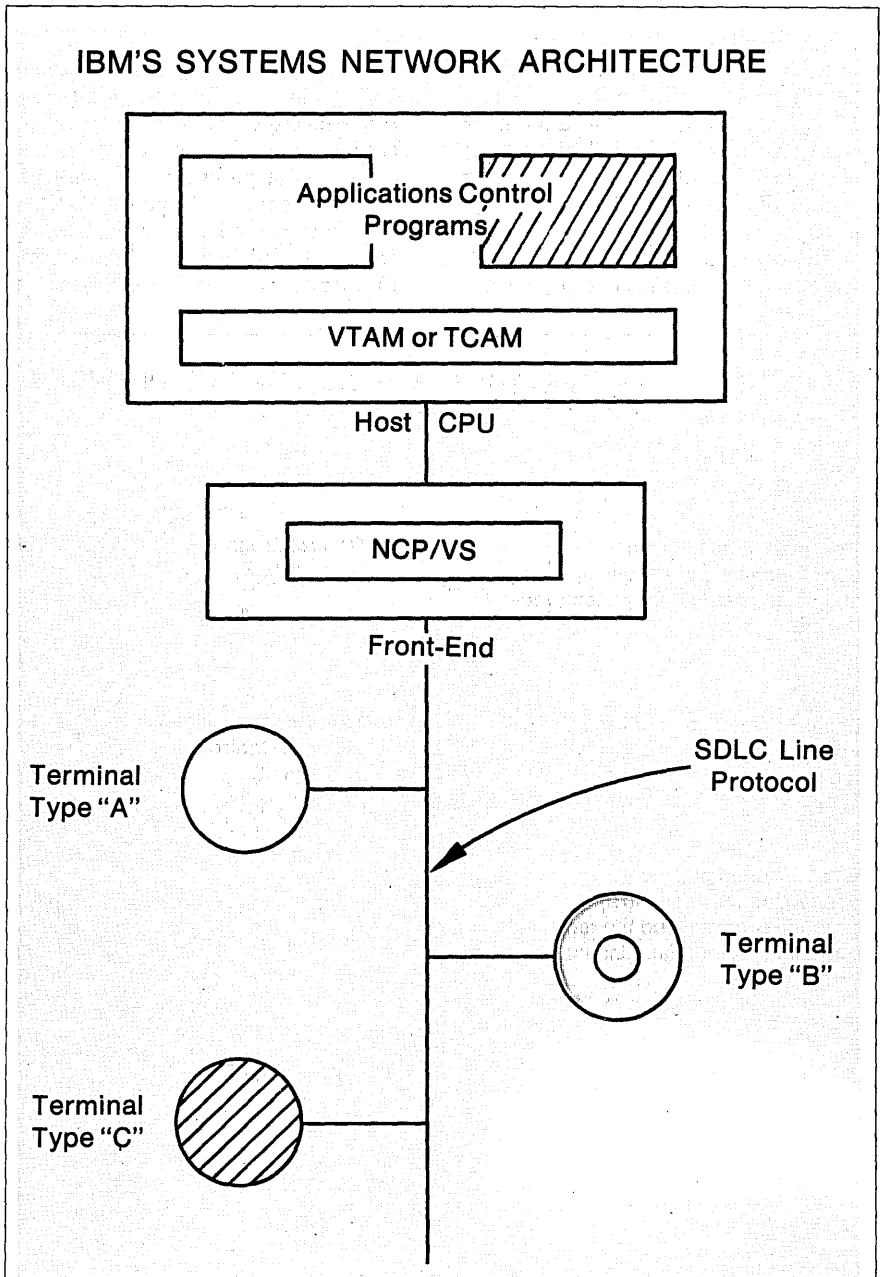


Fig. 2. From a product standpoint, IBM's SNA incorporates four major components: the Telecommunications Access Method, the Network Control Program in the front end, the SDLC line protocol, and SDLC-compatible terminals.

programs from terminal characteristics.

As originally announced, SNA addressed the network objectives of a single TAM and the support of multiple terminal types on a single network. Notably absent was the capability to support multiple hosts on a single network, but this was modified late in 1976 with IBM's announcement of Advanced Communication Function (ACF) versions of VTAM, NCP and TCAM.

> The majority of networks for some time to come will be the simple star type.

The so-called Multisystem Networking Facility of ACF enabled multiple host support as shown in Fig. 3. The terminal in Fig. 3 is a member of the so called "domain" of host *A*; that is, it is one of the elements under the control of host *A*'s VTAM. Suppose the terminal wants to run an application in host *B*. It first requests its VTAM via path "*a*" to connect it to the application in host *B*. This connection would be referred to as a "session," a logical connection between two end users. VTAM-*A* then works with VTAM-*B* to establish the session. Once established, the session proceeds via path "*b*," and does not continue through VTAM-*A*.

This illustrates SNA's present characteristic centralized control. The access method, now either VTAM or TCAM, is called the System Services Control Point (SSCP) and acts as the single controller for communications within its host's domain. It is responsible for initiating, maintaining, and terminating sessions between end users, and is also involved in establishing sessions between its domain and other hosts. The SSCP is the nail from which centralized control and a hierarchical network hangs.

There are three levels of protocol or control in SNA, corresponding to the three levels of connection mentioned earlier. A basic unit of data which originates at an end user is called the RU or Request Response Unit. To this is appended a Request/Response Header which includes data necessary to manage the end user-to-end user connection. To this is appended a Transmission Header which includes the data to manage the path connec-

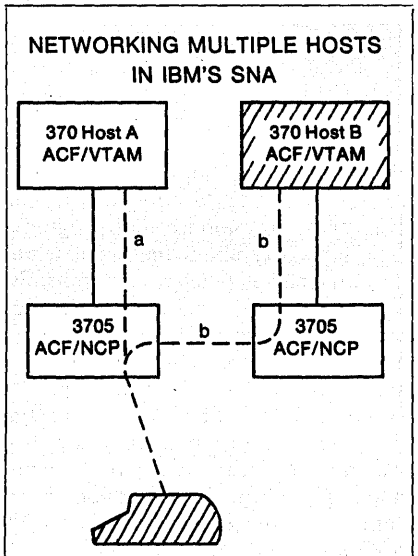


Fig. 3. SNA was widely criticized for being dependent on a host computer, but facilities are now provided for multi-host networking and for taking over the domain of a processor that's down.

FEATURES WHICH CONTROL NETWORK FUNCTIONS

FUNCTION	IBM	UNIVAC	NCR
Flow management from application to application, and device dependency accommodations	Control program (e.g. IMS)	Termination System	NCR/TAM
Logical connection between application program and the network	VTAM (the System Services Control Point)		
Establishment of logical connection between the application program and the remote terminal or remote application program		Application Management Services + Network Management Services	Communication System Services
Flow control within the network	Path control	Data Unit Control	Route Management
Routing within the network		Route Control	
Transmission to next node	Datalink control via SDLC	Trunk control using the sub architecture interface called UDLC	Link control via NCR/DLC

Table 1.

tion. Finally, the TH + RH + RU are packaged into the information field of an SDLC message frame for the link connection.

SNA is a "top-down" or hierarchical and centralized control architecture. It supports the basic objective of networking: multiple terminal types and multiple hosts on one network, with full freedom of access between terminals and application programs.

The common criticism is the centralized control philosophy. If a host goes down, all terminals in its domain are isolated because of the loss of the System Services Control Point, VTAM. It is possible, however, for another host on the network to take control of the domain of the failed host. This must be manually initiated, but it can be automated via user coding within IBM's Network Operation Support Program, NOSP in a VTAM environment or through Telecommunications Control System under TCAM.

For those multihost nets that will come into being, the ability through ACF to automatically take over the domain of a failed host, moots the issue of SNA's host dependency. Then, as with single host nets, the question becomes one of how many terminals are isolated per communication processor failure. With distributed control and alternate routing, there will be fewer terminals lost per commo processor failure.

This is achieved, however, at the cost of the added processors and trunks for bypass. If these added costs outweigh savings in terminal feeder lines, the additional premium must be justified by the value of keeping the rest of the system up. Such increased availability through alternate routing facilities has thus far been difficult to cost justify in private networks using any vendor's products.

A secondary criticism would be the absence thus far of full duplex cluster controllers, which prevents getting maximum benefit from SDLC. The latter, itself, is not all it could be when compared to some other link protocols which allow for up to 127 outstanding (unacknowledged) frames versus the seven of SDLC. Others also provide for selective retransmission of erroneous frames rather than the erroneous-plus-all-since philosophy of SDLC.

Finally, SNA does not support X.25, the present recommended interface for public packet networks. A similar interface was announced by IBM World Trade for Canada and France. One would think it also appropriate for the U.S. where we enjoy the world's first public packet network, Telenet, which has inaugurated X.25 service and plans to quickly expand its availability.

Univac's DCA

Sperry Univac's Distributed Communications Architecture (DCA) is a general plan for achieving all of the networking objectives that have been mentioned. In fact, in terms of those needs, its salient difference from SNA is that network control can be distributed throughout the network, as opposed to SNA's host-linked control. As with the other architectures, DCA is a set of concepts and interface specifications under which hardware and software can be designed.

> Univac has made a point of announcing DCA support for existing products.

While Univac emphasizes that DCA is a plan and not a product, certain items were announced as initial implementation. These included a Distributed Communications Processor (DCP) with network software, and a host-DCP interface package for 1100 series computers. The DCP can be employed as a front-end processor, a remote concentrator, or a nodal processor (that is, one which connects only to other DCP's). The software system which controls the DCP is referred to by Univac as the "Telcon" system.

The logical entities in DCA are illustrated in Fig. 3. We see again the idea of end users being either paired application programs or consisting of a terminal and program pair.

In Univac jargon, the communication system consists of the Transport Network (TN) and Termination System (yep, TS). The TN is comprised of all interconnecting communications facilities, be they private lines, dial-up, or even public packet-switching networks. The TN also includes any communications processors required. The Communication System User or CSU, technically not part of the communication system, would be a piece of code to interface a family of end users having some commonality. Examples would be transaction handling control systems, like TIP on the 1100 and IMS/90 on Series 90 cpu's, under which specific transaction types could be run.

The Termination System interfaces the CSU's to the Transport Network, and can be thought of as the telecommunications access method as it typically would be host resident. However, it also has the function management tasks, such as flow control, and presentation services (formatting suitable for the target end user), and can be thought of as managing, with the CSU, the end user-to-end user level connection.

In terminal systems, the CSU and TS functions will exist functionally, but may be only modestly realized in hardware or firmware.

The establishment of an end to end logical connection, again called a "session," is handled jointly by entities

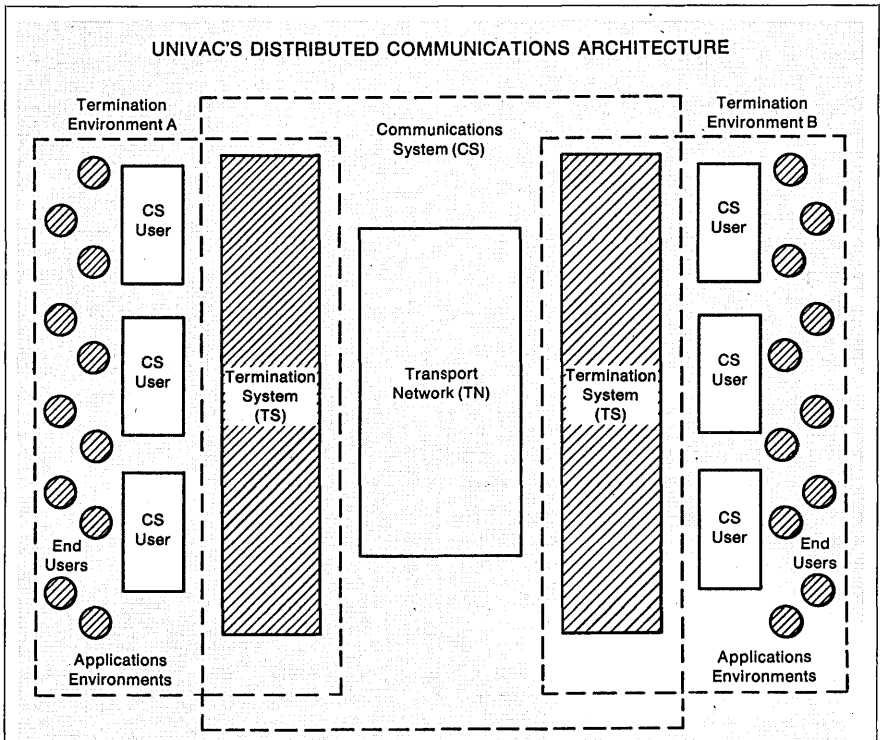


Fig. 4. The logical elements in Univac's DCA are the Transport Network (the communications facility, including the telephone company), the Termination System (roughly comparable to telecommunications access method software), the Communications System User (also usually software), and the "end users" (which, again, are not necessarily people).

called AMS (for Application Management Services) and NMS (for Network Management Services). AMS would be a CSU responsible for linking any end user in its environment with the NMS which are resident in the DCP's of the Transport Network. (How's that for alphabet soup?)

The Transport Network Control function, handled in the DCP, is illustrated in Fig. 4 (p. 83). The Data Unit Control (DUC) interfaces end user data units from the TS to the TN, and regulates flow within the TN to prevent network saturation. Since the Data Unit Control is the point of entry to the network, it also performs relative address transformation between the TS and the TN. Route Control manages the connection at the path level, that is, to that set of Transport Network Control elements serving the target Termination System. The route can be fixed when the session is initiated, or it can be dynamically defined during the session as a function of trunk utilizations and queues, but at a cost of greater network overhead for updating routing tables. Both of these approaches are in contrast with SNA, which does not thus far provide for any alternate routing.

The final control element is Trunk Control. Trunk Control load-levels the traffic on multiple links between two adjacent Transport Network Control elements (which, again, exist in the communications processors). The management of the physical links (including initialization, recovery, and their queues) is done by the Sub-Architectural Interface (SAI). For private communications links, the SAI would employ the link protocol UDLC; for parallel interfaces between hosts and front-ends, it uses a channel oriented protocol instead. An SAI is present in all nodes and manages the physical connection to adjacent nodes regardless of the composition of the connection. This idea of an SAI is unique to Univac, thus far.

All network control is vested in Network Management Services elements resident in the DCP's. Hence the loss of any host does not bring the network down. The loss of a DCP will isolate those terminals connected to it, but terminals on other DCP's can use the remainder of the network if alternate routing facilities have been installed.

Sperry Univac has made a point of announcing support for most existing communications products, both hardware and software, under DCA. Exceptions are products of long field history, such as the CTMC and DCS 16. Non-DCA products whether of Univac or other manufacture will be supported through the so-called ADAPT function. ADAPT will bridge the non-DCA characteristics to the requirements of DCA, and may be viewed as a form of Communications System User. Total conversion will be a function of the CSU and of the Termination System.

No particular non-Univac device support has been announced, but one would expect it in the case of some of the more widespread batch and interactive terminal protocols.

Univac has also made a commitment to support X.25 for interfacing public packet networks. UDLC is a superset of X.25's HDLC, and the X.25 packet level interface logic can be added as an option in the Sub-Architecture Interface. DCA is interesting, however, in that not only would X.25 be supported on facilities in the Transport Network, but also on circuits between terminals and their associated DCP and between DCP's.

> Like Univac, NCR distributes network control.

DCA spans Univac's small systems as well as its large ones. Processors in the 90/30 range, the smallest ones, will incorporate the Termination Systems with an SAI; that is, they'll connect to a network through their own kind of link interface, Univac claims. Direct connection may even work for simple network arrangements.

DCA is only now beginning to emerge in terms of releases so it is too early for the industry to have developed any hard judgments on it or even reactions to it. It is unquestionably different from present SNA in the centralized vs. distributed control question, and in alternate routing capability. These characteristics, however, will probably be meaningful only in multi-host nets. After all, if the front end of a single host net goes down, or if the host itself goes down, all of its supported terminals will be isolated. And as Univac points out, the majority of networks for some time will be the simple star-connected type.

NCR's DNA

NCR's Distributed Network Architecture (DNA), is described as a means to consolidate and unify telecommunications processing across NCR's entire product line. It is intended to permit all products to be interconnected, regardless of their internal architecture. It is also intended to permit a terminal to access more than one application, and to enable dissimilar terminals to share the same network. As with Univac's DCA and in contrast to IBM's SNA, the NCR approach is that of decentralized or distributed control, and with intended capability for dynamic and alternate routing. As such, a terminal is vulnerable to failure of the remote concentrator or front end from which it is served, but is not isolated should one of the hosts in a multi-host system fail.

NCR's concept of support allows a customer to ease into the complexities of networking, on his way going through three basic stages: (1) the simplest, where communications processor functions are integrated into terminals and other hardware; (2) the intermediate, where communications tasks are assigned to a separate processor but multiple paths through the network are not supported; and (3) the full-blown, where node processors form a multi-pathing Data Transporting Network and messages have logical

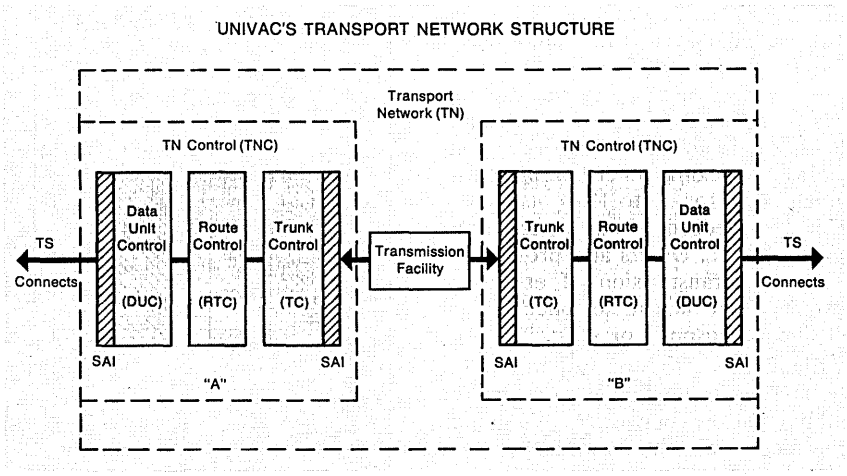


Fig. 5. Univac's conception of the Transport Network includes the communications facility, plus Transport Network Control functions in communications processors at each end. Each Data Communications Processor performs three functions: Data Unit Control to interface the end user to the rest of the system, Route Control to manage the path level connection from the entry node to the exit node, and Trunk Control to manage the use of the links between any two nodes.

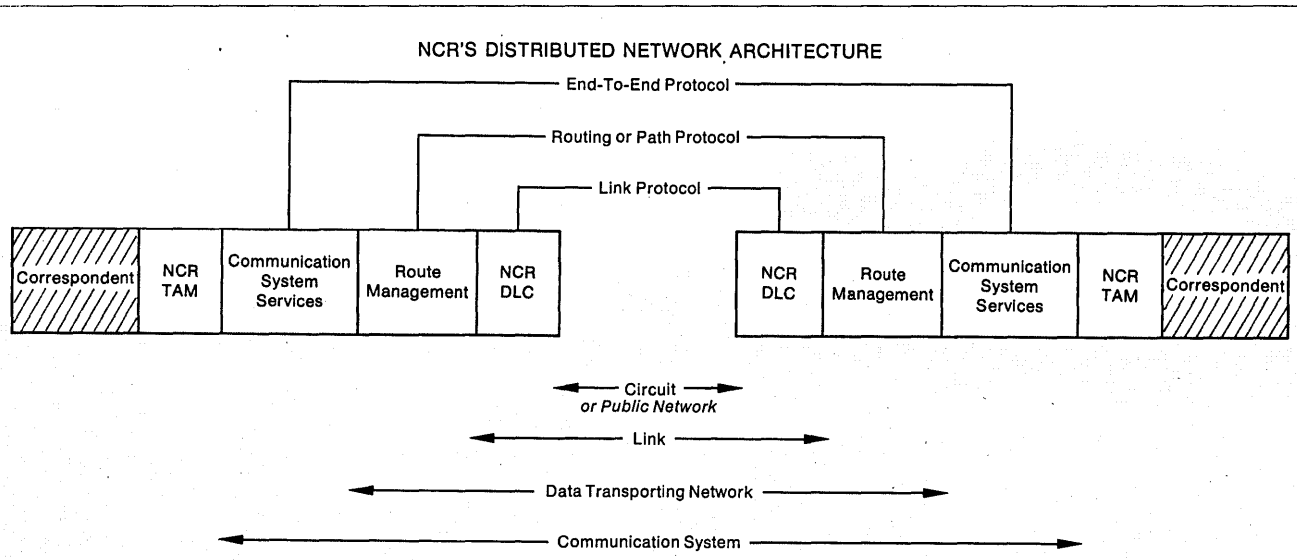


Fig. 6. In NCR's parlance, "end users" are called "Correspondents" and are linked by NCR/TAM access method software to Communications System Services which handle the making and breaking up of packets. Route Management handles the steering of packets and the data link control NCR/DLC handles the links.

routing headers for identifying their destinations. Applications programs are insensitive to which of the three stages is used.

Thus, the fully optioned DNA package is comprised of a new telecommunications access method, NCR/TAM, and the Data Transporting Network called NCR/DTN. The host-resident NCR/TAM functions as a boundary between application programs and the communication system; and the standard application program interface is defined as the Message Control System in ANSI COBOL '74. Other NCR/TAM functions include queue management and translation between application program symbolic names and communication system logical addresses.

The Data Transporting Network consists of communication lines or services interconnecting communication processors. The processors may be front-end processors, remote concentrators, of nodal processors; in any case, it is their software which supports multiple paths through the network, for better throughput or load distribution, or for alternate routing backup. Decentralization is achieved by having each communications processor share in regulating and directing traffic, and by providing alternate routing for bypassing a failed communications processor.

The layering and various connection levels of DNA are shown in Fig. 5. The structure contains functional elements or layers, peer layer protocols between correspondent machines, and interfaces between adjacent layers. Communication between two correspondents (NCR's name for application processes or terminal functions, equivalent to the end users in the IBM and Univac approaches) is managed by the Communication System Services layer in the two end systems.

The sending NCR/TAM presents the message and the logical addresses of the origin and destination to Communication System Services (CSS) which packs the data and ships it to the receiving CSS over the communication system. At the receiving CSS the packet is broken down and passed with logical addresses to another NCR/TAM (or a terminal's equivalent function) for delivery to the receiving correspondent.

Two basic types of communication may occur between CSS pairs: unnumbered or numbered service. For unnumbered service the message must be no larger than a single packet, and is sent through the Data Transporting Network that way. Messages larger than a single packet are sent with packet sequence numbers in the numbered service. (This makes interfacing the "virtual circuit" kind of public packet network possible.) Notably, however, in-sequence delivery is an option, meaning that the CSS *could* be made to take on the message integrity and sequencing duties. (And this suggests the potential for meeting a "datagram" interface.)

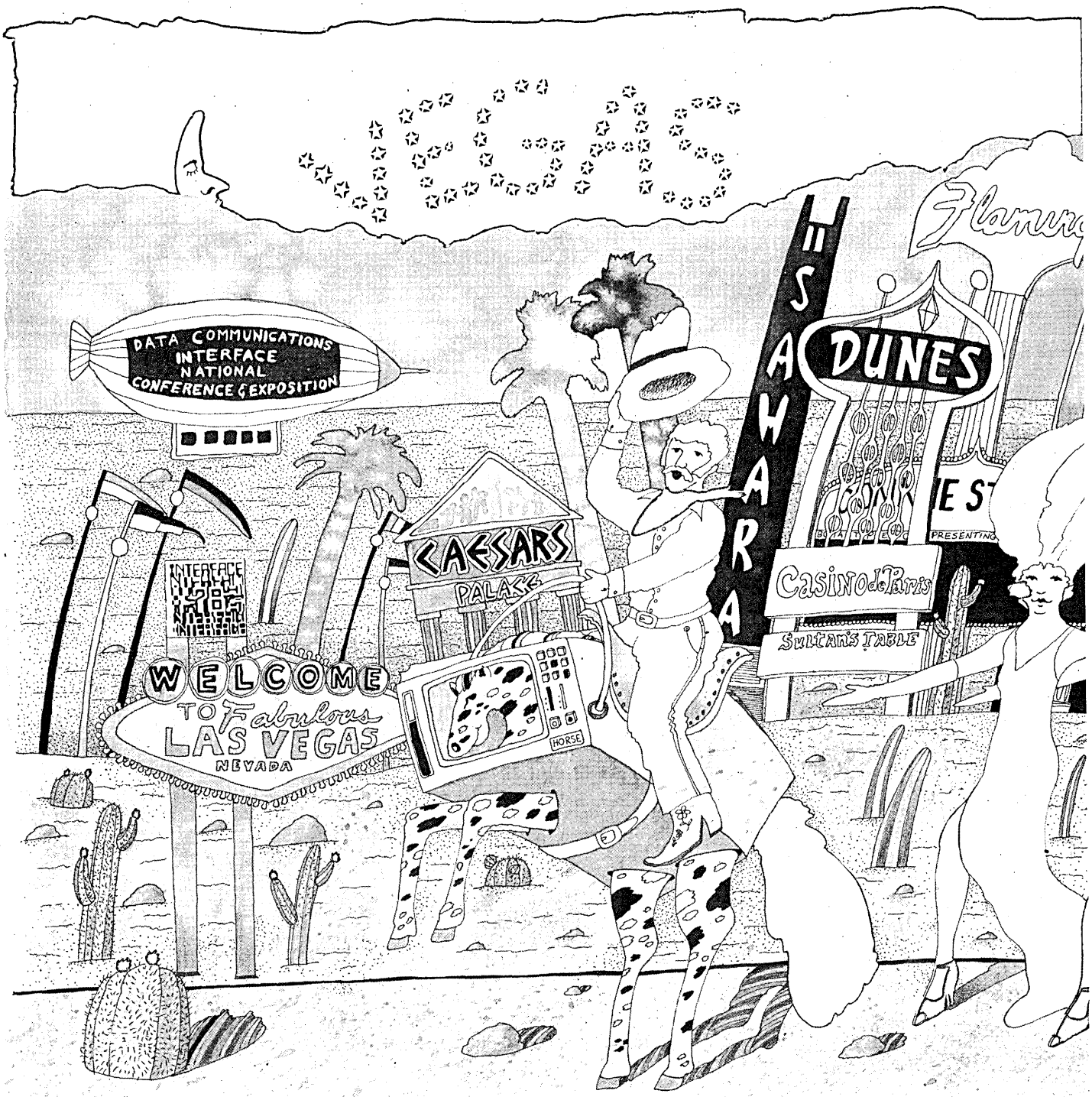
Route Management, the name for NCR's path level connection, provides physical steering of packets by translating logical addresses to physical addresses and routing them through specific communication links. The links may be point-to-point, multipoint, dial-up, or X.25-compatible packet networks, while the data link control, NCR/DLC, is intended to be compatible with ADCCP, HDLC, or SDLC as required.

Even less detail of NCR/DNA is generally known than of Univac's DCA. What is known, however, certainly addresses the needs associated with networking; and it appears that NCR will respond more fully as those needs further evolve.

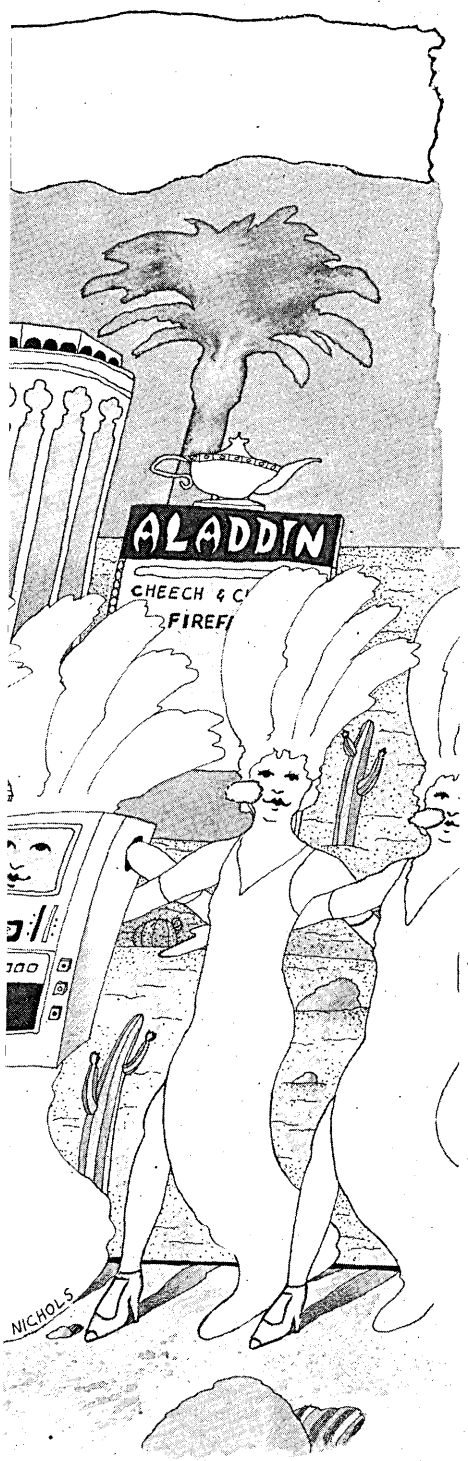
The information presented in this article was originally supplied by the vendors involved, although sometimes their contributions required interpretation. Contributors from IBM *included Charles R. Blair, James P. Gray, and E. Glenn Huff.* NCR's *information came through Frank B. Andrews. Univac's had to be gleaned from its brochures.* ❋

Mr. Berglund is a principal in Berglund & Smith, a data communications consulting firm headquartered in Cherry Hill, N.J. In his ten-plus years of consulting, he has performed audits, simulations, optimizations and other services for more than 70 client companies, including end users, suppliers, government agencies, and investment firms. Prior to becoming a consultant, he put in seven years in engineering and management with a computer vendor and a data communications equipment supplier.

Multinational companies worry over impact of privacy laws. Datacomm



conferences to confront the issues in panel discussions and debates.



Interface '78: Airing International Issues

The ease with which information on individuals is accessible through the computer has forced nations to enact privacy laws for the protection of their citizens. But this has raised a hornet's nest of dispute—and fear—among some companies doing international business, over what legally can be transmitted across the borders of these nations. France, for example, could impose penalties of one to five years in prison and fines ranging from $4,000 to $400,000 for violations. And many regulations are ambiguous.

U.S. and European vendors of network services are concerned. They seek a sort of international agreement on what data can be exchanged and what cannot. And what must be updated. And how often.

Otherwise, say the few experts who follow the issue, such privacy measures and the restrictions on access to national data bases could lead to the confusion that protectionism caused in the early stages of international trade.

U.S. interests such as General Electric, Control Data Corp., the Assn. of Data Processing Service Organizations (ADAPSO) and System Development Corp.—all offering multinational services in communications—have expressed their concern over the lack of a focal point within the U.S. government for coordinating and effectively promoting U.S. information policies abroad.

John Eger, former acting director of the Federal Office of Telecommunications Policy, has called the issue an "economic war" in which the U.S. is engaged against "the rest of the world." He says one of the enemy's chief weapons is data flow restriction. The other is the effort of other nations to discourage the use of private networks that mostly are owned by foreigners.

An "economic war" in which the U.S. is engaged against the rest of the world.

This is the setting for what appears will be highly informative discussions at two conferences on data communications this winter: Datacom 78 in Washington, D.C. (see box) and Data Communications Interface '78 at the Las Vegas convention center in Neva-

da. Eger, who now is a consultant on communications law and regulatory policy, will participate in both.

Keynote debate

At the Interface conference, being held March 6-9, Eger will engage in the conference's keynote debate with France's outspoken Louis Pouzin on the subject, "The Privacy Crisis vs. Datacom's Future Worldwide." Pouzin, who is better known as the director of Cyclades, an experimental computer network that links universities and research centers in France, and who is an ardent advocate of user interests in network access requirements, will explain the workings of France's privacy regulations as they apply to the type of data that can be sent across frontiers.

Eger said he will counter with the argument that in this "Information Age," we are in a transnational world and that it is a mistake for France and other nations to be unwilling to compete. But he adds, he also will point out that the U.S. is remiss for failing to state its case. Eger said he believes that

Three days, 35 exhibitors, and 4,000 data communications and computer industry personnel.

behind the enactments of privacy restrictions on the flow of data across national boundaries lies a desire by these nations to build their own viable computer industries. Still, he says, computers and communication represent the most significant forces of change in the world today. They represent the arteries of contact between U.S. industry and the rest of the world. Restrictive laws are cutting off those arteries.

175 exhibitors

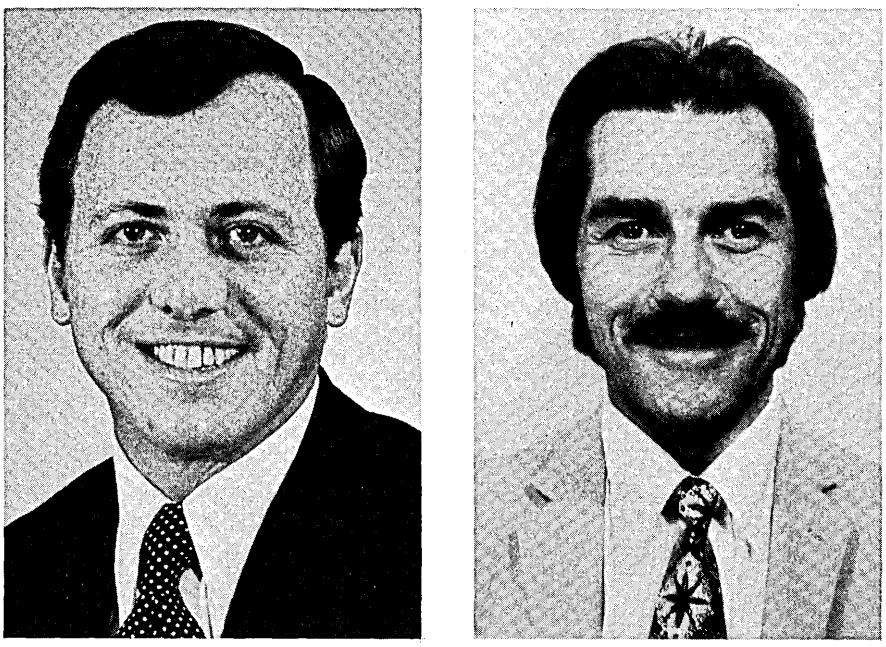
The debate is a highlight of Interface '78, which has been growing by leaps and bounds since it was started six years ago in Dallas. It's been held in New Orleans, Miami, Atlanta, and this year in Las Vegas where its sponsors say it will draw an audience of more than 8,000 persons and have 70 sessions on the program. Some 175 companies will participate in the trade exhibit.

Two other debates are on the program, "The Information Age: Are We Ready for It or Not?" and "The Data Communications Industry vs. Its Legal and Policy-Making Processes." Speakers for these had not been selected in early January, but Robert Lively, the program organizer, said he was attempting to include representatives of AT&T and IBM, since both topics revolve around services by both.

Datacomm school

Another highlight of the conference is its Datacomm School, aimed at educating the novice in fundamentals of data communications. Lively said "lots of new ideas and approaches will be woven into the program to arm attendees with the basics for datacomm decision making. Four classes emphasize the 'how to' of data communications rather than technical details."

The school, which regularly attracts about 500-600 persons, will have: a session on communications processing and software, conducted by Gary Audin, director of operations in North America for Logica, Ltd.; a session on terminals and terminal systems conducted by Elton Sherman, market director with General Automation Corp.; and an introduction to distributed computing networks, conducted by communications consultant Howard Frank of Network Analysis Corp. Speakers for two other sessions, Fundamentals of Data Communications and Interfacing and Transmission, had not been named early in January.



THEY'LL DEBATE privacy laws at Interface '78. John Eger, left, and Louis Pouzin.

The conference

Lively and Alan Kaplan, who are organizing the program, said they were sifting through a list of nearly 150 persons who had expressed interest in speaking at the conference.

Among the other subjects:

Hardware Highlights: A series of six sessions covering major data communication product areas.

Micro Technology for Datacomm: Four sessions spanning from microprocessor interfaces to maxi disc drives, giving the user an awareness of new, cost-effective computing system tools to improve the efficiency of his network.

Privacy: A Worldwide Datacomm Problem: An extension of the keynote debate, this session will feature discussions on the following subjects: Data for War or Peace in the Information Age; What IRC's and PTT's Have in Mind for the User; Privacy Solutions Through Systems Design.

Time-Shared Services and Systems: Three sessions describe what is happening in shared services, both general purpose and dedicated, plus in-house systems.

Network Workshops: Seven sessions will discuss planning concepts, simulations of alternative designs, network monitoring devices and software, and methods of measuring productivity.

The Services Scene: A discussion of alternatives in transmission service, such as MTS and WATS modifications, packet switching advances, service sharing and resale opportunities, and offerings from independent carriers.

Getting Into Packet Services: Three sessions address the following subjects: principles of packet switching; planning for packet service use; and user strategies for optimizing packet services.

Datacomm Management: Sessions cover the economic issues involved in data communications operations, and attention will be drawn to current management issues in vendor contract

negotiations and network security.

Datacomm: The Administrative Tool: Speakers will point out that distributed computing systems, word processing, facsimile, and computer-controlled telephone systems join together under data communications control to provide totally new administrative systems such as electronic mail and teleconferencing.

Distributed Computing Workshops: This will consist of a paper on the progress of distributed computing, a discussion on vendor-designed network architectures, and sessions on turnkey applications.

Software Strategies: Six sessions address software architectures and network operating system elements.

Applications Progress Sessions: Use of data communications in EFT, inventory control, reservations, production control, order entry and information retrieval.

Technology Forum for the Future: In what way and at what cost does one implement the data communication innovations being continually announced in micros, fiber optics, dense memories, transmission alternatives, and software optimization techniques?

Datacomm 78: Aimed at Federal Users

Three topical issues—world communications, change, and security—will be given a special airing at Datacomm 78, a three-day conference in Washington D.C., Feb. 21-23. It's the conference's second annual outing in Washington's Sheraton Park Hotel and is aimed at the huge federal data communications-using market and persons associated with regulatory policy making.

Program director Ed Bride said he expects a turnout of 4,000 data communications and computer industry personnel to the talks and to an exhibit by about 35 companies including AT&T, IBM, WUI, General Electric and a host of related suppliers.

Former chairman of the Federal Communications Commission, Richard C. Wiley, will deliver the keynote address.

Laws on data flow

One of the three special sessions, "Crucial Junctions in World Communications," will be chaired by John Eger, former acting director of the Federal Office of Telecommunications Policy, now a consultant on communications law and regulatory policy. It will focus on problems associated with the future licensing of computer data bases and restrictive laws governing the flow of data among nations.

Joining Eger for the presentation will be: Oswald Ganley, deputy assistant secretary of State and director of the Federal Bureau of Science and Technology Affairs; Walter Hinchman, chief of the FCC's Common Carrier Bureau; Hugh P. Donaghue, vice president of Control Data Corp. and chairman of the State Department's multinational task force on transborder data flow; and William J. Durka, manager of international legislative and trade policy with General Electric. It will be held at 3 p.m. on Tuesday, Feb. 21.

Ganley will discuss information technology and its impact on world politics. Hinchman will outline proposals currently before Congress for the restructing of international communications policies, and discuss the role the data communications industry can play in affecting those proposals. Donaghue will speak on laws passed by individual nations which deal with privacy, security, the licensing of data bases, and other matters of concern to data communications professionals. Durka will discuss the problems multinational corporations face in building international data communications networks, including the problems of dealing with individual Postal Telephone and Telegraph (PTT) bureaucracies.

"Waves of change"

Eger also will participate in a session Wednesday morning, called the "Waves of Change," which will be a presentation by Charles P. Lecht, author of a book with the same title. Lecht, president of Advanced Computer Techniques, will discuss the long-term market strategies of IBM and AT&T and the collision course those strategies seem to signal. "The IBM vs. AT&T battle will heat up during the 1978-80 period," Lecht says, "and the outcome of this confrontation could dramatically change the scope and shape of the data processing market in the 1980s."

Following his presentation Lecht will participate in a panel discussion with Eger, Frederic G. Withington, computer industry analyst with Arthur D. Little Corp., and Drake Lundell, editor of *Computerworld.*

Security

Belden Menkus, a consultant, will lead a third special session, "Issues in Data Communications Security," in which participants will discuss regulatory trends, review encryption standards, and look at industry espionage.

The Datacomm technical program will consist of some 40 panel discussions, vendor-user workshops, tutorial presentations and open meetings. Topics include data communications network architecture, network security, plus data communications software and product trends in such areas as modems, multiplexers, facsimile systems, data entry, and distributed processing terminals.

Further details are available from The Conference Company, 60 Austin St., Newton, Mass. 02160.

Focal point

Interface '78 conference director Sheldon Adleson said the conference has grown in six years to where it now is the "focal point for the dissemination of data communications information." This year's expected turnout of 175 exhibitors is ahead of the 135 last year in Atlanta, and the expected attendance of 8,000 compares with about 6,500 last year.

Primarily to accommodate exhibitors, the conference this year has been extended to four days from three in prior years, but with the same number of sessions. And lunch breaks range from two and a half hours to three hours, compared with only an hour and a half last year.

> Interface: "now the focal point for data communications dissemination of information."

Adleson said 30% of the turnout represents computer manufacturers and 70% end users. And all parts of the nation are well represented, with the exception of the West Coast. So, last November Adleson staged "Interface West" in Los Angeles and drew about 7,000 persons. That has led some exhibitors to have doubts about the projected 8,000 attendance at Interface '78 because it's also being held in the West and only four months after the Los Angeles affair. But Adleson says he's confident he'll meet his projections. "Two years ago in Miami we asked our audience where they'd best like to attend a conference and surprisingly San Francisco ranked first. So geography isn't a factor."

Next year's conference is in Chicago, where Adleson expects more exhibitors and an audience of 15,000.

Further information is available from Interface '78 at 800-225-4620 (or in Massachusetts, 617-879-4502).

(Interface Product Preview starts on page 93)

A multiple choice

A multifunction data entry system from Data 100.

(WARNING: there may be more than one right answer to each question)

---

1. Keybatch is:

(a) a multifunction intelligent key-to-disk data entry system.

(b) a brand new multifunction system from Data 100.

(c) a multifunction system which supports high volume concurrent batch capabilities.

2. Keybatch is also:

(a) a multifunction system offering stand-alone RPG for expanded user flexibility.

(b) a multifunction system that can operate with on-line file inquiry capabilities (3271 compatible) via common key-stations for both data entry and on-line file inquiry.

(c) a system capable of handling mail sorting and other office tasks.

3. As a data entry system:

(a) Keybatch has up to 20 megabyte disk storage capacity.

(b) Keybatch is proven with approximately 900 units now in use.

(c) Keybatch can be configured with 2 to 16 keystations.

4. For the end user:

(a) Keybatch meets short range goals such as appreciable dollar savings.

(b) Keybatch provides for long range system growth.

(c) Keybatch offers both of the above.

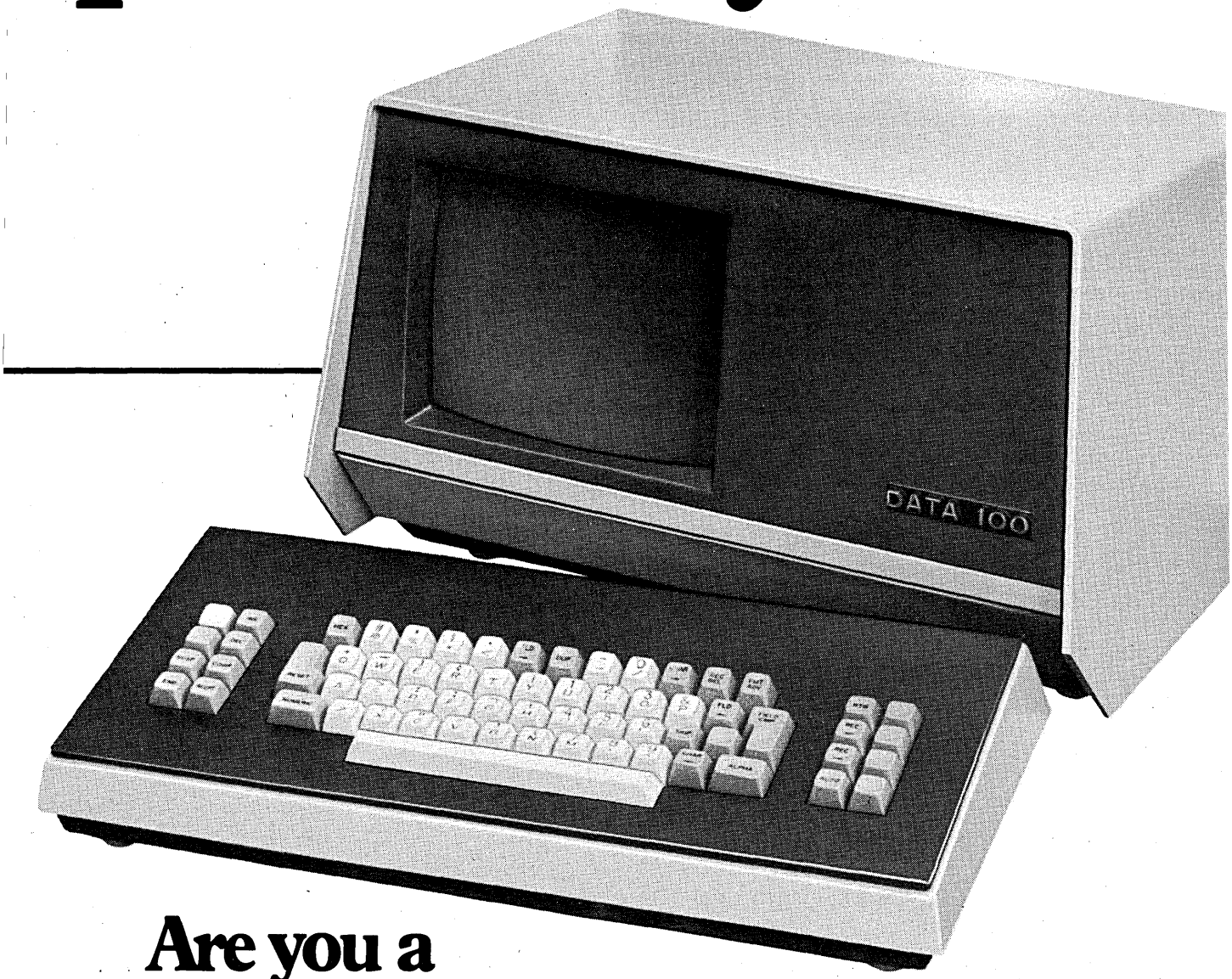
5. For more information on Keybatch, you should:

(a) search frantically through your EDP literature files.

(b) write Data 100 at 6110 Blue Circle Drive, Minnetonka, MN 55343.

(c) call your nearest Data 100 sales office or one of the numbers we've listed.

quiz on Keybatch.®



Are you a multifunction expert? Check these correct answers.

All answers but four are correct.

1b: Keybatch isn't brand new, was introduced in 1974.

2c: Sorry, Keybatch can't do everything.

3b: There are actually 1500 Keybatch systems on the job worldwide.

5a: No need to search when we're so easy to write or phone. Do it now!

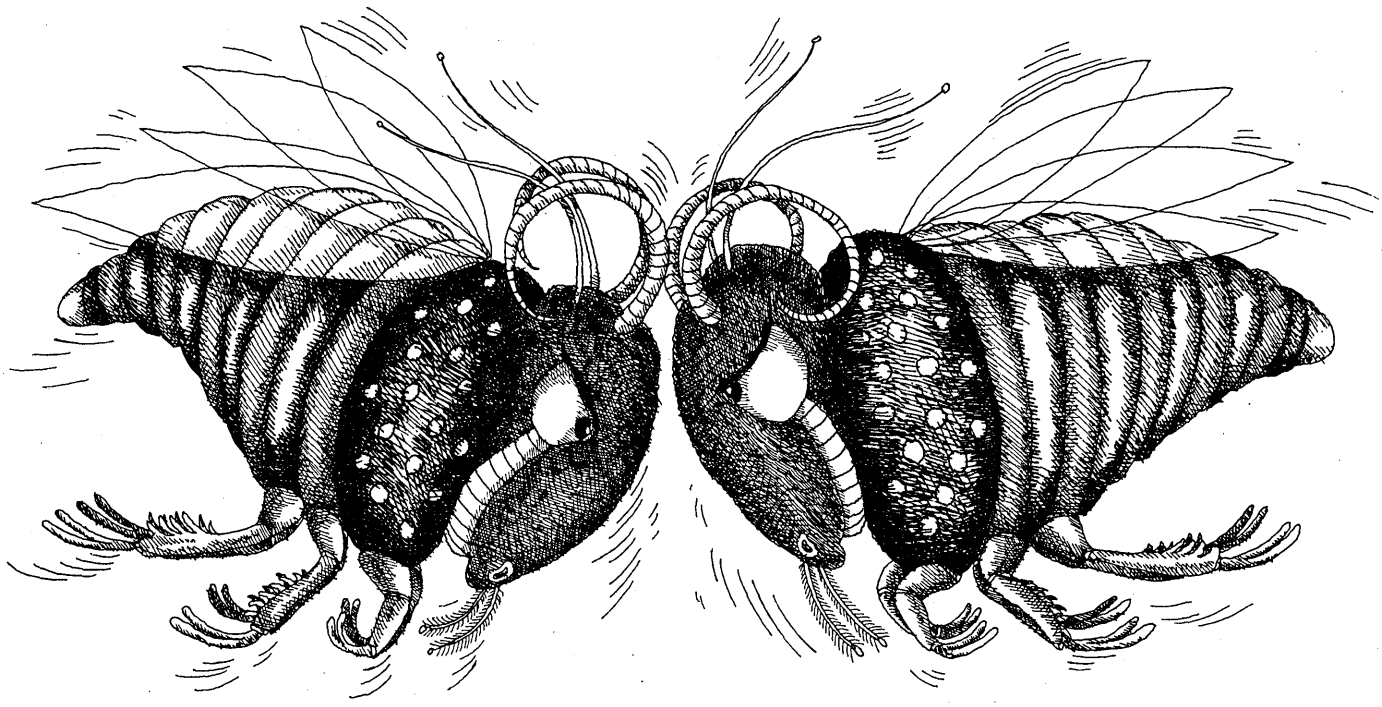
DATA 100 CORPORATION

multifunction data processing

LOS ANGELES 213/645-4300 • SAN FRANCISCO 415/546-6000 • CHICAGO 312/992-0850 • BOSTON 617/848-6100 • DETROIT 313/358-5065 • MINNEAPOLIS 612/941-6500 • NEW YORK 212/867-6200 • PITTSBURGH 412/391-5425 • HOUSTON 713/777-4413 • WASHINGTON D.C. 703/790-5560 • WOODBRIDGE N.J. 201/634-7800 • ATLANTA 404/455-3895 • ST. LOUIS 314/878-4911 • TORONTO 416/494-0434 • MONTREAL 514/761-5894 • LONDON ENGLAND (0442) 69161 • MELBOURNE AUSTRALIA 267•3544 • FRANKFURT GERMANY 72•04•71 • PARIS FRANCE 630•2144

CIRCLE 58 ON READER CARD

The Head Crash Bugs.

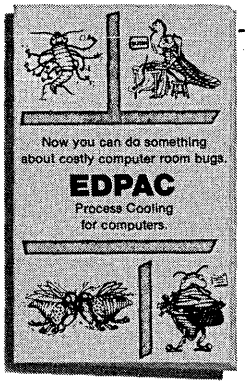


The right environment will control these costly pests.

When dirty air particles or extreme temperature changes happen in your computer room, it's open season for the Head Crash Bugs. That means expensive replacement costs and loss of computer time. And, they attack minicomputers as well as large-scale systems, with the same costly results.

EDPAC Process Cooling Systems are specially designed to create precise, controlled environments that prevent such problems. So you can rely on EDPAC to protect your computer like no regular air conditioning system can.

Before the Head Crash Bugs cause more collisions in your computer room, contact EDPAC today! FREE BOOKLET. HOW TO GET THE BUGS OUT.



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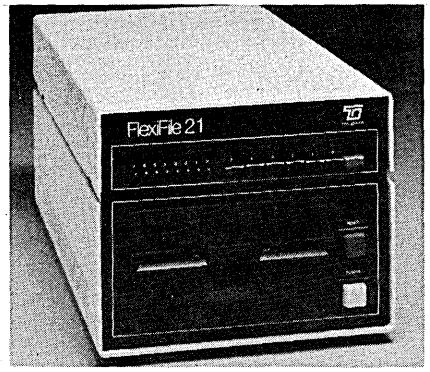
INTERFACE PRODUCT PREVIEW

TRI-DATA CORP.
Mountain View, Calif. Booth 867

Smart Floppy
Designed for applications in text editing, on-line data collection, program loading, and data logging, the microprocessor-based FlexiFile 21 includes a file management system with commands for searching, inserting, deleting, and listing data. Operating software may be loaded from diskette or, optionally, held in ROM. Interfaces include dual RS232 ports, 20mA (teletypewriter) current loop, and TTL parallel. Transmission rates are program selectable from 50bps to 19,200bps. A single FlexiFile 21 sells for $1,995.



FOR DATA CIRCLE 237 ON READER CARD

GENERAL DATACOMM INDUSTRIES, INC.
Danbury, Conn. Booth 1

Modems
These two microprocessor-based, 4800bps synchronous modems feature built-in diagnostics. The $2,800 Model GDC 208B/A works on the switched network or over private lines. Model GDC 4801 FP operates over full- or half-duplex lines, and includes a fast poll option in its $3,600 price. The units will be available in May and June respectively.

FOR DATA CIRCLE 239 ON READER CARD

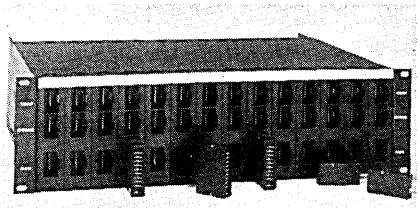
NETWORK ANALYSIS CORP.
Great Neck, N.Y. Booth 564

Communications Modeling
Demonstrations of this vendor's Modular Interactive Network Designer, MIND, will be given at the show. The model, which can be accessed through any ASCII terminal, can produce least-cost multipoint and point-to-point line layouts, simulate network performance, and maintain records of network resources. (A more detailed description of this software system can be found in this issue's "Software & Services" department.)

FOR DATA CIRCLE 238 ON READER CARD

ADC TELECOMMUNICATIONS
Minneapolis, Minn. Booths 624 & 626

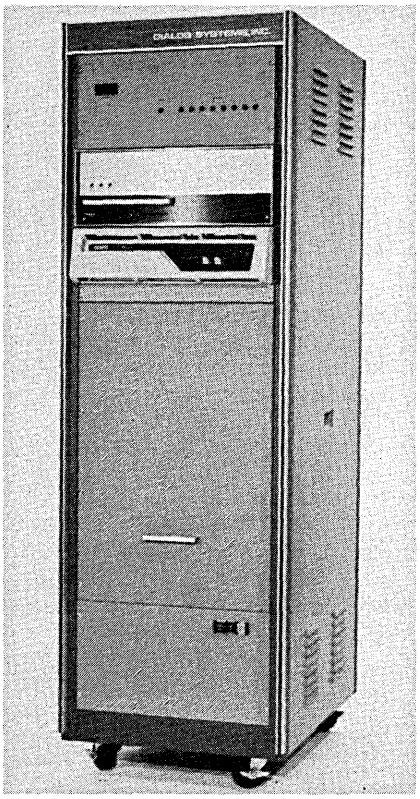
Data Patching
The Data Mate, an EIA RS232 data patching and access system, provides access to all RS232 interface conductors. It's used to test, switch, or substitute terminals or other equipment in a data communications network, and also to monitor the central leads in a data circuit. In quantities of 10 to 24 modules, the Data Mate sells for $74.50.



FOR DATA CIRCLE 235 ON READER CARD

DIALOG SYSTEMS, INC.
Belmont, Mass. Booth 272

Voice Input Paging
Designed for use in paging operations, the model 810 is an end-to-end signaling decoder which works without a human operator. A telephone caller can have a person paged simply by speaking the digits of his paging number. The unit acts as an interface between the caller and the standard types of "beepers" and other terminals used by the paging industry. An 810 can handle as many as eight telephone lines simultaneously. It sells for $70,000, and will be available next month.



FOR DATA CIRCLE 236 ON READER CARD

CONRAC CORP.
Covina, Calif. Booth 876

Intelligent Terminal
Based on Motorola's 6800 microprocessor, the Model 480 intelligent crt terminal is a modular hardware and software system designed for OEM's. The unit's computer-type card cage and bus can accept plug-in cards with up to 48KB of memory. Other cards include interfaces for flexible disc drives, printers, and remote crt's. Operating software may reside in ROM or be down-line loaded from a host cpu into RAM. The modular 480 will be announced this month (a predecessor, the 480/25, was introduced two years ago). Typical quantity 100 prices range from $1,500 to $3,000, depending on configuration.

FOR DATA CIRCLE 240 ON READER CARD

VEN-TEL, INC.
Santa Clara, Calif. Booth 661

Modem
The Model 212 full-duplex modem operates at 300bps (FSK) and 1200bps (PSM). It's compatible with Bell's 212A and includes an FCC-certified Direct Access Arrangement (DAA), allowing direct connection to the telephone system. Acoustic coupling is optional. The units, which became available at the beginning of this month, sell for $750 or rent for $30 per month.

FOR DATA CIRCLE 241 ON READER CARD

WOODFORD SYSTEMS CORP.
Atlanta, Georgia Booth 958

Key-to-Disc System
Consisting of a crt and two floppy disc drives controlled by a local processor, the WK3 includes a text editor written in BASIC. Options include a line printer and two more floppy drives. An entry level system sells for $5,495; availability begins on April 1.

FOR DATA CIRCLE 242 ON READER CARD

PULSECOM DIV., HARVEY HUBBELL, INC.
Falls Church, Va. Booth 462

Terminal Controller
A standalone multifunction controller, the Micromite 402 operates as an interface between data terminal equipment and asynchronous selective calling networks. In quantities of 10, the unit sells for less than $1,000. It will be available next month.

FOR DATA CIRCLE 243 ON READER CARD

(Continued on page 94)

PRODUCT PREVIEW

DATA FLO CORP.
Hopkins, Minn. **Booth 872**

Multiplexor/Concentrator

Designed for the large scale, long haul data communications user, the Complexor is a modular data transmission device consisting of compaction modules, demand multiplexor modules, and monitor/test modules. It compacts and multiplexes digital data for full-duplex communications under HASP workstation, 2780, 3780, 3270, and asynchronous protocols. Multiple compactor modules may be incorporated to allow the Complexor to operate under several protocols.

Data are dynamically multiplexed onto multiple communications lines or a shared line to be received by another Complexor at the other end of the communications link. Thus, a typical configuration for a wideband user consists of a 40.8Kbps Compactor, a two-port, two-line demand multiplexor, and a 3270 compactor. This configuration carries a monthly charge of $931 on a one-year lease; its purchase price is $23,275.

FOR DATA CIRCLE 244 ON READER CARD

IN BRIEF...

VALTEC CORP. (Booth 671) will show a fiber optic RS232 asynchronous data link. . . DIABLO SYSTEMS, INC. (Booth 361) will demonstrate its 3200 small business system in a communications mode. . . RAYTHEON DATA SYSTEMS CO. (Booth 420) built a fancy new 2100 square foot booth where it will demonstrate its PTS/2100 distributed processing system. . . PARADYNE CORP. (Booth 463) will show modems, an automatic network restoration management system, and its PIX-II virtual data link. . . NEC INFORMATION SYSTEMS, INC. (Booth 105) plans to show its Spinwriter series of printers, which use a "thimble" print element. . . INFOREX, INC. (Booth 820) will show data entry and distributed processing systems. . . QANTEL (Booth 300) will be on hand with its small business systems. . . GANDALF DATA INC. (Booth 932) features a line-up of modems and its Private Automatic Computer Exchange, PACX, a port contention and switching system. . . AZURDATA, INC. (Booth 957) will have portable, battery-powered data entry terminals on deck. . . BEEHIVE INTERNATIONAL (Booth 518) is bringing its B150 and B550 video display terminals to Las Vegas. . . CABLE & WIRELESS INC. (Booths 362 and 461) will demonstrate its worldwide telecommunications capabilities. . . ASTROCOM CORP. (Booth 12) plans to show its Minichek data transmission test set, along with other communications equipment. . . IBM's GENERAL SYSTEMS DIV. (Booths 922, 924, 926, 928, 920, and 930) will emphasize data communications between terminals and systems. Hardware demonstrated will include Series 1, System/34, 5230 Data Collection Systems, and the 5100 system. . . TDX SYSTEMS, INC. (Booth 268) offers a way to reduce telecommunications charges: it will show its Telemax system, an add-on to existing PBX and Centrex systems. . . WUI, INC. (Booth 936), which provides international communications via telex, leased channels, and cablegrams, will emphasize private leased teleprinter channels and data/voice services. . . HEKIMIAN LABORATORIES, INC. (Booths 761 and 763) will show transmission test equipment, including its microwave in-service monitoring system. . . DATA SET CABLE CO. (Booth 385) will show a variety of interface cables, including RS232 ribbon cables. . . MSI DATA CORP. (Booth 869) has demonstrations of its Source 7600 data terminal planned. Also at the show: its portable Source 2200 and MSI/77 terminals. . . ❋

ADDS SYSTEM 70. OEM.

7 good reasons why System 70 is easy to buy and even easier to sell

1 *Buy a lot. Save a lot. Big OEM discounts mean money in the bank.*

2 *ADDS* PLUS Data Entry Language, Advanced Diskette Operating System (ADOS), BASIC, FORTRAN IV, Assembler, editing and debugging software are all field proven. And, this extensive software simplifies implementation and saves you dollars.*

3 *We build 'em for you fast. Our 45 day delivery schedule means less inventory and more money in your pocket.*

4 *Our Nationwide service means you've got it easy. Over 50 service locations make sure that System 70s keep on working. We provide the service. You save the dollars.*

5 *With more than 50,000 terminals already installed, ADDS reputation for quality and reliability is unsurpassed.*

6 *Our terminals fit your customers. System 70's beautiful exterior is human engineered for maximum operator convenience and ease of operation.*

7 *IBM 3780, Burroughs and teletypewriter communications are all available, making System 70 the right choice for almost any distributed processing environment.*

ADDS

Quality, Reliability, Integrity, It all adds up to ADDS.

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DEPT. 70.

I need more information on the System 70. OEM.

Name _____

Firm _____

Title _____

Address _____

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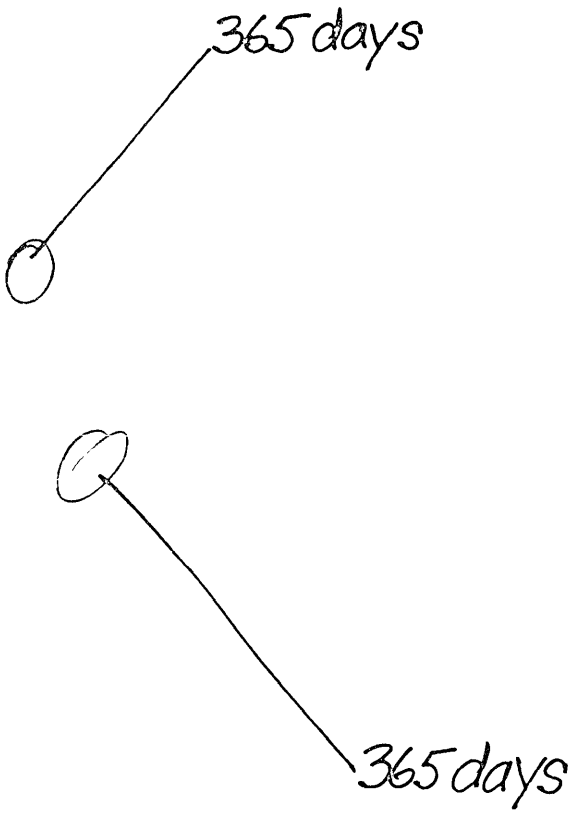
Phone _____

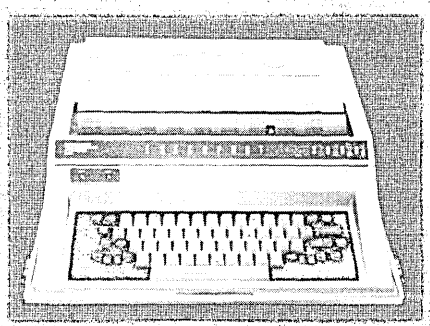
CIRCLE 111 ON READER CARD



We just re-designed our Execuport's least-used feature.

Our Execuport 3000 wide-carriage portable is so reliable, its warranty is almost never used. As a result, we've decided to increase the warranty. Make it 275 days longer.

This means you get a full year of warranty protection (although, with our track record, you'll probably never get to use this warranty either).



Things you will use on our 3000 include an exclusive data logger that can print all the control characters, a wide carriage (that also takes narrow paper), plotting with ½-line stepping, optional ASCII/APL switchable codes, plus a typewriter-type keyboard that makes using the 3000 a pleasure.

So, there are two reasons for buying our 3000. The things you will use on it. And the things you won't.

Don't you think it warrants further investigation? Just call Charles Kaplan or Shirley Newman at (201) 261-6800. And while you're at it ask about our reduced quantity prices.

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CTSI

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CIRCLE 32 ON READER CARD

Introducing The Rapifax System 50

The "intelligent" system that makes electronic mail a reality – today!

See it at the Interface Show, Booth 864.

If you're not attending Interface
and would like information about the System 50,
write or call:
Gary Winkler, Marketing Manager,
Rapifax Corporation,
7 Kingsbridge Road, Fairfield, New Jersey 07006,
Telephone: 800•631-1155.

RAPIFAX

RAPIFAX CORPORATION, 7 Kingsbridge Road, Fairfield, New Jersey 07006, Telephone: 800•631-1155.

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We make COM live up to its potential.

DATACORP

CIRCLE 64 ON READER CARD

Where Is the Industry Going?

by Pender M. McCarter

Is this the midpoint of a 12 order-of-magnitude change in computing?

The data processing industry will continue to double in dollar volume every five years worldwide from 1970 to 1990.

Total user spending on data processing in the United States will rise from 2.1% of the Gross National Product (GNP) in 1970 to 13% in 1990, and from $101 per capita to $1,253.

By 1990, as many as one in five of the U.S. labor force will require some knowledge of data processing. In addition, by that year more than six out of 10 in the U.S. labor force will depend in some way on data processing. Finally, by 1990, more than 90% of the cost of dp will be attributable to personnel costs, perhaps making data processing the nation's most labor-intensive field.

These are some of the conclusions of a report completed last fall by the Washington Office of the American Federation of Information Processing Societies, Inc. (AFIPS), entitled *Information Processing in the United States: A Quantitative Summary.*

Although the federal government continues to be the largest single user of computers in the U.S., federal usage is not increasing as fast as it is in the U.S. at large. The number of computers owned or leased by the federal government has increased from approximately 6,000 in 1971 to nearly 10,000 in 1976, but the ratio of federal computers to the total computers installed in the U.S. actually has declined. For example, in 1971, the government employed one in 16 computers located in the U.S. By 1976, this ratio dropped to one in 22.

Why Government dp drop?

At least some of this decline can be attributed to the federal government's practice of maintaining low inventories, necessitated by budgetary constraints. Another factor is suggested by the feeling among federal dp officials that these usage figures (based on 1977 General Services Administration data) may not completely reflect government work done by service bureaus.

Not surprisingly, as of 1976, the Department of Defense (DOD) accounted for most of the federal government's computer usage, some 46% of the total. Within DOD, the Air Force employed the most computers (18% of all federal usage), followed by the Navy (14%), the Army (12%), and "other DOD" (2%).

The now defunct Energy and Research Development Administration (ERDA) accounted for the second largest number of computers in the gov-

WHERE IS THE INDUSTRY GOING?

ernment after DOD, 24% of total federal dp usage. ERDA's reorganization into the Cabinet-level Department of Energy (DOE) may place it closer to DOD as the largest computer user in the federal government in future inventories, since DOE incorporates some other federal energy agencies using computers in addition to ERDA.

With 13% of all computers in the government, the National Aeronautics and Space Administration (NASA), originator of the space program and the source of the public's generally high expectations concerning computer performance, may be a surprising third among the three main users of computers in the federal government.

In addition to being the largest single user of computers, the federal government is also the largest single employer of data processing personnel. Similarly, as the largest user of computers within the government, the DOD (as of 1975, according to the latest available U.S. Civil Service Commission data) employs the largest number of data processing personnel, more than half of the federal total. However, in contrast to the amount of computer usage, data on employment of dp personnel within DOD is reversed in order. The Army is the largest employer (22%), followed by the Navy (18%), and the Air Force (15%). A combination of "other civil agencies" constitutes the second largest employer of data processing personnel in the federal government (11%). The Department of Health, Education and Welfare (HEW) is third with 10%.

As of 1975, almost half of the data processing personnel employed by the government were either systems analysts, programmers or "other specialists," as defined by the Civil Service Commission.

Financial dp

After the federal government, the insurance industry depends most heavily on computers. As of 1976, according to 1977 industry statistics, approximately 76% of all insurance firms employed computer equipment and/or services. Insurance is followed by banking, with almost 71% of all banks employing computer equipment and/or services.

Of the two groups, the insurance industry employs more in-house computers (51% of the total) and banking uses more service bureaus (also, coincidentally, 51% of the total).

As of 1975, again according to data supplied in 1977, the insurance, banking, and other finance sectors taken together employed approximately 18% of the general purpose computer systems in the U.S. (second only to manufacturing, described below), and about 7% of the minicomputers (which puts the financial group sixth, after manufacturing, in the use of minis).

The best figures for dp personnel employed by industry are for 1974. According to data published in 1977 by the Department of Labor (DOL), the insurance, banking, and other financial segments of industry employed 14% of the total dp labor force in 1974. This number includes programmers, systems analysts, equipment operators, keypunch operators, and machine repairers—which the Labor Dept. defines to be the universe of computing-related occupations.

According to estimates in the AFIPS study, this financial group will account for the same percentage of the dp labor force in 1985, 14%, but that labor force will be much larger then. Employment in computing occupations is expected to grow by 30% by 1985, compared to a growth of only 20% for all U.S. employment.

If a national securities market—now in the planning stages—is implemented to link trading floors across the country by 1985, then it is possible that the financial segment of industry will see a net increase in dp employment, giving it more than its present 14% share. If this occurs, it will make the financial group unusual in that respect; most other industry groups are expected to actually decrease in share of dp employment.

Manufacturing dp

Although a larger percentage of firms in the financial industry group made use of computing equipment and services in 1974, manufacturers spent the most funds of all industry groups on those items (34% of all dp user spending). The financial group was second (23%), followed by transportation and utilities (12%).

The best figures for equipment use are for 1975, when 25% of all general purpose computers in the U.S. were thought to be accounted for by the manufacturing industry. In the same year, manufacturing marked up more than 35% of the minis in use.

Coming in second in the use of general purpose computers was finance with 18%; services was third with 17%. In the use of minis, manufacturing is followed directly by services, with 13%, and education, tallying 11% in spite of the overall decline in hardware and software produced for computer assisted instruction.

The AFIPS report attributes manufacturing's prominent role in the use of dp equipment and services partly to the

CAUTION

Keep Out of the Reach of the Careless

As a note of warning AFIPS stated in its study:

. . . It is important that the reader exercise extreme caution in comparing data which are drawn from different sources. While all of the sources used in this study are believed to be credible, each individual source uses different data collection techniques and data categories, such that the data are not directly comparable. Further, although efforts have been made to present the most current data available, information in the various figures are *not* presented for the same years. It is nonetheless felt that general comparisons can be useful, and areas where data appear to be comparable are noted. Forecasts are obviously to be considered less reliable than current or historical data.

It should also be emphasized that there are inherent dangers in attempting to develop a static description of a field as dynamic as information processing. In particular, data collected over several years reflect categories of measurement which appeared appropriate at the beginning of that period; since a period as short as five years is a major segment of the lifetime of the information processing field, such data reflect a somewhat retrospective view of the field. ❋

The report from which these conclusions were taken, "Information Processing in the United States: A Quantitative Summary," was produced with the help of Arthur D. Little, Inc., Auerbach Associates, Inc., and International Data Corp. Originally presented to the White House Office of Science and Technology Policy, it is now available for $6 (prepaid) from AFIPS Press, 210 Summit Avenue, Montvale, NJ 07645.

industrial control function. Minis and dedicated application systems, especially, have been increasingly used for on-line control of continuous processes and machine tools.

According to Labor Dept. figures, again for 1974, manufacturing employs the largest percentage of the computer labor force, almost 29%. It is followed by services at about 27% and by finance, as previously noted, with its 14%.

Like most industries, however, manufacturing is expected to see a *decrease* in its dp employment by 1985; most likely it will fall off 4% to be about 25% of all dp employment. Only the services industry is expected to grow; it is expected to overtake manufacturing by 1985, ending up with as much as 35% of the dp personnel resource.

Dp revenues

With respect to total computer output, revenues derived from general purpose computer systems, minicomputers, terminals, services and supplies doubled in the five years from 1971 to 1976, and are expected to double again in the five years from 1976 to 1981. We also note that revenues reflect all earnings from computer equipment, services, and supplies in a given year.

Unfortunately, revenues may be an inadequate measure of current deliveries of computer equipment for any specific period because they include expenditures for rentals and leases allocated over a longer term. However, we also conclude that services and supplies are adequately covered in the revenues category; they don't have the rented or leased problem.

The report employs two other indicators of total computer output: *shipments*, the list sales price of equipment actually delivered by manufacturers in a given year; and the *installed base*, the total of all equipment already in place, computed at original list sales prices.

Data for AFIPS' 1972 study and for this 1977 report, are based on a consensus of three market research firms: Arthur D. Little, Inc.; Auerbach Associates, Inc.; and International Data Corp. According to their consensus, while increasing in dollar value, revenues from general purpose computer systems are decreasing as a percentage of total dp revenues. Thus, we note that these revenues dropped from 62% of the total in 1971, to 56% in 1976, with 47% projected in 1981.

However, the portion of revenues that can be traced to minicomputers is increasing. It has gone from 2% of the total in 1971 to 7% in 1976, with 12% projected in 1981. Similarly, revenues attributed to terminals in 1976 were 13% of total computer output, and are projected to be 14% of the total in 1981.

In the services area, only a slight rise is indicated in revenues from 16% of the total computer output in 1976, with 20% of the total projected for 1981.

Finally, in the supplies and "Other" area revenues are stabilizing, representing 8% of total output in 1976, with 7% projected for 1981. (The category includes leasing, used computer sales, and education.)

In the education area, the market research firm representatives agreed that their earlier projections had underestimated the decline of the "for-profit" data processing schools. The 1976 consensus estimate for revenues derived from education is $60 million; but for 1981 these are forecast as "negligible."

"Shipments" are the most sensitive indicator of current manufacturing activity, as they relate to computer equipment. While expenditures on shipments of general purpose systems have increased in dollar value from 1971 to 1976, and are projected to increase in dollar value from 1976 to 1981, shipments of general purpose computer systems, expressed as a percentage of all computer equipment (including minis and terminals) from 1971 to 1981, are also decreasing. Thus, general purpose computer shipments dropped from 95% of the total in 1971, to 73% in 1976, with 61% projected for 1981.

Conversely, expenditures on shipments of minicomputers from 1971 to 1981, expressed as a percentage of all

U.S. DP USER SPENDING 1970-1985

Year	$ billions	% of GNP	Per capita
1970	$ 21	2.1%	$101
1975	$ 41	3.2%	$191
1980	$ 82	5.2%	$355
1985	$164	8.3%	$670

Source: The SILT Report, "Data Processing in 1980-1985: A Study of Potential Limitations to Progress"

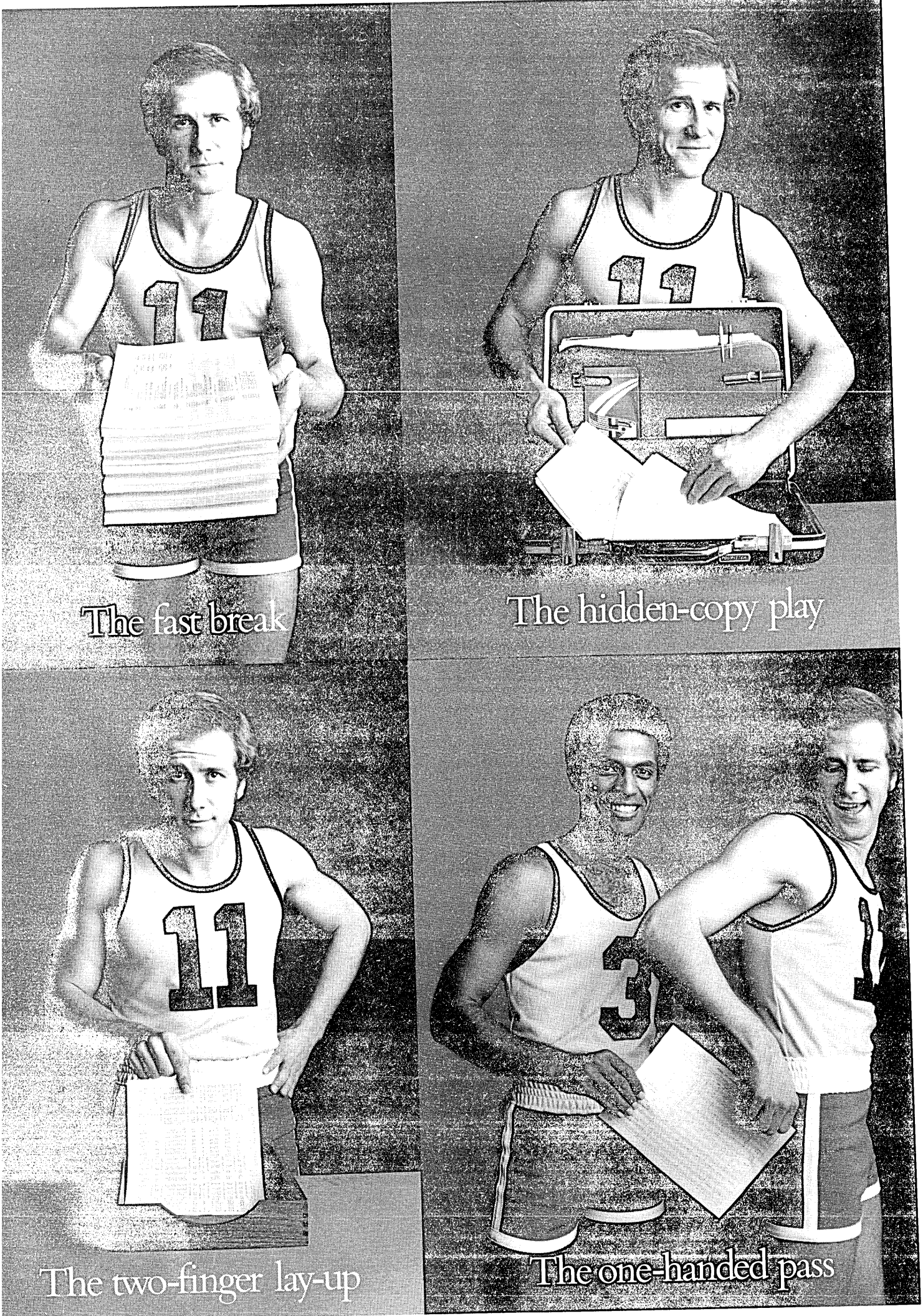
While expenditures on dp double approximately every five years, total computer "capability" may increase far more quickly, since the performance/cost ratio also improves. (Note that the amounts above are all expressed in 1970 dollars.)

WORLD REVENUES FOR U.S. FIRMS

	1971 ($ millions in 1971 dollars)			1976 ($ millions in 1976 dollars)			1981 ($ millions in 1976 dollars)
	U.S.	Overseas	World Total	U.S.	Overseas	World Total	World Total
EQUIPMENT							
General Purpose Computers	5,300	3,300	8,600	9,500	7,000	16,500	28,000
Mini & Dedicated Application Computers	250	60	310	1,200	800	2,000	7,000
Peripherals:							
Data Entry & Terminal Equip. from Mainframe Manufacturers	350	180	530	1,000	800	1,800	4,000
Data Entry & Terminal Equip. from Independent Suppliers	165	60	225	1,600	600	2,200	5,000
Machine Room Peripherals from Independent Suppliers	180	140	320	1,000	400	1,400	2,500
Leasing	600	70	670	1,000	100	1,100	1,500
Used Computer Sales	40	*	40	100	*	100	300
SERVICES							
Batch	950	110	1,060	1,700	200	1,900	2,400
On-Line	500	90	590	1,400	300	1,700	5,600
Software	750	40	790	1,100	500	1,600	5,000
Education	160	*	160	60	*	60	*
SUPPLIES	1,100	*	1,100	1,200	300	1,500	2,700
TOTALS	10,345	4,050	14,395	20,860	11,000	31,860	64,000

Source: AFIPS
*Negligible

The dollar value of computer shipments should approximately double in each five year period, with the segment for minicomputers and dedicated application systems actually increasing much faster than that. (Note that some of the growth from 1971 to 1976 may be due to inflation.)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computer equipment, are increasing. Shipments are expected to grow from 4% in 1971 to 13% in 1976, with 21% projected for 1981. Dollar expenditures on minicomputer shipments from 1971 to 1976, it should be noted, increased seven times, and are projected to increase three times from 1976 to 1981. Expenditures on terminal shipments are by 1981 forecast to stabilize at 15% to 20% of total computer output.

As indicated in the study, 1976 estimates and 1981 forecasts are in 1976 dollars. Thus, the market research firms did not attempt to project inflation.

Similar trends reflecting the decline of computer activity allocated to general purpose computer systems are present in data on the installed base. Since minicomputers are usually less expensive than what is called "general purpose computer systems," their dramatic increases are better defined as a percentage of all computers installed by number, instead of a percentage of value. (We defined minicomputers in the report as small systems having at least 4,000 words of random access memory and at least one product, in a family of computers, costing from $2,000 to $25,000 for a basic system.) Thus, mini and dedicated application computer systems constituted 38% of the 88,000 computers installed in the U.S. in 1971, rising to 70% of the 229,000 computers installed in the U.S. in 1976.

The market research firms note that projections (made in the 1972 study) underestimated the phenomenal growth in mini and dedicated application computer systems.

Although, as of 1976, more than one-half of all of the 374,000 computers in the world are located in the U.S., more than half of U.S. revenues, $11 billion in 1976, were derived from sales overseas. Also according to market research firm data as of 1976, U.S. computer equipment manufacturers dominated the world market, accounting for 87% of the world's installed base by value. However, the U.S. share of the market presently is decreasing due to competition from foreign manufacturers (especially Japan), and is expected to decrease further (down to 81%) by 1981.

Western Europe and Canada are also developing other sources for computer equipment and services outside of the U.S. In Western Europe, for example, particularly France, there is growing sentiment for the development of national data bases independent of the U.S. In this connection, it is significant that overseas' restrictions on the exchange of computer data among foreign countries is expected to jeopardize as much as $1 billion in U.S. transmission and computer services sold in certain Western European countries (according to a recent Department of State position paper).

There's another side of the picture. Whereas, Japan, Western Europe and Canada are projected to become less dependent on the U.S. for computers, Eastern Europe is expected to become more so. This is up in the air now. The House Committee on International Relations is scheduling imminent hearings on technology export which may affect future U.S. computer exports to the Soviet Bloc.

U.S. exports of computer equipment, according to the latest 1977 data from the U.S. Department of Commerce, exceeded imports in 1975 by a factor of 15 to one, and will result in a trade surplus (in dp categories) of $2.8 billion in 1977.

It's big business

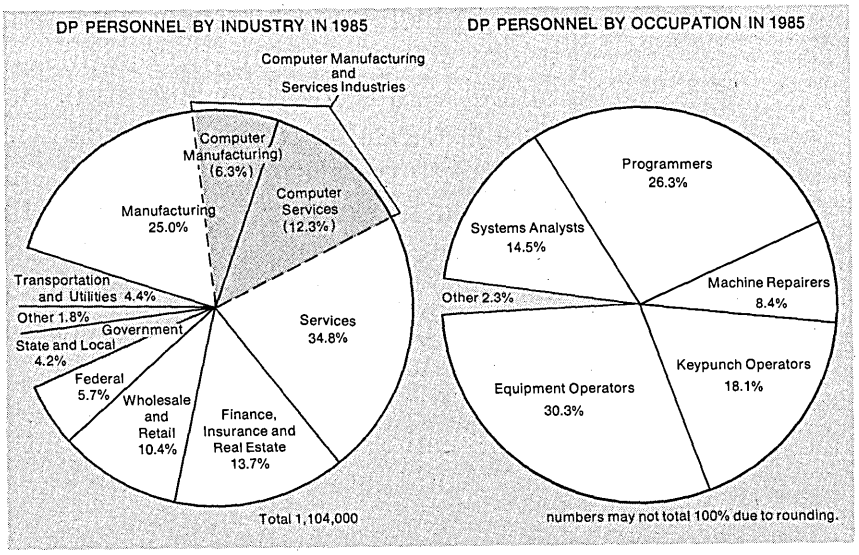
With respect to computer usage in general, as of 1976, almost $39 billion was allotted to user spending (including overhead). Of this amount, $20 billion was devoted to computer goods and services, $10 billion to related user salaries, and $8.4 billion to related overhead. That's according to one source of data.

In the same year, another source estimated $30.9 billion in user spending excluding overhead: $9.9 billion for salaries; $6 billion for rentals and leases; $3.6 billion for services; $3 billion for general purpose computer systems; $2.6 billion for data communications equipment and lines; $1.7 billion for software packages and facilities management; $1.5 billion for minicomputers; $1.4 billion for data entry equipment and applications-unique terminals; and $1.2 billion for supplies.

The very high proportionate cost of software in the first set of figures is included in goods and services as well as in salaries and personnel-related overhead. In the second accounting, software is included in salaries, services, general purpose computer systems, minis, and rentals and leases. Note that, since software costs accumulate over time, they are extremely difficult to estimate.

Dp personnel

With respect to total employment in the field (based on the latest available



CHANGE IN DP PERSONNEL BY OCCUPATION

Occupation	1974	1985	Change
Systems Analysts	97,000	160,000	+64.9%
Programmers	195,000	290,000	+48.7%
Other Specialists	16,000	26,000	+62.5%
Equipment Operators	246,000	335,000	+36.2%
Machine Repairers	50,000	93,000	+86.0%
Keypunch Operators	249,000	200,000	−19.7%
Total DP Employment	853,000	1,104,000	+29.4%
Total U.S. Employment	85,936,600	103,355,000	+20.3%

Source: AFIPS, based on data supplied by the Bureau of Labor Statistics, U.S. Department of Labor, 1977.

Dp employment is expected to expand somewhat more rapidly than total employment between now and 1985. And although data entry personnel may show up more frequently in user departments in 1985—leading to the only net loss for the dp department—note the health of the other categories. For example, who says programming is a dying profession?

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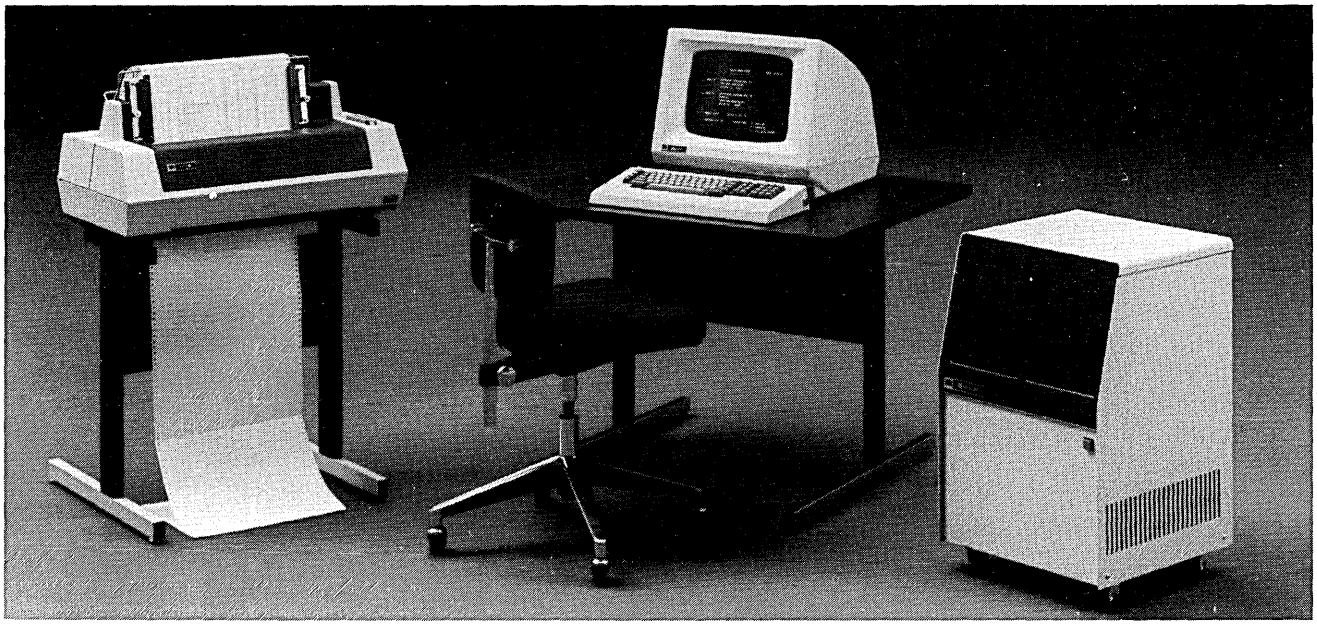

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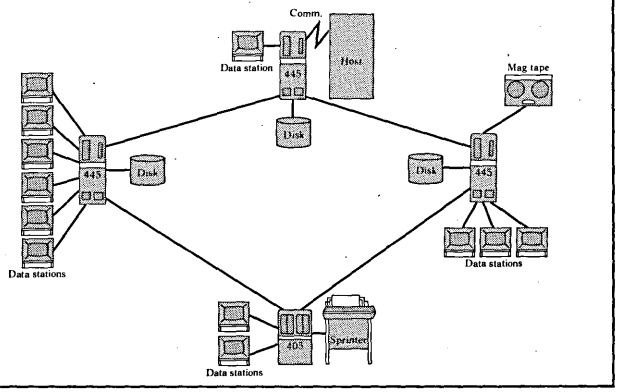

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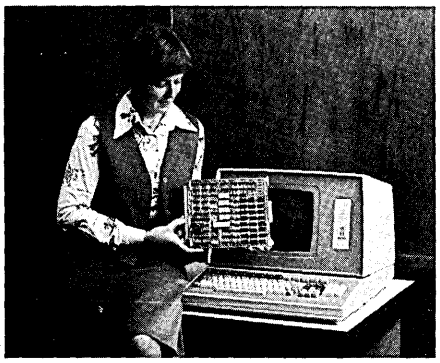

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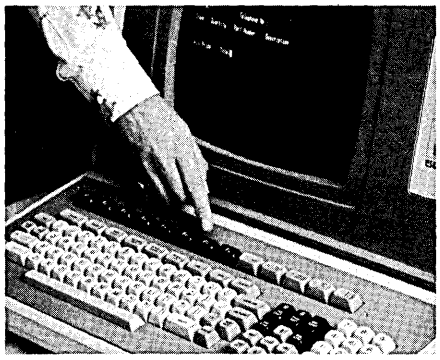

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WHERE IS THE INDUSTRY GOING?

DOL data) there are more than one million people distributed among all occupations in the computer manufacturing and services industries and in computing occupations in other industries. More than 850,000 individuals are in computer-related occupations, as defined by DOL. (Included in the 850,000-plus are more than 110,000 individuals employed by the computer manufacturing and services industries in computer-related occupations; the other 740,000 individuals are employed by users.) Almost 350,000 more are encompassed by the computer manufacturing and services industries.

By 1985 (again on the basis of the DOL figures) we will see a 74% increase in personnel employed in all occupations by computer manufacturers, and an 86% increase in personnel employed in all occupations by computer service organizations, for a 78% increase overall. That looks pretty good compared to a 20% increase in total overall U.S. employment in that period.

We should stress that these figures do not reflect the increasing use of computers by "non-programmer users." As noted in the report, by 1976 there were 1.2 million general and special purpose terminals employed in the U.S. Many of these terminals are operated by airline and hotel reservation clerks, department store clerks, bank tellers, and consumers. This reflects an increasing use of computers by individuals who have primary occupations in some other field but interact with computers in their work. For example, general and special purpose terminals are forecast to grow to three million by 1980.

Who's doing what in those computing jobs? As of 1974, according to the latest available 1977 statistics, the computer labor force (using DOL categories) consists of: keypunch operators, 29%; "equipment" operators, 29%; programmers, 23%; systems analysts, 11%; machine repairers, 6%; and "other specialists," 2%.

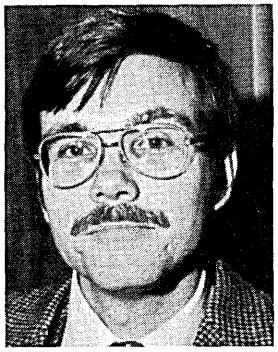
In 1985, the study projects the following: equipment operators, 30%; programmers, 26%; keypunch operators, 18%; systems analysts, 15%; machine repairers, 8%; and "other specialists," 2%. (The percentages do not add to 100% due to rounding off.) Thus, from 1974 to 1985, an 86% increase in machine repairers is predicted (a disconcerting sign); a 65% increase in systems analysts; a 63% increase in "other specialists"; a 49% increase in programmers (Who says programming is a dying profession?); a 36% increase in equipment operators; and a 20% *decrease* in keypunch operators. The decline in keypunch operators may be attributed to the fact that data entry is now accomplished by many individuals who are engaged in non-computer-related occupations. Finally, these figures represent a 29% overall increase in the computer labor force.

What does it mean?

In conclusion, as stated by Mark Shepherd, Jr., chairman and chief executive officer of Texas Instruments Inc. (in his Keynote Address to the 1977 National Computer Conference in Dallas): "The remarkable fact is that in computing technology . . . we stand today about at the midpoint of a 12 order-of-magnitude change in the nature of the computing world.

"There is no way we can envision what this kind of change really means. When major, step-function advances are achieved, their potential usually is realized in successive stages. First, we do better the things we already were doing. Next, we do new things. Finally, the advances pervade and change our entire life style and become an essential, built-in part of our society. The computer revolution is just reaching the threshold of this third stage. . . .

"The U.S. is clearly ahead in the fundamental technologies which permit the distribution of computing power to the point of use. And with this capability, we can lead an intellectual revolution which will have greater impact on living standards than that of the industrial revolution." ❋



Mr. McCarter is a research associate for AFIPS. He is the editor of the "AFIPS Washington Report" and was a coeditor—with Philip S. Nyborg and William Erickson—of the report on which this article is based. Prior to joining AFIPS he was the editor of three newsletters in the dp field ("Peripherals Weekly," "EFTS—Industry Report," and "Software Digest"), acting editor of "EDP Daily" and associate editor of "EDP Weekly."

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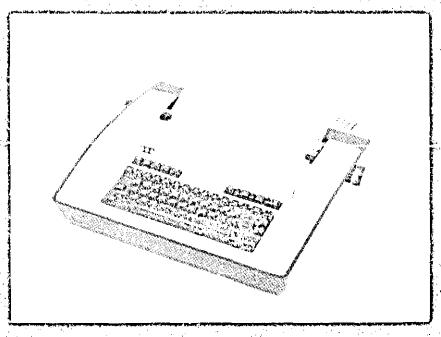

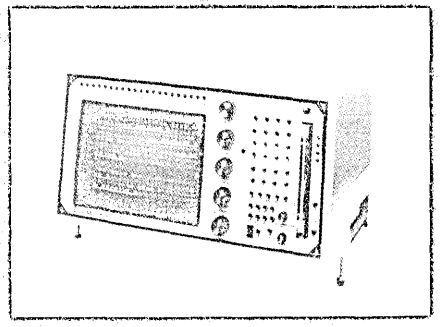

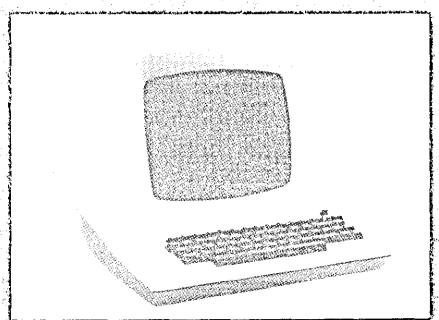

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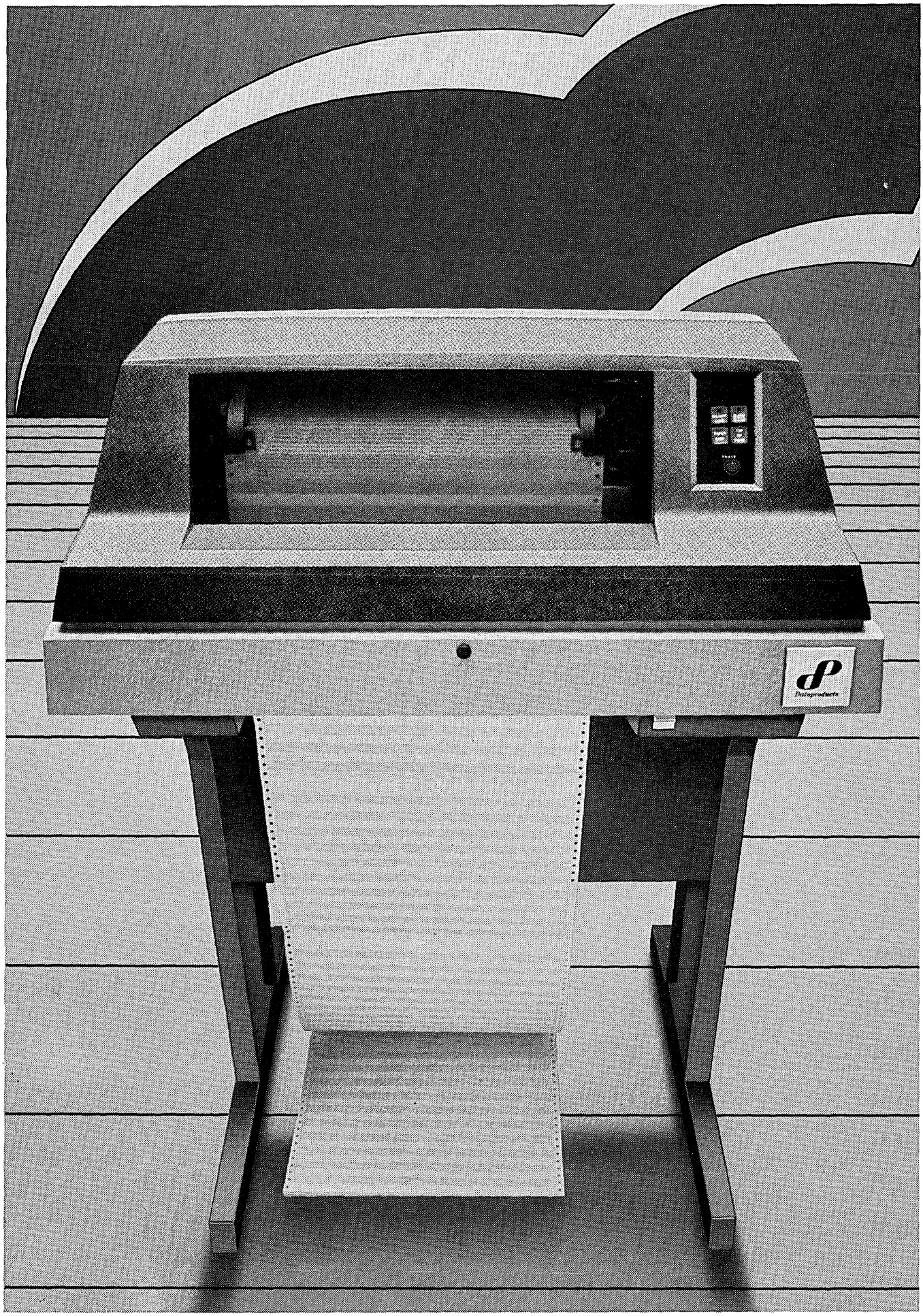

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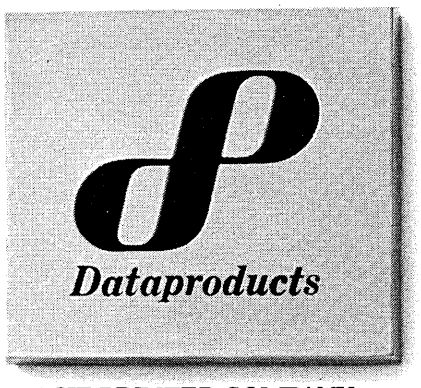

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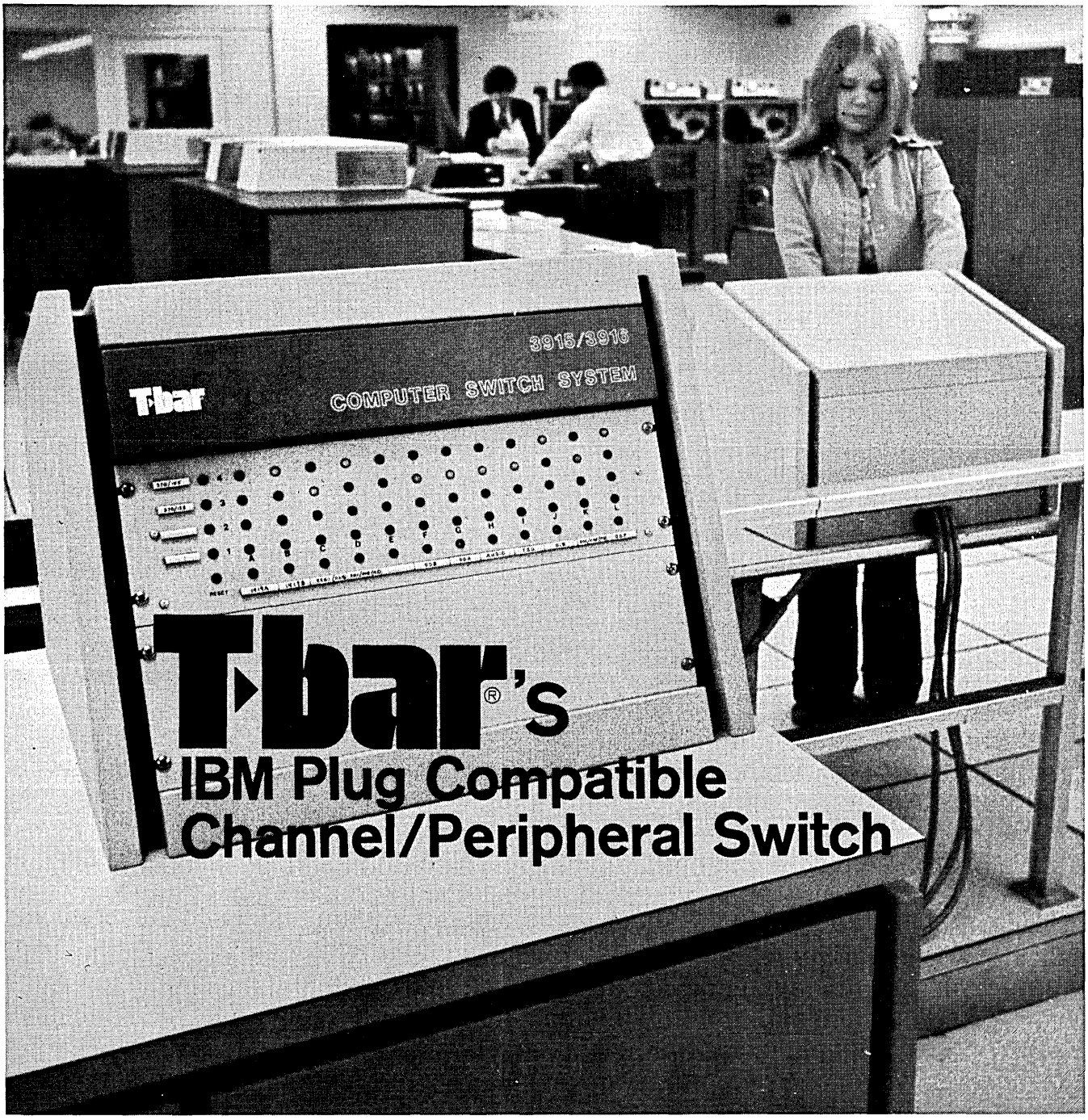

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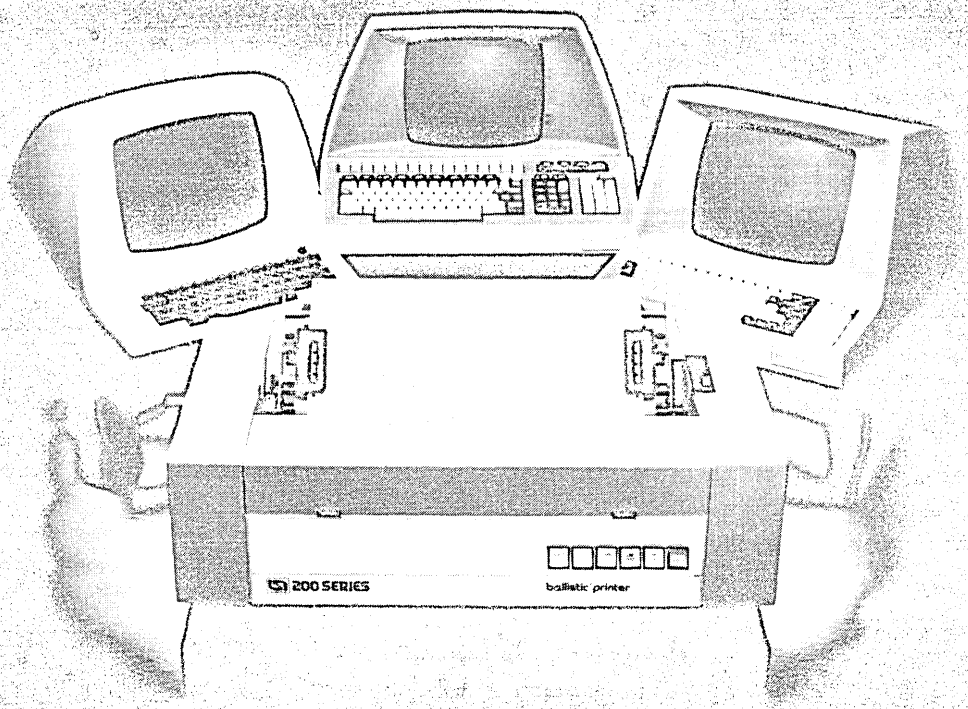

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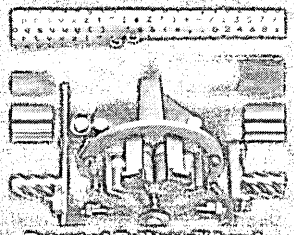
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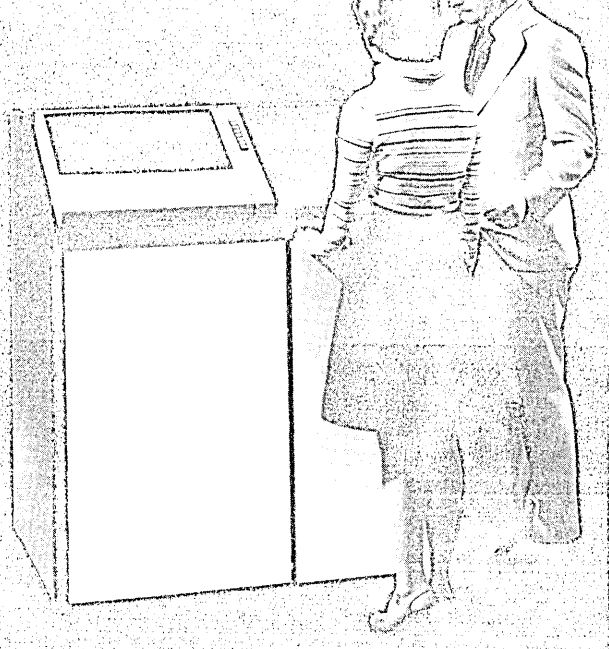

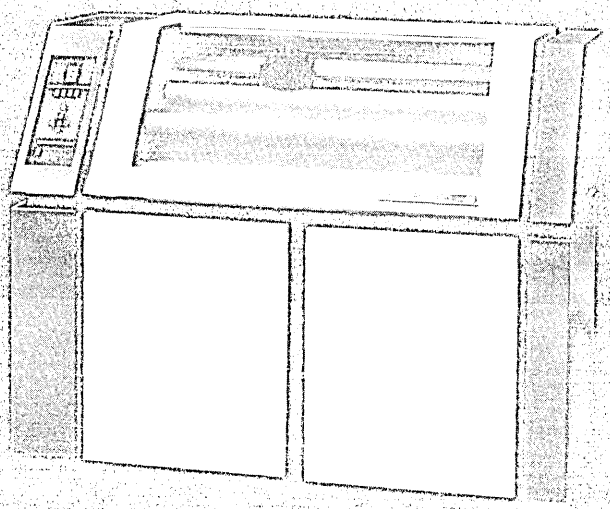

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CIRCLE 133 ON READER CARD

DP's Role Is Changing

by C. W. Getz

Either the MIS manager will lead the merger of the firm's data resources activities, or someone outside of dp will do it for him.

The world of MIS is changing. Innovations and inventions in computer technology, telecommunications, circuitry, and related fields have meshed. As the computer becomes a practical and economic tool in a wide variety of applications, old skills become obsolete and new ones emerge, causing traditional divisions of labor in the organization to disappear.

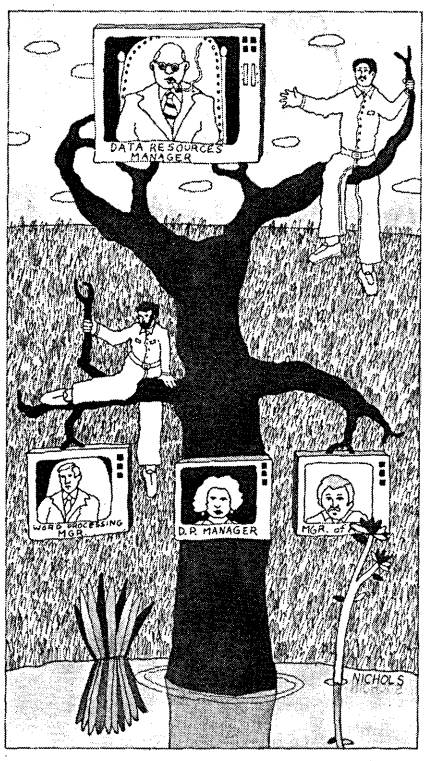
Amidst this technological uproar, the MIS manager must assess the future in a new way. As computer and communications devices and systems permeate all parts of the organization, even interfacing directly with customers, the problems of planning, budgeting and controlling these systems blur in a mist of organization confusion.

Only one common element runs through this management maze; it is the *data resource*, the stuff that computers compute, communication devices communicate, word processors process, and humans use or misuse. It is to the management of *data* that the manager must turn his attention; the alternative may be to see his influence eroded by other data managers in the organization.

Data is man's oldest resource. The history of the world has always been influenced by data or the lack of it. Control of writing materials and skills formed societies, established social levels, created power structures, and shaped the moral and political fiber of nations. Of course, writing materials and the skill of writing are for recording and communicating data. The late Professor Harold Innis made these points, and believed that monopolies of knowledge develop and then lose influence in direct relation to the method of communication of the times. He said this in his work *The Bias of Communication* (Univ. of Toronto Press, 1951):

A complex system of writing becomes the possession of a special class and tends to support aristocracies. . . . Inventions in communications compel realignments in the monopoly or oligopoly of knowledge.

Monopolies of writing skills and monopolies of knowledge are found today. Persons who have the knowledge to communicate with the computer have become a special class of experts in the context of Innis. These specialists have held a monopoly over a field that is increasing in importance in



all activities of human endeavor.

Specialists in the organization present numerous problems. The brilliant and controversial Harold Laski believed that the specialist (he used the name expert) sacrifices common sense insights to the intensity of his experience in his special field. In a 1930 *Harper's Magazine* article, Laski wrote that the specialist will not trust common sense in himself or others, because common sense is based on broad experience that goes beyond his field of special training. The specialist often has an aversion to new ideas, and often is the first to oppose innovation. Specialists seldom see the whole problem. They sometimes assume their field of specialty is the center of importance and relate everything to it.

Some specialists have a feeling of superiority, a lack of humility which makes them blind to the obvious. Further, specialists tend to strongly identify with fellow specialists. Evidence and arguments suggested by non-specialists are usually viewed with suspicion. They frequently keep the layman ignorant, and also assume that he is ignorant because he is a layman.

A final point about specialists is that they sometimes confuse knowledge with wisdom. Wisdom is by no means the sole property of specialists. Specialists are necessary and inherent in the complex division of labor that characterizes our society. But society, the business firm, and government all need both specialists and wisdom; they cannot be governed by specialists alone.

Data specialists are found in many specialized organizations, not just in dp. For example, when the scribes, oracles and priests controlled the skill and materials of writing, they became the first publishers, the first librarians, and the first archivists, and could be found in the highly structured environment of the court, temple, or church. They were the earliest data processing experts. (See P. 120 for some of the historical highlights.)

The birth of movable type in the fifteenth century was also the birth of another kind of data processing organization—the printing industry—and more specialists. Inventions and innovations in the same technical fields that have influenced automated data processing progress also have had a direct impact on developments in the printing industry—electricity, telegraphy, radio, computers (particularly the minicomputer), circuitry, just to name a few. The printing, or publishing, industry has spawned its own offshoots too; thus, the newspaper industry hardly relates itself to the book publishing business, although they have the same genesis.

Newspapers began using electronic, key-driven typesetting over two decades ago, and the computer was introduced into the process in 1961. A whole page can be composed on a minicomputer-driven crt, including pictures, different font types and formats; a press-ready master will be automatically produced. News stories from all over the world are transmitted instantly via satellite to newspapers everywhere. It is only a short step to when newspapers will be composed remotely and delivered via fiber optic telephone lines or satellites to a facsimile device in the home. Even now, libraries can be created on video tape units.

Then came xerography and new, cheap document binders. Every office could be in the publishing business. Thus, still another group of specialists became collectors, producers, and

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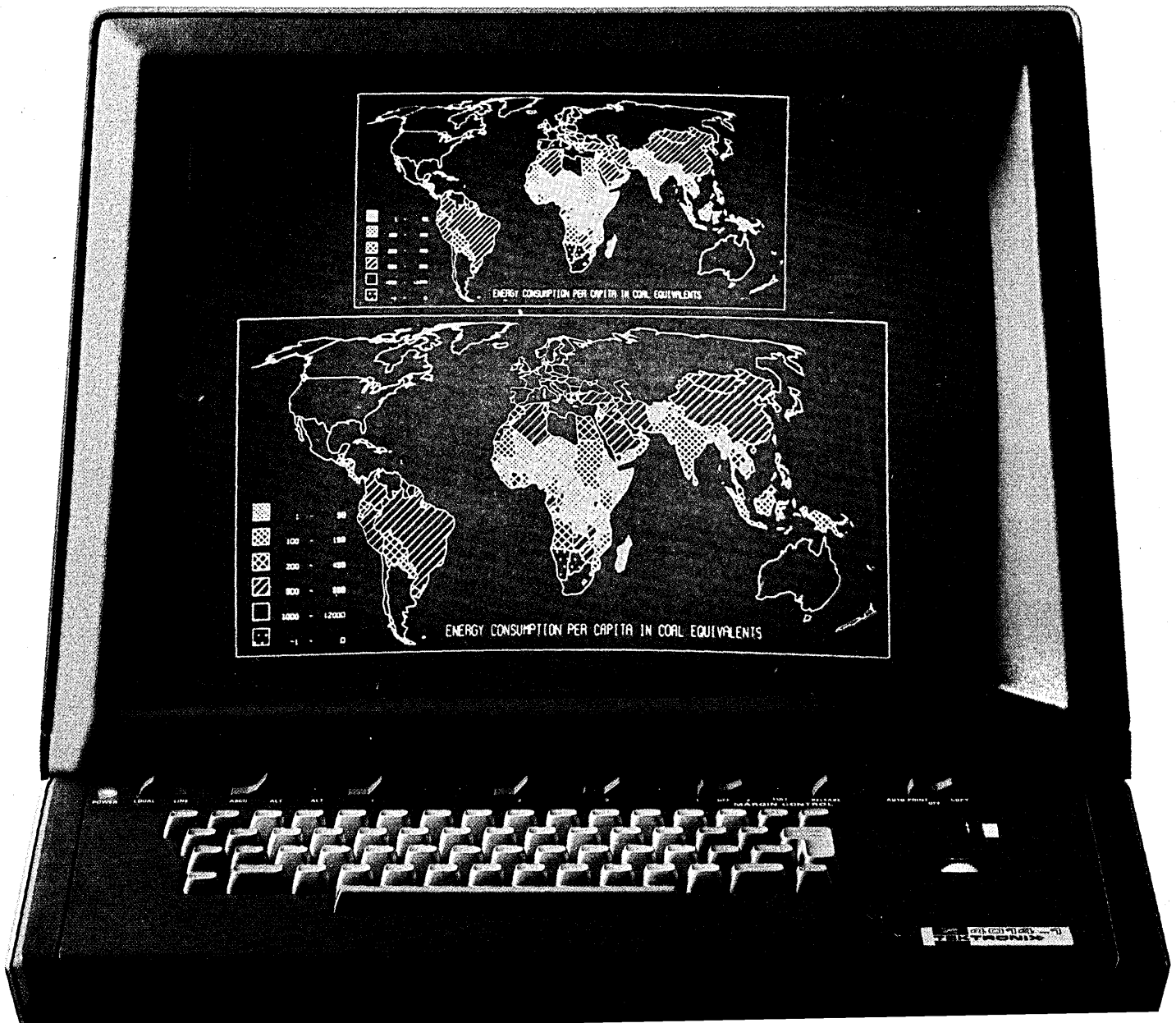
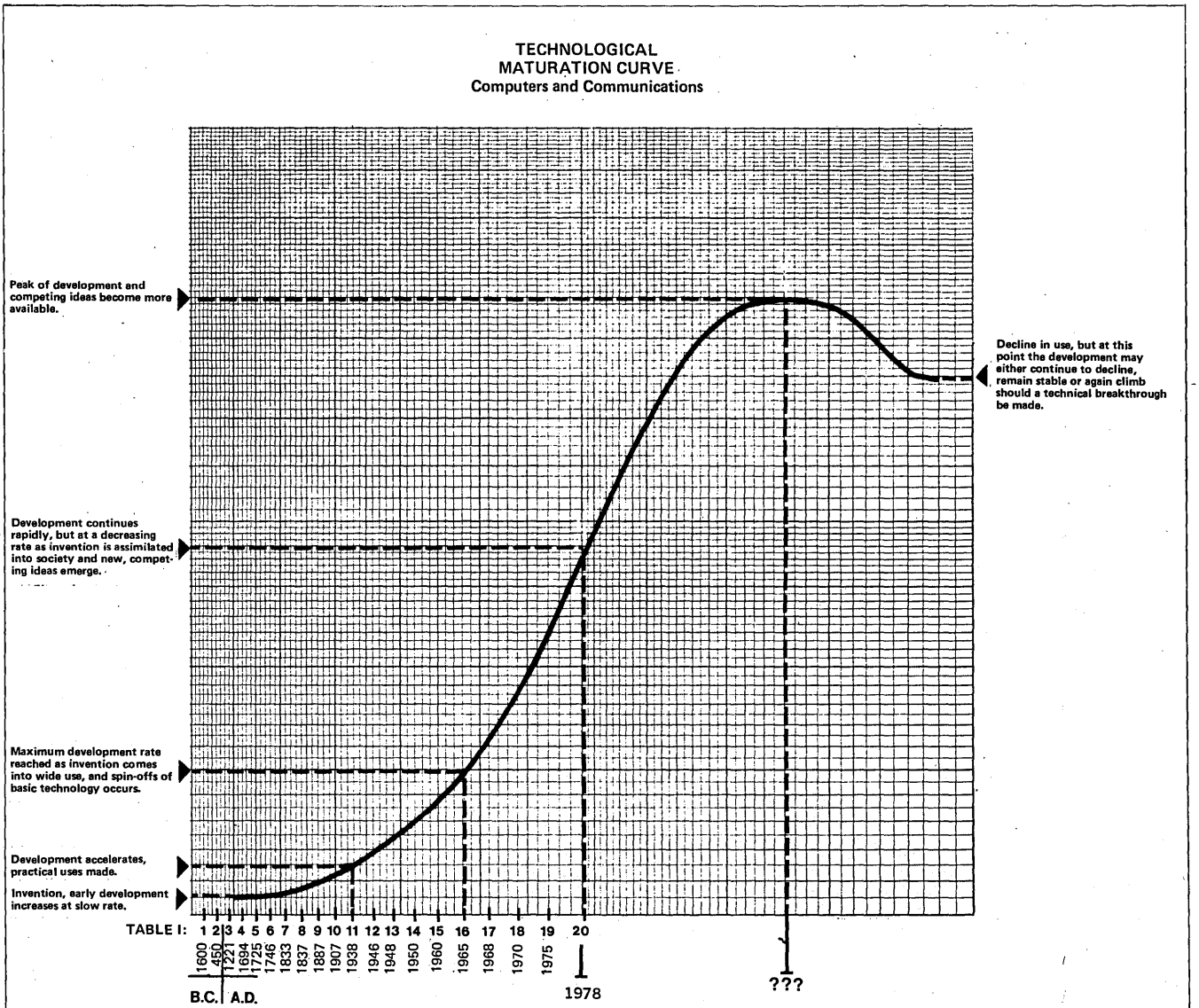


communicators of data.

Information is data made useful, and to be useful, information must be communicated. Communications is an integral part of any data processing system. The communications industry, with its many specialists, is of comparatively recent vintage, although one cannot arbitrarily eliminate smoke signals, drum beats, flag-waving, and the Pony Express from historical contention as early communications systems. It is interesting to note too that most early communication networks—except the horse—were digital. The invention of the telephone gave us the analog signal, but we are now rapidly going back to all digital networks, even in voice communications. This kind of flip-flop in technology happens frequently, we'll find.

The communications industry has traditionally been a combination of regulated oligopolies, and non-regulated equipment vendors. Carterfone opened competition, but it was technology that created competition. In the decade since the Carterfone decision, the technical inventions and innovations in communication devices and services stagger comprehension—fiber optic and laser beam voice circuits, satellite voice communications around the world, and data transmission speeds that can transmit William L. Shirer's monumental *The Rise and Fall of the Third Reich* in 1/10th of a second!

Computers have been used in the communications industry for many years, but the process of coalescence began infiltrating telephone systems when in recent years the telephone company's main switching device became more of an electronic computer than an electromechanical switch. Electronic switches and electronic speeds have made the communication of data and information instantaneous to match and merge with the computation speeds of computers. Computers



1. 1600 B.C. Babylonian math tablet
2. 450 B.C. Abacus
3. 1221 A.D. Abi Bakr Astrolabe
4. 1694 A.D. Leibniz calculating machine
5. 1725 A.D. Bouchon's punched card weaving machine
6. 1746 A.D. Ben Franklin's kite and electricity
7. 1833 A.D. Babbage's Differential Engine
8. 1837 A.D. Morse's telegraphy
9. 1887 A.D. Herman Hollerith's tabulating equipment
10. 1907 A.D. Vacuum tube
11. 1938 A.D. Mark I electromechanical "computer"
12. 1946 A.D. First electronic computer
13. 1948 A.D. Solid state circuitry
14. 1950 A.D. Internally programmable computer
15. 1960 A.D. Multiprogramming, multiprocessing, large networks
16. 1965 A.D. Chip technology, wide use of electronic switching
17. 1968 A.D. Carterfone decision
18. 1970 A.D. Minicomputers, word processors
19. 1975 A.D. LSI MOS circuitry, microcomputers, distributed processing, merging of computers with communications and word processing
20. 1978 A.D. The end of the beginning

and communications are technological Siamese twins. Marshall McLuhan once said (in the keynote of the 1974 annual SMIS Conference):

The speed of light is what is happening to your daily lives, and to the organization of our businesses. At the speed of light, you do not have any past, and you do not have any future. It is all right here and now. You cannot have a view of the future at electric speed, nor can you have a goal, at electric speed. It is already here. It is already realized. . . . With electric speed. . . there is not transportation, but there is transformation. When I think of that in terms of your computers and programs, you are not transporting anything, but you are transforming everything. There is no transportation at electric speed. It is simultaneous everywhere.

The paper jam

Two other data-related functions have been performed by specialists in organizations for years before the computer, and were early efforts in data management. They are generally referred to as records and form management (also called paperwork management), and reports management. The former of these two functions has its own professional publications and societies, and is closely related to the library sciences. It is still a widespread activity in government and industry.

The latter of these two functions, reports management, is of more recent origin. It is a product of the depression years and the proliferation of government agencies in the late 1930s. Demands for reports from individuals and industrial organizations, often duplicated and complicated, caused reaction in Congress that finally resulted in passage of the Federal Reports Act of 1942. The results of this legislation were, first, to give new impetus to reports management, and secondly, to create organizations with their experts to administer the new act. But reports control was only the tip of the iceberg.

Paperwork management is the direct predecessor to data resources management. According to Joseph Kish and James Morris, paperwork management is in transition as a result of automatic data processing (*Paperwork Management in Transition,* American Mgmt. Assn., N.Y., 1964). They point out that most paperwork management techniques emphasized the limitations of type, and of the number and distribution of forms, reports, and correspondence. These older paperwork reduction techniques are still very much in evidence. There was a wide acceptance of records control programs as their savings could be seen. But the techniques developed when most data was processed either manually or by key-driven machinery now are being critically reviewed in light of computer-driven high speed printers, computer output microfilm, and computer-driven word processors.

Kish and Morris go even further and suggest that, as a result of the computer environment, radical changes are needed in the organization of the administration function. They warned that the responsibility is shifting to the computer expert. Kish and Morris foresaw a complete revolution in the management of paperwork, which, they say, is already taking place. They wrote their prophetic words a decade ago, two decades after Executive Order 9784 recognized the burgeoning mountains of files of paper from WWII and required federal agencies to conduct active, continuing programs for the effective management and disposition of records. But not much was done, even though succeeding Hoover Commission reports in 1949 and 1955 gave impetus to paperwork management in the government and the Federal Records Acts of 1950 and 1976 were passed.

> The manager must turn his attention to the management of data, or have his influence eroded.

There are many estimates of how much paperwork is costing the taxpayer. One federal estimate says over $15 billion a year for the government, and a more recent one says $40 billion a year for both government and private sector costs! Whatever the true figure, we know it is incomprehensible. Unfortunately, the organizations created to administer the government's reports control program were not the same ones charged with the paperwork management programs; each group developed their own set of experts. There is presently a Federal Paperwork Commission chartered to again study this growing problem. From the information available, it appears this commission is traveling down the same road as its predecessor: reduce the number of forms; manage the paperwork instead of managing the raw material that requires the paperwork—data!

The flip-flop flips back

There are two common elements in the changes underway in specialized data management organizations. First, the data, regardless of the name given to the organization responsible for it—whether a printing company, a library, or a data processing unit—is still essentially the same raw material used in different ways. Second, there is more and more dependence by all these organizations upon the computer as their principal data processing tool. As a result, organization patterns are changing as the computer takes on the day-to-day tasks of data clerks and forces new skills upon older arts.

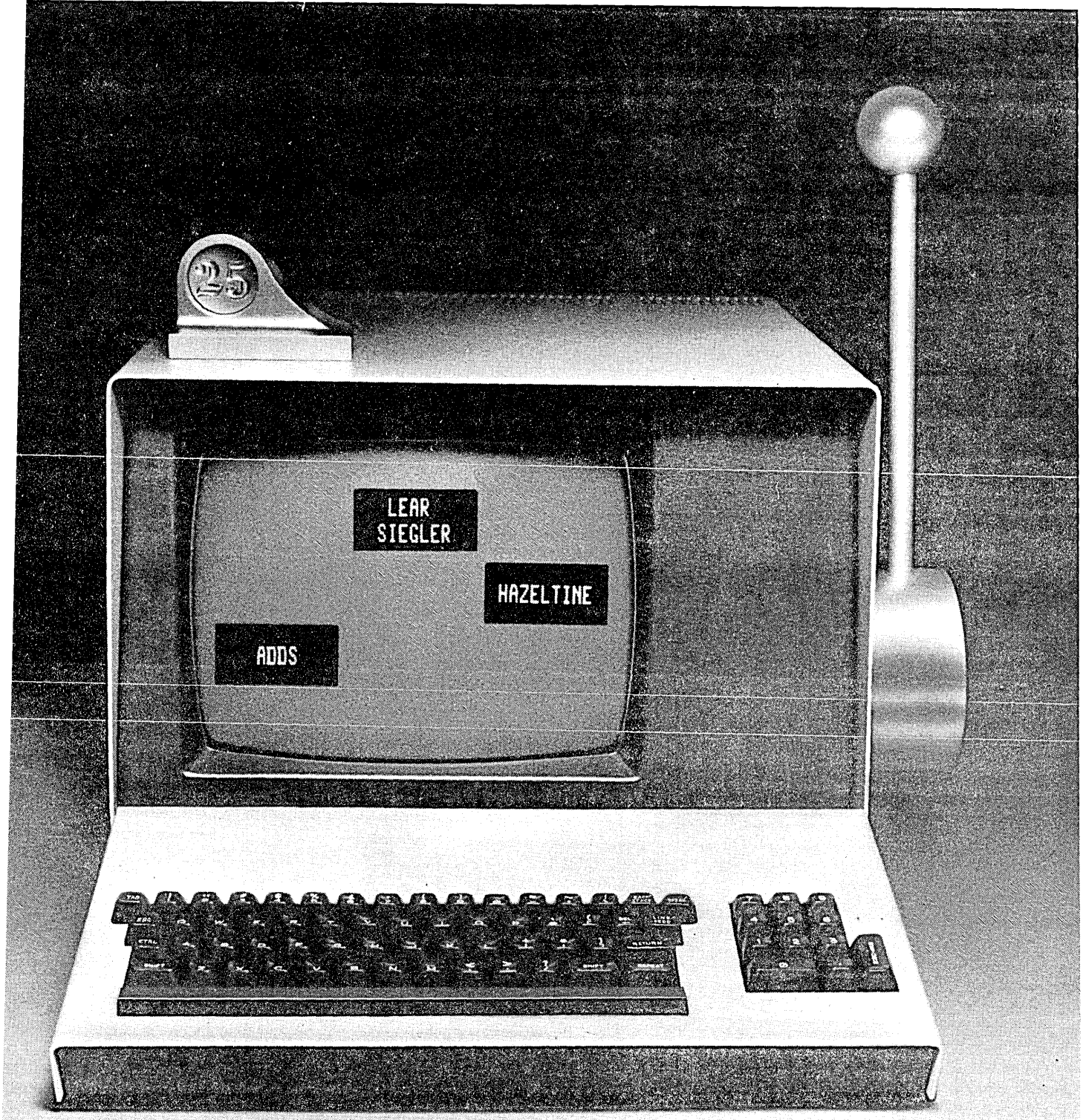
Over the years, the various groups having responsibilities for data processing, reports control, libraries, publications, communications, or paperwork management, have formed spheres of specialties, organized professional societies, developed jargons understandable only to their peers, and have adopted all the other basic trappings of Laski's "experts."

With each major technological advance, whole new industries and professional fields were created. Old skills became obsolete. The scribes of the churches were wiped out by Gutenberg. The punched card of Jacquard eliminated the weaver. Babbage saved the world from eternal dependence upon the abacus and so on and so forth. But we live in a cyclical world. Where technology once divided us into many fields of specialty, we now find that technology is eliminating the need for some specialists and the generalist is again on the rise. As McLuhan said in his keynote address,

What does this technology do to things that have been pushed out much earlier? Invention unexpectedly brings back something that had been pushed aside long ago. . . . Every technology pushed to its limits, flips into the opposite form of what it began. . .

What has the computer flipped into as a result of being pushed? . . . The job becomes a role, the sequential becomes simultaneous, the visual becomes acoustic, and if I push bureaucracy up to very high speeds, what does the computer do? Anarchy. I have only to speed up any bureaucratic system to have complete anarchy. . . . Inevitably, the man who is the center of decision making does not wait for any delegation of authority. He is the electric model in action. I think you will find that he is everywhere today. In the highly informed world, you do not wait for delegated information.

A vivid example of this flip-flop caused by technology is the medical profession. At one time, a doctor performed all the medical tasks, as personified by the old country doctor image. But as medical knowledge expanded, a plethora of specialists emerged and it has become almost a self-diagnosis problem to know which specialist to consult. In fact, there is a specialist to tell you which specialist to see! As a result, and just in the past decade, there has been a slow return to the family practitioner or generalist, *as a field of specialty*!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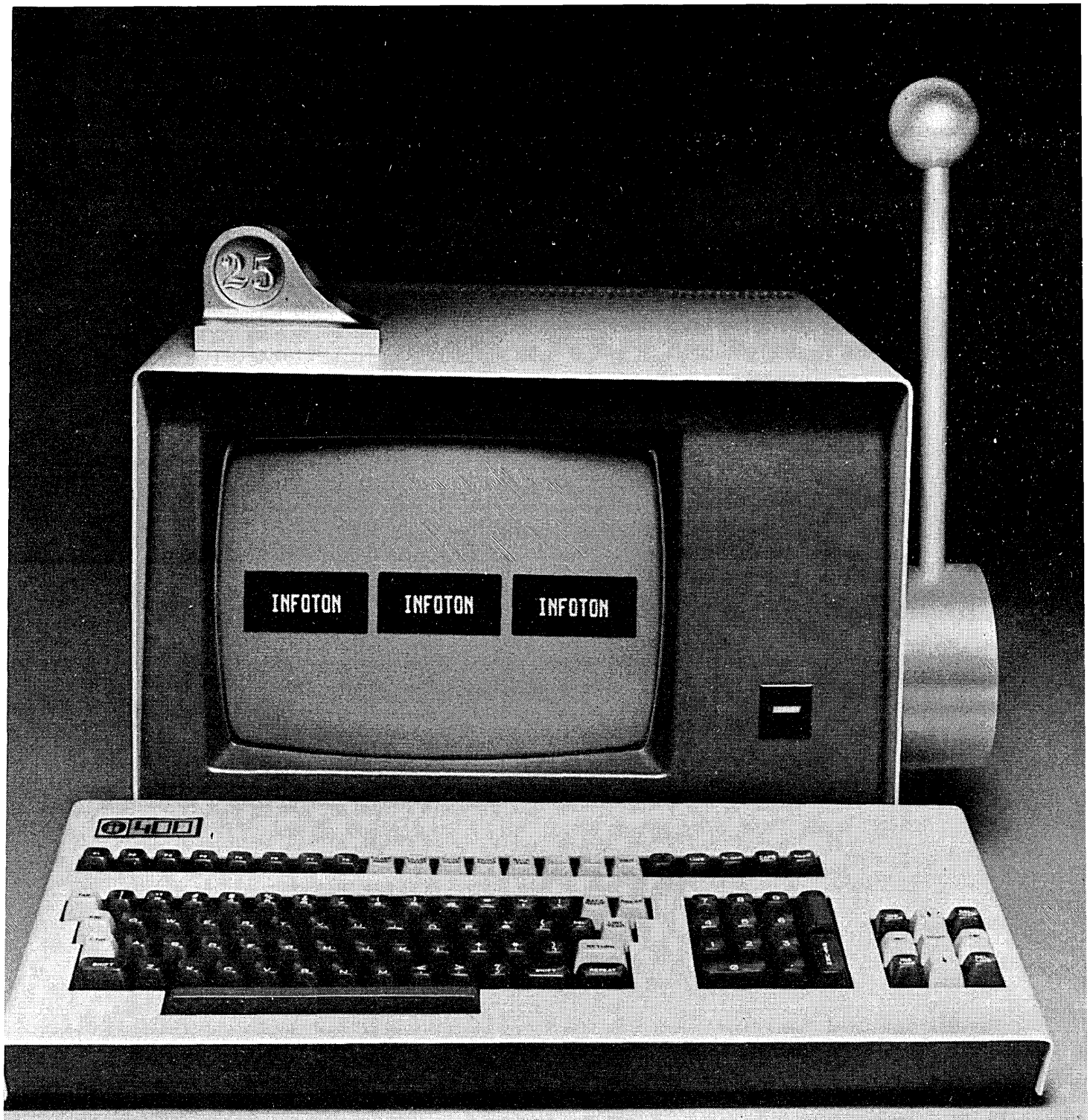

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CIRCLE 72 ON READER CARD

DP's ROLE

Data processing technology may also cause a flip-flop in the qualifications of the dp professional. In 1946 it was essential to be a physicist or mathematician to communicate with the computer. In 1977 you need only know how to read and write, and even that can be at a very basic level (chimpanzees have been trained to work with a computer). As mini and microprocessors become more common, the large processors will take on the more sophisticated tasks, and operating systems will become more complex in order to make the user end more simple. Therefore, the dp professional will be found at the large centers where expert knowledge and skills are required.

The coalescence of functions

So, the coalescence or merging of different functional fields is progressing at McLuhan's electric speeds. It is straining the confining lines of conventional organization charts. The librarian is a computer specialist, the paperwork manager is a terminal operator and so is the newspaper typesetter, and the communicator is a data processor. IBM wants to be in the communications carrier business. AT&T wants to be in data processing. Both are being sued by the government for antitrust. Western Union is in the post office business; the Post Office wants to be in the electronic mail business. Everyone wants to be in the publications business.

The process of coalescence may be moving at electrical speeds, but it is also generating plenty of heat. In one procurement organization, as an example, there is a difference of opinion as to whether word processors should be bought by the same people who procure paper, pencils, and automobiles or by the people who buy computers and communications equipment and services. Among many federal agencies, there is a controversy on whether a facsimile machine is a communications device or an office machine like a duplicator or typewriter. Debate continues on whether telecommunications management should be merged with data processing management and who should emerge as the leader in such a merger. The people who conduct paperwork management studies in still another agency cannot cross the boundary into automatic data processing—that is someone else's responsibility. And the proliferation of reports in the government goes unchecked because responsibilities are unclear and controls ineffective.

It is worth repeating that there is one common thread to the coalescence of these diverse technologies and diverse functions—the data resource. It is *data* that is being collected, processed, published, filed, transmitted, used and misused. It is data, man's oldest resource, that is causing paperwork management problems. It is data that is demanding more and more of the company's resource dollar for capital investment. It is data, the raw material, that continues unmanaged, uncontrolled, and as the subject of today's privacy issues.

What's ahead

Sometimes it is easier to predict what will happen than to accurately record or retrieve what has been. It requires no surfeit of imagination to foresee the consequences of coalescence, and these predictions are plausible:

- From these technological *ashes of confusion* shall arise a new *Phoenix of organization*—the data resources management organization. The manager of this new area will be a generalist with a solid understanding of technology, but a better understanding of business conditions and needs. This data resources manager will be responsible for assuring that all elements of the organization are provided with the most effective and economical means to gather, process, and use the firm's data resources. Data will then be managed in the same sense that the other human and physical resources of the firm are managed.
- There also will be a coalescence of data-related legislation, and the Privacy Act of 1974, the Federal Records Act of 1976, the Federal Reports Act of 1942, and other similar statutes will be merged into a new Data Management Act, applicable to all federal agencies.
- The efforts of the current Federal Paperwork Commission will result in only a modest reduction in government paperwork. Like earlier efforts, there is too much concentration on the control of forms, a media for communicating or storing data, and not enough upon the data itself. It is encouraging to note that the commission's director has been talking about *treating information as a resource and showing that, once identified, the normal management tools of budget, appropriation and other controls can be brought to bear.* Until government managers are forced to budget for and pay for the data they use, there will be no effective, long-lasting reduction in government paperwork.

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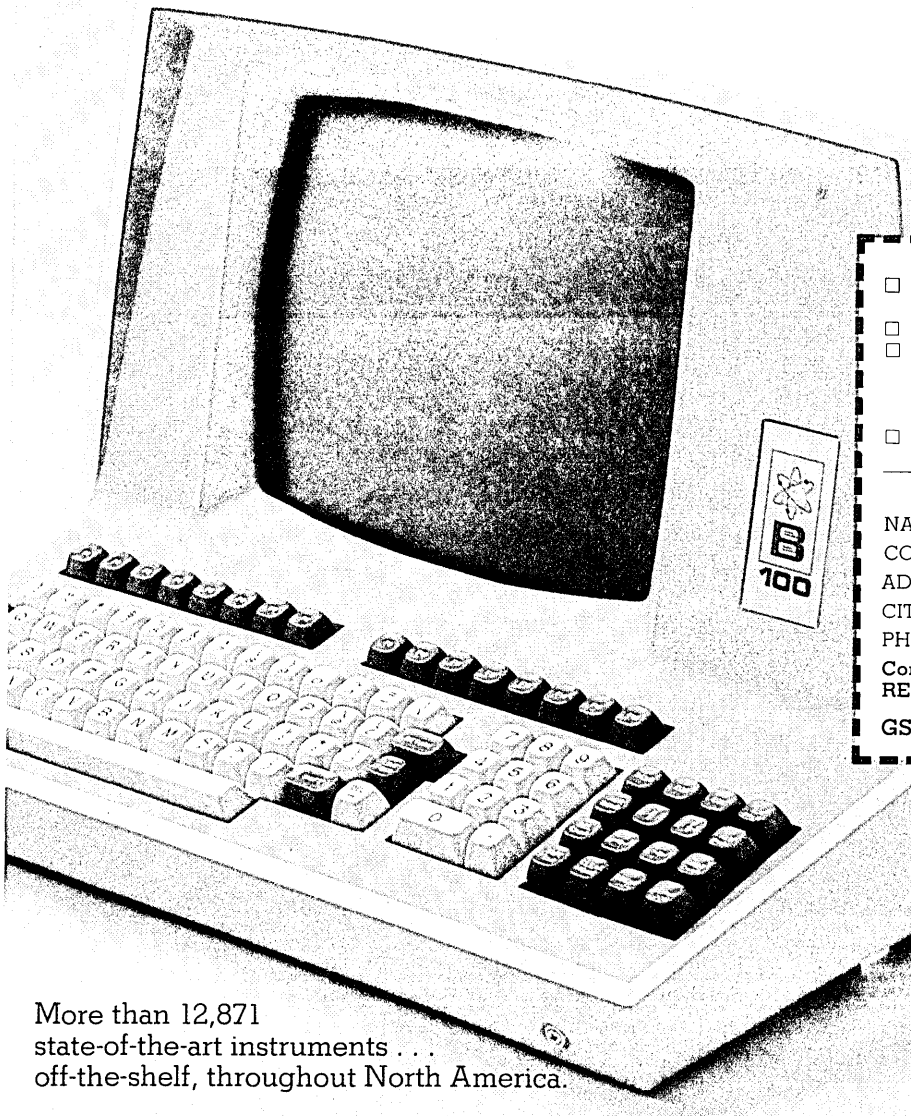

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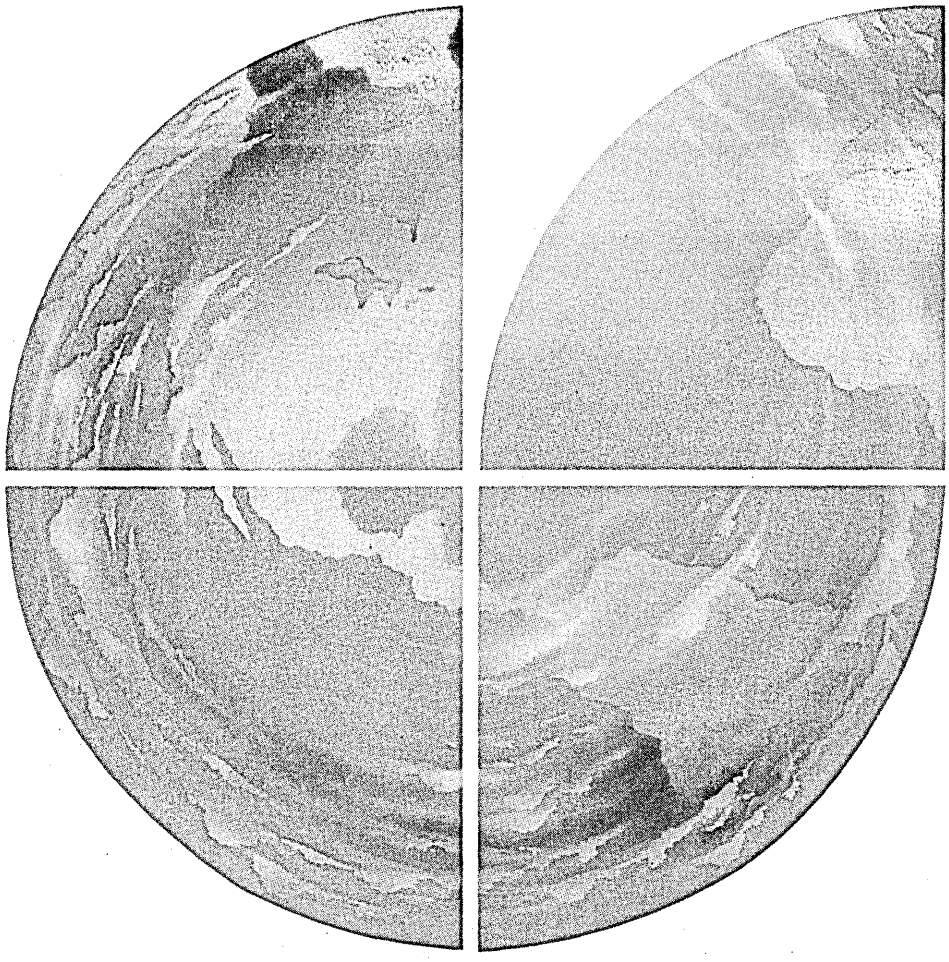

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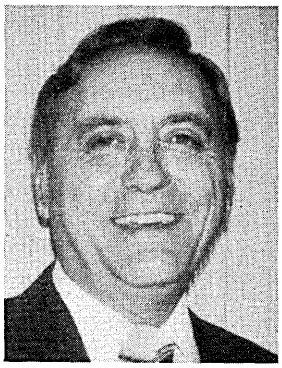
DP's ROLE

- And finally, all of these predictions will be accomplished within the next decade. Coalescence is the inevitable fate of data processing, and it is also the inevitable fate of most data-related activities of the organization. The message is quite clear; either the MIS manager will take the initiative to lead this merger of the firm's data resources activities and get some sense into their management, or some other data specialist outside of the MIS organization will do it for him.

Earlier I stated that data has influenced man from the beginning of time. Now I suggest that management of the data resources has a much broader implication for the future. Data, information, and communications are resources that, when available and properly applied, raise the intellectual level of people. The result as seen in history is an improvement in material existence. This has bred pride, satisfied want, and provided people with the ability to contribute to society and not seek contributions from it. Thus, the technology associated with the data resource can accelerate these achievements into the remotest corners of the world. When viewed in this perspective, *data* is not only a basic resource of the organization, but a basic resource of mankind. ❋



Dr. Getz is the Western Commissioner of the Automated Data and Telecommunications Service of the General Services Administration. Until 1972 he had his own information services consulting firm. Previous positions include vice-president of BankAmericard, Inc.; president of Telecheck, Inc., chairman of the board of Cole Engineering, and various MIS-related positions within the U.S. Air Force. Dr. Getz has received many awards and commendations for his work in management, including The Order of the Legion of Merit, the nation's third highest peacetime award, for his work with the Air Force.

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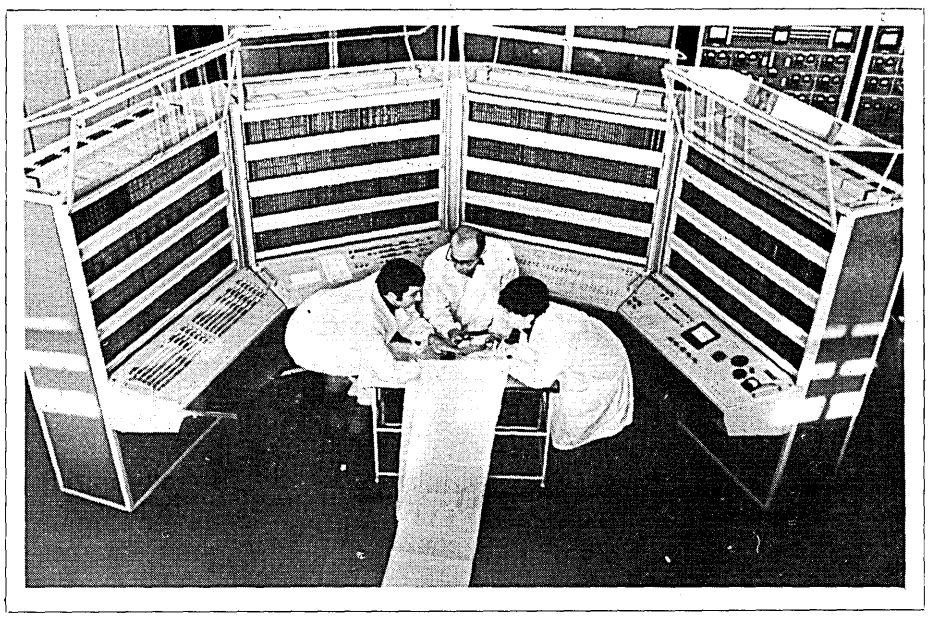

Snapshots of Soviet Computing

by Donald J. Reifer

Recently, the doors to Soviet computing installations have been opened wider for visitors. Here are some glimpses of what's behind them.

There is a serious lack of computing power in the Soviet Union that will not be corrected in the near future. Compounding this problem are the lack of reliable peripherals and an absence of sophisticated software for large machines.

These are some of the conclusions we came to during a two-week tour of Soviet computing installations which was arranged for the U.S. delegation to the 1977 Popov Society Congress in Moscow. Since 1957 the Popov Society and the IEEE have sent delegates to each other's meetings. This year, 17 IEEE members representing four nations (the U.S., Australia, Canada, and England) traveled to the USSR. While there, the delegation toured several computer facilities for which textual "snapshots" can be provided.

Academy of Sciences

The delegation's first technical visit was to the computer center of the USSR. Academy of Sciences, in Moscow. The center operates two 64K word (X 48 bits) BESM-6 computers and one of the 128K words. (See photo above.) Although these are second generation machines using discrete transistor technology, they are still the most powerful computers constructed by the Soviets. The BESM-6s reportedly have a through-put of one million operations/sec, making them roughly comparable to a CDC 3600 in computing power. For all their power, however, the machines use a 15-bit address, which means that special kludges are necessary for the 64K and 128K memories.

The second generation BESM-6 is still the most powerful Soviet computer.

Peripherals observed include several 7.25MB discs arranged as a shared disc system, ten 14-track tape drives, plotters, a 600 cpm card reader, and several ancient looking 480 lpm printers.

There were no telecommunication hookups. When questioned about this, Yuri Torgov, the center's spokesman, said that they were trying to implement a 1200 baud system but were having trouble getting well-maintained telephone lines.

The computer center operates 24 hours per day, seven days per week. Its BESM-6s are said to be quite reliable (up an average 23 hours per day), and there are no present plans to replace them. Other users must feel the same; Torgov mentioned that approximately 100 of the 6s are in operation.

According to him, the computer's operating systems support either batch or time-sharing for up to 12 simultaneous users, with fixed partitions. Both operating systems are frequently updated, and neither virtual machine nor virtual storage operating systems are planned.

Languages currently available include ALGOL 60, FORTRAN, COBOL, and PL/1. These were built at the center as the need arose, but in the absence of language standards or a centralized support service. As a consequence, each BESM-6 installation uses its own non-standard compiler, and these are of poor quality and also frequently updated. However, the BESM-6 *is* supported by a comprehensive set of utilities and a large math library.

Primary applications supported at the center are computer-aided design,

scientific computing, and numerical analysis. The design of an oil field for the Oil Ministry (the plan for the placement of pipelines, determination of flow rates, etc.) was cited as an example. Torgov was proud that 22 million rubles (roughly $8¼ million at official exchange rates) had been saved over what the project would have cost had manual design methods been used.

The Academy of Science has 14 laboratories which use 70% of the center's available computer time. (The remainder is used by other industries in the Moscow area.) Each lab also has its own computing facility, typically based on minicomputers. When a lab requires the power of a larger machine, it gets time on the BESM-6s.

There are 450 computer people in the academy, of which 120 are programmers. Of these 120, 100 are assigned to the computer center itself. Forty of the 100 are programmers and most of their activity deals with developing algorithms and maintaining existing software. There is no central software bureau.

Training for programmers involves four years of schooling and two years of on-the-job training in problem solving. The programmers are conversant with modern programming techniques such as structured programming, and the Soviets receive all the appropriate journals and magazines, including the *IBM Systems Journal, DATAMATION,* and *Communications of the ACM.*

The Soviet government does not recognize a need for centralization in computing services. Torgov stated that there is little if any cooperation between the different computing groups within the academy. The high degree of duplication also gives evidence to this. For example, the academy assigns individual hardware maintenance teams to service each computer, instead of using a centralized maintenance department. Within the computer center, this means there are three maintenance teams for the three BESM-6s where one would probably suffice. The Soviet government also seems to lack confidence in the leaders of the computer field. Torgov attributed this to the fact that there is no preeminent authority whom the government trusted and that many promises of results had been made to influential people and then broken. This is reminiscent of the "confidence gap" that existed in the U.S. not too long ago.

Strapped to his belt, Torgov had an H-P 45 calculator of which he was very proud. He stated that acquiring it took six months and the approval of the director of the academy. When questioned about Soviet microprocessors, he stated that there is no mass production of micros in the Soviet Union, and that microprocessors are used there for one of a kind applications.

All-Union Institute for Electro-Telecommunications

This institute has a staff of 27 doctors, 106 doctoral candidates, 150 assistants, and a student body of 1,200 (most of whom train by correspondence).

The institute runs a RIAD ES-1020 and an ES-1022 (which are compatible with the IBM 360 and roughly as powerful as Model 30s). The director of the institute said he could get as many of these computers as his budget would allow; they are priced at roughly 400,000 rubles (approximately $150,000).

The computer center had 7-track tapes and four 7.25MB discs (of which two were down). We watched the printer dump what looked like IBM JCL and BAL, and the director said that the computer ran under a modified version of DOS/VS. When asked how frequently the operating system was updated, he responded, "We don't change the operating system once we get it working."

The Institute of Cybernetics

At the Institute of Cybernetics in Kiev, Academician Skolynician was our host. The institute is one of the largest of the 60 research centers that comprise the Ukranian Academy of Science. Founded in 1962, it has a staff of 5,000 persons. Approximately 50% of the staff are women (who work mostly in software) and 30% are ser-

The Riad Series of computers was designed to be compatible with the IBM 360 line, and IBM software is often used with them. This one appears to be about the size of a Model 30.

TASS from SOVFOTO

vice personnel. The number of hardware and software engineers is about equal.

The staff is also split equally between the Special Design Bureau and the Research Institute. The Special Design Bureau contains the applied research laboratories, the design laboratories, and the small pilot plants. (The tendency at the institute is to form scientific-industrial complexes so that the transition from research to production can be accomplished under one roof.)

The institute conducts several national minicomputer, microcomputer, and special purpose machine development programs. Its research side is broken into five divisions which all work in fields associated with computer science. The Theoretical and Economical Cybernetics Div. pursues advances in computer theory, design automation, and economic models, for example. About 400 persons are assigned here.

The Engineering Cybernetics Div. has a staff of about 200 working in the area of automatic control.

The Computer Engineering Div. has a staff of approximately 500 designing and developing minicomputers and microcomputers for scientific experiments and special applications. The

The first terminals for the institute are planned for 1980.

MIR series machines (minis for scientific calculations) were developed here. Production of the RIAD-compatible MIR-3 computer was recently completed with the assistance of Special Design Bureau personnel. (The MIR-3 directly executes an ALGOL-like syntax. The design philosophy employed was to provide users with a microprogrammed ALGOL translator and control program which could be extended, if needed, using software—an approach which minimized the amount of software that must be provided by the factory and reduced the field maintenance problem.)

This division is also producing the first generation PMOS microcomputers (4KB to 32KB). Because these are slow, work is under way on an NMOS version. The division is also doing work on multiprocessing theory and in emulation technology.

The Systems Engineering Div. has an estimated 600 people developing management information systems, experimental data processing systems, numerical control systems, and robotics support systems.

Finally, the Science Div. has roughly 250 people involved in problems of forecasting, social problems, and medical applications. As an example, the all-state management system used to forecast economic growth was given as a product of this group. Academician Skolynician stated that economic planning is as important to the Soviet Union as space and nuclear programs. (For more on this subject, see the adjoining story "Computer-Aided Planning and Decision-Making in the USSR.)

He introduced software as follows: "Without software, our computers are only monuments for museums. Our software people move in the highest circles of the institute." He then stated that there had been a 500% increase in manpower expenditures for software over the last two years. Their software research is primarily aimed at five areas:

(1) Their researchers have developed a compiler writing system incorporating an automatic analyzer which recognizes structure and generates semantics for ALGOL, PL/1, and other languages.

(2) Research in artificial intelligence is being pursued. It is directed toward "situation recognition," including forecasting phenomena such as sunspots and recognizing new properties of known chemical elements.

(3) Heuristic dialogs are being investigated.

(4) Operationally oriented applied research is being done in distributed data bases, computer networks, and multiaccess systems.

(5) Finally, pattern recognition (for both speech and visual information) is being looked into. They claim to have an experimental speech recognition system which understands 300 to 400 separately pronounced words with an error rate of less than 1%, and an optical system that can read printed matter at a rate of 200 cps with an error rate of one per 10,000 characters.

Several interesting bits of information were acquired through side discussions. For instance, all computer programs and algorithms produced in the Ukraine are cataloged and made available to other Soviet institutes. Also, in the area of microprogramming, the institute is standardizing on PL/M and is developing several cross-compilers. Presently, hardware engineers develop the microprograms at the institute because they understand both the architecture and detailed bit-level mechanics of the individual chips. Use of high level languages which will enable programmers to develop chip-independent microcode is expected to reduce the effort involved.

Another interesting fact was that the institute gets many IBM programs from abroad through SHARE or through purchases, etc. They then use these for the 360-compatible RIAD ES series systems and applications library, a practice which has saved the institute millions of rubles.

The institute has in operation two BESM-6s, one RIAD ES-1010, one 1020, one 1022, two 1030s, one 1040, two MIR-1s, plus three MIR-2 and MIR-3 computers. They also have an ES-1050 on order (which is just a little less powerful than an IBM 360/65) and expect it to be delivered by the end of the year. Their computer center was orderly and clean. And once again the largest discs in service are of 7.25MB capacity but larger ones supposedly "will be delivered later this year."

We witnessed several demonstrations, including a BESM-6 computer with a fast Fourier series speech recognition system—it took 32 seconds to recognize a six word sentence (in Russian). An enhanced MIR-2 computer with a throughput claimed to equal that of an IBM 360/65 was also demonstrated. The system solved a nonlinear oscillator problem (using second order Van der Pole equations) in five minutes. Last, we watched the operation of a robot with visual sensors.

V. I. Lenin Institute of Electrical Engineering

This institute is both the largest (12,000 students) and oldest electrical engineering institute (its 90th year) in the Soviet Union. Its three fields of instruction are cybernetics, radio techniques, and solid-state physics.

All students here learn computing techniques. They are encouraged to use these techniques throughout their training and must pass a computing practice exam after their third year. The standard seven-term curriculum in computing includes three terms studying large computers and algorithmic languages, two in hardware principles, and two in software techniques. The institute graduates 250 computer specialists annually, and currently has 70 Ph.D. students.

The institute's computer center recently has been updated. Older M222 and Minsk 32 machines have been replaced with an ES-1022 and 1033. The throughput of the 1022 was claimed to be 70,000 instructions/sec; that of the 1033, 210,000 instructions/sec. The operating system for both is called OCS, and support is provided for ALGOL 60, FORTRAN IV, COBOL, and PL/1. And still once more the 7.25MB disc is "soon to be upgraded to the 29MB version." The institute won't install its first terminals until 1980, but there are about 150 minicomputers and microcomputers in use at the institute, of which the MIR-1 and -2 seem to be the most common.

Here too, we were treated to several

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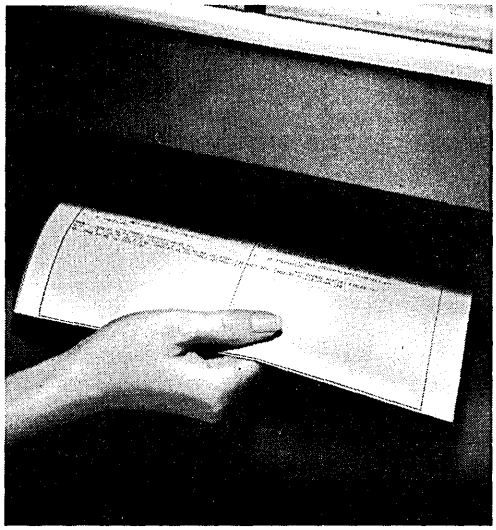

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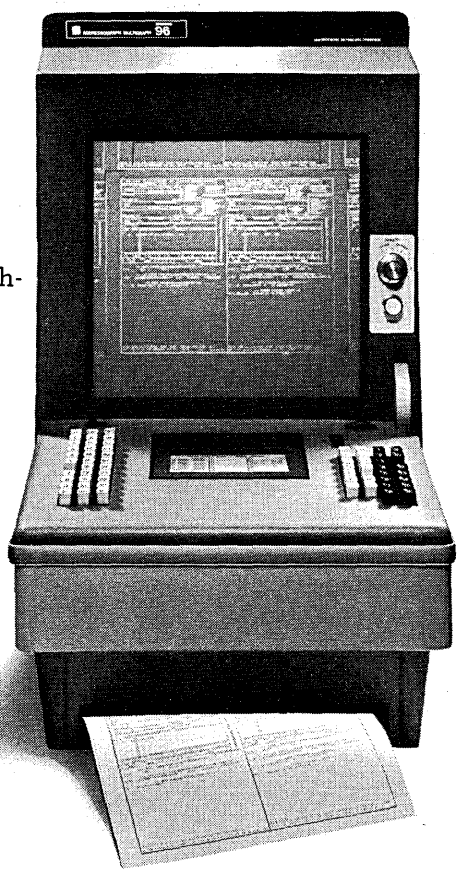

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demonstrations, including that of a microcontrolled EKG system.

Before leaving we were shown how a MIR-1 is used to produce masks for the production of hybrids in the microelectronics lab, where equipment for thin film production was located.

Putting it into perspective

The Soviet government allowed our delegation to see only what they wanted us to see, and what we saw was definitely not the cutting edge of Soviet technology. However, our conversations with our Soviet counterparts and our visits allowed us to form some impressions of their technology.

> . . . a detailed knowledge of the Intel 8080 and Motorola 6800.

It seems clear that the serious lack of computing power within the Soviet Union will not be corrected in the near future. The Soviets long have had the RIAD ES series in operation, but these are not very powerful by today's standards. The BESM-6 is still the biggest and best they have to offer.

Distributed processing using nets of midicomputers communicating over data links (satellite, wideband, and telephone) offers them one way to exploit what power they have, but major problems in data communications and networking seem to be hindering progress in this direction. Specific problems include: (1) a misunderstanding of Western literature, (2) the lack of reliable data links, and (3) the lack of experience in the development of sophisticated control programs (either software or firmware based) needed to mechanize these computing networks. The Soviets are conducting research in these areas, but making the transition from research into practice is years away. The only feasible method for acquisition of this capability may be purchase from the West.

The lack of adequate mass storage and peripheral devices will further handicap Soviet computer growth. Large, fast discs are essential for efficiently storing and processing large data bases.

Noticeably missing was any research into charge-coupled devices or bubble memories. Missing also were crt displays; none were seen in any of the installations visited. In addition, line printers and card readers seemed slow and noisy. Reliability seemed to be still another problem; many discs and some other peripherals were out of service when seen.

On the positive side, many of the researchers are using minicomputers to control experiments in their labs. Other minis supposedly were being used extensively in process control and industrial automation; they seem to have permeated the factory, research center, and teaching institution there just as in the United States.

We saw no examples of Soviet microprocessors during our travels, yet there were many discussions about them and a great deal of interest shown in the subject. The microprocessor papers presented by our delegation at the Popov Congress were well attended and stimulated many questions. The Soviets seem to have a detailed knowledge of our commercially available chips, such as the Intel 8080 and Motorola 6800. They talked about developing microprocessor standards and support software (including that PL/M compiler), and also about training microprogrammers and producing prototype chips from their pilot plants. They seem to be giving the technology a great amount of attention.

The Soviets seem to have accompli hed something unique in the minicomputer software area, too. They are combating their software problems using a "firmware instead" approach.

> Software acquired from the West can be used with little or no modification.

The MIR minis reportedly are shipped to users with a factory microprogrammed control program and ALGOL translator. As mentioned, this reduces software field maintenance. It also improves processor performance through increased compilation speed and reduced executive overhead. Its main disadvantage is that it limits a user's flexibility in coping with his unique problems, but with the Soviets' limited software work force, this seems to be a small price to pay.

There is no doubt that they also are having major difficulties in software. They lack leadership in the field and suffer a shortage of skilled and experienced personnel. Even the BESM-6 operating systems are crude and unsophisticated after a full decade of development time has passed. They are predominantly batch-oriented and do not accommodate multiprocessing; data management facilities for them do not exist. Language translators do exist, but in so many varieties that transferability of software between BESM-6 installations is unheard of. On the other hand, scientific packages are available and are good. The Soviets seem very skilled in algorithm development and numerical techniques.

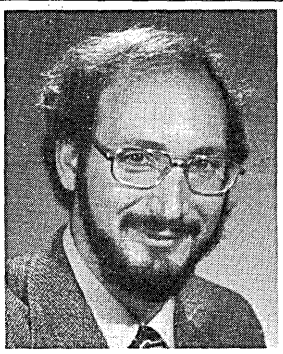
They seem to be attacking their software problems with several approaches. First, they have recognized their deficiencies and allocated a substantial budget for research and training. Curricula in the teaching institutions are up to date and good. Research is aimed at high payoff areas such as data communications, networking, distributed processing, emulation, and microprogramming tools.

Their placing research and design in the same institute simplifies the problem of moving from theory to practice. These specific efforts are beginning to show signs of reaching fruition. The size of their software workforce is increasing, and management is paying attention to software needs. Trust is being reestablished as evidenced by the transition of microprogramming tasks for critical applications from hardware to software personnel.

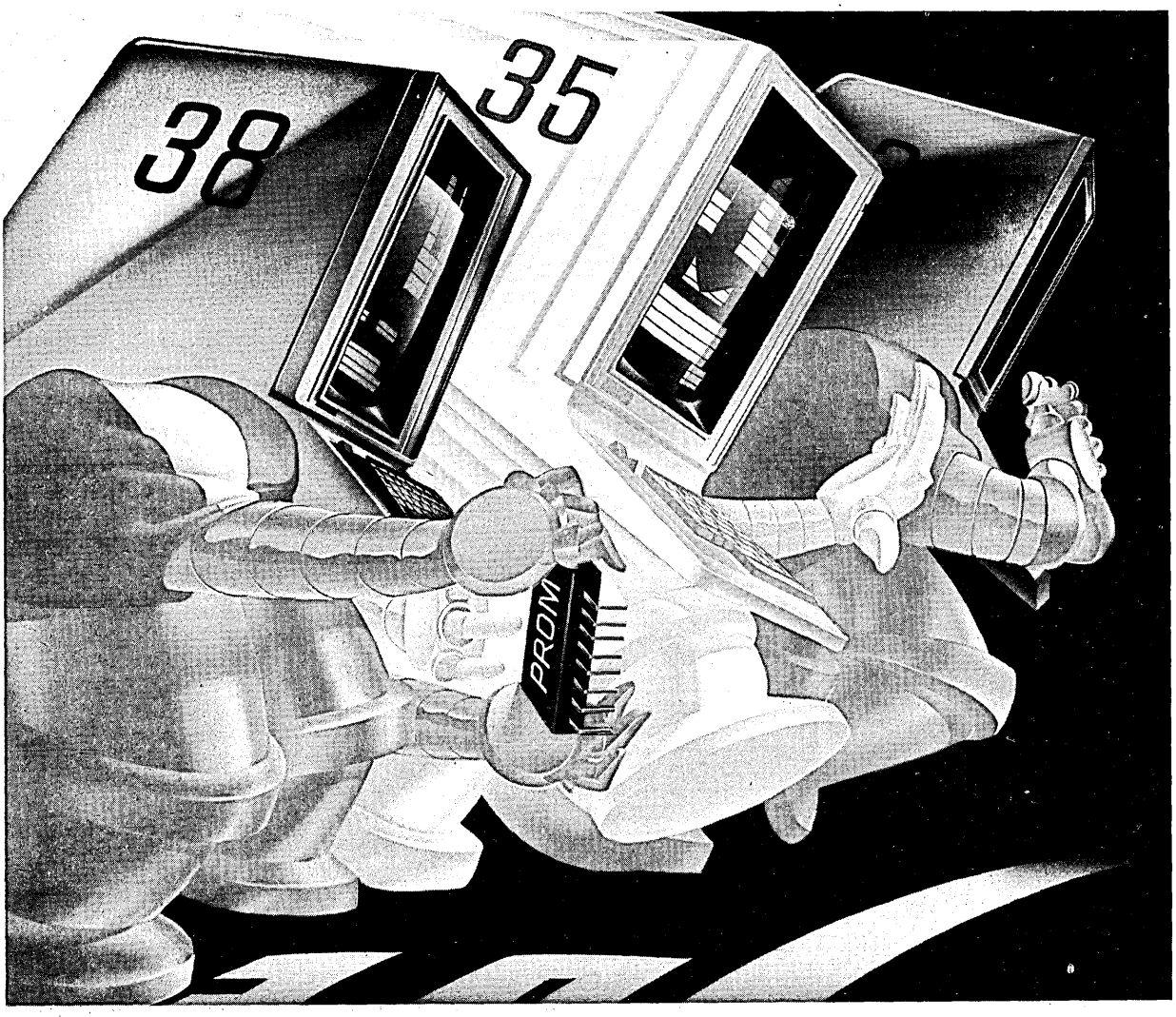
The second approach being exploited is the previously described "firmware instead" technique. If it is difficult to do in software at the user sites, why not do it in firmware?

The development of "software compatible" machines that emulate Western hardware is the final approach being used to solve the software problem. Software acquired from the West can be used with little or no modification on the RIAD ES series. Why develop something that is cheap or free?

All these tactics point to a determined effort on the part of the Soviets to catch up. But until they do, they will have to purchase and use technology from outside their borders to fill their needs. ❋



Currently at TRW, Mr. Reifer was previously responsible for all Space Shuttle software support in his employment with The Aerospace Corp.'s Space Transportation Directorate. Mr. Reifer has been a project engineer and manager for various Air Force computer technology programs, including the AIDS Inventory and Space Data Systems Facility projects. Previous affiliation was with Hughes Aircraft Co., where he was responsible for factory automation, computer systems simulation and software verification and validation research.



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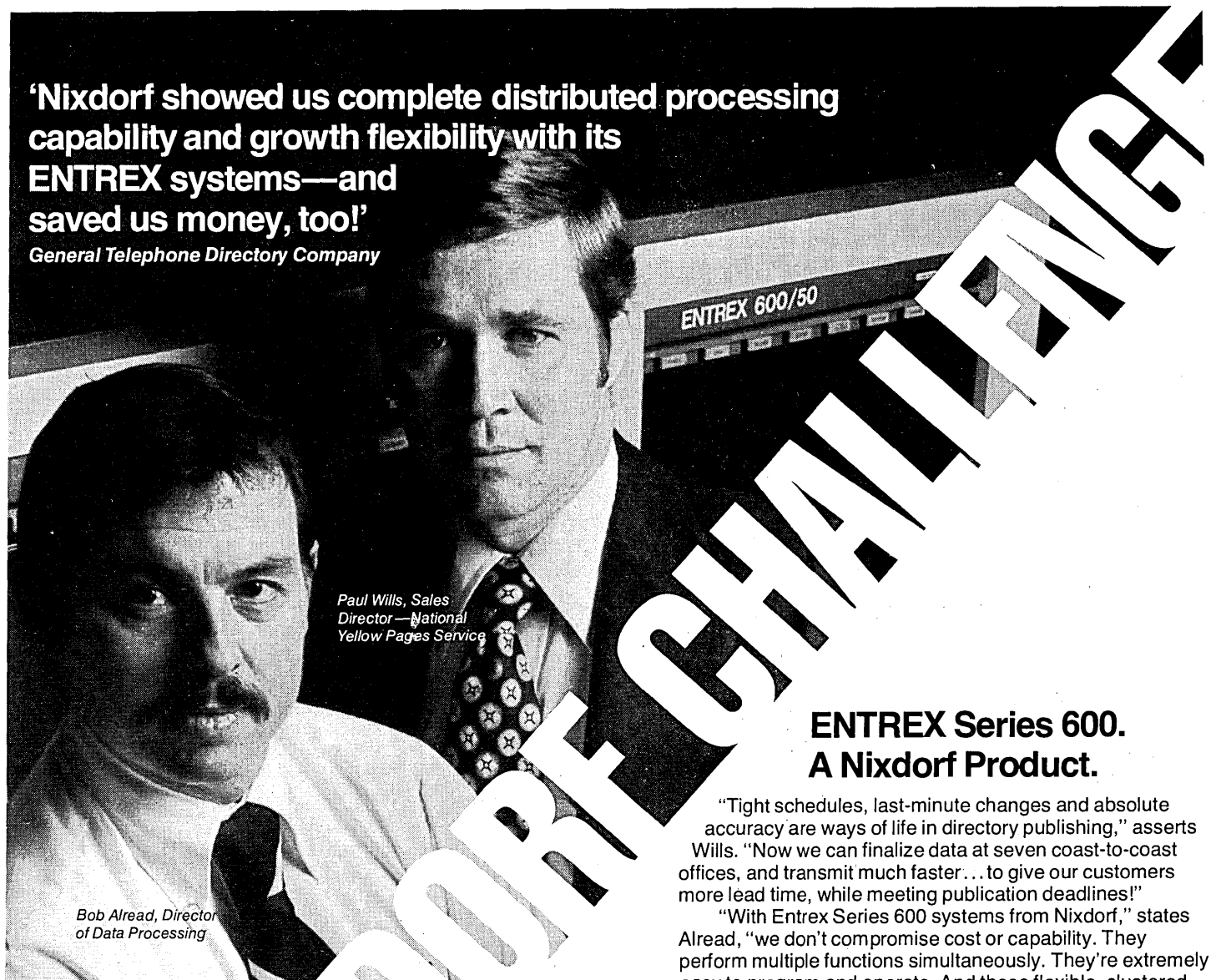

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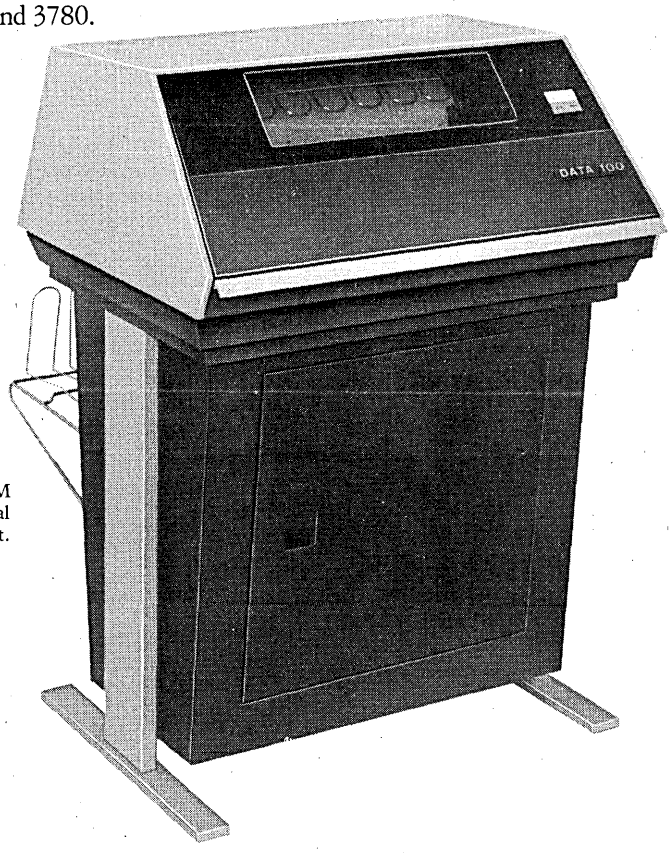

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Looking For A COM Recorder?

by William J. Muldowney

Computer Output Microfilm isn't right for every installation, but any shop producing half a million pages of paper each month ought to look into it.

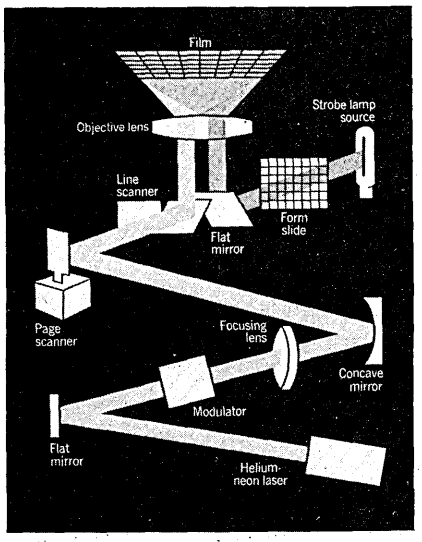
Just as optical character reading never replaced the manual keying of input data, so also computer output microfilm (COM) has never replaced the ubiquitous line printer. But COM has nonetheless made considerable progress.

Technologically there are now self-contained units that produce finished, dry microfiche. There are also models that require no developing chemicals, using instead dry silver films that develop with heat. Thus the dp manager who balked at having additional plumbing in the computer room may find comfort in the fact that this is not necessary. Those machines that do employ chemicals have been greatly simplified as far as replenishing the supply is concerned. The COM unit of today looks like and operates like, a computer peripheral rather than a photo lab.

In terms of installations, industry sources estimate the installed base at year-end 1977 at some 4,025 units, and forecast this base would grow by 8,840 by 1980 and to 15,700 by 1985.

DatagraphiX is the dominant force vying for the lion's share of those installations, with Eastman Kodak in hot pursuit. Neither of these firms is a computer manufacturer. Few of the active COM firms are, although many computer vendors once also offered COM as part of their product line.

Companies that have withdrawn from the field include Burroughs, Gould, Harris, IBM, Pertec, Seaco, Sperry Rand, and Synergraphics. Defectors from the COM business in the past two years alone include Singer, the U.S. operations of NCR, and CalComp. (NCR will continue to service its installed U.S. base, as well as units installed by Quantor, and will continue to market outside the States.)



Kodak's latest equipment uses laser recording and dry processing. This figure illustrates how the form overlay and printing are merged.

Stepping in to take the places of those departed are Applicon, which has acquired the marketing rights to the Singer product line, and Dicomed, a producer of digital color film recording equipment. Both of these companies are heavily graphics oriented, and their COM recorders have graphics capabilities. The Dicomed unit can even record in color, not surprisingly.

This article and the accompanying tables are condensed from material published in **Datapro 70**, a three-volume looseleaf information service that includes reports on a wide variety of computer-related products. The 22-page report, "All About Computer Output Microfilm (COM)" can be obtained separately from Datapro Research Corp., 1805 Underwood Blvd., Delran, NJ 08075. The price is $12.

Special COM properties

A COM recorder is not simply a printer that imprints on film instead of paper. It has a number of useful properties that go beyond the impact printer, which uniformly prints computer output in a single font and with not more than 64 lines per page. Although the low cost alphanumeric COM printers are similarly restricted, others can print in many fonts, underline, subscript, print in several sizes, print in several intensities, rotate text automatically within a given frame, and draw graphic plots.

Also, a standard format consisting of lines and headings that are to appear on all printouts can be automatically superimposed on the frame area. A common procedure is to photoengrave the form on a glass slide and then project the image onto the film by flashing a high-intensity light. Alternatively, these standard forms can be stored in the memory of an internal controller. A particular form is then plotted on the crt screen along with the formation of alphanumeric data.

Another feature of alphanumeric COM recorders is the ability to add page retrieval coding to each page of microfilm. This feature becomes necessary because of the nature of microfilm and the difficulties of "flipping through it" to find the data being sought. The COM recorder can imbed retrieval coding data between the page frame images to enable operators of the microfilm readers and viewers to find the desired data within seconds. Bar codes, frame counts, and various binary patterns are

the coding techniques most frequently used with today's popular microfilm viewers.

A feature called "abutment" ("butting" a frame directly against the one preceding) can join page-length colums of data into long, continuous "multi-page" columns without the customary breaks marking where one paper page joins the next, and without the normal page headings. Other features permit on-line marking of unrecognizable characters with an error symbol and writing titles that are large enough to be read directly without magnification.

Attractions of COM

An open-minded manager presiding over a modest monthly volume of report production (say, not more than 500,000 pages), may not yet need to regard inhouse COM seriously. Nevertheless, volumes of this order might well be handled advantageously by a COM system when there are special formatting considerations, lengthy distribution lists, limited storage space for filing paper copies, or special retrieval requirements. And once the internally distributed output volume approaches a million pages per month, there is little question that an information system based on paper is wasteful.

Placing the crossover of economic advantage from the printer to COM at about 500,000 pages per month is a cautious estimate. As duplication needs and distribution costs of an application increase, this crossover point goes down. Indeed, some analysts put the crossover point as low as 200,000 pages and project a cost reduction of 50% at the 500,000 page level. Since many variables in the environmental equation are changeable, it is prudent to take a cautious approach.

> The crossover point from line printer to COM is somewhere around 500,000 pages per month.

Then there's size. Even a film cassette occupies less than 1% of the space required for a paper stack of equivalent reports, and a fiche occupies less than 0.05% as much space as the equivalent paper. Similar proportions hold for weight. An exercise with postal rates would show that cost savings in distributing fiche, for example, can be enormous. Another exercise involving rental for storage space would demonstrate that significant savings can be realized in this respect as well. Then too, film can be retrieved in approximately 1/10th the time required to access a paper document, and film duplicates produced at about 1/10th of a cent per frame (even less at high reduction ratios).

Disadvantages of COM

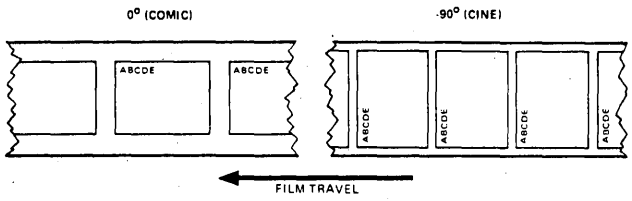
There are also some disadvantages of an in-house COM installation:

- High investment: A COM recorder and its necessary accessories are an expensive investment. Often COM does not replace other equipment, such as a line printer, but is used in addition to other installed data processing equipment. A steady, high-volume workload must be present to justify its installation.
- Software: Depending on the nature of his COM recorder, the user may be forced to create two versions of his print tapes, one especially formatted for the COM unit and one for the line printer in case the COM unit becomes inoperative. Moreover, large program libraries may have to be modified to change printer output tapes to effective COM input tapes. In extreme cases mainframe operating systems may have to be modified.
- Political impact: The introduction of COM and micrographics to a facility may affect its organizational structure. There is no doubt that an impact printer is part of the data processing department. But when film processors and duplicators are installed, they are usually located in a company's publications department. Where does an off-line COM go? Questions of this kind should be considered carefully during the planning stage.
- Personnel training: During the transitional period, personnel must be trained to cope with the various parts of a total COM system. Operating a COM recorder, developing film, and duplicating film are new skills that are unfamiliar to dp personnel. Training in the proper use of readers is also advisable.

Service bureaus vs. in-house COM

Before getting into the details of hardware, software, speeds, film types, etc. we should say that companies can enjoy the benefits of COM without necessarily buying or leasing the equipment. There are many COM service bureaus that will pick up print image tapes and deliver completely processed microfilm or fiche.

In fact, even those environments with sufficiently large report volumes to qualify for in-house COM would probably do well to learn the subtleties of this new operating methodology from a service bureau. Then, planners often overlook the need for backup, and a service bureau is a logical selection for this.



Microfilm images may be produced in either the comic or cine orientation (where the names are taken from comic strip art and movie film). The primary difference between the two modes is that the cine mode packs about 22 frames per foot of film compared to the comic mode's 20.

It has been estimated that the use of a service bureau is the most economical choice for computer output microfilming of up to 200,000 pages per month, and some experts even maintain that the crossover point is beyond the 500,000 pages previously used as a milestone. Somewhere in this vicinity the changeover to in-house operation is usually justified.

The *disadvantages* of using a service bureau are the increased turnaround time from creation of the tape to receipt of the film, and the requirement for potentially confidential company information to be processed outside the company.

COM software

The early COM recorders executed numerous complex functions uncommon to an impact printer, such as variable character intensity, variable character size, multiple fonts, program image rotation, subscripting and superscripting, and graphics. The applied record format, therefore, had to contain appropriate instruction codes. From these considerations it should be evident that one of the original obstacles to COM was the obligation of the user to write subroutine modifications to his operating system, or to link appropriate subroutines supplied by the COM manufacturer—when available.

Designers of on-line microfilm printers, such as the Memorex 1603, sidestepped this problem by orienting their equipment toward the operating environment of the IBM System 370. The 1603 operates directly from the

normal data stream intended for the IBM 1402 Printer. In adhering to linear (simplex) recording, and imprinting simple code line retrieval marks, the 1603 did in fact escape from the software plague. But the price was to lock the 1603 into a comparatively limited functional role.

With the introduction of simple alphanumeric printers that could emulate the IBM 1403 in a linear recording mode on 16mm film, there seemed to be another opportunity to sidestep programming entanglements. A relatively simple plugboard was adequate for duplicating the program format tape of the 1403 and otherwise attaining the plug-to-plug compatibility necessary for operating from a standard IBM print tape.

Other COM recorders, such as the Bell & Howell 3700, can operate from a standard tape without any special programming, but a reduction in throughput is suffered.

With the perfection of more sophisticated cameras and electromechanical gear the production of fiche became more practical. Accordingly, a movement toward fiche and away from strip film began in 1971. Besides improved data compression and film utilization, the division of a data bank into a succession of discrete fiche segments was conducive to more convenient indexing and retrieval.

Overhead functions can reduce COM throughput to 50% of its advertised output rate.

Then, to produce indexing in the form of a dedicated frame and to label the fiche with humanly readable characters—usually at the top, but occasionally along the sides or bottom—a revolution in COM operation was inaugurated. Operation from a standard IBM print tape became absolutely impossible. A particular tape with imbedded codes for instructing the COM unit to generate the titles and to print appropriate headings in the index frame, along with appropriate frame references, became mandatory.

There are two basic procedures for producing such tapes, the older and still more usual method is to leave the computer program unmolested and let it print the standard print tape in the normal manner. By means of a special conversion or translation program, the data stream from the print tape, when it is run through the computer in a second pass, is restructured into the desired COM format.

A more recent and more sophisticated approach is to break into the operating system of the host computer and delay all tape output instructions until the data can be passed through newly introduced subroutines. The format of the data stream emerging from these subroutines is that required by the COM and contains all the instruction codes necessary to operate it. DatagraphiX, Eastman Kodak, Quantor, and 3M offer packages of this type. These companies also offer programs of the tape translation type.

Still another technique circumvents both the second-pass tape translation process and the need to break into the mainframe operating system. This method interfaces the COM recorder to the standard print tape with a control processor as an intermediary. The necessary translation is done in this external processor.

Reading the tables

If a user's investigation and experiments indicate that installing a COM recorder is economically justifiable, then he is faced with the complex task of evaluating and selecting the most suitable hardware. The tables which follow are intended to help in that selection.

There are some points to keep in mind in using the tables. One is that it is not always clear which features are standard and thus included in the prices. Contact the vendor if that becomes a problem, either by using the address information listed in the Vendor Index or by circling the appropriate number on the reader service card bound into this issue.

Another point of confusion has to do with the ease of changing fonts (or typefaces). Again, the vendor is the source of the information listed, and is the best agent of clarification.

Finally, the prospective COM user should note that the advertised frames per minute performance measure is an optimum kind of figure, since it makes no allowance for overhead functions such as preparing the camera, loading film, mounting the tape, etc. There are many such functions to perform, and they can reduce the real output in a given day by as much as 50%. ❋

(Tables start on page 146)

Mr. Muldowney is peripherals editor of Datapro 70, the three-volume reference service published by Datapro Research Corp. Prior to joining Datapro, he was a product manager for Okidata Corp. He has also worked for Kranzley and Co. and Quantum Science Corp., where his primary assignments were developing hardware specifications and business plans. Mr. Muldowney has been associated with the computer industry since 1959, when he joined the product planning staff of RCA's EDP Div.

COM Recorder Vendor Index

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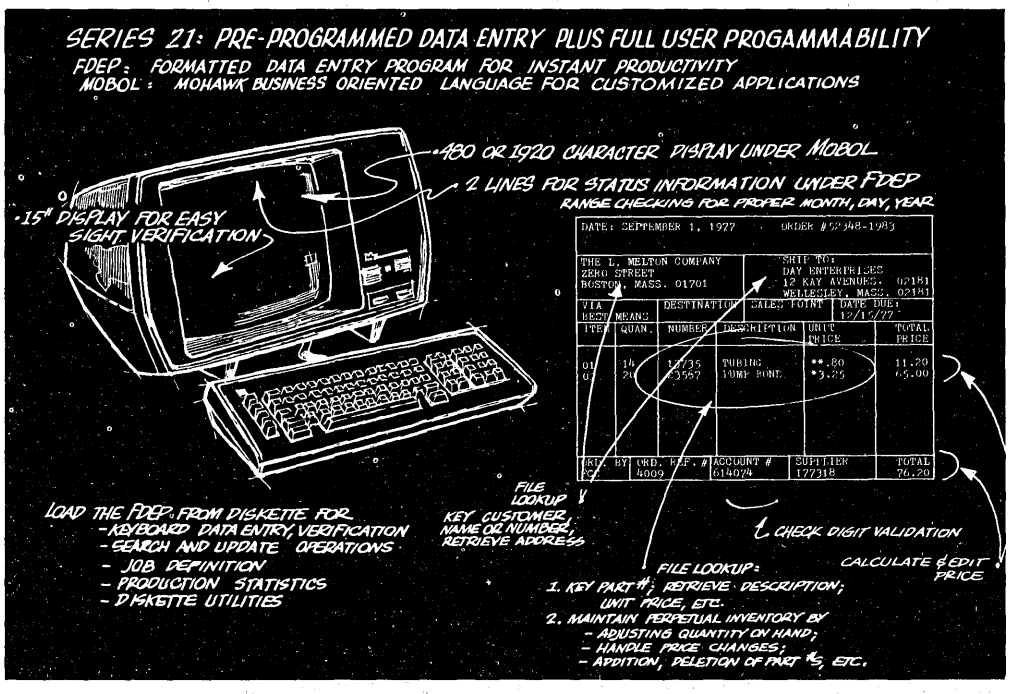
CIRCLE 359 ON READER CARD

MANUFACTURER AND MODEL	Applicon AP75	Bell & Howell Model 3700	Bell & Howell Model 3800	DatagraphiX 4530
ON-LINE USAGE	yes	no	no	no
Input data transfer rate, chars./sec.	up to 600KC			
Computer system interfaces	DEC PDP-11			
OFF-LINE USAGE (with magnetic tape)	yes	yes	yes	yes
Input data transfer rate, chars./sec.	14KC-240KC	60KC	75,000	72KC
Acceptable data codes	any	any	any	any
Tape drive included?				
INTERNAL COMPUTER CONTROLLER	yes	no	yes	no
Manufacturer	DEC		DEC	
Memory size, words	24K		30K	
CHARACTER GENERATION TECHNIQUE	stroke	7 x 9 dot matrix or stroke	dot or stroke	Charactron
MONITOR	crt	viewing port	viewing port	none; align. telescope
FILM				
Width, mm	16, 35, 105mm	16, 35, 105mm	16, 35, 105mm	16, 105mm
Form	roll, fiche, aper.	roll, fiche	roll, fiche	roll, fiche, cart.
Frame orientation	cine or comic	cine or comic	4-axis	cine or comic
ALPHANUMERIC CAPABILITY				
Characters per font	122 chars	93 or 128 chars	128 chars	185 chars
Standard and max. fonts	1 font	1 font	programmable fonts	1-7 fonts
Character sizes	8 sizes	2 sizes	6 sizes	2 sizes
Intensity levels	8 intensities	1 intensity	1 intensity	2 intensities
GRAPHICS CAPABILITY	yes	no	no	no
Addressable spot positions	256 x 10^6 spots			
Resolvable elements	16 x 10^6 elements			
Points per second	500KC			
Point sizes	8 sizes			
Line widths	8 widths			
Intensity levels	64 intensities			
FORMS OVERLAY TECHNIQUES	programmed	forms flash	forms flash	forms flash
RETRIEVAL CODES	programmable	image count, titles, index frame	image count, titles, index frame	image count
ERROR MARKING	programmable	void mark, parity symbol	parity symbol	special character and void mark
OPTIONAL FEATURES	—	horizontal tabbing	—	triple lenses, tabbing
PERFORMANCE DATA				
Frame advance rate, msec.	30msec	135msec	135msec	120msec
Characters printed/second	30KC	60KC	60KC	72KC
132-character lines/minute	18,000 lpm	27,000 lpm	27,000 lpm	14,000 lpm
Frames/minute	30 fpm	245 fpm	225 fpm	219 fpm
PRICING AND AVAILABILITY				
Purchase price	$200K-$300K	$84,150	$124,650	$125,000
Monthly rental, including maintenance (1-year lease)	vendor will not release	$2,000/month	vendor will not release	$2,575/month
Date of first delivery	April 1977	December 1977	May 1976	vendor will not release
Number installed to date	vendor will not release	vendor will not release	vendor will not release	vendor will not release
COMMENTS	High-speed graphics plotting	Extensive reformatting software is provided; acquired from Pertec Corp.		

MANUFACTURER AND MODEL	DatagraphiX 4540	DatagraphiX 4550	DatagraphiX 4560	DatagraphiX AutoCOM	DatagraphiX Mini AutoCOM
ON-LINE USAGE	no	no	no	no	no
Input data transfer rate, chars./sec.					
Computer system interfaces					
OFF-LINE USAGE (with magnetic tape)	yes	yes	yes	yes	yes
Input data transfer rate, chars./sec.	72KC	90KC	72KC	60KC	60KC
Acceptable data codes	any	any	any	EBCDIC, BCD	any
Tape drive included?	yes	yes	yes	no	no
INTERNAL COMPUTER CONTROLLER	no	yes	yes	no	yes
Manufacturer		Lockheed SUE	Lockheed SUE		Lockheed SUE
Memory size, words		16K-31K	30K		16K-30K
CHARACTER GENERATION TECHNIQUE	Charactron	Charactron	Charactron	Charactron	Charactron
MONITOR	none; align. telescope	none; align. telescope	none; align. telescope	none; align. telescope	none; align. telescope
FILM					
Width, mm	16, 105mm	105mm	16, 35, 82.5, 105mm	105mm	105mm
Form	fiche, others	roll, fiche, cart.	fiche, others	fiche	fiche
Frame orientation	cine or comic	cine or comic	cine or comic	comic	comic
ALPHANUMERIC CAPABILITY					
Characters per font	185 chars	185 chars	185 chars	126 chars	126 chars
Standard and max. fonts	1-7 fonts	1-7 fonts	any font	any font	any font
Character sizes	2 sizes	2 sizes	2 sizes	1 size	1 size
Intensity levels	2 intensities	2 intensities	2 intensities	1 intensity	1 intensity
GRAPHICS CAPABILITY	no	no	no	no	no
Addressable spot positions					
Resolvable elements					
Points per second					
Point sizes					
Line widths					
Intensity levels					
FORMS OVERLAY TECHNIQUES	forms flash	forms flash	forms flash	forms flash	forms flash
RETRIEVAL CODES	image count	image count	image count, Miracode optional	no	no
ERROR MARKING	special character and void mark	void mark	void mark	void frame	void frame
OPTIONAL FEATURES	triple lenses, tabbing, format console	card reader, printer, disc format console	card reader, printer, disc	reversal processing	reversal processing
PERFORMANCE DATA					
Frame advance rate, msec.	95msec.	120msec.	95msec.	95msec.	95msec.
Characters printed/second	72KC	90KC	90KC	60KC	80KC
132-character lines/minute	18,000 lpm	14,000 lpm	20,000 lpm	up to 12,000 lpm	up to 15,000 lpm
Frames/minute	311 fpm	219 fpm	311 fpm	190 fpm	210 fpm
PRICING AND AVAILABLILITY					
Purchase price	$137,500	$175,000	$195,000	from $57,500	from $91,400
Monthly rental, including maintenance (1-year lease)	$3,165/month	$4,325/month	$5,305/month	from $1,882/ month	from $3,235/ month
Date of first delivery	vendor will not release	vendor will not release	May 1975	October 1976	June 1977
Number installed to date	vendor will not release	vendor will not release	vendor will not release	vendor will not release	vendor will not release
COMMENTS				42 or 48X	42 or 48X, in-line film processing

MANUFACTURER AND MODEL	DatagraphIX On-line AutoCOM	Dicomed D48 Graphic Recorder	Dicomed D48 Graphic COM System	Eastman Kodak KOM-80	Eastman Kodak KOM-90
ON-LINE USAGE	yes	yes	yes	no	no
Input data transfer rate, chars./sec.	IBM 360/25 up;	250KC			
Computer system interfaces	IBM 370 all models	any	any		
OFF-LINE USAGE (with magnetic tape)	optional	yes	yes	yes	yes
Input data transfer rate, chars./sec.	60KC	36KC/72KC	36KC/72KC	60KC-120KC	7.5KC-120KC
Acceptable data codes	EBCDIC, BCD	any	any	EBCDIC	BCD, ASCII, EBCDIC
Tape drive included?	no	no	yes	no	no
INTERNAL COMPUTER CONTROLLER	no	no	yes	no	no
Manufacturer			DEC		
Memory size, words			32K, 16-bit words		
CHARACTER GENERATION TECHNIQUE		stroke	stroke	stroke	stroke
MONITOR	none; align. telescope	crt	crt	image	image
Width, mm	105mm	any	any	16, 35, 82.5, 105mm	16, 35, 82.5, 105mm
Form	fiche	all	all	roll, cartr., fiche	roll, cartridge
Frame orientation	comic	cine or comic	cine or comic	cine or comic	cine or comic
ALPHANUMERIC CAPABILITY					
Characters per font	126 chars	128 or 192 chars	128 or 192 chars	82 chars	121 chars
Standard amd max. fonts	any fonts	programmable fonts	programmable fonts	2 fonts	2 fonts
Character sizes	1 size	256 sizes	256 sizes	2 sizes	2 sizes
Intensity levels	1 intensity	8 intensities	8 intensities	10 intensities	10 intensities
GRAPHICS CAPABILITY	no	yes	yes	no	no
Adressable spot positions		1074 x 10^6 spots	1074 x 10^6 spots		
Resolvable elements		16 x 10^6 elements	16 x 10^6 elements		
Points per second		100KC	100KC		
Point sizes		16 sizes	16 sizes		
Line widths		16 widths	16 widths		
Intensity levels		256 intensities	256 intensities		
FORMS OVERLAY TECHNIQUES	forms flash	programmed	programmed	forms flash	forms flash
RETRIEVAL CODES	no	programmable	programmable	image count	Miracode, image count, code line
ERROR MARKING	void frame	programmable	programmable	special characters	special characters
OPTIONAL FEATURES	reversal processing	color, Polaroid	color, Polaroid	Miracode, code line retrieval coding; interfaced operation with HP 21MX	Interfaced operation with HP 21MX
PERFORMANCE DATA					
Frame advance rate, msec.	95msec.	33msec.	33msec.	50-100msec.	50-100msec.
Characters printed/second	60KC	25KC	25KC	60KC-120KC	60KC-120KC
132-character lines/minute	to 12,000 lpm	12,000 lpm	12,000 lpm	20,000 lpm	20,000 lpm
Frames/minute	190 fpm	140 fpm	140 fpm	312 fpm	312 fpm
PRICING AND AVAILABILITY					
Purchase Price	from $61,000	$125,000-$200,000	$225,000-$300,000	$80K-$110K (see comments)	$95K-$130K (see comments)
Monthly rental, including maintenance (1-year lease)	from $2,180/mo.	vendor will not release	vendor will not release	$1,600/month (see comments)	$2,850/month (see comments)
Date of first delivery	February 1978	vendor will not release	vendor will not release	1971	1969
Number installed to date				vendor will not release	vendor will not release
COMMENTS	42 or 48X, in-line film processing, full-page buffer, built-in diagnostics		Special color control software available	Lease price covers 10 hr/mo. Usage plan for additional operation is available. All prices are Datapro estimates	Lease price covers 20.1 hrs/mo. Usage plan for additional operation is available. All prices are Datapro estimates

MDS Series 21. Engineered for distributed processing with or without programming.



The cost of programming a distributed processing system can easily exceed the cost of the equipment. Series 21™ from Mohawk Data Sciences solves that problem by eliminating the need for programming in many of the applications most common today—those requiring from one to four operator stations for use in source data entry/verification, and remote batch communications.

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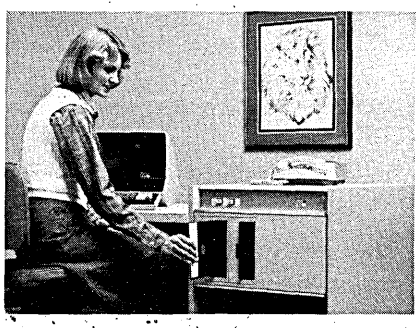

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DM28

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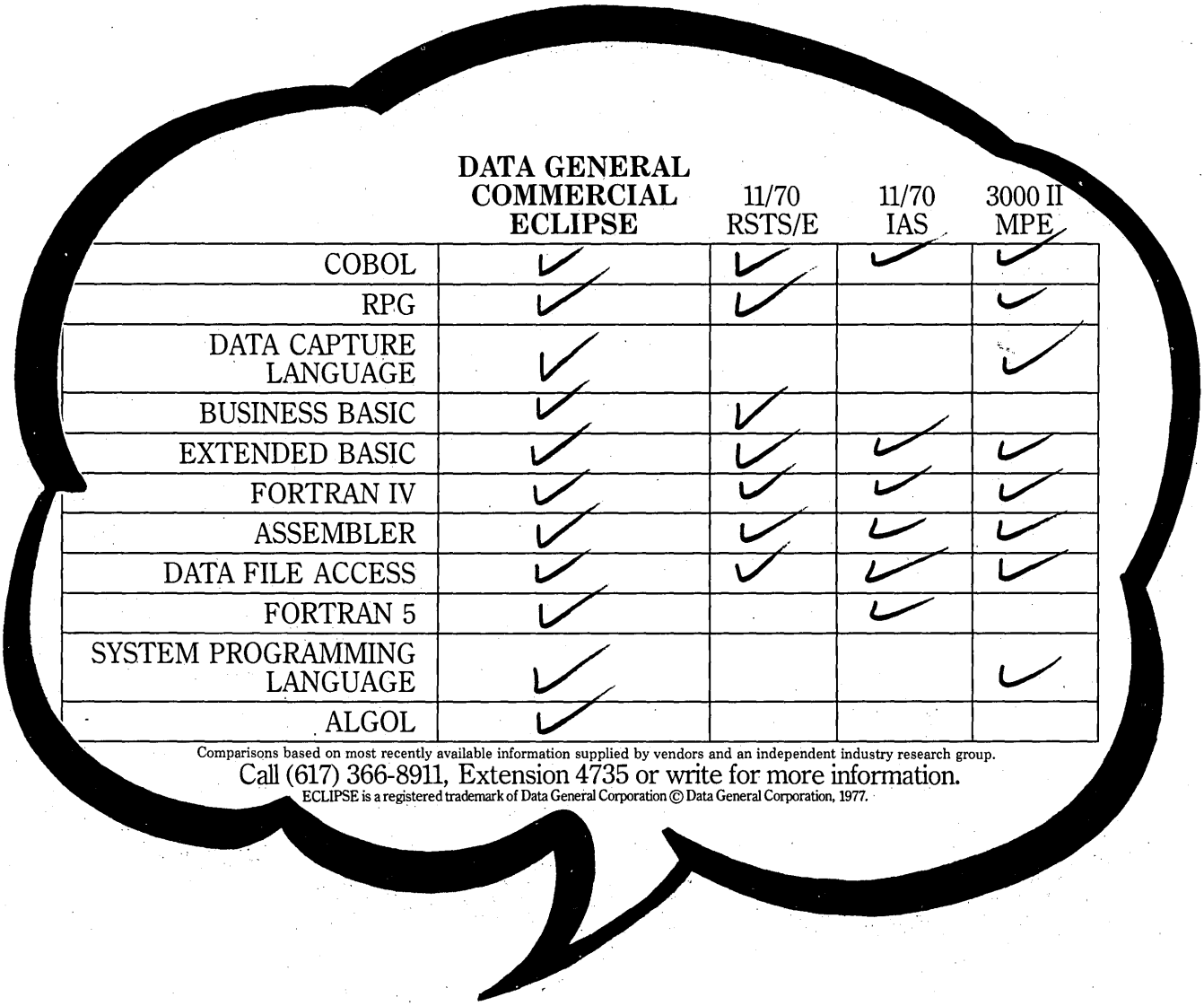

	DATA GENERAL COMMERCIAL ECLIPSE	11/70 RSTS/E	11/70 IAS	3000 II MPE
COBOL	✓	✓	✓	✓
RPG	✓	✓		✓
DATA CAPTURE LANGUAGE	✓			✓
BUSINESS BASIC	✓	✓		
EXTENDED BASIC	✓	✓	✓	✓
FORTRAN IV	✓	✓	✓	✓
ASSEMBLER	✓	✓	✓	✓
DATA FILE ACCESS	✓	✓	✓	✓
FORTRAN 5	✓		✓	
SYSTEM PROGRAMMING LANGUAGE	✓			✓
ALGOL	✓			

Comparisons based on most recently available information supplied by vendors and an independent industry research group.

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MANUFACTURER AND MODEL	Eastman Kodak KOM-85	Eastman Kodak KOMSTAR 100/200	Eastman Kodak KOMSTAR 300	Information International FR-80	Information International COMp80
ON-LINE USAGE	no	yes	no	yes	no
Input data transfer rate, chars./sec.		500KC		50KC	
Computer system interfaces		IBM 360/370		any	
OFF-LINE USAGE (with magnetic tape)	yes	no	yes	yes	yes
Input data transfer rate, chars./sec.	120KC			30K	30KC/60KC
Acceptable data codes	EBCDIC, BCD		any	BCD, ASCII, EBCDIC	BCD, ASCII, EBCDIC
Tape drive included?	no		no	yes	yes
INTERNAL COMPUTER CONTROLLER	optional (external)	yes	no	yes	yes
Manufacturer	Hewlett-Packard			I.I.I.	I.I.I.
Memory size, words	32K			4K-32K	8K-32K
CHARACTER GENERATION TECHNIQUE	stroke	dot matrix	dot matrix	stroke	stroke
MONITOR	image	alignment image	alignment image	crt	crt
FILM					
Width, mm	16 35, 82.5, 105mm	16, 105mm	16, 105mm	16, 35, 105mm	16, 35, 82.5, 105mm
Form	roll, fiche	roll, fiche	roll, fiche	roll, fiche	roll, fiche
Frame orientation	cine or comic	comic	comic	any	any
ALPHANUMERIC CAPABILITY					
Characters per font	82 chars	67 chars	67 chars	128 chars	128 chars
Standard and max. fonts	2 fonts	1 or 2 fonts	1 or 2 fonts		
Character sizes	2 sizes	2 sizes	2 sizes	64 sizes	64 sizes
Intensity levels	10 intensities	8 intensities	8 intensities	8-64 intensities	8-64 intensities
GRAPHICS CAPABILITY	no	no	no	yes	yes
Addressable spot positions				16K x 16K spots	256 x 106 spots
Resolvable elements				4K elements	16 x 106 elements
Points per second				90KC	50KC
Point sizes				8 sizes	8 sizes
Line widths				8 widths	8 widths
Intensity levels				8 intensities	8-64 intensities
FORMS OVERLAY TECHNIQUES	forms flash	forms flash	forms flash	programmed	programmed
RETRIEVAL CODES	image count, optional key descriptor coding	Oracle, image count	Oracle, image count	image count, bar code, code line, Miracode	image count, bar code, code line Miracode
ERROR MARKING	special characters	special characters	special characters	any	any
OPTIONAL FEATURES	tape reformating via HP mini	ROM character set	ROM character set	color film; disc storage	optical merge, disc storage
PERFORMANCE DATA					
Frame advance rate, msec.	50-100msec	100-150msec	100-150msec	74msec	74msec
Characters printed/second	60KC-120KC	41,250cps	41,250cps	8KC/40KC	250KC/40KC
132-character lines/minute	20,000 lpm	12,500 lpm	12,500 lpm	3,600/18,000 lpm	110-18,000 lpm
Frames/minute	312 fpm	2 fpm	2 fpm	52/194 fpm	52/194 fpm
PRICING AND AVAILABILITY					
Purchase price	vendor will not release	vendor will not release	vendor will not release	$233,000	$300,750
Monthly rental, including maintenance (1-year lease)	vendor will not release	vendor will not release	vendor will not release	$7,865/mo.	$9,500/mo.
Date of first delivery	vendor will not release	1978	1977	July 1969	June 1971
Number installed to date	vendor will not release	—	vendor will not release	50	25
COMMENTS		features integrated dry film processing	features integrated dry film processing	different font generators can be substituted	the COMp 80 adds to the FR-80 further photo-composition power. Different font generators can be substituted

MANUFACTURER AND MODEL	Quantor Q 118	3M Company LBR	3M Company COM 700S	3M Company COM 700H
ON-LINE USAGE	no	no	no	no
Input data transfer rate, chars/sec.				
Computer system interfaces				
OFF-LINE USAGE (with magnetic tape)	yes	yes	yes	yes
Input data transfer rate, chars/sec.	72KC	36KC	36KC	60KC
Acceptable data codes	any	any	any	any
Tape drive included?	yes	yes	yes	yes
INTERNAL COMPUTER CONTROLLER	yes	yes	yes	yes
Manufacturer	NCR	H-P	DEC	DEC
Memory size, words	32K-64K	12K-24K	16K-32K	16K-32K
CHARACTER GENERATION TECHNIQUE	7 x 10 dot matrix	dot matrix	dot matrix	stroke
MONITOR	none	none	none	none
FILM				
Width, mm	16, 105mm	16, 105mm	16, 35, 70, 105mm	16, 35, 70, 105mm
Form	roll, fiche	roll, fiche	roll, fiche	roll, fiche
Frame orientation	cine or comic	cine or comic	cine or comic	cine or comic
ALPHANUMERIC CAPABILITY				
Characters per font	128 or 192 chars	128 chars	128 chars	98 chars
Standard and max. fonts				
Character sizes	5 sizes	1 size	3 sizes	8 sizes
Intensity levels	2 intensities	1 intensity	4 intensities	8 intensities
GRAPHICS CAPABILITY	see comments	no	yes	yes
Addressable spot positions			16 x 10^6 spots	16 x 10^6 spots
Resolvable elements			1 x 10^6 elements	1 x 10^6 elements
Points per second			100KC	100KC
Point sizes			1 size	1 size
Line widths			1 width	1 width
Intensity levels			4 intensities	4 intensities
FORMS OVERLAY TECHNIQUES	forms flash	forms flash	forms flash or programmed	forms flash or programmed
RETRIEVAL CODES	index and eye-readable titles	blip	blip or Miracode	blip or Miracode
ERROR MARKING	programmed interrupt	programmed mark	void or programmed mark	void or programmed mark
OPTIONAL FEATURES	on-line film process- and image merge	—	axis rector generator, card reader, paper tape reader/punch, and disc drive	axis rector generator, card reader, paper tape reader/punch, and disc drive
PERFORMANCE DATA				
Frame advance rate, msec.	120msec	50msec	100msec	100msec
Character printed/second	40KC	20KC	40KC	80KC
132-character lines/minute	18,180 lpm	8,000 lpm	14,000 lpm	19,000 lpm
Frames/minute	220 fpm	120 fpm	175 fpm	250 fpm
PRICING AND AVAILABILITY				
Purchase price	$174,500	$130,800	$137,750	$152,500
Monthly rental, including maintenance (1-year lease)	$5,515/month	$2,995/month	vendor will not release	vendor will not release
Date of first delivery	October 1977	December 1974	January 1972	October 1975
Number installed to date	vendor will not release	vendor will not release	vendor will not release	vendor will not release
COMMENTS	Optional graphics merge permits overlaying all or part of 35mm slide into fiche page	dry process		

MANUFACTURER AND MODEL	Information International COMp 80/2	Memorex 1603	Quantor Q 101	Quantor Q 105	Quantor Q 115
ON-LINE USAGE	yes	yes	no	no	no
Input data transfer rate, chars./sec.	50KC	500KC			
Computer system interfaces	any	IBM 360/370			
OFF-LINE USAGE (with magnetic tape)	yes	no	yes	yes	yes
Input data transfer rate, chars./sec.	30KC		30KC	30KC	72KC
Acceptable data codes	BCD, ASCII, EBCDIC		any	any	any
Tape drive included?	yes		yes	yes	yes
INTERNAL COMPUTER CONTROLLER	yes	no	no	no	yes
Manufacturer	I.I.I.				NCR
Memory size, words	8K-32K				24K-64K
CHARACTER GENERATION TECHNIQUE	stroke	5 x 7 dot matrix	7 x 10 dot matrix	7 x 10 dot matrix	7 x 10 dot matrix
MONITOR	crt	none	none	none	none
FILM	16, 35, 82.5, 105, 400mm	16mm	105mm	105mm	16, 105mm
Width, mm					
Form	roll, fiche	roll	roll, fiche	roll, fiche	roll, fiche
Frame orientation	any	cine	comic	comic	comic or cine
ALPHANUMERIC CAPABILITY					
Characters per font	128 chars	64 chars	64 or 128 chars	64 or 128 chars	128 or 192 chars
Standard and max. fonts	programmable fonts	1 font	1 or 2 fonts	1 or 2 fonts	programmable fonts
Character sizes	64 sizes	1 size	5 sizes	5 sizes	5 sizes
Intensity levels	8-64 intensities	1 intensity	2 intensities	2 intensities	2 intensities
GRAPHICS CAPABILITY	yes	no	no	no	see comments
Addressable spot positions	65K x 65K spots				
Resolvable elements	4K elements				
Points per second	50KC				
Point sizes	8 sizes				
Line widths	8 widths				
Intensity levels	8 intensities				
FORMS OVERLAY TECHNIQUES	programmed	forms flash	forms flash	forms flash	forms flash
RETRIEVAL CODES	image count, bar code, code line, Miracode	code line	index and eye-readable titles	index and eye-readable titles	index and eye-readable titles
ERROR MARKING	any	any	special character plus underline page	special character plus underline page	programmed interrupt
OPTIONAL FEATURES	scan line drawings	none	on-line film processing	on-line film processing	on-line film processing and image merge
PERFORMANCE DATA					
Frame advance rate, msec.	74msec	42msec	120msec	120msec	120msec
Characters printed/second	30KC	22KC	30KC	30KC	40KC
132-character lines/minute	—	10,000 lpm	13,800 lpm	13,800 lpm	18,180 lpm
Frames/minute	52/194 fpm	141 fpm	200 fpm	200 fpm	220 fpm
PRICING AND AVAILABILITY					
Purchase price	$300,750	$44,250	$52,500	$72,950	$149,500
Monthly rental, including maintenance (1-year lease)	$9,500/month	$895/month	$950/month	$2,800/month	$4,695/month
Date of first delivery	September 1977	April 1970	January 1977	November 1971	August 1976
Number installed to date	vendor will not release	vendor will not release	35	over 500	85
COMMENTS		This unit is no longer being manufactured			Optional graphics merge permits overlaying all or part of 35mm slide onto fiche page.

(Tables continue on page 156)

HOW WE HELP SOLVE THE 1403-N1 USER'S TWO BIG PROBLEMS:

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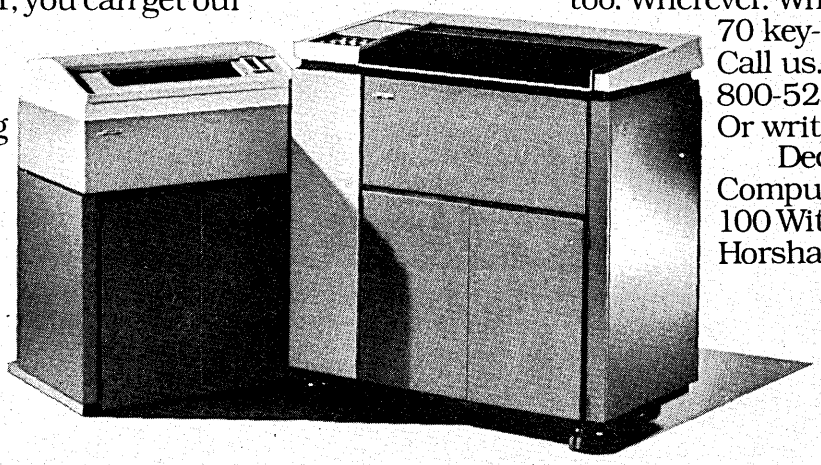

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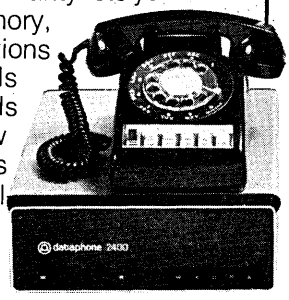

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DP72/D28

MANUFACTURER AND MODEL	3M Company COM 800	3M Company LFR Laser Fiche Recorder	3M Company System 710	3M Company System 715 Dry COM
ON-LINE USAGE	no	no	no	no
Input data transfer rate, chars./sec.				
Computer system interfaces				
OFF-LINE USAGE (with magnetic tape)	yes	yes	yes	yes
Input data transfer rate, chars./sec.	36KC	36KC	36KC	36KC
Acceptable data codes	any	any	any	any
Tape drive included?	yes	yes	yes	yes
INTERNAL COMPUTER CONTROLLER	yes	no	yes	yes
Manufacturer	DEC		DEC	DEC
Memory size, words	16K-32K		16K	32K
CHARACTER GENERATION TECHNIQUE	stroke	dot matrix	stroke	stroke
MONITOR	crt optional	none	none	none
FILM				
Width, mm	16, 35, 70, 82.5, 105mm	105mm	all	all
Form	roll, fiche	fiche	roll, fiche	roll, fiche
Frame orientation	cine or comic	comic	cine or comic	cine or comic
ALPHANUMERIC CAPABILITY				
Characters per font	96 or 128 chars	64 or 128 chars	110 or 256 chars	110 or 256 chars
Standard and max. fonts	programmable fonts	1 font	3 fonts	3 fonts
Character sizes	16 sizes	1 size	8 sizes	8 sizes
Intensity levels	18 intensities	1 intensity	8 intensities	8 intensities
GRAPHICS CAPABILITY	yes	no	yes	yes
Addressable spot positions	256 x 10^6 spots		16 x 10^6 spots	16 x 10^6 spots
Resolvable elements	6 x 10^6 elements		1 x 10^6 elements	1 x 10^6 elements
Points per second	200KC		100KC	100KC
Point sizes	1 size		1 size	1 size
Line widths	8 widths		1 width	1 width
Intensity levels	8 intensities		4 intensities	4 intensities
FORMS OVERLAY TECHNIQUES	forms flash or programmed	forms flash	forms flash	forms flash
RETRIEVAL CODES	blip or Miracode	image count	image count	image count
ERROR MARKING	void or programmed mark	programmed mark	void or programmed mark	void or programmed mark
OPTIONAL FEATURES				dry silver or silver halide
PERFORMANCE DATA				
Frame advance rate, msec.	100msec	50msec	100msec	100+msec
Characters printed/second	20KC	20KC	80KC	80KC
132-character lines/minute	9,100 lpm	8,000 lpm	20,000 lpm	20,000 lpm
Frames/minute	115 fpm	120 fpm	250 fpm	250+ fpm
PRICING AND AVAILABILITY				
Purchase price	$195,000	$60,000	$132,000	$137,500
Monthly rental, including maintenance (1-year lease)	vendor will not release	vendor will not release	vendor will not release	vendor will not release
Date of first delivery	April 1975	1976	1977	1978
Number installed to date	vendor will not release	vendor will not release	vendor will not release	
COMMENTS		Delivers dry silver cut processed fiche		Can use dry silver or or silver halide film

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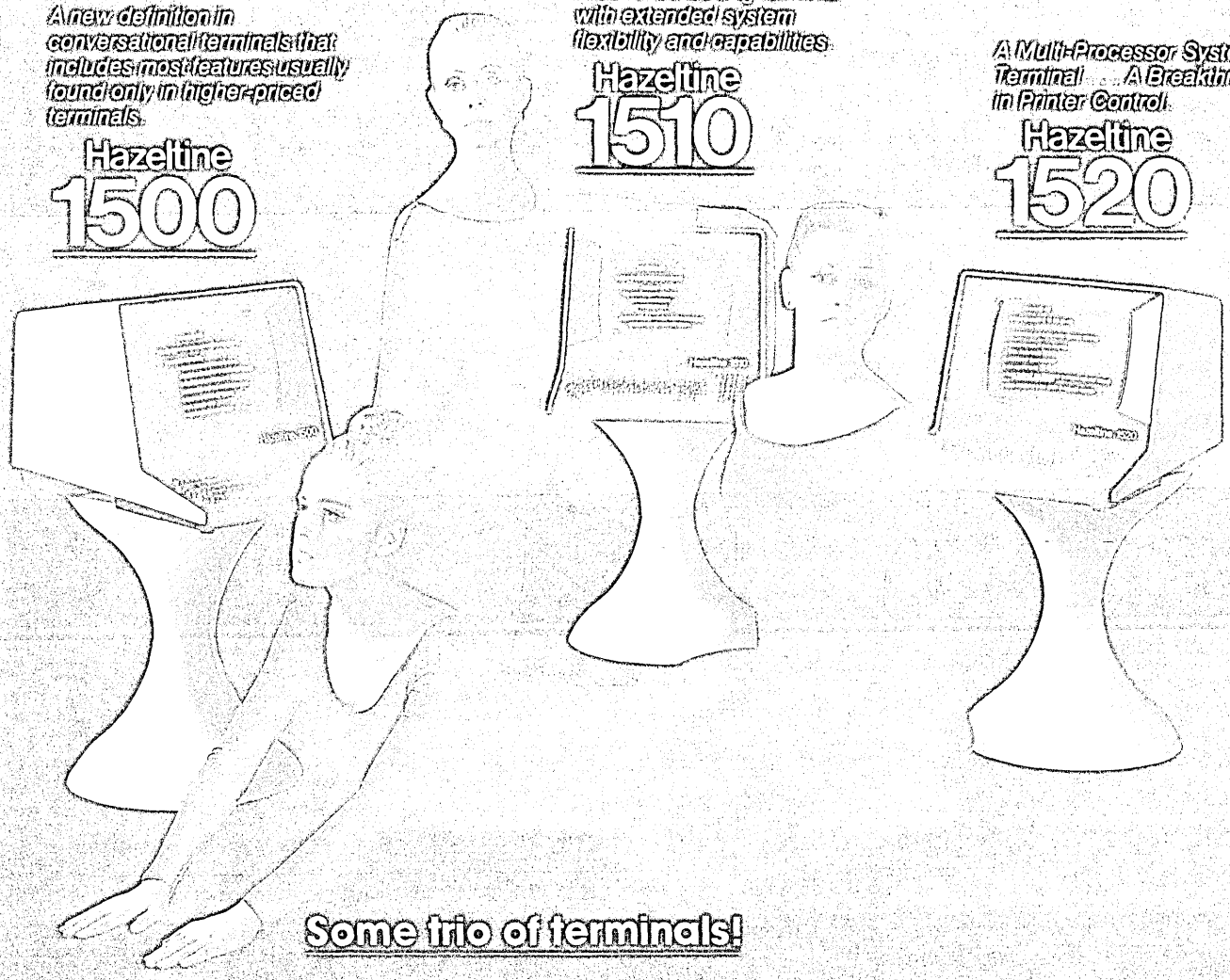

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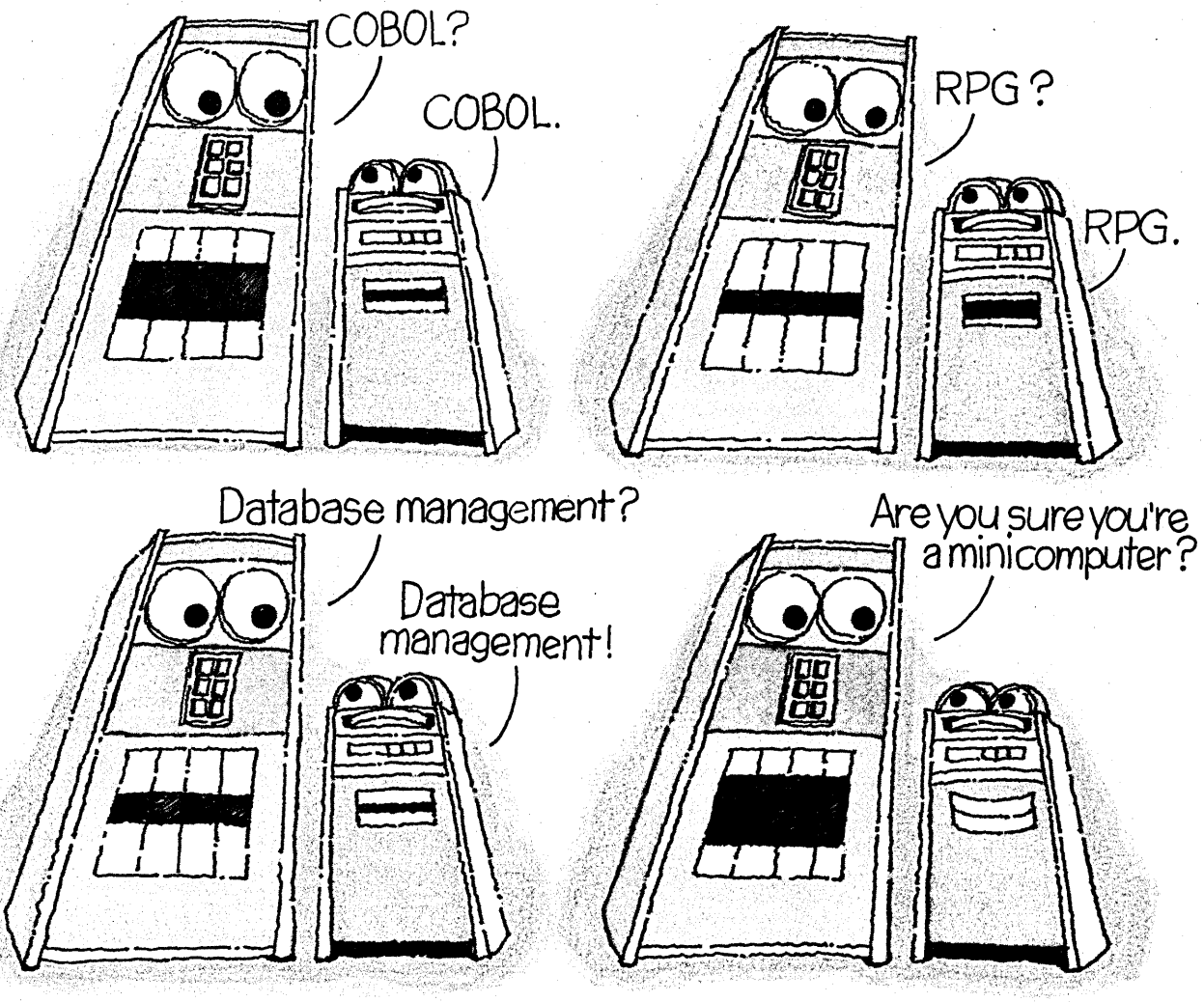

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Taking Another Approach to Supercomputing

by Carl Jensen

In building a number-cruncher, Burroughs takes it own path—as usual.

Burroughs' designs often depart from convention, and the design of the company's new large-scale scientific processor is no exception. Announced in the spring of 1977, the machine is an extremely fast, Fortran-based array processor. It has some characteristics which are similar to those of other array processors, some which are like all other Burroughs computers, some which are like only the earlier Burroughs Illiac IV, and some which are unlike those of any other machine from Burroughs or other vendors.

So far, it is a unique design, one which could be—at least for its manufacturer—the first in a new generation of supercomputers.

The Burroughs Scientific Processor (BSP) is not intended to displace, or upgrade any other Burroughs computer. In fact, a BSP system *includes* one of Burroughs' large general purpose computers as a system manager. Hence the global structure of the BSP itself is very simple. It consists of an instruction processor (really a pre-processor), a main memory, an instruction or control memory, and a single I/O device.

Vector processing

Central to the BSP processor are 16 parallel arithmetic elements (AE's) driven in lock step by a single instruction stream. Hence, the BSP employs a single instruction-multiple data stream (SIMD) architecture. In this respect, it does resemble other large pipeline or parallel scientific processors, including the CRAY 1, CDC Star, and Texas Instruments ASC.

These SIMD machines were designed to process linear vectors, that is, operands made up of sequences of numbers —for example, an array of subscripted Fortran variables—whose consecutive element addresses in memory differ by a constant.

Such vectors are the most elementary kind, and are often formed by program loops like Fortran DO loops. It is this fact, that linear vectors are a natural fallout of loops, which caused the SIMD architecture to emerge as the front runner in attempts to gain increased scientific processing speed through parallelism.

The linear vector has two immense advantages over other parallel operands. One advantage is the relative ease of building hardware that will efficiently fetch linear vectors from memory under the control of a simple vector descriptor. The other advantage is that, inside a loop, the same operation is specified between all the consecutive element pairs of vector operands (such as in $A_i = B_i + C$, where all the elements of A are added to their counterparts in B).

> ... 16 parallel processors driven in lock step by a single instruction stream ...

Taken together, these two advantages imply that, while operations between linear vectors can be done using parallel hardware, the control of such operations can be from a single instruction using simple data descriptors. As a consequence, the relatively simple SIMD architecture represents sufficient control capability to exploit this kind of parallelism.

The SIMD architecture has already appeared in several forms: 64 processing elements, with their private memories, driven by a single instruction processor in the Illiac IV; and sets of pipelines where each stage in a pipeline does a part of an arithmetic operation, as in some commercially available supercomputers. However, regardless of the nature and method of implementation, all of these machines, including the BSP, have been designed to function most effectively with linear vectors as operands. Hence, it is reasonable to regard them all as linear vector machines or, more commonly, vector machines. The use of parallel arithmetic elements in the BSP and in the Illiac IV, then, does not make them fundamentally different from pipeline-based supercomputers.

With a different slant

However, one very important difference has been pointed out. This is that the BSP, from the beginning, was intended to be paired with another processor (see Fig. 1, p. 160).

In a conventional computer, the objective of such a pairing would be to enhance the power of the system manager through offloading. In contrast, the basic motivation for attaching the BSP to a system manager is the reverse: to free the BSP for its intended purpose of executing those programs or very large parts of massive scientific problems for which it was designed.

To the user, the net result of the BSP's unique design is simultaneous accessibility to immense scientific *and* business data processing power at less cost than would be incurred for equivalent power in separate machines, an economy measured both in hardware and in program development and maintenance costs. A further consideration is the modularity of this total system since it can be expanded extensively, without reprogramming, as the user's requirements expand in either or both application realms.

The BSP differs from competing machines in another important respect. This is its use of an instruction processor which is only loosely coupled to the parallel arithmetic elements. The approach is a generalization of the "overlapped" instruction execution mode in Illiac IV which allows one non-parallel processor to prepare instructions for simultaneous execution on the other, parallel ones. Illiac IV runs more than twice as fast in the overlapped mode as in a non-overlapped mode.

To assist in obtaining this instruc-

tion preparation/execution overlaps the BSP has a queue between the instruction processor and the unit which drives the arithmetic elements, just as Illiac IV has. However, the BSP queue can contain many more entries. Additionally, this queue contains hardware which checks for out-of-bound array references and optimizes the choice between "inner" and "outer" Fortran DO loops.

The latter feature is very important for such functions as processing the Fast Fourier Transforms (FFT's) used in such applications as seismic data processing and structural analysis. FFT's have an inner loop whose length is decreasing, while the next outer loop's length is increasing. In the BSP this loop length optimization keeps a 256-point (or more) FFT running at over 75% of maximum machine speed. This is because all vectors will be forced to be of length 16 or more (and hence efficient on 16 arithmetic elements), even though the programmer may have written a structure which implies vector lengths of 8, 4, 2, and 1 in the final FFT stages.

(The BSP's instruction set is designed around the concept of linear vectors of *arbitrary* length. The need to accommodate vectors whose lengths are not integer multiples of the number of arithmetic elements is handled entirely by the control hardware. Not even the compiler is aware that there are 16 arithmetic elements. The compiler deals only with vectors and issues vector instructions, the hardware does the rest.)

The BSP also has arithmetic capability in its instruction processor, which is called the scalar processing unit (SPU). The SPU can calculate loop indices, or do floating-point math. It also has a private memory called Control Memory for storing instructions, indexing parameters, and vector descriptors. Taken together, these features build on the concept of overlap between vector instruction processing and vector instruction execution.

The last basic difference between the BSP and its competitors, its scalar processing, is likely to be the most controversial. This difference stems from the BSP's sequence in the design history of linear vector-based supercomputers.

Learning from predecessors

When the BSP was designed, some experience already had been accumulated with respect to the ways in which the linear vector approach to parallelism could be applied to real world problems.

> For vector processors, regular scalar computing is a headache.

Some ideas and problems which were understood when the BSP design started are:

1. Maximum speed is not nearly as important as sustainable speed.

2. A conventional one-dimensional memory like those used on general-purpose computers (that is, one which is efficient only for linear vectors whose elements are packed adjacent to one another) is not sufficiently general for an array processor.

3. Assembly language level programming is incompatible with linear vector programming. Even the set of Fortran primitives cannot directly express many simple linear vector constructs. If the programmer is to think effectively about his problem at the linear vector level, he must be as free as possible from concern with machine details.

4. It is possible to construct Fortran program analyzers which find a large percentage of the intrinsic parallelism in programs. However, if the target machine structure is not simple and general at a high level, an analyzer cannot create useful object code from the parallelism it has found.

5. A science in the use of parallelism is beginning to emerge. In particular, linear recurrence relations (where the current value of a variable depends on the previous value, as in $A_i = A_i + 1$) are now known to be susceptible to parallelism.

6. Conversion to a linear vector machine should only have to be done once. Any new design should take the future in mind, so the user will not have a substantial problem converting to a successor machine.

Call it the "scalar problem"

There is a substantial difficulty implicit in the simultaneous solution to points 1, 4, and 6. This is due to what has come to be called the "scalar problem," which is easy to describe but difficult to get one's arms around. For example, imagine a linear vector pro-

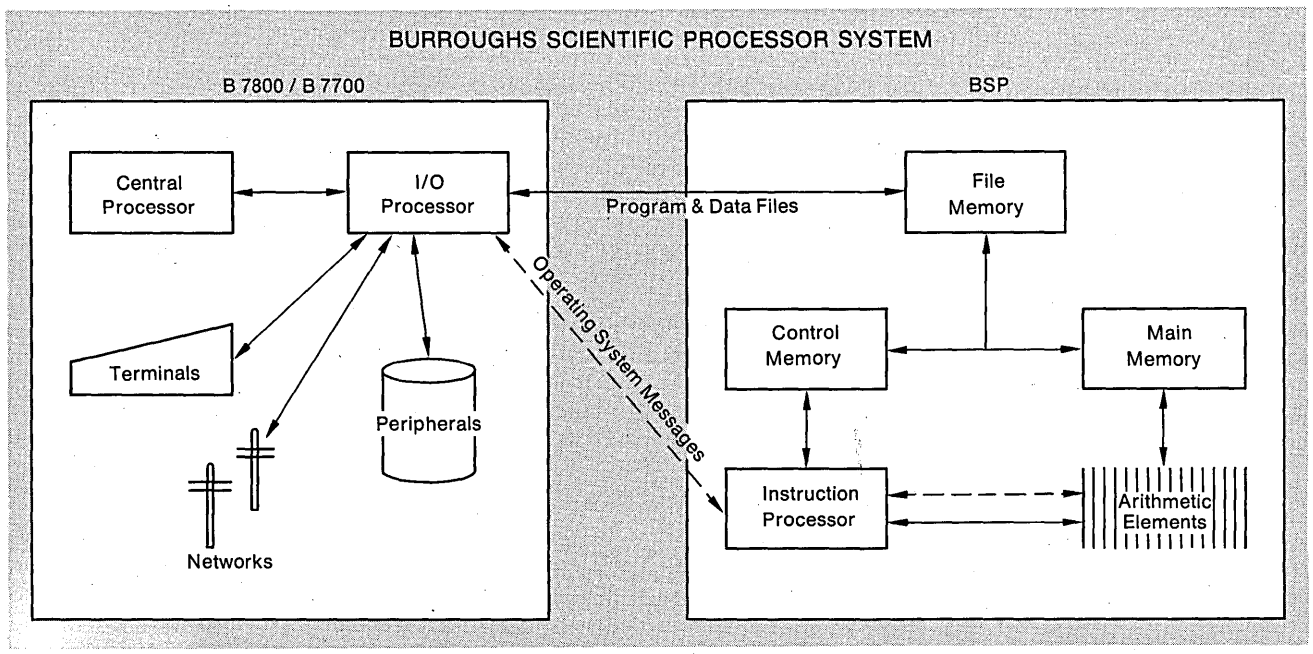

Fig. 1. Unlike other array processing or pipeline processing computers, the Burroughs Scientific Processor was designed to be operated as a peripheral to another large-scale system.

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cessor which could do vectors at infinite speed, but could do scalars no faster than, say, one operation every microsecond. If the total problem contained 90% vectors and 10% scalars, the vectors would be done in no time at all, but the scalars would be done one operation every microsecond. Because only 10% of the problem was scalars, we would divide one operation per microsecond by 0.1, to obtain an overall speed of 10 operations per microsecond on our example problem.

This speed is equivalent to 10 million instructions/sec, but in today's terms it isn't very fast; users now want at least 20 floating-point operations per microsecond. Yet the example isn't unreasonable, because many vector machines, with maximum speeds over 50 floating-point operations per microsecond, have a difficult time sustaining 10 floating-point operations per microsecond on important problems.

Before discussing how to speed up scalar operations, let's decide what a scalar operation is. This turns out to be no simple task. First of all, some apparent scalars aren't there. For example, the memory indexing hardware on most vector computers fetches the entire linear vector, based only on some simple information such as start of vector, address difference between vector elements, and length of vector. Similarly, doing the vector operation is the same as executing an inner loop of a program. This means that many indexing operations and much loop overhead present in an ordinary scalar machine, have gone away as part of the basic idea of the linear vector processor.

Then too, some apparently "scalar" operations turn out to be vectorizeable. For example, on the BSP the DO loop:

```
DO I =2, N
A(I) = C(I) * A(I-1) + B (I)
END
```

is executed in parallel with a maximum speed well over 10 operations per microsecond. This is where the BSP parts company with the other recent vector machines, for on other vector machines this rather frequent construct must be executed as a scalar sequence.

To solve this recurrence, and some other problems, conventional wisdom at present says you have to include a fast scalar processor in your design. But there are three big problems with this point of view. The first is that the fast scalar processor may add very substantially to the total hardware cost.

The second problem is more insidious, and probably more severe. To the extent that the compiler must choose between sometimes using the scalar hardware and sometimes using the vector hardware, the compiler has the job of compiling to two machines. As a result the compiler may be unable to generate object code for all the parallelism it has found. For example, if the scalar code is intimately dependent on the vector code, or vice versa, either the hardware must have extremely clever synchronizing mechanisms to tie the processors together, or the compiler will have to decide that some mixed code will be arbitrarily categorized as all being of one type.

The third problem is also insidious and, conceivably, the most costly in the long run. This problem is that the arbitrary introduction of a fast scalar processor, to solve a problem in an ad hoc way, almost guarantees that a successor machine by the same manufacturer will require a substantial reconversion. The successor machine is not likely to retain the structure of its predecessor.

For these reasons, the BSP foregoes the mixed blessing of an ultra-fast and expensive scalar unit. Although the BSP compiler will use the SPU for some scalar operations, the compiler is likely to treat a floating-point scalar as a vector of length one, or to treat a sequence of floating-point scalars as a non-linear vector operation sequence. This approach allows the compiler to concentrate on taking good advantage of detected parallelism. And it allows the user to convert code to a successor machine, with recompiling being the likely maximum conversion penalty.

This approach is also intended to permit a smooth initial conversion *to* the BSP. In a first pass, a program conversion may leave an undesirable number of scalars. But, with uniform treatment of operands, a scalar doesn't have to be made part of a vector of length 100 to be efficiently processed. If three scalars are grouped into a vector of length 3, then each is processed 3 times as fast as before. Vectors of lengths on the order of 10 are processed with reasonable efficiency. The idea is that a conversion may be done in manageable stages, with useful effect for one's efforts at each stage.

Thus, the BSP approach is to design a more general vector processor, and to forego the very fast scalar hardware. Is the science of parallelism somewhat young for such a design? If so, the urgency of application requirements coupled with the BSP's allowances for later conversions should provoke rapid maturation.

Scientific I/O is different

The major BSP design elements include the system manager, I/O subsystem, parallel main memory, arithmetic elements, scalar processor, parallel processor control unit, and the control and maintenance processor. Also included is BSP software, job flow management software, and various user interfaces.

It's easiest to describe the I/O subsystem first. In scientific computations the dominant I/O patterns are quite different from those in business data processing, where a small number of operations affect a very large data base. So, for business data processing, a computer's limiting factor may be I/O capacity because any single job may not demand much memory to execute with adequate efficiency. This is an ideal environment for multiprogramming. Many problems may reside in main memory at once. A few will be active; the rest will be waiting for I/O.

In business data processing, the programmer is delighted to have sophisticated operating systems doing his I/O for him. And he doesn't mind if the operating system is trying to optimize I/O for all the jobs in the mix.

The situation is quite different for scientific computation. A given job usually requires a large amount of memory before it can execute efficiently. With present processor speeds and memory sizes, the larger bread-and-butter jobs execute best if each one has main memory to itself.

Also, for many scientific jobs some of the data on secondary storage is best regarded as an overflow of main memory—this data is what wouldn't fit in main memory, but the programmer really wishes it were there. Hence, this overflow data is quite tightly coupled to the processing of data in main memory, and the programmer may want to exercise a great degree of control over the I/O process since it may be viewed as an extension of memory management.

Therefore, the scientific programmer resents software I/O control. He wants as much memory as he can get, and he wants as direct control over I/O as possible. For this reason, and due to details of particular hardware systems, many scientific programmers have reported spending the bulk of their programming effort trying to optimize I/O.

Such a state of affairs is doubly unfortunate because the overall flow of high speed I/O in most scientific problems is very simple. If the scientific programmer weren't simultaneously battling an operating system and I/O devices inadequate to his particular purpose, he could describe his I/O needs with a few simple statements.

A CCD file

How did all this affect BSP I/O design? The design is based on the idea that high speed I/O , and its associated storage devices, be included with the processor and the main memory inside what is called the "computational envelope." The performance of the secon-

dary I/O subsystem is designed to support the processor and main memory. This performance is completely under user control. Finally, for simplicity, a single I/O device is used for this secondary storage system.

Conventional I/O devices, however, cannot support the speed requirements of supercomputers. Also, access times associated with conventional devices are much too long. Because access time is a discontinuity that must be smoothed over in I/O operations, long access times imply the need for large main memory I/O buffers. If, at the same time, the transfer rate must be increased, then the buffers must be even larger. For many problems examined in designing the BSP, main memory buffer sizes would have approached half a million 48-bit words if discs were used for the secondary storage.

Hence, the BSP's secondary storage, called "file memory," uses 64Kbit charge-coupled device (CCD) technology. The result is average latencies under 1msec and sustainable transfer rates over 60MB/sec. Buffer sizes are kept reasonable and optimum performance attained with simple standard Fortran statements.

CCD's for secondary storage yield latencies under 1msec and transfer rates of 60MB.

A fallout from the use of CCD's is better reliability. Disc errors can involve failures on multiple bits in a block of data. With proper partitioning, CCD errors are held to failures on single bits (and therefore are correctable using Hamming codes). The file memory uses single-bit error correction /double-bit error detection on all its memory cells and data paths.

The file memory is expandable from 4 to 64 million words (where a "million" is 2^{20}). In certain circumstances, some files may overflow this amount. For this reason an additional capability is provided, allowing the user to specify that a file is to be "chaptered," with only one chapter available on file memory at any given time. (This is like paging, but Burroughs uses "paging" to mean something slightly different.)

Fig. 1 shows the BSP connected to a B 7800 or a B 7700 system manager, illustrating that the BSP is the realization of the "computational envelope" discussed earlier. High speed I/O transfers occur inside the BSP between main memory and file memory. New jobs are staged to the file memory, and output from finished jobs is staged to the system manager from the file memory.

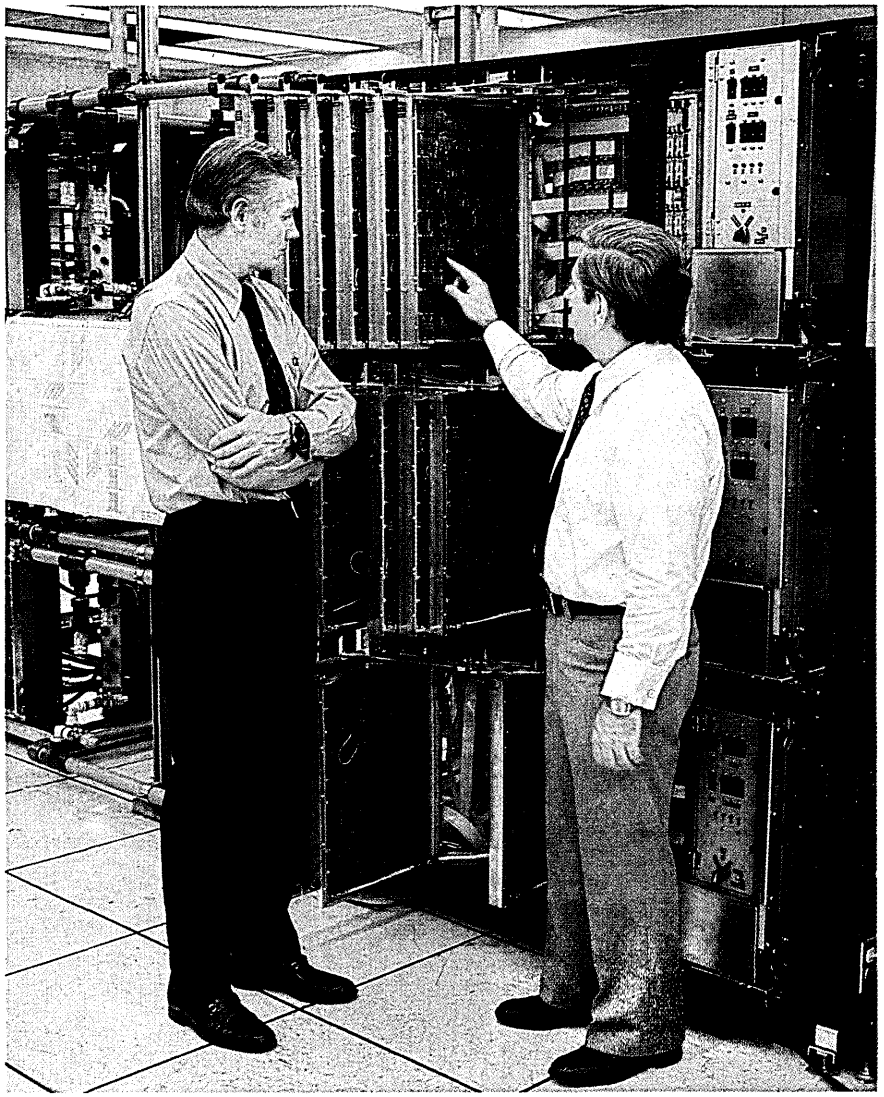
Fig. 1 also shows some specialized communication paths between the BSP and the system manager. These are used for operating system communications, performance logging, hardware error logging, and for maintenance and diagnostic purposes.

The connection to the B 7800 or B 7700 is through a standard I/O port. Hence if a B 7700 owner wished to attach a BSP, he would install the BSP, connect the cables to a B 7700 I/O processor, recompile the operating system with the "BSP" option set, and go.

It is evident from the way in which the BSP is connected to the system manager, and the arguments upon which the computational envelope approach is based, that normal job flow through the BSP is first in-first out. However, priority overrides are provided. These are primarily for job debugging purposes, because the system manager will be providing the text-editing, compiling, file management, etc., that constitutes the usual overhead load on a scientific processing system.

The file memory controller is the key to fast file memory response, user control, low operating system overhead, and file security. On a "file open" command by a user the operating system in the BSP is invoked. This system determines the user's access rights to the file and then sets status bits in the file memory controller to correspond to these access rights. Subsequent references to the file by the user are done with in-line code in user mode, since the file memory controller will not respond to an improper request.

There are two potential "users," however: the current job running on the BSP, and the system manager. Both are treated in essentially the same way. In the case of dealings with the system manager, the BSP operating system will also manage file memory space allocations before it responds to a request,



Serial Number One of the BSP line is still under construction at a Burroughs plant near Paoli, Pennsylvania. Here Richard Stokes, manager of the plant, and Herbert White, manager of manufacturing, are pictured next to the machine's control processor. Burrough's Current Mode Logic packaging shows on the swing-out panels, which are called "islands" and are interconnected by ribbon cables rather than a back plane.

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and space deallocation after the system manager has removed a file from file memory. The file memory is divided into pages and file references are logical addresses, which the file memory controller translates to physical addresses. Hence, a file need not occupy contiguous pages in file memory.

Major components

Fig. 2 shows the major elements within the BSP. It illustrates that there are four types of parallelism in it. That is, four different classes of processing occur simultaneously. They are:

a) arithmetic done by the 16 AE's
b) memory fetches and stores, and the transmission of data between memory and the AE's
c) indexing, vector length, and loop control computations in the parallel processor control unit
d) the generation of linear vector operation descriptions, which takes place in the SPU.

The problem of keeping the AE's, the alignment network, and the memory simultaneously busy is interesting. These global elements, taken together, form a pipeline. That is, data is first fetched from memory; it is then transmitted to the AE's over the alignment network which assures that the vector elements get to the appropriate AE. Then it's processed by the AE's, transmitted back to memory, and stored. This is a five step process, executed with four major elements (memory, input alignment network, AE's, and output alignment network). The parallel processor control unit keeps these system elements as busy as possible by the use of precoded microinstructions called "templates."

A template is a description of the entire sequence of operations which a group of associated sets of 16 numbers follow. For example, such a group of sets of numbers could be the addition of 16 elements of "*A*" to 16 elements of "*B*" to form 16 elements of "*C*". In other words, with one template we are talking about controlling 16 arithmetic operations which can simultaneously be done by the 16 AE's, plus all the associated memory and data transmission operations.

The problem which the parallel processor control unit must solve is the interleaving of one such set of operations, or template, with the next set. In the general case, one template will not be the same as that which follows it. For example, a follower template may be generating the first 16 elements of $Z = Q * R + P$, while the preceding template was doing the last 16 (or fewer) elements of $C = A + B$.

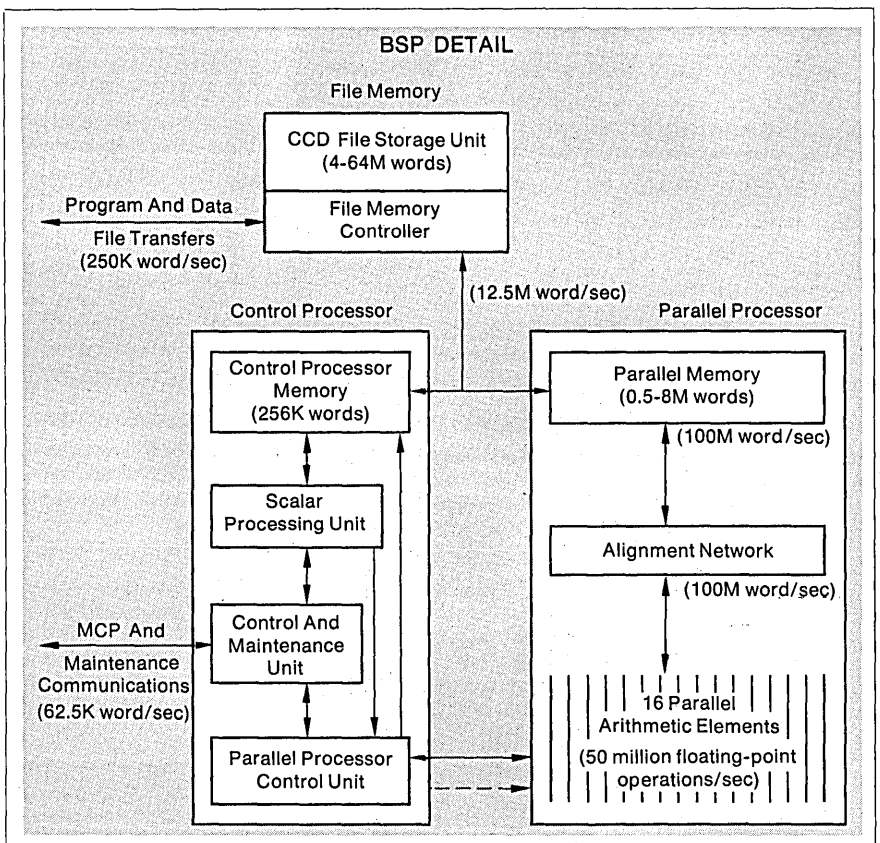


Fig. 2. Four levels of parallelism operate within the BSP "computing envelope": arithmetic done by the arithmetic elements, data transmission between the AE's and memory, vector-related computations done in the parallel processing control unit, and instruction pre-processing done in the scalar processing unit.

If dissimilar templates were not interleaved, then the pipeline formed by the memory, the alignment networks, and the AE set would have to be emptied between the completion of one vector operation and the start of the next. If this were to happen the BSP would suffer from the same vector start up problem which has plagued some pipeline machines. In short, the user would find the machine inefficient for operation on short vectors because of the start-up idle time.

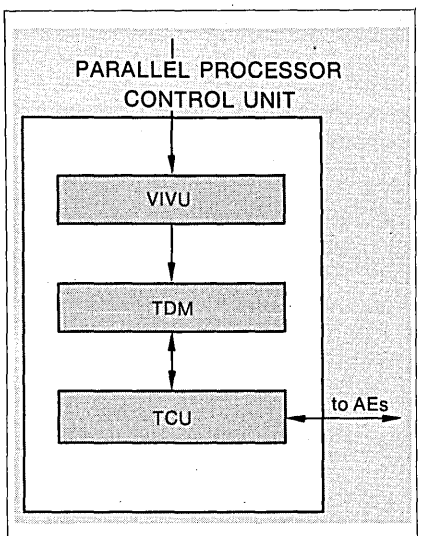


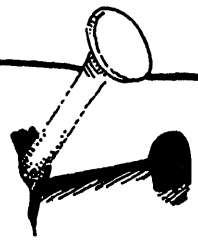
Fig. 3. The elements within the parallel processor control unit form a pipeline all their own, one which readies the single instruction stream for processing the multiple data streams.

Given that a template is a microsequence specified at system design time, the job of the parallel processor control unit is substantially simplified. Instead of having somehow to efficiently interleave the control of several dissimilar units, the parallel processor controller only has to select the next stored sequence.

The basis of the selection is optimization of system efficiency. Clearly, the power of the processor required to make this selection is miniscule compared with the power required to attempt to optimize system utilization dynamically.

There is a nice bonus associated with the use of templates in the parallel processor control. This is the ability to implement retry on vector operations. Upon detection of a non-correctable error, the control lets the last successful template finish, resets any partially started templates, and retries the template which failed. The BSP is the only supercomputer with vector operation retry.

A problem can occur with a system which has this much overlap. The problem is called a vector "hazard." For example, if $A = B + C$ is followed



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by $Q = A * R$, then the elements of A must be stored by the first statement before they are used in the second. If the vector operations are long, no problem exists. If they are short, it may be necessary to hold up the second operation until the first has finished, even though this costs some lost cycles. The parallel processor control unit detects and solves this problem situation. The template control processor adopts a different strategy in this case. Instead of maximizing overlap, it selects templates which minimize time lost between operations.

The parallel processors

All 16 arithmetic elements are identical. The set of 16 is driven from a single microsequence, in keeping with the single instruction-multiple data stream nature of the machine.

Each of the 16 is quite soft, in the sense that only the most primitive operators are hardwired. The control word is over 100 bits wide, partly due to direct access to primitive functions and partly because the arithmetic element has an unusual range of processing capability. That is, besides being a floating-point machine, the AE has extensive non-numeric capability. Complete field manipulation and editing operators are available. Additionally, a special set of operators is available specifically for Fortran Format conversion, as in converting binary numbers for printing.

(These capabilities lead to an anomaly: While the BSP is being marketed as a floating-point number-cruncher, in actuality, with its CCD file memory, large main memory, and versatile AE's, it may well represent the largest available non-numeric processor as well.)

Floating-point add, subtract, and multiply each take two memory clocks in an AE. This is because a design decision was made for memory bandwidth to be exactly balanced with AE bandwidth for triadic operations. (A triadic operation is defined as having three operands and one result.) Evidently, this does result in balance, because the four memory clocks required to handle the operands and result are balanced by the four clocks required by the two arithmetic operations which convert three operands into one result.

The BSP is the only supercomputer with vector operation retry.

The BSP memory system cycle time is 160nsec. The AE cycle time is the same. A shorter AE clock would have allowed the arithmetic elements to be used more often per operation. However, offsetting factors were the high level of integration in the Burroughs Current Mode Logic (BCM) circuits, and the desire for ease of manufacturing and straightforward maintenance. To some extent, the level of function integration required a longer clock; the chips do more, but take longer to operate.

As mentioned earlier, the BSP floating-point word is 48 bits long. It has 36 bits of significand and 10 bits of binary exponent. This gives a range of 10 ± 307 and about 11 decimal digits of precision. The floating-point arithmetic is done using guard bits to detect overflow/underflow and good rounding algorithms. Even for large problems, it is rare for more precision to be needed. However, if needed, the AE has double-length accumulators and double-length registers in key places. This provides direct implementation of double precision operators in the hardware. The AE also permits software implementation of greater precision.

Note that with 16 AE's each generating an add, subtract, or multiply in 320nsec, and with the parallel processor control giving full overlap, the maximum speed of the BSP is 50 million floating-point operations per sec-

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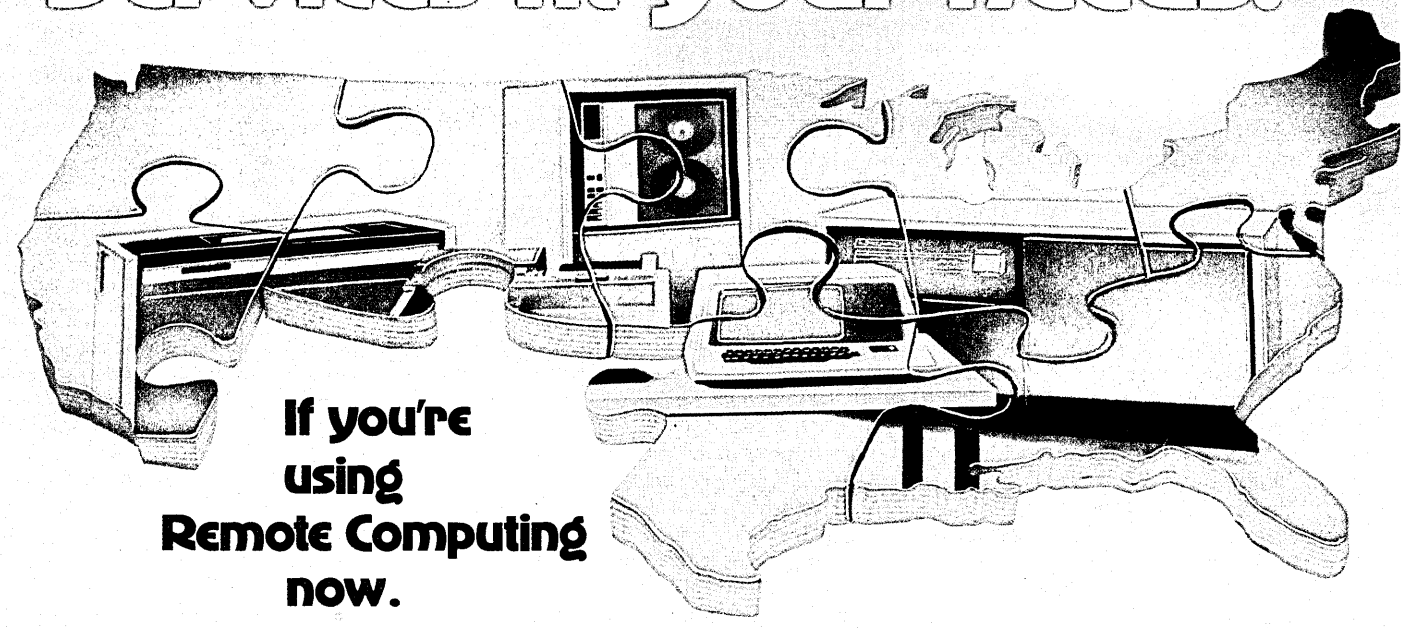

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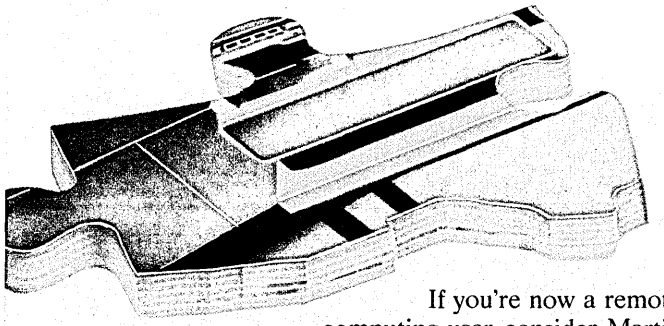

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ond. And the overall design philosophy has been to produce a machine which can *sustain* a substantial percentage of its maximum operation rate.

A different memory organization

A unique feature of the BSP is its memory system. This memory system delivers a useful number to each AE, on each memory cycle even when the data elements are not stored contiguously. Therefore, DO loops may contain non-unity increments, or the program may access rows, columns, or diagonals of matrices without penalty.

This kind of memory capability has not been available before with memory parts of modest speed. Either one has made do with memories that had severe access restrictions, or one used expensive fast memory parts to attain a degree of conflict-free access through bandwidth overkill.

The hardware techniques used to generate the conflict-free access are a prime number of memory ports, the alignment network between the memory ports and the AE's, and special memory index and alignment tag generation.

The index and tag generators compute the proper address for one particular address pattern. This address pattern is the one used by ordinary serial computers. That is, each higher memory address refers to the "next" word in memory. With this pattern, the parallel memory will be completely compatible with all the constructs of present programming languages. In particular, Fortran Equivalence, Common, and array parameter passing can be implemented in the same way as on a conventional computer.

The memory organization yields an AE centrist vantage point. That is, the first logical element of the vector goes to the first AE, etc. There is nothing special about this approach beyond a certain comfortableness in thinking.

> A maximum speed of 50 million floating-point operations per second.

The important point is the following: As long as the same set of storage equations is always applied to the data, from the first time it comes in as I/O onward, then the storage pattern is completely invisible to the user. This applies to program dumps, etc., as well. The hardware always obeys the same rules.

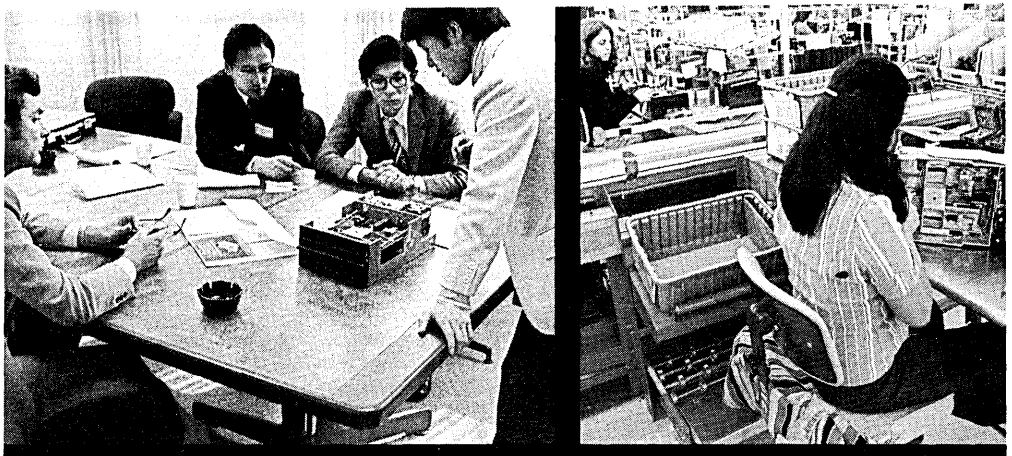
BSP memory diagnosability is also an important feature. Instead of placing the Hamming code generators, detectors, and correctors on the memories, as is usual, they are placed at the AE's. This way the entire loop, from the AE's to the memory and back again, is Hamming code corrected.

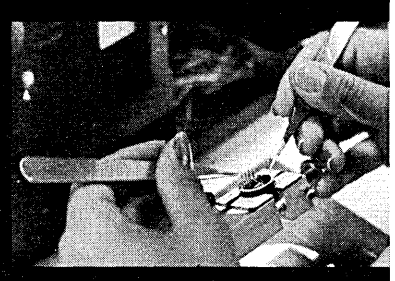
A side benefit of the conflict-free access hardware is that control information can be buried in the Hamming code is such a way that failing control elements are detected and identified. Hence, not only are memory elements and data paths checked, but control logic is checked as well.

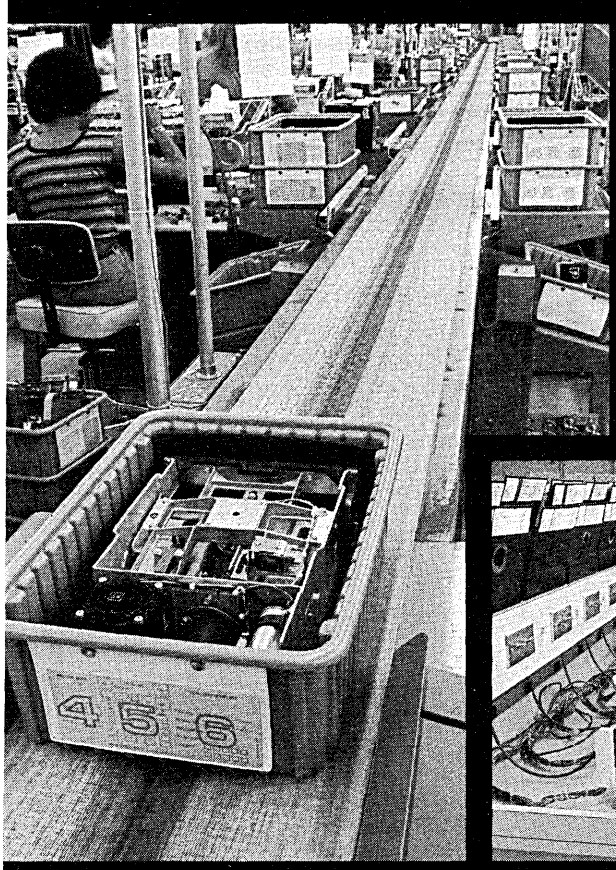
A Fortran machine

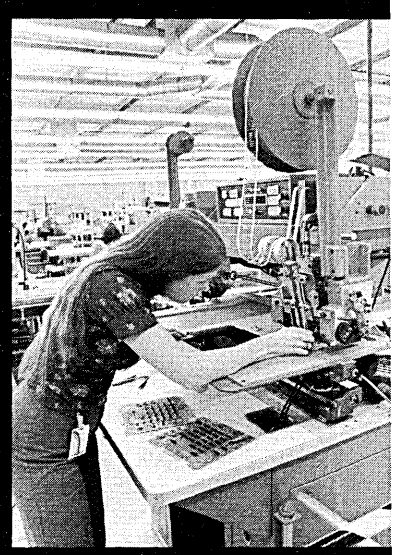
In keeping with Burroughs' policy of designing standard product computers as language processors, it was determined early in the BSP design cycle that the machine would process assignment statements ($A = B$, $A = B * C$, etc.). Arithmetic assignment statements are the basic ingredient to most numerical processing. This impacts everything. The templates were designed as memory to memory entities because assignment statements are memory to memory statements, for example.

In the case of Burroughs' stack machines, such as the B 7800, the source language translates almost directly into object language with little need for run-time processing to aid in the descrip-









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CIRCLE 62 ON READER CARD

tion of the object language. Hence, in the B 7800 this run-time processing is automatically invoked in the hardware.

It was not possible to take the same approach with the BSP. The most general BSP parallel processor construct is a sequence of vectors, essentially a nested pair of DO loops. Because, in the general case, all of the parameters used to describe an operation could be run-time variables, so much language processing is involved that it makes no sense to try to do it in automatic hardware. A moment's reflection will show this—parametrized descriptions of operations on sets of vectors, where the parameters are computed at run time, involve a great deal of run-time processing to convert the parametrized source language into object code.

This general consideration defines the need for the SPU as well as the point in the processing sequence at which the SPU passes instructions to the parallel processor control unit. This point is where run-time source language processing ceases and all subsequent vector operation processing can be done in a uniform way. From a language point of view, this point is the time at which actual parameters can be inserted into a formal assignment statement.

Hence, we see that the BSP is a Fortran language processor.

The Scalar Processing Unit

The SPU is a register-oriented processor operating on an 80nsec cycle. It has 16 48-bit wide general purpose registers, a complement of numeric and non-numeric operators, and an instruction processor which includes content addressable memory-controlled in-buffer looping capability. The unusual features of the SPU relate to subroutine entry and to instruction issue to the parallel processor control unit.

In addition to the 16 general purpose registers there are 16 120-bit vector data buffers (VDB's)—120 bits is the maximum width of any parallel processor control unit instruction.

The SPU uses a push-down stack for subroutine linkage. The data which goes on the stack is the return address and a register address translation table. The 48- and 120-bit registers are referenced via an address translation unit. This capability assists in parameter passing and in the minimization of register saves and restores during subroutine entry and exit.

A second stack is maintained for processing in the SPU executive state. Control memory is divided into the executive area, user read/write area, and user read-only area. The user stack is at one end of the user read/write area.

And, of course, the software

Wherever possible, the BSP takes advantage of existing B 7700/B 7800 software. Necessary additional items are a small operating system to run on the SPU, a BSP compiler with the associated linkage editor and intrinsic functions, and the diagnostic package.

Perhaps the most interesting aspect of the SPU operating system is its facility for staying out of the way. For example, as has been mentioned, I/O is done in user mode. Assuming I/O is overlapped by computations, the SPU spends less than a microsecond in managing a transfer. Overlay management and chaptered file management are the major operating system functions performed for a running program. The hardware assists in overlay management by allowing "presence" bits in a memory control word to be assigned to each phase of a program. Hence, the operating system is dropped into automatically, if and only if the program attempts to enter a routine which is not present in BSP memory.

> Perhaps the most interesting aspect of the SPU's operating system is its facility for staying out of the way.

The Fortran compiler has a number of interesting features too. The most important is the vectorization pass over the program, which converts serial Fortran into vector constructs. The vectorization pass is a more complete parallel analysis of a program than previously has been inserted into product compilers. The usual approach has been to attempt to vectorize only loops which did not contain branches or cyclic dependencies. But if an analysis of the dependency shows it is equivalent to a linear recurrence (the $A_1 = A_{i1} + \ldots$ etc.), then appropriate vector instructions are issued.

These types of parallelism are the most frequent which can be detected using rigorously defined algorithms. There are some important cases, such as when a user has undertaken to manage indices, for which only ad hoc vectorization techniques are known. These will be vectorized as well, but clear-cut statements about the extent of vectorization are not possible.

The Fortran compiler also contains the facility to directly express vector and array constructs. Assignment statements like $A = A + 1$, where A is an array, are permitted. Index expressions are permitted on array identifiers. For example, if A is a 3 dimensional array, then A (10:50:2, 6, 1:10) would refer to a 21x20 array which is a subspace of A. Clearly, this reference need only generate a descriptor, no actual subset of A is generated.

Another interesting special feature of the compiler is a source code regenerator. This regenerator creates standard Fortran statements. Hence, a programmer can indulge in the use of array processing extensions beyond Fortran, but retain full compatibility with standard Fortran.

Then, for maintenance, standard B 7700/B 7800 terminals or network connections can be used to run BSP diagnostics. A field engineer can invoke a sequence of routines which will result in a printout of suspect IC locations. He can replace the suspect IC's and bring the BSP back up again, if it is down. This concept is extended to the ability to use home office BSP engineers on-line in the diagnostic process. Thus, the field engineer and the customer are assured prompt system recovery.

For the long haul

The BSP is Burroughs' commercial entry into the large scientific processor marketplace. It is interesting in its similarities of objective to Burroughs designs in other areas, but has been based on a new perception of the marketplace. We feel it proves the feasibility of creating a SIMD architecture which can survive several design generations without forcing generation-to-generation conversion problems onto the user. It exploits the science of parallelism at a time when demonstrated demands for speed make the use of parallelism essential. ❋

For several years, Dr. Jensen was an associate professor of Applied Science at the Univ. of California at Davis. Then he worked for a year at the Lawrence Livermore Laboratory on fitting LLL's computer applications to the Control Data Star supercomputer, after which he joined Burroughs in 1973 to participate in the design of the Scientific Processor.

Although still with Burroughs when he drafted this article, he has recently gone to the Los Alamos Scientific Laboratory to become an alternate division leader for the Computer Div.

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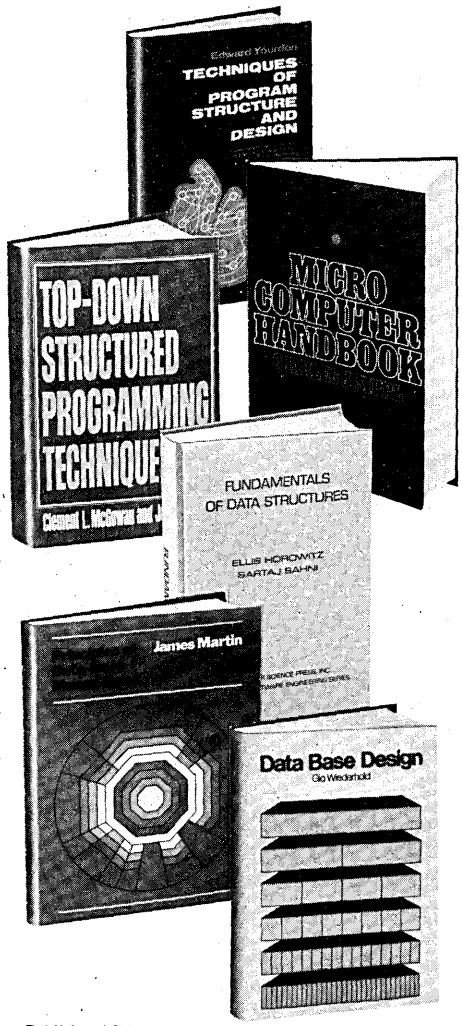

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Networks

IBM's Offering of SNA: Some Find it a Success

Of 15 users surveyed, six say it will pay for itself in two years.

The target of heavy criticism, IBM's System Network Architecture to date has not been one of your basic success stories. Users say it is terribly complex, that there are desired pieces of hardware and software still unavailable, and the costs associated with it are horrendous. There have been estimates that fewer than 100 installations worldwide are running under the concept.

But a study just completed and based on discussions with 15 accounts that have been operational with SNA for anywhere from six to 24 months shows a unanimous agreement that the decision to go to SNA was a wise move. Six of the 15 companies figure the benefits gained from SNA would pay for the entire development effort in two years, and the remainder said it would be paid for in five years.

Further, researchers at SBS Publishing in San Jose, Calif., say their initial estimate of 50 operational SNA users in the U.S. was off by at least a factor of four. They say IBM now claims there are a thousand. "I could easily believe 400," says a spokesman for SBS (formerly Small Business Systems).

Everyone interviewed for this study agreed that the network architecture is complex. It's frustrating at the beginning and takes about a year to learn. But the concensus was that after you understand it, after you get to know what you can do with it, it's worth it. Of the 15 host sites selected for examination, two or three had been operational with SNA for six months, an equal number for two years, and the remainder for 12 to 18 months. Most of them, thus, had gone through the learning curve, were in production with the applications that took them to SNA, and now were looking at the second, third, or fourth applications. Many had 5- and 10-year plans.

Going to ACF

And many are going to the Advanced Communications Function, having two or more mainframes as the hub of the network. One user, a large manufacturing concern, has plans for three 303Xs at the hub of the network, a second tier comprised of seven 158s at the divisional level, and a third tier consisting of 3790s or System/34s supporting remote crt terminals. Most of the sites interviewed were looking at implementing the hierarchical approach over the next 10 years. Two or three also mentioned plans for a 3850 mass storage system at the host site, along with 3800 printers.

In addition to the benefits of being able to put up on-line applications in a network environment, which may be difficult to put a dollar figure on, one user claims to have had a $2,000/month savings in communications line costs that are directly attributable to SDLC. Another says it will implement electronic mail in a few years, and the savings just in the cost of shuffling paper would pay for SNA. That would be an extra benefit because they will have paid for it earlier with their applications.

Retail and banking

The biggest paybacks at these installations occurred in applications benefits stemming from the ability to use specific SDLC terminals. The largest percentage of users were in the retail/wholesale and banking/financial industries. For these people IBM provides applications-oriented SDLC products, such as the ATS banking terminals and the 3600 series of retail and POS terminals. Between the availability of these products, which facilitate the development of new on-line business functions, and the fact that SNA and SDLC make it easier than with bisynch to network these types of transactions, the dollar savings resulting from those new applications are said to pay for the costs of SNA.

One of the first lessons these people learned after implementation is the requirement for more memory; this is followed by a recognition of the need for a larger mainframe. But apparently there's no hard and fast guideline as to the cpu load one can expect from the use of VTAM. This varies considerably between large and small networks, probably because of the types of on-line applications running, the number of data base accesses performed, the number of terminals out there, and just the total mix of applications.

But the need for more hardware stems not solely from VTAM's voracious appetite for real memory. Users also tend to implement more on-line applications from terminals, and that uses more processing power, more core, and requires more buffering. Also, it is said, the 3705 front end doesn't offload the cpu as effectively as IBM would have one believe, leaving VTAM to do a lot of that buffering for the controller.

Marketing tool

This helps to explain the comments of an analyst at the research firm. "SNA is not just a tool in the hands of the dp user," he says. "It's also a marketing tool of vast significance in the hands of its manufacturer, because SNA inevitably sells add-on equipment for IBM." It sells mainframes, it sells memory in the 370X controller, it sells a DBMS if one is not already in place—and that requires more memory and more buffers—and VTAM sells a whale of a lot of memory. Said one respondent, "VTAM is a core pig." Some people with SNA running for less than two years had doubled main memory twice.

Surprisingly, the 3790 was not badmouthed as much as one would have expected, although some people are thinking of the Series/1 mini as a substitute for it. On the other hand, several of the large installations were happy with the 3790 because while it provides the users with the impression they have processing power and autonomy, the home office knows they aren't giving those remote users anything. "It's a con game and they admitted it," reports the researcher. "It's a compromise, really, the users getting some horsepower while central authority is being retained at the host site. And I think you're going to see a tremendous spur in sales of the 3790 because of this."

Indeed a couple of installations intend to order 10 to 20 of them, in some instances replacing 3271 clusters with 3790s, thereby gaining local storage, local printing, and some local processing. In addition, if the host mainframe goes down, the 3790 would continue to service its terminals while the 3271 controller would follow the host down.

Memory expansion being in the interest of the vendor, it isn't surprising to learn from this study, priced at $149, of a 145 user who started with one megabyte and expanded to the full capacity, two megs, within one year. One dp honcho said anyone running SNA with a 145 or 155 is wasting his time, no matter how

small his network; the absolute minimum was said by him to be a 158 or 168. That user started with a 155, soon went to a 158, and has a 303X on order—which is what the user should've gone to directly from the 155.

In a bind

Many SNA users making this mainframe upgrade are finding themselves in a bind created by late deliveries on 303Xs. So they're going to a 158 or 168 on an interim basis. Early SNA users were found to have seen the need for a larger mainframe and put in their orders for their 303X when it first was announced by IBM; others find they can't get delivery until mid-1980 and find the need now for that interim machine.

At two of the installations contacted, the Amdahl mainframe was mentioned. One said they were going to order an Amdahl, another said they're studying this move. Others, asked about hardware from PCM vendors, allowed as to how they'd prefer to get about two years' experience with SNA first to achieve a smoothly running network, to get things stabilized, including applications, before looking to trim costs.

Thus it is being conjectured that IBM is downplaying the number of host processors running SNA—just to delay the entry of independent terminals manufacturers to this market.

Useless interim trips

But it also looks like IBM is deliberately leading SNA users through a number of useless interim steps on their way to that stabilized network status. The vendor is not painting the entire picture to users, some say, allowing the users to make gradual one-step upgrades when the account salesman knows the user should be moving up two steps. All users surveyed agreed they had underestimated the demand for system resources from new applications and functions at the terminals.

Most users had remote terminals installed before going to SNA. But they find that with SNA and SDLC, compared with bisynch, the demand is much greater with their new applications and functions, not only from the field but also from the hub. And they're finding that the number of applications being implemented is double what was initially projected.

Those having terminals from independent vendors indicated that these suppliers will have to provide a transparent SDLC capability. It appears that SNA users are moving toward becoming a vanilla shop where everything is compatible, where the technical support group and everyone else can concentrate on applications, instead of trying to fit together a lot of odd-shaped pieces.

"Point blank, SNA helps dp managers keep their jobs," remarks an SBS analyst.

Not my fault

The managers are counting on an SDLC terminal working under SDLC, and IBM making fixes when it doesn't, he adds. They're falling back on IBM's reputation for support and the ability to say to upper management, "I made the wisest decision because I went with the biggest guy who knows the most. And if something goes wrong, it's definitely not *my* fault . . ."

Says the analyst: "It's a beautiful cover."

As can be expected, users' complaints were legion. Most of them said it hasn't been a piece of cake. A retailer with the 3650 POS system in his department stores is pleased with the terminals, but the control units in the stores have not made the managers happy. They require a full-time operator, and each time there's any problem or a change in operating system the store manager must be present—for security reasons. He reportedly must be awakened at home and must come down to the store for perhaps 20 minutes during the fix or changeover.

There also have been problems interfacing 3790s to VTAM and problems with the interface between VTAM and the operating systems. But most users agree that VTAM, compared with the situation two years ago, is beginning to look solid. The same reportedly is true with NCP on the controller, and no one has had problems with SDLC. Most of them also gave IBM exceptionally high grades for service, figuring they got better service than they would have under bisynch. One user, however, said IBM has been nowhere near as responsive as he had expected. Perhaps, he sighed, he was spoiled by RCA.

Still, one user remarked, "If you're doing business with IBM, it's not just a question of *are* you going to go to SNA. It's really a question of *when.*"

—Edward K. Yasaki

USER EXPERIENCES WITH IBM'S SYSTEM NETWORK ARCHITECTURE

User	Before SNA	Current SNA cpu	Number of SDLC Terminals	Average Number Documents/Day	On-Line DBMS	VTAM Load %	SNA Load %
1	No change	1MB 145	100	75,000	No	40	
2	No change	1MB 145	25	5,000	Yes		25
3	1MB 155	2MB 155	825	165,000	No	60	
4	1MB 145	2MB 155	58	25,000	Yes		60
5	1MB 158	3MB 158	78	60,000	Yes		50
6	145	3MB 158	180	75,000	Yes		75
7	1MB 158	3MB 158	45	10,000	No	40	
8	No change	3MB 158	100	30,000	No	50	
9	No change	2MB 158	65	30,000	Yes		50
10	No change	2MB 158	50	40,000	No	50	
11	1MB 158	2MB 158	12	5,000	Yes		70
12	2MB 168	4MB 168	31	5,000	Yes		40
13	3MB 168	5MB 168	450	100,000	Yes	35	
14	4MB 168	6MB 168	800	130,000	Yes		100
15	3MB 158	8MB 168	825	200,000	Yes		50

Memory and mainframe upgrades necessitated by the move to SNA, some of them interim steps, are indicated in a recent study of 15 users. The percentage of systems utilization attributable to SNA and VTAM is indicated in the last two columns.

Antitrust

Market Share or Profit?

Question from government case is expected to come up in Memorex trial.

Among the 3,000 documents the Justice Dept. has introduced in its antitrust trial against IBM is a memo written by Thomas J. Watson, Jr., then chairman of IBM, to his brother Arthur. It said in part: "I think the main aim of this company must be to protect and expand our position in the marketplace, and this must be a consideration well above that of profit."

It is the contention of the prosecution that if a company with dominant power in an industry pursues market share in lieu of profits it then can be presumed to intend to maintain a monopoly in violation of antitrust laws.

In the most recent of 19 private suits against IBM since the Justice Dept. filed its own suit nine years ago, Memorex Corp. last month in San Francisco seemed to be following the same strategy. Its lawyer, John Endicott, said in his opening statement that when Memorex became a force in the peripherals industry around 1970, IBM began to take serious note of the company and made a "major study" of it and later organized an "IBM task force" to combat the company's threat.

Endicott said the study wasn't a normal business practice, "but the kind done only if you plan to buy a company or destroy it."

Memorex' antitrust suit against IBM asks for $1 billion in triple damages, and charges the huge computer company with monopolizing the field as a whole, and particularly peripheral products from 1968 to the present.

Price manipulation

Endicott, from the Los Angeles law firm of Gibson, Dunn & Crutcher, told the jury they would be presented evidence that showed IBM had manipulated its prices to force others to also lower theirs to the point where the competition could not remain profitable. He charged IBM with redesigning the interfaces to disc drives, not only thwarting the plug-compatible peripheral manufacturers, but also allegedly tying in the sale of one product with the mandatory acquisition of another.

> A jury of six men and six women with no alternates was all that remained as the first witness was called by Memorex.

He also said IBM in early 1970 formed a peripherals task force "to decide what to do about the challenge presented by the emergence of these plug-compatible competitors," and said this group was the source of the "acts of which we complain in this action."

Armed with a detailed computer model of Memorex, Endicott charged, IBM "studied how Memorex would plan to raise capital, where it would go for it. They studied how long they (Memorex) could stay in business with how much capital, and that is what this lawsuit is about.

"Memorex . . . got itself in trouble because it tried to be too much of a high flyer . . . It tried to break the bank for those favorite investors who were on the inside. And it counted on doing that by pulling a financial shenanigan it was caught in the act of doing. And as a result

THE JURY: six men and six women with no alternate

Courtroom drawings by Bill Robles/Joan Lesser Etcetera

JUDGE SAMUEL CONTI:
"The case might last only 12 days."

of that, its credibility in the financial community was put in serious doubt . . . And this lawsuit . . . is not based upon damage or injury unless the injury be the fact of having to meet competition . . ."

That was the way IBM's lawyer wound up his opening statement to the jury.

Denies wrongdoing

IBM, as it did in the antitrust suits brought unsuccessfully against it earlier by Telex, Greyhound, and CalComp, denies any wrongdoing in the marketplace. Its attorney, Patrick Lynch, defended IBM by saying ". . . the only way in the competitive system you can be profitable is to be competitive."

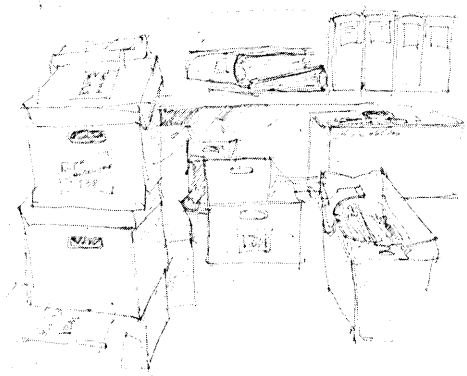
Memorex attorney John Endicott charged that IBM had monopolistic power in the relevant markets, that it had the power to exclude companies from those markets, and that the computer giant did unnecessarily exclude such competitors.

Throughout all of its antitrust cases, IBM has maintained that all it had done was pursue good competitive practices.

IBM attorney Lynch denied there was anything illegal in what IBM did and charged that, "Memorex did not manage itself adequately." He charged the former management of Memorex with running the company for their personal gain "and for the personal gain of some inside investors," explaining that the firm's stock at one time reached a price of $170 a share. It was hovering around $28 as the trial opened.

Lynch also pointed to Memorex' formation of ILC Peripherals Leasing Corp., one of the plaintiffs in the suit, as a cause of damage to the reputation of the parent company with the financial community. Memorex' practice of reporting sales to this affiliate in 1970, before the affiliate was capitalized, was questioned by a number of accountants. This, Lynch alleged, was what made it difficult for Memorex to raise the capital it required.

A jury of six men and six women with no alternates was all that remained as the first witness was called by Memorex. Judge Samuel Conti of the U.S. District Court excused one juror on the day opening statements were to begin because the juror's employer was concerned about the potential length of the trial. A second was excused just before the first witness was called because of failure to report that day. At this rate, the judge quipped, the case might last only 12 days. Its duration, however, is expected to be counted in months.



"Fifty million pieces of paper."

Six but not five

Judge Conti later said he would allow the jury to dwindle to six and still would continue the trial. He said he only would continue it with as few as five, the lower legal limit, with the consent of both parties.

Before the jury filed in on the first day, the judge had said he would have preferred that the trial not be a jury trial because of its technical nature, "but if that's what you people want . . ." A trial judge in deciding a case has to explain every part of his decision, as did Judge Sherman Christensen in the Telex case. His decision was overturned by an appeals court. A jury doesn't have to explain, which is why a jury verdict is considered harder to overturn.

Judge Conti made one decision before the jury had filed in the first day. IBM attorney Lynch objected to introduction of a document Memorex had said it was going to use in its case. It was a memo alleged to have been written by the laboratory director of IBM San Jose but never was sent. Purportedly depressed about things at the time, the director is alleged to have complained in the memo to top management that the price set for a specific product was much higher than manufacturing costs warranted. Lynch argued that a lab director is not necessarily an expert on manufacturing costs. The judge agreed and disallowed the document.

The study wasn't a normal business practice, "but the kind done only if you plan to buy a company or destroy it."

The actual number of pieces of paper which have been filed in the case since it was begun in December 1973 is close to 50 million. Some 20,000 exhibits already have been marked.

Memorex attorney Endicott had comments on both the IBM opening statement and the judge's instructions to the jury. He said the judge's instructions included the term "predatory pricing." That phrase, he said, would not be used by Memorex or any of its witnesses. The

judge nevertheless chose to leave it in his opening instructions which earlier had been reviewed by lawyers for both parties to the suit.

Defining the law

Of IBM's opening statement, Endicott said Lynch was "trying to define the law."

"Don't worry," he was advised by the judge. "When the time comes, I'll define the law." The judge categorized Lynch's opening statement as rambling and something of a combination opening and closing statement. "I often got tied up in transition."

The Memorex case is one of the most significant of the "West Coast cases," not only because it is one of the largest private lawsuits to be tried, but because of the recent ruling by a federal appeals court in San Francisco that Greyhound Computer Corp.'s monopoly complaint against IBM should be retried before a jury.

The first of the West Coast cases, California Computer Products vs. IBM, ended in a directed verdict last spring for IBM, but CalComp is appealing. A CalComp lawyer said the Greyhound decision breathed new life into the CalComp appeal.

Greyhound in 1972 had charged IBM with breach of contract and violation of antitrust laws, and the judge, Walter E. Craig, ruled in the jury trial that Greyhound hadn't made a case. Last summer the appeals court agreed with the judge that IBM hadn't breached a contract with Greyhound, but it did agree there was sufficient evidence for a jury to determine if IBM had violated antitrust laws.

> "And this lawsuit . . . is not based upon damage or injury unless the injury be the fact of having to meet competition . . ."

Supreme Court review

IBM asked for a Supreme Court review of the decision, but the court last month refused to interfere with the ruling. The computer colossus, in urging the high court review, said the Greyhound case ruling would affect six of the other private suits which are under the jurisdiction of the same appeals court. IBM said that because of the appeals court decision these cases "will go forward at almost unimaginably high cost to litigants and courts—all threatened by a totally erroneous set of legal standards."

Throughout all of its antitrust cases, IBM has maintained that all it had done was pursue good competitive practices, exercising "superior skill, foresight, and industry" in one of the "most vigorously competitive industries" in the U.S.

Its chairman, Frank Cary, referring to the two and a half year old Justice Dept. trial, complained recently of the "psychological burden" the trial has had on the company's 300,000 employees. He said these employees "have had to read in the newspapers week by week all of the unproven charges the government has made against us. Although it hasn't affected our operations, it has been a psychological burden."

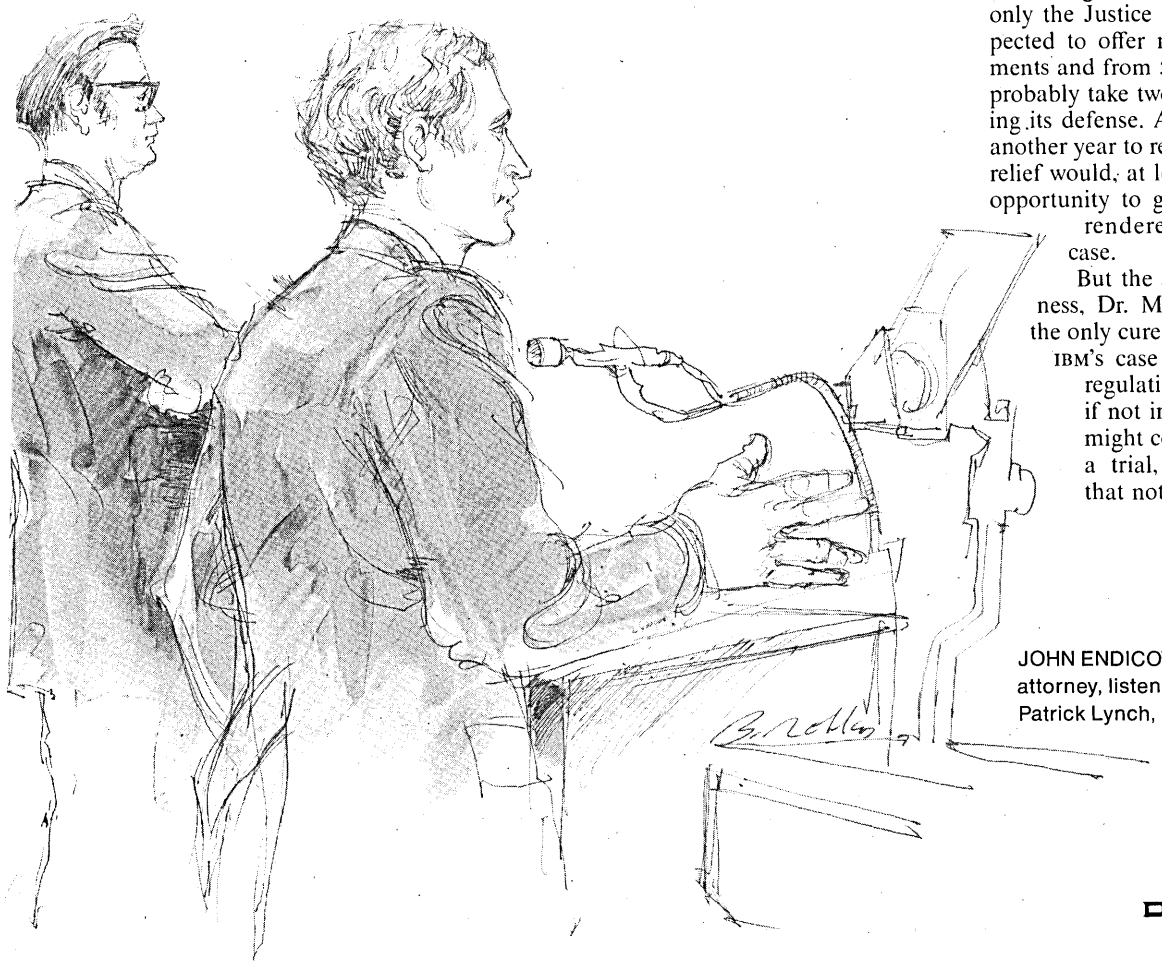
In December, IBM filed a motion for mistrial in the government case. In a 66-page memorandum with ten appendices, the company said the government had changed its market definition claim through the testimony of Dr. Alan K. McAdams, the Justice Dept's chief economic advisor for the case. It claimed McAdams' definition took on different characteristics from different time periods.

Interim relief

The government, actively considering asking the trial Judge David N. Edelstein for interim relief, called the IBM motion a "sham" that is "wholly devoid of merit." It said the government has not changed its position on market definition and that "government counsel have, repeatedly and unequivocally, stated (this)."

Some observers think that if the government asks for interim relief, Judge Edelstein might be disposed to grant it. The case is in its ninth year and the trial, which began in May of 1975, has heard only the Justice Dept.'s side. IBM is expected to offer more than 5,000 documents and from 50 to 350 witnesses and probably take two to four years presenting its defense. And the judge will take another year to reach a decision. Interim relief would, at least, give the judge the opportunity to go on record as having rendered an opinion in the case.

But the Justice Dept.'s key witness, Dr. McAdams, has said that the only cure for monopoly power in IBM's case is divestiture, because regulation would be ineffective, if not impossible. IBM, in what might come to be a trial within a trial, certainly would fight that notion.



JOHN ENDICOTT (left), Memorex attorney, listens as IBM attorney, Patrick Lynch, attempts to make a point.

Ross Perot Rides Again

Resurgence of EDS may be somewhat precarious, however

Four years ago last month H. Ross Perot, the man *Fortune* magazine once dubbed "the fastest, richest Texan ever," ordered a plane in New York and flew home to Dallas, walking away from one of the most spectacular failures in the annals of Wall Street.

Ever since, Perot, president and chairman of the board of Electronic Data Systems, the facilities management company he founded in 1962 with an investment of $1,000, has been maintaining a low profile, sticking close to the 178-acre EDS complex in Dallas and quietly rebuilding his corporate empire.

And now with revenues up $31 million (23%) over last year and total revenues expected to exceed $200 million in fiscal 1978, EDS seems to be back on the track.

> Perot seemed on top of the world, but by 1973 the bottom would drop out of the stock market.

The company has bolstered profits and added new business both domestically and internationally. Moreover, a number of analysts and sources close to the firm speculate that Perot, now 47, may be ready to revert to the wheeling and dealing style that characterized his operations during EDS' heyday.

Billionaire on paper

Perot's fortunes—and those of EDS—have fluctuated widely over the years. At one point in 1970 EDS stock was selling at more than $160 a share, and Perot, on paper at least, was worth more than a billion dollars. Further, the controversial former IBM salesman had gained widespread attention because of his involvement in the national scene.

During the Vietnam war Perot founded something called United We Stand, an organization run largely by a mysterious ex-marine and then EDS employee named John Halman and purportedly set up to help free American prisoners of war. Perot himself spent $2 million in a much-publicized attempt to deliver 26 tons of Christmas presents to POW's in North Vietnam in 1970 as part of the UWS effort.

He could also boast close ties with the Nixon Administration. Two top EDS executives, then president Milledge A. Hart and v.p. Thomas J. Marquez, gave $87,833 and $111,685 (about three times what Marquez made at the time) respectively to the 1968 Nixon campaign, while Perot served as a member of the Nixon foundation, an organization established to organize Nixon's pre-presidential papers—papers that Nixon would later donate to the National Archives, taking a $576,000 tax deduction that the IRS later disallowed.

And Perot himself contributed $450,000 to a fund for the 1970 congressional campaign run by Herbert W. Kalmbach, Nixon's chief fund raiser.

Bottom dropped out

Perot seemed on top of the world, but by 1973 the bottom would drop out of the stock market, with EDS stock plummeting to a low of $15 a share. Additionally, his ill-fated attempt to provide computer services to the brokerage community and in the process revitalize Wall Street in the name of the national interest ("I feel strongly that everyone ought to make every contribution he can to the country," he told a reporter at the time. "I'm best able to make my contribution in the area of business.") aborted dramatically with the collapse of two brokerage firms he had taken control of and realigned, DuPont, Glore Forgan and Walston & Co. Perot had reportedly invested $70 million in the two brokerage companies, which together represented the third largest concern on Wall Street, before DuPont Walston declared bankruptcy.

The Texan's troubles were mounting on other fronts as well. In 1973 he lost out on the $30 million a year New York Welfare and Medicaid contract when Social Service officials charged that then Gov. Nelson Rockefeller had personally intervened on Perot's behalf after the EDS bid on the preliminary study contract had already been rejected.

Hitting repeatedly on the Nixon/Perot/Rockefeller (the governor had run Nixon's 1972 drive in New York) link, critics of the EDS award cried political cronyism, and in the heat of their accusations the award to Perot was dropped.

Meanwhile, EDS contracts in West Virginia and Ohio were under investigation by the U.S. General Accounting Office. The contracts, on which EDS had been the highest bidder, had been personally approved in 1972 by Nixon's Secretary of Health Education and Welfare Elliot Richardson.

Under increasing scrutiny, Perot would soon return to Dallas having apparently had enough of the limelight. As suddenly and dramatically as he'd appeared on the scene in the '60s, Perot dropped from view. And EDS, once the glamor stock of the computer industry, was just another "cat and dog" selling for a few dollars and change.

Itchy feet?

"Is Mr. Perot getting itchy feet?" Value Line, a stock analysis service that follows EDS, asked in a recent report. The advisory firm noted that EDS had significantly improved its capital position and speculated that Perot "may be in search of new acquisition adventures." Other sources view the appearance of EDS v.p. Tom Marquez at the annual Computer and Communications Industry Assn. meeting last fall in Los Angeles as an indication that the company may be coming out of its self-imposed shell with an eye to making an acquisition in the

service area. And there's talk in Dallas that Perot is seriously weighing a move into the microcomputer market.

EDS watchers also note that Morton Meyerson, who in effect ran DuPont Walston for Perot and reportedly was in Perot's dog house after the collapse ("No one would talk to Meyerson or his secretary for a year," a former EDS executive claims.) is back in Perot's good graces. This is borne out by the fact that Meyerson received a $50,000 bonus for his efforts in fiscal 1977 on top of his $100,000 salary. That ties him with another v.p., William Gayden, as the highest paid executive in the firm. (Perot only pays himself $68,000 but he still owns some 7.4 million EDS shares.)

Then there's the election of a new EDS board member, William P. Clements, Jr., former U.S. deputy secretary of defense and now chairman of the board of FEDCO, a major oil drilling Dallas-based service firm with extensive interests in the Middle East.

Flush times back

These events are a surface indication that flush times have returned at EDS. After several lean years that followed on the heels of the DuPont Walston debacle, the company landed some big contracts including a four year, eight month agreement to underwrite the state of Texas Medicaid program. Additionally, EDS recently entered into a far-reaching agreement with Iran where, incidentally,

There's a surface indication that flush times have returned at EDS.

FEDCO, EDS board member Clements firm, also does a major share of its business. The agreement calls for EDS to establish and operate a national health insurance and social welfare data processing system for that country while recruiting and training Iranian personnel in the dp area.

Even by Iranian standards the agreement, which involves an EDS subsidiary and an EDS co-venture with an educational foundation headed by the Shah, seems highly lucrative.

Though EDS does not specify exactly how much the contract is worth in its Securities and Exchange Commission filing, one can get an idea of what's involved by looking at the fees being charged to recruit and train Iranian personnel.

Charges for training systems engineers, for example, amount to $3,000 a man-month; computer operators, $2,400 a man-month; and clerical supervisors, $2,000. Next year, the minimum requirement is for 675 SE's, 755 computer operators, and 80 clerical supervisors.

EDS' resurgence may be somewhat precarious, however. The social security organization of Iran (the "SSO") can cancel the national health insurance agreement at any time upon payment of certain termination expenses. And under the Texas agreement, EDS, instead of charging a fee for its services, has to pay all premiums and administrative expenses before pocketing whatever remains—terms that could prove a major millstone to the company, Value Line speculates.

And last August, EDS had $42.5 million in contracts from the state of Massachusetts cancelled when it was discovered that two members of the state's contract selection committee were principals of a Wakefield, Mass., consulting firm called Sci-Tek involved in a joint venture with EDS.

Moreover, several of Perot's earlier problems continue to plague him. On July 1, 1975, the Trustee in Bankruptcy of DuPont Walston filed a $90 million suit against Perot; William Gayden, who had been on the board of Walston before joining EDS; Morton Meyerson; former EDS president Milledge Hart; and several other principals in EDS subsidiaries and shell companies.

The suit is complicated. But basically it alleges that Perot, aware that DuPont, Glore Forgan, his initial Wall Street venture, was about to go under because of sustained losses, illegally took control of Walston and Co.—then a viable and respected firm. Subsequently Walston was saddled with DuPont's liabilities, while its own capital was siphoned off deliberately by Perot's group through excessive computer charges and various financial vehicles.

Acting on behalf of Nella Walston, widow of the firm's founder, and other embittered former Walston principals, the Bankruptcy Trustee asserts that prior to the realignment agreement, Walston had more than $30 million in assets.

When it filed for bankruptcy not long after, its assets were less than $2 million and creditors claims amounted to more than $75 million.

The case has moved slowly with EDS seeking to have it settled through arbitration and the Walston interests holding out for litigation in a jury trial. EDS won an initial victory when Bankruptcy Judge Ray Babitt ruled for arbitration. The Walston interests subsequently appealed, with Babitt's ruling being reversed last year by the U.S. Court of Appeals.

Finally, EDS asked for a hearing by the U.S. Supreme Court and was turned down. Now the case will go before a jury and the same judge who initially was overruled, Roy Babitt.

Schaefer suit

Perot is also embroiled in another suit (April 1977, p. 154) in which the F & M Schaefer Corp. alleged EDS was negligent in the design and implementation of a system it developed for the brewery concern. Schaefer wants $115 million in actual and punitive damages while EDS has come back with a countersuit seeking $19.3 million.

The jury trial of the case, scheduled to kick off in mid-April, will feature Ross Perot's videotaped testimony which has

Schaefer trial will feature Perot testimony on videotape.

already been obtained by Schaefer attorneys in Dallas. Interestingly, the brewer's case will focus closely on certain Perot activities during EDS' boom years, particularly 1969.

At that time, Schaefer charges, Perot wanted to unload a major share of his EDS stock (150,000 shares) at a price well above the mid-June 1969 market level of $52 a share.

To get the above market price, he had to establish that EDS' revenues would continue to double each year as they had in the past. Consequently EDS entered into a seven-year contract with Schaefer for a system it allegedly never intended to build, and claimed all seven years of the Schaefer revenue within the first 22 months of the contract, Schaefer charges.

Further, the brewer alleged that "by its fiscal year ended June 30, 1971, when EDS had claimed all the revenues it was to receive from development of the system for Schaefer (on the theory that it had done all of the work, even though it had not been paid yet), EDS was not even close to having completed systems development for Schaefer. Moreover, the amount of revenues claimed bore absolutely no relationship to the work EDS actually did during the period it claimed the revenue. Needless to say, all of these facts were hidden from EDS' auditors, Arthur Young & Co., who were told that 'the conversion was completed' (meaning the system had been developed for Schaefer).

"In fact," the Schaefer attorney concludes, "the signing of the Schaefer contract had met its intended purpose—within two weeks thereafter, H. Ross Perot entered into a private agreement for the sale of 150,000 shares of EDS stock at a price $11 per share greater than that then being offered publicly . . . As a result, Perot received $9,450,000 for the sale of his stock."

Whatever the outcome of the Schaefer trial, it will mark the return of H. Ross Perot to New York—on videotape at least.

—Laton McCartney

New Customer, New Capability

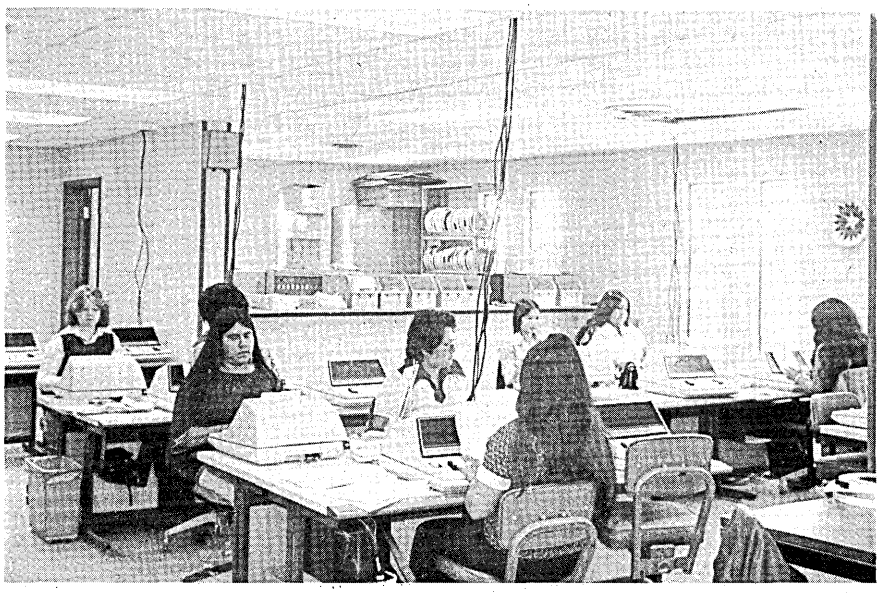
The only data processing firm majority-owned by American Indians (Sept. 15, 1971, p. 7) is growing.

FM4 Gila River Corp. late last year outgrew one 1,200 sq. ft. facility on the Pima Maricopa Indian Reservation and moved into another, 32,000 sq. ft. in size. The company had grown from 21 employees when it was founded in 1971 to 52, most Pima and Maricopa Indians. And the data entry firm had acquired a major new customer which led to development of a new capability.

The customer is Petroleum Information Corp. (PIC) of Denver, a subsidiary of the A. C. Nielsen Co. PIC compiles and furnishes technical data for oil and gas exploration. "Acquiring this account," said Roger B. MacKenzie, FM4 president, "meant FM4 personnel had to become proficient in preparing and encoding information for keypunching onto tape from raw data sources, such as oil and gas well scouting reports. This new capability has greatly expanded the company's potential market."

John L. Stout, manager of PIC's Well History Control System, said, "FM4 converts oil and gas well drilling history from scouting reports to computer tapes. We send FM4 the reports on microfilm. They analyze them, extract the pertinent well history from each one, and transcribe it to coding sheets for data entry conversion. Then they do the conversion and send the tapes to us in Denver. This requires that their personnel understand petroleum industry terminology so that they can extract and process from crude reports just those items of information that we require. Selected FM4 operators learned encoding from our people in Denver and Houston and went back and trained others. At the end of a 45-day trial period, the FM4 operators had surpassed all expectations."

FM4, founded as a minority company, is 58.29% owned by its employees. It lost money in its first four years then broke into the black in 1975 with a net income of $7,000. This went up to $57,000 in 1976 and to $88,000 for the first nine months of 1977.



FM4 employees, most of whom are Pima and Maricopa Indians, operate some of the 26 keying stations in the firm's new 32,000 sq. ft. facility.

Taxes

"We'll Pack the Room," Says STAG

"We intend to pack the room," said Ronald Carpenter, president of Intellidata Inc., a Sunnyvale, Calif., data entry and contract programming firm.

Carpenter, a member of the board of directors of California's Sales Tax Action Group (STAG), was talking about a hearing before the Board of Equalization on its Rule 1502 covering "Automatic Data Processing Services and Equipment." The board has been imposing sales and use taxes on software and some services since 1972 and recently has been issuing retroactive assessments (May 1977, p. 155).

The Board of Equalization hearing first was tentatively scheduled for the week of Feb. 6 (January, p. 201) and later was formally set for 2 p.m., April 5, at 1020 N St., Room 102, Sacramento.

"I think it will be one of the most important meetings (on the subject of the computer industry and taxes) ever held in California," said Carpenter. He said he was disappointed at the 2 p.m. timing, feeling that means that the hearing probably won't run for more than two or three hours. "We'd asked for a four to five hour time slot but the board said there was not enough new information available to warrant that."

He said talks by STAG directors probably will be first on the agenda. He didn't know in late January whether there would be participation by other organized groups. As for his own presentation, he said it will "be a little bit of attack, a little bit of appeal, and a little bit of it (Rule 1502) doesn't conform to the law and doesn't meet rules of reason."

If we go to court

STAG held a full membership meeting Jan. 11, at which directors updated members on their activities and announced the April 5 hearing. A question Carpenter said came up at the meeting was, "Have we contacted IBM? We haven't. If there's one way the board is going to be swayed at all it's by a lot of little companies affected adversely. We're trying for a picture of economic hardship. Bringing in IBM would not do that. If we go to court, then's the time, when we need a lot of money."

Carpenter had no predictions as to the outcome of the April meeting. "It could work out like it did in New York (a hearing before that state's tax commission last year led to effective exclusion of software, time-sharing, and computer services from sales and use taxes) or we could request legislation or we could go to court."

> "Have we contacted IBM? We haven't. If we go to court, then's the time."

He said he wasn't overly optimistic about the short-term results of the hearing but was optimistic about the end results. "And that's a gut feeling. We have momentum now."

He said he doesn't "have a lot of faith in the Board of Equalization, its membership, or its staff. There's too much rattling of cages. They're still going out with new assessments in California in spite of themselves."

Intellidata last year received a $29,000 retroactive assessment from the state of California based on section F-2 of 1502 which says, in part, ". . . tax applies to the sale of custom programs transferred to the customer in the form of punched cards, or in tape, disc, drum, or similar form, or in the form of typed or printed sheets to be used as input media in an optical character recognition system."

Had a hearing

Carpenter contended that the work his company did more properly comes under section G-6 of the rule which exempts provision of "technical help, analysts, and programmers, usually on an hourly basis." Intellidata had a hearing with a Board of Equalization hearing officer in

which, Carpenter said, "part of my liability was thrown out, yet later I heard of another firm that was assessed for exactly what was thrown out in my case."

Intellidata was to have had another hearing with the full board, but that was postponed when the April open hearing was announced.

In a written document submitted to the board by STAG which led to the granting of the open meeting, STAG attempted to show that Rule 1502 is being enforced in an inconsistent, discriminatory, and uneven fashion, and that it (the rule) doesn't comport with current-day technology. The group said it would broaden the scope of its objections at the open hearing "to sales and use taxation on data processing companies in California as presently enforced."

STAG requested the hearing on grounds that: "there have been numerous inconsistent interpretations of Regulation 1502 by the State Board of Equalization; Regulation 1502 does not reflect current technology; and as a result of the difficulty of responsible businessmen, lawyers, and accountants interpreting Regulation 1502 in the first instance, the inconsistent interpretations of Regulation 1502 by the State Board of Equalization, and the fact

> "Later I heard of another firm that was assessed for exactly what was thrown out in my case."

that Regulation 1502 does not reflect current technology, there is an overall quandary within the computer services industry as to when sales and use tax is to be charged and when it is not to be charged."

As an illustration of the inconsistent interpretation of 1502, STAG cited the case of a foreign corporation licensing and selling prewritten canned programs in California. Rule 1502 became effective on March 25, 1972, and specifically provides for the application of sales and use tax on prewritten canned programs. STAG said the foreign company received an assessment from the Chicago office of the California State Board of Equalization for prewritten canned programs licensed and sold in California for a period predating March 25, 1972.

No clarity

"When that corporation expressed indecision to the Chicago office as to whether or not to pay the assessment, it was advised by the Chicago office to contest the assessment on the basis that there is no clarity in Regulation 1502 as to whether or not computer software is tangible personal property and is thereby taxable. Although the taxpayer's petition for a reversal of the assessment, based upon the advice it received from the Chicago office, was denied in May 1977, Tax Counsel for the State Board of Equalization stated in writing to another taxpayer that a program is not tangible personal property."

STAG cited a case of a taxpayer who provides custom computer programs whereby the program is keyed directly onto discs owned by customers. "It provides neither punched tapes, discs, cards, nor any other instructions or programs in tangible form. Counsel for the taxpayer conferred with attorneys of the State Board of Equalization to inquire if this activity of the taxpayer's business fell within the ambit of Regulation 1502. In May 1977, the response from attorneys of the State Board of Equalization to the taxpayer's attorney was that custom programs keyed directly into customer-owned discs were not directly covered by existing statutes or regulations. Nevertheless, attorneys for the State Board of Equalization felt that the facts fit the definition of a taxable sale on the theory that the situation was analogous to printing or lithography on paper or other materials furnished by the customer."

Another taxpayer cited by STAG sells and leases small and middle-size office computers and charges separately for the equipment and its associated custom programming, installation, and training services. STAG said the taxpayer relied on 1502, which provides that charges for such services may be excluded from the measure of tax from the sale of the equipment. "An auditor for the State Board of Equalization, who spent just under a continuous period of 12 months on the taxpayer's premises conducting the audit, included the value of all such services for the purposes of levying an assessment for unpaid sales taxes."

Remote transmission

STAG contended that imposition of sales and use tax on the transfer of prewritten, canned programs is "apparently predicated on 1502 (c) (1) providing for taxation of the transfer of title to tangible personal property." Now, however, said a group spokesman, "prewritten, canned computer programs are frequently transferred by means of remote telecommunications resulting in no transfer of any tangible personal property." He said the concept of taxing all computer software "has become so ingrained that one taxpayer had to proceed through a hearing to obtain a reversal of its assessment for software introduced into its computer by means of remote telecommunications. Unfortunately, this exemption applies only to the taxpayer in question and not to the industry as a whole. Assessments for software transmitted by means of remote telecommunications continue to be taxed although such transactions are wholly absent of any indicia of the transfer of tangible personal property."

This, STAG contends, is an example of 1502 not reflecting current technology. Another, it said, is the provision in 1502 for taxation of "all copies in excess of those produced on multicarbon paper simultaneously with the production of the original and on the same printer. Technology has and continues to render obsolete the use of multipart carbon paper. New printing equipment that is now a peripheral part of many computer systems produces multiple copies as the original output, thereby leaving in question the taxability of such multiple copies produced as the original output."

> The State Board of Equalization stated in writing to another taxpayer that a program is not tangible personal property.

California was the first state to impose sales and use taxes on computer software and services, and many tax-hungry states attempted to follow its example with a variety of results leading to an ongoing proliferation of confusion and controversy involving tax commissions, legislatures, and the courts. "California's where it all started," say some who have been burned in other states. If the April hearing leads to the end hoped for by STAG, maybe it will end in California, too. **—E. M.**

Administration

The Personnel Man's Very Own Computer

Christmas came early at Information Science, Inc. and the new crew out in Montvale, N.J., where the firm is headquartered was counting their blessings one at a time.

First, they were no longer a subsidiary of CPC International, the conglomerate; second, the area in which this software and services organization specializes—something called Human Resources Management—has been growing like crazy lately; and finally, President Dale H. Learn and the InSci management team were in good spirits because they believe they're going to sell your organization's personnel director his or her own computer, one that will function completely independent of the internal dp department.

Found in 1965 by Learn and several other ex-IBMers, InSci has been peddling non-payroll personnel-oriented software retrieval packages long enough to be known as the oldest and biggest firm in the human resources management field. Even so, business never really began to take off until a few years ago when the federal government started cranking out a whole array of employee-related regulations with strange sounding names like OSHA (Occupational Safety and Health Act); ERISA (Employee Retirement Income Security Act); and EEO (Equal Employment Opportunity).

Massive reporting

All this legislation added up to a large pain in the neck for the business community which suddenly was burdened with massive reporting requirements to ensure

JOHN PHILLIPS (left) of InSci demonstrates mini-based computer to Sen. Abraham Ribicoff at InSci's 8th national conference on human resource systems. Looking on from left are Edgar Mitchell, chairman; Dale Learn, president; and Jack Hight, chairman of the executive committee at InSci.

that, for example, the proper number of minority workers were on the payroll, or that employees' pension funds were being managed properly. For InSci, however, these stringently enforced government regulations meant a big chunk of potential new business. Suddenly, collecting and processing personnel-related data became a major budget item—one in which an average of about $75 a year per employee was being spent.

Moreover, if a company didn't comply, it could be hit with a massive suit, and ther's nothing like a major suit to alert corporate bigwigs to the importance of what an InSci was selling. "The most interested people in what we're offering are those who've just been hit with a compliance suit," notes InSci marketing v.p. F. Gordon Smith.

As business prospects brightened because of the regulatory climate, InSci also managed to extricate itself from an unhappy business liaison. As a subsidiary of CPC, which is principally in the food business, InSci was an unwanted stepchild. "The CPC board of directors was disinterested in us," says President Learn. "And their decisions regarding our activities often were a long time coming."

Happily for InSci, the firm, which currently has revenues at the $10 million a year mark, was purchased last October by senior management employees together with an investment group headed by former astronaut Edgar Mitchell and Jack Hight, who comes out as the key figure in the acquisition.

EDS strategy

Hight, now chairman of the firm's executive committee, was a cofounder with H. Ross Perot of Electronic Data Systems, Federal, IBM's super lobbyist, and a Lyndon Johnson protege. In his current role with InSci, Hight has been instrumental in shifting the concern's focus from selling software or doing compliance-oriented consulting on a one-time basis to an outfit trying to keep clients in the fold on an ongoing basis à la EDS.

Key to this strategy is the mini-based personnel system InSci hopes to sell to personnel managers who would have a CRT resting on their desks and access to InSci's data base. The price tag? Roughly $50,000 a year, says the company's senior v.p. and cofounder William E. Berry, who designed the system.

InSci has already got one big customer, Phillip Morris, signed up. It hopes others, nervous that the government will suddenly call on them to produce necessary records, will come on board. But the significant thing from the dp viewpoint is that these systems are being sold directly to the personnel department with the ptich that henceforth personnel types will no longer have to depend on their organization's internal computer operations for processing. That trend, if it catches on, could have some interesting implications for the corporate dp department. **—L.M.**

Services

Going Outside for Growth

Computer Sciences forms new group to seek acquisitions

Computer Sciences Corp., whose growth in the '60s was marked by a whirlwind of new startups or acquisitions, many of which later were to flop or to be sold, gently is stepping back into a "moderately aggressive acquisition program."

Projects such as Computax, Computicket, and Commonwealth Services quickly were dropped in the early '70s as the company ran into financial trouble. At the annual meeting in 1973, when CSC's stock had dropped to $3.50 from a high of $68, a stockholder plaintively said: "You've managed to save the company by selling off subsidiaries. Now all you've got left to sell is Infonet."

But Infonet, the company's network services offering, made it. It became profitable in 1974 and today accounts for a fourth of CSC's business and is about to become the major element in a new Data Services Group that will oversee the acquisition program. (In the nine months ended last Dec. 31, Infonet revenues rose 34% to $56.1 million and the company said it will do about $80 million by its fiscal year end next March 31. Total CSC revenues reached $199.4 million for the first nine months, an increase of 16%.

In late January its stock was selling at about $9, which some analysts thought to be a very modest increase considering that it had reduced its bank debt to zero from the $30 million it had accumulated in 1972 and at the end of its last fiscal year had working capital of $44 million and cash of $10.5 million. And even though it's going the acquisition route,

JOHN W. LUKE
today's customers buy value

there are positive signs that it will continue to grow from within.

Time to diversify

"There's substantial opportunity for growth from within," William R. Hoover, chairman and president, said recently, noting that corporate revenue grew 18% a year, compounded annually over the past 10 years. But like such other network service companies as Tymshare, National CSS, and Control Data Corp., it's time to diversify, or as Hoover put it in a press release, "to leverage our Infonet marketing organization and communications network with additional service products (to) provide a strong potential for profitable growth."

Heading this effort is John W. Luke, a tireless worker who, as president of Infonet, managed to bring the division in seven years from zero revenues to its present status as one of the largest network services in the remote computing industry. Luke, a personable and articulate former IBM marketing executive, talked recently of the remote services (or time-sharing) industry, of its growth potential, its position regarding the proliferation of small business computers, of the potential reentrance in the U.S. of IBM, and of his company's position regarding growth by acquisition.

Throughout most of his seven years with Infonet, Luke, 50, worked 14-hour days, getting into the El Segundo offices from his home in nearby Palos Verdes at 6 a.m. and working through to 8 or 9 p.m.

Company will look at non-government business.

Now he works a more leisurely 12-hour day as a newly appointed corporate vice president and president of the Data Services group, which consists of the Infonet Div. and its subsidiaries in Canada and Europe.

Processing drug claims

The company has acquired the commercial claims processing business of Paid Prescriptions, Inc., of Burlingame, which processes some 12 million prescription drug claims annually for group medical plans and insurance companies, and Economic Models, Ltd., of London, which does modeling of European economic trends.

Luke said the company is looking at non-government business. More than half of the company's revenues comes from the federal government. The government provides about 60% of Infonet's revenues, mainly due to a huge contract the firm won in 1972 from the General Services Administration, a contract that saved Infonet from possible extinction.

The computer services industry, a $5.3 billion a year business in 1976, should double this volume in five years. Infonet is among the 10 largest companies which share about 25% of that volume. The rest is distributed among some 2,000 to 2,500 smaller companies. It is Luke's job to examine what kinds of offerings by smaller companies could fit within CSC's offerings. Or should the company develop its own similar products and compete? Or should it go the joint venture route? "These many options require my long hours," Luke said.

Selling hardware

Luke said that at present the proliferation of small business computers that threaten the time-sharing industry doesn't affect Computer Sciences. "We're not in the payroll business," he says. Many such computers are dedicated to specific applications, and they do them well.

But the company is "studying the concept" of selling computers that complement the firm's networking and software facilities in distributed data processing applications.

Some competitors offer or are planning to sell hardware. Automatic Data Processing, Inc., for example, has installed about 60 Microdata-manufactured minicomputers that it sells to customers who want to combine in-house with remote services processing. National CSS, another time-sharing firm, announced last month it will sell its own small computers within six months. National said it will earn most of its revenues, however, from network communications fees and special customer services, rather than from the hardware it sells.

Nor does CSC worry over the speculation that IBM will reenter the computer services business in the U.S. that it abandoned until 1979 as part of its antitrust lawsuit settlement with Control Data. IBM sold its Service Bureau Corp. to the Minneapolis company in 1973, and promised not to compete for six years. Luke says IBM never was as service-oriented as are many of today's network services. But he says that if IBM does reenter, there is one factor he likes: "IBM isn't a price discounter."

Although prices offered by time-sharing companies have stabilized in recent years, there still remain some vestiges of the earlier days when companies often priced each other out of business. Even today, few companies in that business are willing to discuss the question of pricing. Luke's low key assessment: "Some will offer less than standard prices," in competing for large orders.

Generally, though, most services say that pricing isn't all that significant any longer. Customers buy value.

Robert Weissman, president of National CSS, said recently that once a customer (after looking at benchmarks which compare one service's offering with another) has made his buy decision, somebody else coming along and saying he can do it for 30% less will not get the business. In other words, as Luke puts it, "customers today buy value." You understand his needs and you sell him a service so that he doesn't have to look elsewhere," Luke explains.

> About IBM in the services business: "IBM isn't a price discounter."

More than raw computer time

Nor do the traditional measures of pricing apply, says Jack Kramer who succeeded Luke as president of the Infonet division. Connect time, cpu time, storage, etc. apparently have been displaced by the value of software and related support services. Kramer, who says the services are now selling more than raw computer time, notes that Infonet has instituted contractual arrangements for mass storage use.

In its acquisition program, CSC initially is looking for companies in the data services business that provide specialized services to the financial and health care industries. Later it will seek companies that offer services to the field of office automation.

Many observers of the industry envision immense growth in the health care industries, especially as a national health insurance program emerges. "I have no idea when such a program will be implemented," Luke says, but he agrees that it is a growing industry. Paid Prescriptions, which now processes claims for drugs, later could handle claims for treatment of eye problems and eventually for dental claims, he says.

Nor is CSC a newcomer to the medical claims field. It recently designed a system for the Blue Cross Assn. and the National Assn. of Blue Shield Plans to unify their more than 90 separate plans throughout the country. A Blue Cross spokesman said that a national health insurance plan could lead to an increase in the processing of such claims of several orders of magnitude. It would be a plum for CSC to get only a portion of that excess processing business that the Blue Cross organizations are preparing for.

And sometime during his 12-hour work days, Luke has to be thinking of this. **—Tom McCusker**

news in perspective

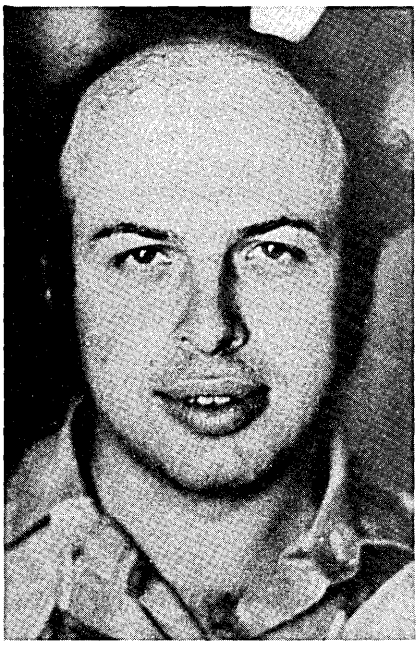
People

The Shcharansky Plight Continues

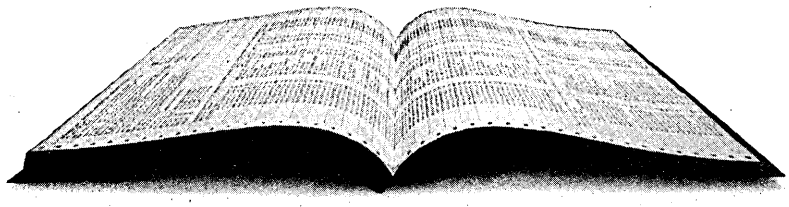
Should the scientific community sever contact with its Russian colleagues until the human rights issue—currently focused on the case of computer scientist Anatoly Shcharansky—has been resolved?

Nobel prize winner Andrei Sakharov seems to feel they should. Sakharov and Nohim Meiman, Soviet professor of mathematics, commended a resolution by the Assn. for Computing Machinery (ACM) that "ACM not cooperate with or cosponsor any meeting to be held in the U.S.S.R., and to question at the appropriate time ACM's participation in other international computer activities with dominant or heavy Russian support" (October 1977, p. 152). The resolution was inspired by the case of Anatoly Shcharansky.

> "Your courageous and noble stand is not simply ethically best, but the only practical one."



ANATOLY SHCHARANSKY
No lawyers will take his case



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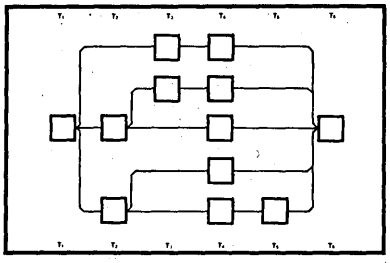
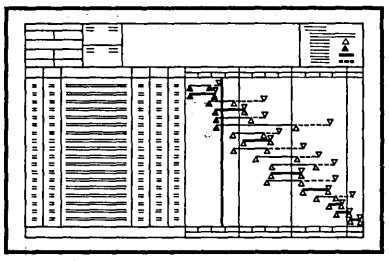
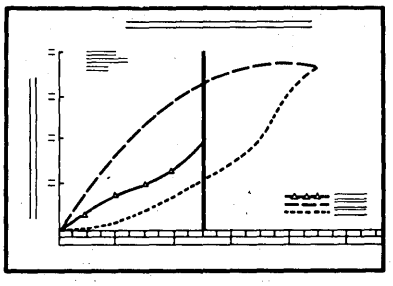


Time Scale Networks



Gantt Barcharts



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Waiting for the next new product advance can often make a lot of sense. Unless there is an immediately available alternative that has far more capabilities and can produce far greater cost savings and productivity benefits.

Raytheon's PTS/1200 system is such a product. It is a fully-programmable distributed processing system that uses an easy-to-use English-language compiler, has a main memory capacity of up to 128K bytes, handles up to 32 operator displays—*plus* dozens of additional downline displays in a multipoint network control mode—and can have a large peripheral equipment complement and local data base as well.

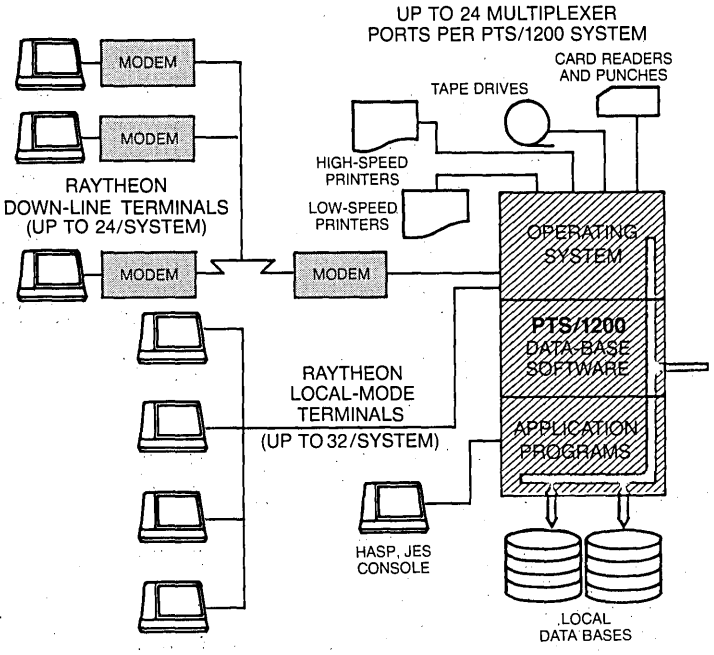
And the PTS/1200 operates in a fully compatible mode with IBM 3270 operator display devices. It not only emulates every 3270 function, but it performs total batch processing and spooling functions as well—simultaneously—and with no degradation in response times in either interactive or batch mode.

If you are waiting for the next 3270-type product to come on the market, wait no longer. For the PTS/1200 is far more powerful, cost efficient and adaptable—in a 3270 environment—than any product you can find today. And you can take delivery in just 30 days.

Look at what else the PTS/1200 can do for you:

- ✓ Operate in full 3270-compatible mode
- ✓ Control up to 32 operator displays
- ✓ Perform local batch processing concurrently with 3270 interactive processing
- ✓ Attach up to 24 peripheral devices
- ✓ Attach a large local data base
- ✓ Perform all 3270-type data entry tasks
- ✓ Perform all 3270-type inquiry/response tasks
- ✓ Operate as a HASP/JES workstation at the same time it is performing 3270 emulation
- ✓ Perform multiprogramming functions
- ✓ Control, in addition, a multipoint network of up to 24 terminals in 3270 mode.

Consider these five benefits, and you'll look a lot harder at the PTS/1200:



1 No Change To Host Processor

The PTS/1200 installs immediately within your existing network with no change required in your host CPU, in the 370X front-end, in your existing applications software, or in your Emulation Program. It goes to work under 3270 bisynch protocol the day you install it.

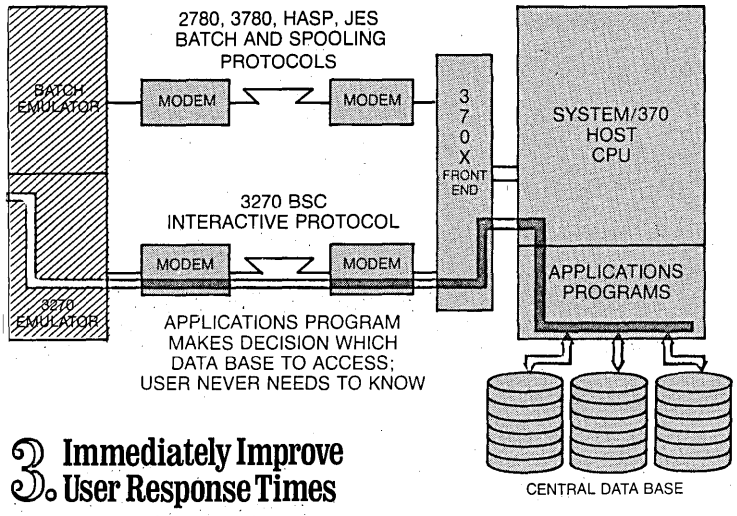
2 Cut Mainframe Overhead

The enormous power of the PTS/1200 permits you to develop and store local formats and perform advanced data editing prior to transmission to the host CPU. This one feature alone can reduce your mainframe overhead by 30 per cent or more. The PTS/1200, in addition, runs its own multipoint network of up to 24 Raytheon terminals in 3270 mode—saving even more CPU time.

ntelligent terminal system, t in just 30 days.

4. Reduce Communications Line Loading

With the PTS/1200, you perform a high percentage of the data entry and inquiry functions of a 3270 locally. In many cases, that can eliminate up to 90 per cent of the wasted communications overheads involved in polling, ACKing and NACKing, and in retransmitting. Your system becomes much more efficient in its use of communications lines.



3. Immediately Improve User Response Times

The busy times that often degrade each operator's response time from the host CPU disappear when you install a PTS/1200. Instead of operator waits of 20 or even 30 seconds when the network is busy, with the PTS/1200 the response is instantaneous for every operator, with every transaction. Multiply the number of operator stations by the number of messages by the average degradation delay and you get some feel for the productivity advantages that the PTS/1200's local format and data base storage features offer you.

☐ Tell me more about the PTS/1200. I am currently planning to develop _____ 3270-type links, with about _____ terminals, using Model _____ mainframe equipment.

☐ I need immediate delivery of _____ 3270 emulation terminals. Tell me how fast I can get them. We'll talk about PTS/1200 features later.

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Title: _____

Company: _____

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___ Raytheon's packet network systems
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news in perspective

"We would like to express to you our deep gratitude for your resolute actions on behalf of Anatoly Shcharansky," said a letter from Sakharov and Meiman to the ACM. "You have hit just the right nail. The Soviet authorities extremely appreciate the cooperation in science and technology, thus there is nothing to induce them so factually and effectively."

Sakharov and Meiman obviously feel some strict measures must be taken to have any impact in the Soviet Union.

"Your courageous and noble stand is not simply ethically best, but the only practical one," the letter continues. "Do not believe and do not take seriously any assertion that your decision allegedly could only embitter the Soviet authorities and aggravate the situation of Soviet scientists. Do not doubt that your humane and professional solidarity will bring positive results."

Grows more grim

The story of Shcharansky's plight (October 1977, p. 150) grows more grim by the day. This is the eleventh month since the young human rights activist was whisked off the wintry Moscow streets to Lefortovo prison. The charge would be treason and espionage, he was told. But still no formal charges have been filed. Still, no one has heard from him since that day, March 15.

Soviet law states that charges must be filed within nine months. That time has come and gone. The state has granted itself a six month extension, and that, say Soviet law experts here, is almost unheard of. The new deadline is May 15, but trial could come at a moment's notice.

Shcharansky's father had a heart attack in November and lies critically ill. Requests to allow his son to visit have been refused.

Mrs. Anatoly Shcharansky also believes strict measures are called for. "This is the only language they understand. The soft measures have not worked." She said her husband's mother has scoured the country to find a Soviet lawyer to defend him. One hundred and twenty lawyers have either refused or said they would accept if he pleaded guilty to treason (punishable by ten to fifteen years in a labor camp or death). Only one, Dina Kaminskaya, said she would take the case if she had the security clearance required to handle a "sensitive" case. Her offer caused her downfall. She was first ejected from the legal corps, and then from her country.

But offers poured in from abroad—from British lawyers, from the president of the French bar, from Americans like Prof. Alan Dershowitz of Harvard. Soviet authorities rigidly refused all such efforts. They said they would provide a lawyer when the time came, Mrs. Shcharansky relates.

The tale of tragic frustration does not end. Shcharansky's father suffered a heart attack in November and lies critically ill. Requests to allow his son to visit him have been refused.

What secrets?

Shcharansky's arrest was the result of his unsuccessful effort to emigrate to Israel, his subsequent involvement in human rights activities, and his contact with western scientists, politicians, and journalists as an English-speaking translator for Sakharov. What secrets he possesses no one can tell, since in order to emigrate he had, said Mrs. Shcharansky, carefully avoided studies or jobs that would expose him to critical information.

For the last eleven months, Shcharansky's young wife Avital–(she was Natalya in Russia and took her new Hebrew name in Israel) separated from him since the day after they were married in 1974–has trekked from country to country to garner support for him. President Carter and Secretary of State Cyrus Vance have privately pressured the Soviets. Many congressmen are working on all fronts. The Canadian government has laid it more directly on the line. In December, all the paper work was bypassed to grant Shcharansky "landed immigrant" status in Canada. The offer was made through the Soviet ambassador and a response was requested in 48 hours. There is no answer yet, but Canadian officials reportedly have been told the human rights issue and Soviet Jewry immigration would be taken up by the Soviet Parliament after it convened in January.

Numerous groups of scientists, besides ACM, have written Leonid Brezhnev and other key Russian figures about their concern for Shcharansky. At the fifth International Joint Conference on Artificial Intelligence, the Committee for Concerned Scientists (CCS) presented a petition that was signed by 319 attendees and sent to Brezhnev. The message was clear: "The Shcharansky case has already had a harmful effect on the relations between Soviet scientists and those from other countries. We do not want relations to deteriorate further."

> IFIP . . . refused to allow the issue to be addressed formally, seeking a pure, apolitical stance.

Dr. Jack Minker, vice chairman of CCS and chairman of the Univ. of Maryland Computer Sciences Dept., told of other efforts. The commission on Justice for Anatoly Shcharansky held a hearing in Washington in October. Included was testimony by several people who had met the young scientist and who stated the nature of their meeting. This hearing was filmed in hopes that the Soviet court would allow it to be shown during the trial. Among commission members: Columbia Univ. president William McGill, Sen. Frank Church, Baird Rustin, Prof. Alan Dershowitz.

The National Academy of Sciences has also expressed its dismay. Dr. Phillip Handler has written the Soviet academy to request that an American lawyer be allowed to observe the trial.

Other groups

We hear that other groups are organizing, including Canadian computer scientists–an outgrowth of an effort started at the IFIP Congress '77 in Toronto. That was where IFIP officers refused to allow the issue to be addressed formally, seeking to maintain a pure, apolitical stance, but did permit a band of attendees an element of free assembly. Another group taking up IFIP's sentiments that East-West contact is vital at all costs is the Assn. for Computer Programmers and Analysts. It recently attacked the ACM's resolution.

Prof. Minker believes that, "for Anatoly Shcharansky, the issue is no longer one of leaving the Soviet Union. It is basic survival."

Mrs. Shcharansky pleaded, haltingly, this "is an important time for my husband. It is important to understand, and to pressure. If everyone stops, it will be a catastrophe."

While this young scientist sits in some corner of Lefortovo, another scientist who was also refused emigration lies ill. Dr. Alexander Lerner collapsed late last year when he was told he would have to go to Lefortovo for interrogation.

The ACM resolution, issued in support of Shcharansky, followed a series of related events which began in October 1975, when the ACM council resolved to assist another dissident Soviet scientist, Valentin Turchin, in his effort to obtain an exit visa in order to accept a teaching position in the United States. Turchin, who recently arrived in the U.S., has issued public statements applauding ACM's position. **–Angeline Pantages**

Communications

Italian Connection

Tariffs based on volume worry U.S. companies

U.S. data communications users appeared to be the winners in the latest round of a continuing battle with carriers over volume-sensitive tariffs. That, at least, is one interpretation. Another is that the users have walked into a trap.

Early last year, the Italian PTT (Postal Telephone and Telegraph) proposed a study to investigate the "possibility" of replacing the present flat-rate pricing system for international leased circuits with one "governed basically by the amount of traffic exchanged by the user." Next May, at a meeting in Geneva, members of CCITT's Study Group 3 are scheduled to decide whether they should proceed with this study.

(CCITT, for Consultative Committee on International Telephone and Telegraphy, is a worldwide association of telephone and telegraph carriers which adopts "recommendations" regarding tariffs and related matters that are almost invariably adopted by its members for use in their own operations.)

Since virtually all the members of CCITT favor volume-sensitive rates—because it might increase their revenues significantly—the decision is more or less a foregone conclusion. But there is a good deal of uncertainty about the precise scope and content of the study, and that's what was on the table in January when U.S. delegates to the meeting in May foregathered in Washington with other interested parties.

Repercussions later

At first glance, their discussion may seem only dimly related to the rates data communications users pay for international circuits. But CCITT meetings like the one in Geneva usually generate repercussions in the marketplace soon afterwards. For example, last May, within a month after CCITT tentatively approved the Italian study proposal, Japan's overseas carrier—KDD—unveiled a new tariff for leased voice-grade circuits. Previously a user paid the same amount regardless of the transmission speed he employed. (A voice-grade circuit can accommodate speeds up to 9600 bps.) Under the new scheme, he pays 10% extra for 4800 bps and 20% extra for 9600 bps service.

Two other developments occurred within a short time after last year's CCITT meeting on the Italian study proposal. GE was turned down when it tried to lease, at a flat rate, a private line to Hong Kong from Cable and Wireless, and CDC was rejected when it tried to lease a similar line to Madrid from the Spanish telecommunications administration. In each case, the carrier insisted on charging volume-sensitive rates.

> U.S. will not recognize Italian concerns, but merely acknowledge them.

"If the Italian study goes forward in its presently proposed form," says Earl Barbely, chairman of the U.S. CCITT delegation, "there could be more such demands by foreign administrations before the end of this year. The Italians' apparent goal—elimination of flat-rate private line services—will then have the approval of CCITT's Study Group 3. And member administrations will be able to use that

endorsement to justify restrictions on their flat-rate offerings. They can argue that if the basic goal of the study is to explore the 'possibility' of replacing flat-rate tariffs with volume-sensitive rates, as suggested by the Italians, one good way of finding out would be to replace some actual flat-rate services and see what happens. Given the foreign administrations' desire for more revenues, the outcome of such a test isn't hard to predict."

Write position paper

The main business of last month's meeting in Washington was to write a U.S. position paper (officially known as a "contribution") regarding the Italian proposal. A few weeks earlier, a subgroup of the U.S. CCITT delegation, composed of users and carriers, had drafted a proposed position paper which began with the statement that the United States "recognizes, and to some extent shares, the concerns shown by the Italian Administration . . ." Users, however, were unhappy with this language because despite qualifications included later in the statement, it appeared to endorse the underlying position of the Italians.

> Italians complain about a proliferation of multiple-user circuits and private networks which is getting out of control.

After much wrangling last month, it was decided that the U.S. would not "recognize, and to some extend share" the Italian concerns. Rather, this country would merely "acknowledge" them. This thought was reinforced at the end of the position paper by adding the following language, proposed by GE's Brendan McShane, possibly the most outspoken opponent of volume-sensitive tariffs: "It is the USA's firm position that leased circuits charged on a flat monthly rental basis remain available to all users who require them."

There is some indication the U.S. position will be accepted by CCITT. Recently, Cable and Wireless declared it "would be unable at present to support any change in the monthly flat-rate charging principle as applied to customers using leased circuits for their own traffic." Flat-rate charging has produced "a very considerable expansion of business," Cable and Wireless added.

Boomerang effect

What seems to bother Cable and Wireless, and may also concern the other foreign carriers, is that volume-sensitive rates could boomerang. The new scheme might attract customers with smaller traffic volumes who can't afford any international data communications service at present rates, and then again it might not. While volume-sensitive rates could increase charges for present users with large traffic volumes, they might avoid these extra costs by installing data compression equipment capable of decreasing the bits actually transmitted to a point where the charge for each message sent under a volume-sensitive tariff was less than the charge under the present flat-rate pricing scheme.

The U.S. delegation clearly intends to stress this point in Geneva. The position paper adopted last month—after reminding the carriers that "some customers would be paying less while others might be paying more" if volume-sensitive rates replaced flat-rate tariffs—adds that "any revision in the present rate structure should be weighed against the impact on (PTT) revenues."

Even if the U.S. delegates manage to persuade CCITT not to abandon flat-rate pricing completely, they still won't be out of the woods.

The "major difficulty" in offering full-period circuits is that they may service "users other than the customer," said Cable and Wireless in its recent statement. Because of the "advent of the computer," such use is "becoming increasingly difficult to define . . . In our opinion, this is the area where some disquiet has arisen among (PTT's) and in consequence has led to the idea of volume-sensitive tariffs . . ."

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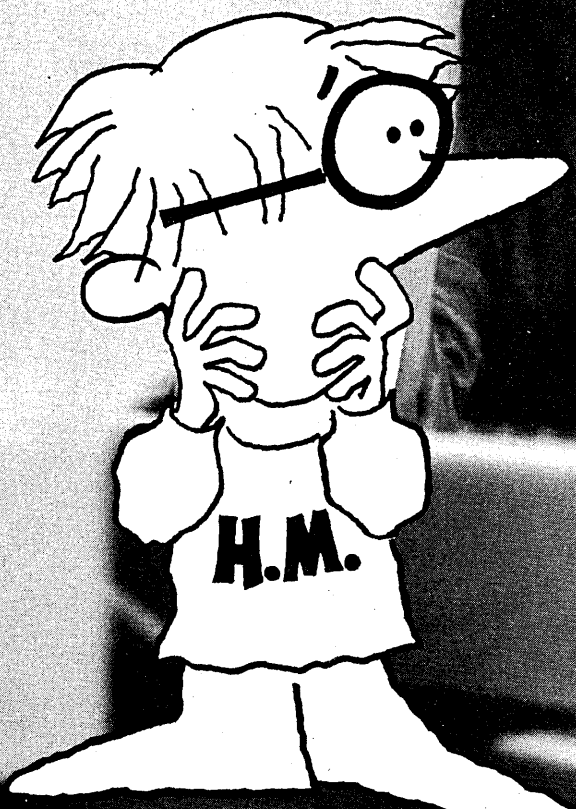

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CIRCLE 119 ON READER CARD

news in perspective

At last month's meeting in Washington, and at an earlier meeting in December, representatives of the U.S. international record carriers (IRC's) argued that the real problem is misuse of international private lines. According to the IRC's, commercial time-sharing vendors, banking, airline, and other industry groups who lease network circuits for specific purposes are allowing their customers to use the facilities for unrelated messages, and thus are providing a general communication service. The carriers are unhappy because they believe such messages are reducing their opportunity to market Telex and other services directly to these users.

But international tariffs contain specific prohibitions against the transmission of unrelated messages, argued the users. Furthermore, when circuits leased from a carrier are re-leased by a network operator to *his* customers or members, the related contract contains additional prohibitions against unrelated message traffic.

The upshot of this discussion was inclusion in the U.S. position paper of a statement saying in effect that the U. S. doesn't believe additional controls against misuse are needed, but since the foreign carriers are so upset the U.S. is willing to have the matter looked at as part of the upcoming study. It is at least possible that GE, CDC, CBEMA, and the others who promoted this position committed a major tactical error by not delving deeper.

The key point is that neither the Italians nor Cable and Wireless said anything about *misuse* of private line circuits. The Italians complained about "a proliferation . . . of multiple-user circuits and private networks which (is) getting out of control," while Cable and Wireless referred to "the use of dedicated customer-leased circuit facilities by users other than customers." In both cases, the alleged villains are not only those who transmit messages that are specifically banned, but also all other "users," meaning customers of international service bureau organizations and members of industry-based international communication networks, who share circuits legitimately.

By not addressing the question of whether circuit *sharing* should be restricted, the U. S. has given foreign carriers a tremendous bargaining advantage. The delegation has said, in effect, that it opposes replacing the present flat-rate structure with one based on volume-sensitive rates but doesn't object to restricting or prohibiting "multiple use"—i.e., sharing.

It appears virtually certain that CCITT's members will exploit this advantage. They already have established a two-tier flat-rate pricing scheme for private line services—one for "single customer" circuits and the other for "all others." In both cases, the rate for an international leased line between two specified points is based on the price of a dial-up telephone circuit, when used 9,000 minutes a month, between those same two points. If the leased circuit is used by a single customer, however, the charge is 83% of the dial-up rate. If it's shared, the customer pays the full amount.

Surcharge for multiple use

This pricing plan has been in effect since 1972. Since at least 1975, the European PTT's have been trying to increase the differential by imposing a surcharge on multiple-user networks. In the case of SWIFT, the new international bank communications network, they've been successful. The new rates have increased the cost of communications among European banks by two to four times, while charges for communications between European and North American SWIFT terminals have gone up ten-fold. Members of the group have asked the European Economic Community (EEC) to persuade the PTT's in member countries to rescind these rate increases. But if CCITT decides there is a possible need to revise the present flat-rate pricing structure to limit or erase multiple-user networks, it will give EEC a good reason for doing nothing about the SWIFT complaint. And if that happens, foreign carriers almost certainly will be encouraged to impose surcharges on other multiple-use networks, including those operated by U.S.-based service bureau and data base vendors.

A trial balloon

According to some observers, the Italian study proposal is really a trial balloon. They point out that during 1978, Britain, France, and West Germany are each scheduled to start up circuit or packet-switched public data networks. Also, Euronet—the EEC-financed network designed to access data bases in member countries—is due to begin operation this year. A number of additional systems and services are likely to be marketed in the next five years. Sometime during this period, the European telecommunication administrations will try to bar *any* shared use of private line circuits, as a means of increasing the potential market for their new offerings.

The Europeans probably would have a hard time eliminating shared private line networks completely. But they can reduce the appeal of sharing considerably by increasing the present rate differential.

adopting new regulations that limit the services provisable over multiple-use circuits, and/or making it more difficult to qualify as a multiple user. This strategy almost certainly would attract less flak than a complete ban on sharing but would accomplish the same basic objective—a substantial shift of traffic to the carriers' new data nets.

Since the carriers' facilities can't be customized to the extent that a private network can, however, some users would have to put up with poorer service. Also, the carriers probably would gain additional control over terminal equipment manufacturers; more terminals would be connected to networks using carrier-specified protocols like X25.

Options for carriers

If, as seems likely, CCITT decides next May that new limitations are needed on multiple-user networks, its member carriers can: a) retain the present flat-rate charging scheme but increase the differential between single customers and others; b) adopt a volume-sensitive tariff; c) lower the present flat-rate charge and add a volume-sensitive surcharge. Significantly, the European carriers already have chosen this latter alternative in the case of SWIFT.

The bank net is now paying a fixed charge for each circuit based roughly on the rate for 6,000 minutes/month of usage on a parallel dial-up telephone circuit plus 3.5 gold French centimes for each message transmitted within Europe or 25 gold French centimes for each message transmitted between Europe and the U.S. (The charge for other private line users, as mentioned earlier, is based on 9,000 minutes/month of dial-up circuit usage, and doesn't include any message surcharge.)

Assuming CCITT adopts a similar tariff, international datacom users in this country and abroad who don't share will be affected only indirectly—they will be discouraged from sharing. But the key question is, how long will it be until volume-sensitive rates are extended to single-customer data circuits? Japan's recent decision to base its overseas private line rates on transmission speed suggests one way for carriers in Europe and elsewhere to move toward this latter goal. (Japan, like many European countries, is building a new data network.)

Admittedly, the Japanese lowered charges for international telegraph-grade circuits when they raised them for voice-grade lines, and Cable and Wireless has indicated that similar reductions ought to be promoted by CCITT. But that raises another question. If the effect of all these changes is to eliminate sharing as an option—both for those who now share and those who might want to—what can the user do if he doesn't like the carrier's service or if, at some future date, the carrier decides to raise his rates?

—Phil Hirsch

(Mr. Hirsch, a free-lance writer, covers communications-related events for this magazine.)

Hardware

Big System For The Navy

Picture, if you can, a multiprocessor system with 16 processors, each with a speed of 15 million instructions/sec (15MIPS) and capable of performing six million floating point operations/sec (6MFLOPS). The latter rate is roughly equivalent to that of a Control Data 7600. In a 16 processor lash-up, that would be a maximum 240M IPS, 90M flops machine.

Such a system has been proposed to the U.S. Navy by the folks at Lawrence Livermore Laboratories in California, where one such processor has been built

and a second is under construction.

These are general purpose machines with special capabilities for signal processing applications in an antisubmarine warfare environment. But it is thought the Navy will be able to find several other applications for them.

Conceived about two years ago at the lab and funded by the office of Naval Research, each processor costs about $100K. Each is a standalone processor, explained the lab's Lowell Wood, but "they are also intended as units of multiple-instruction, multiple-data architectures."

The Illiac IV which also has 16 processors, is a single-instruction, multiple-data (SIMD) machine, which means that all the processors at any given time are either executing the same instructions or standing idle. But in the MIMD design, each processor is free to execute its own instruction stream, independent of whatever else the other processors are doing, on an independent data stream. "And as such," adds Wood, "it's the first large MIMD system that's ever been built."

Most are SISD

Most processors are of the SISD architecture operating on a single instruction stream on a single data stream. And a number of SIMD systems have been built, the Goodyear Staran being a further example. And a small MIMD machine was also built at Carnegie-Mellon Univ.

But while the Livermore multiprocessor exists today only as a uniprocessor, that processor has some interesting features. It is constructed of some 5,500 ECL (Emitter Coupled Logic) chips, of which there are 1,300 LSI ECL memory chips, exclusive of main memory. The processor, with a cycle time of 70 nanoseconds, uses a 9-bit byte, 18-bit half word, 36-bit single word, and 72-bit double word. There are something over 2,000 instructions in the data format in the native instruction repertoire.

These are general purpose machines with special capabilities for signal processing applications.

The reason for the 1,300 memory chips, of 1K bits each, is that the processor uses 1.3 million bits of very high-speed storage. Some 40% of them are components of large cache memories of 4K words each, while the remainder are control stores for microcode for the four microsequencers. "It's a uniquely plastic processor," says Wood. All the control stores for the processor are in RAM, instead of hardwired or ROM. Thus every microcode instruction is user-accessible and modifiable in real-time under software control.

"Perhaps the other relatively unique feature of the machine, in addition to the completely writeable control stores and the large data cache, is the fact that it has a very large virtual address space," continues Wood, who is special studies group leader in the Physics Dept. at LLL. "It is possible to directly address up to 256 million words, or approximately one billion bytes." This is done by using double and triple-word instructions, the addressing structure permitting also single-word instructions.

That seems large, Wood admits. "But the fact of the matter is that you can presently buy the memory for $10 million. We have been offered a rather firm bid on that memory for the end of calendar 1978 of $5 million. And we have been told of prices between $2.5 and $3 million by the end of calendar 1979."

Four page sizes

Virtual memory page size is variable under software control. There are four page sizes, starting at 500 words and going up to one million words. "There are advantages to having large and small pages," Wood explains, "and we weren't able to definitely pin down which advantages would dominate in the Navy application." Further, it purportedly does not take much to provide this flexibility, for the writeable control stores allow the operating system to determine the page size.

news in perspective

Each processor has a maximum of eight I/O ports, each with a microprocessor and a dedicated data store of 4K words each. Thus they've adopted the practice employed in Digital Equipment's PDP/11 family. The maximum data I/O rate for all eight channels is about 250 megabauds.

System software and high-level languages for the new processor are being implemented under subcontract to the Computer Sciences Dept. of Stanford Univ., which also participated extensively in the hardware aspects. A PASCAL compiler has been completed, as has a symbolic assembler, a link loader, and other things. They're about two-thirds completed on a '66 ANSI level FORTRAN compiler. And an advanced operating system for both single and multiprocessor systems is also under design, scheduled to enter the implementation phase in a few months.

All the control stores for the processor are in RAM, instead of hardwired or ROM.

Two graduate students at Stanford, Thomas McWilliams and Lawrence C. Widdoes, Jr., are credited with the design of the processor development of a CAD system for it, and the hardware implementation. They are on the professional staff at LLL and are completing their doctoral dissertations.

Software

Sorting 30 Times Faster with DPS

A young researcher at Warsaw Univ., Poland, has devised an entirely new way of sorting computer data that could make current methods obsolete.

It promises big savings in time and hardware for the data processing community, particularly its large mainframe users . . . and they won't have to pay a cent for it.

Already in extensive tests the new method, called Distributive Partitioning Sort (DPS), has proven on Control Data Corp. hardware that it is 30 times faster than existing techniques, or "classic" sorts. And its originator believes that it can be up to 200 times faster.

WLODZIMIERZ DOBOSIEWICZ
First innovation in 15 years

Interest is expected to be great in the oil, seismic, and big number-crunch areas. Here DPS could mean the difference between spending one hour or 200 hours sorting and comparing data. Big number-crunchers spend much of their time merging and sorting data items.

Incredibly, it is the first real innovation in this area in about 15 years. Since mainframe companies, themselves, made great strides in the 1960s, they seem to have settled back and accepted that nothing further could be done.

This has led to a strange anomaly: today's sophisticated new generations of mainframes—despite all manner of improvements—are still harnessed to the familiar old Quicksort, Heapsort, and Shellsort their fathers (and grandfathers) used.

Algol-like

DPS is written in an Algol-like language, and is the brainchild of Wlodzimierz Dobosiewicz, a young Master of Science in his 20s. He is working under the well-known computing academic Prof. W.M. Turski in the university's Institute of Informatics.

Turski praised his colleague's "audacity in opening up this subject after 15 years." He said he hoped Dobosiewicz would get his Ph.D. for it.

In classic sorts, vectors are obtained from lists of data items. These vectors are then compared. With Quicksort, for example, the vectors are divided into two partitions—large items and small items. DPS goes further to distribute and split these vectors into multiple partitions. Data items are then sprinkled among the partitions at what Dobosiewicz describes as "created intervals." This method, he says, brings about great savings in storage, as well as increases in speed. And it's not likely to make manufacturers too happy because it should mean that DPS can be implemented with less of their hardware than classic sorts.

Free sketch

What's more, users will be able to get a key outline of DPS for free. A sketch detailing its structure is being published in the European scientific newsletter *Information Processing Letters,* which Turski edits for some 800 leading professionals, and which is published by the North-Holland Publishing Co.

W.M. TURSKI
Hopes Dobosiewicz gets Ph.D. for devising DPS

DPS was coded in Fortran for its many tests which were run on a CDC 6400 under the FTN 4.1 compiler. There would be little trouble in writing and debugging it for any mainframe, its author believes. It is thought that it would take an experienced programmer about a week to do this.

Dobosiewicz found that the more data items you had to sort the more DPS outperformed classic sorts. He tested both best-case running times as well as worst-case times—the crucial gauge most installations have to work to. He tested from as few as 100 data items up to 15,000 data item samples, repeating each test several times with different data input.

At 100 items all the sorts performed equally well, with DPS having only a slight edge. Quicksort sorted the 100 in 25 microseconds (best time) and 0.11 seconds (worst case). DPS' times were 26 microseconds for the former and 0.04 seconds for the worst case. On reaching 1,000 items, the times for Quicksort were 351 microseconds (best case) and 9.99 seconds (worst case). DPS, already showing marked improvement, rated 247 microseconds and 1.09 seconds respectively.

Thirty times faster

By the time 5,000 items were reached, the worst case for Quicksort was 244.67 seconds as opposed to DPS' 9.17 seconds—nearly 30 times faster. Dobosiewicz is currently preparing a more detailed study of DPS' behavior. He said it would be easy to program faster selection methods into it and get an immediate five-fold increase of this top figure.

For years these academies have released innovations to the public domain at no cost to the user.

Willem Dijkhuis, North-Holland's computer science publisher, said: "For years there has been a sublime disregard by the industry for anything that smells a bit academic, and yet for years these academies have released such innovations as DPS to the public domain at no cost to the user." He said he will make copies of the letter containing the sketch available to anyone who needs them. Dijkhuis may be reached at North-Holland Publishing Co., 335 Jan Van Galenstraat, P.O. Box 103, 1000 AC Amsterdam, The Netherlands. ✲

Meetings

Festival to Draw 100 Exhibitors

More than 100 companies are expected to exhibit in a Personal Computing Festival to be held next June 6–8 in connection with the National Computer Conference in Anaheim, Calif. That would nearly double the 57 exhibitors who turned out for the first NCC-sponsored personal computing show last summer at the NCC in Dallas.

The American Federation of Information Processing Societies, which stages both events, issued a call for participation in the festival last month. It is asking for letters of intent to present papers at a technical program and for individuals and computer clubs to participate in a contest that will be held during the festival. For the contest, participants are asked to submit a 250-word abstract describing what they'll enter. AFIPS suggested demonstrations such as homebrew disc operating systems, one-board controllers with 1K of memory; graphics terminals and graphics languages; APL, PASCAL, and music languages; educational and business applications; and new games.

Prospective authors also were asked to send 250 word abstracts of papers aimed at the personal computer users for the sessions which will feature papers, panel discussions, and tutorial sessions.

Abstracts for papers should be sent to Jim C. Warren, Jr., Star Route Box 111, Redwood City, CA 94062. Entries for the festival contest are to be sent to Dr. Larry Press, Box 5429, Santa Monica, CA 90405.

AFIPS said it will publish the papers in a softbound book, *Festival Digest '78*, to be sold during the three-day festival.

About 175 booth spaces have been set aside for the exhibit part of the festival which will be held in the Disneyland Hotel about a mile from the Anaheim Convention Center, which will house the NCC. Companies invited to exhibit are involved in selling systems, components, terminals, software, publications, kits, hobby items, disc and tape cassettes, and personal computing services.

The first personal computing show attracted 22,000 to the Dallas Convention Center when it was held last summer as part of the NCC. This year it will be treated as a separate event, although fees paid for one of the events can be applied to the other. For example, AFIPS said, the registration fee for all four days of the NCC is $25 and $10 for one day. This will permit NCC visitors to see the festival. Festival fees of $9 for three days or $5 for one day can be applied to the NCC. ✲

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News in Perspective
BENCHMARKS . . .

A Good Year: The mainframers posted excellent earnings and revenue reports for 1977. *IBM's* revenues increased about 11% to a record $18.1 billion over $16.3 billion in 1976. Its profits rose 15% to a record $2.7 billion, up from $2.4 billion the year before. The company cautioned in its year end statement that it is unlikely that the strong rate of increase in purchased equipment will continue in 1978. Its sales for all products reached $2.2 billion in its last quarter of the year, up 19% from the year before's $1.8 billion, while rental and service revenue rose only 6.3% to $2.8 billion from $2.7 billion. *Burroughs Corp.* reported that its revenue from rentals and services rose 14% in 1977 and revenue from outright purchases was up by 10%, a factor that allowed the company to reduce its debt to about $390 million at the end of 1977 from $517 million at the end of last year. Burroughs revenues rose 12% to $2.1 billion from $1.9 billion in 1976 and earnings were up 16% at $215.2 million from $185.9 million at the end of 1976. *NCR Corp.* reported year-end revenues of $2.52 billion from $2.31 billion a year earlier and a spectacular 50% rise in earnings—to $143.6 million from the year earlier figure of $95.6 million. *Control Data Corp.* reported a 42% increase in 1977 earnings of $63 million. Its earnings from computer operations soared 61% to $20.2 million, from $12.5 million in 1976, based on revenue of $1.5 billion, compared with $1.4 billion the year before. *Honeywell's* computer business earnings nearly doubled to $79 million from $41 million in 1976. *Univac's* year-end results are to be reported in Sperry Rand's FY which ends in March. Sperry's third quarter profit rose 8% and the company said it expected the fourth quarter to be "significantly stronger."

SBS Contract: Satellite Business Systems took a major step in January in its program to offer satellite communications service in early 1981. It awarded Hughes Aircraft a $63 million contract for three communications satellites, the first of which is to be delivered July 1, 1980. The other two will be due at three-month intervals after that. The contract also provides options for SBS to order up to six additional satellites from Hughes at a price of between $15 and $20 million each. The carrier will launch two in the second half of 1980 and the third will serve as a backup on the ground.

Amdahl Trims Prices: Amdahl Corp. cut its prices for the 470V/6–II by 9% and announced a new configuration for its 470V/5 that amounted to a 9% cut on its standard 470V/5. Prices for the model 6 were reduced from $3.5 million with six megabytes to $3.2 and the model 5 was given a new minimum configuration with 4 megabytes of memory and 12 channels. Its price of $2.4 million is the same as the previous model with eight channels. The company said the price revisions are "consistent with the improving product cost trend that is resulting from increased volumes and manufacturing cost efficiencies." Amdahl's model 6 competes with IBM's 3033, priced at $3.4 million. IBM said it will begin shipping the 3033 at the end of March.

Opens in U.K.: Tandem Computers, Inc., Cupertino, Calif., formed a United Kingdom subsidiary near London and received an order from Barclays Bank International, Ltd. for a NonStop 12 computing system. The Tandem computer will be used in a real-time system for the bank's foreign exchange dealing room. The two-processor system, each with a capacity of 384K bytes of internal memory, will be configured with four discs, 40 to 60 terminals, a 600 lpm printer, synchronous communications, and magnetic tapes.

Nixdorf All the Way: Nixdorf Computer A.G., of Paderborn, West Germany, which acquired Entrex, Inc., the Burlington, Mass., data entry firm last year, and first called it Entrex/Nixdorf, now has changed it to Nixdorf Computer Corp. The new company also includes the operations of Nixdorf Computer, Inc. of Chicago which was merged with Entrex. It will sell the Entrex data entry and distributed processing systems and the Nixdorf 8870 small business computer.

Memorex Buy: Memorex Corp. agreed to acquire Telex Corp.'s European operations for a combination of cash and deferred payments totaling approximately the net book value of the assets acquired. The transaction is subject to approval by government agencies in the countries in which Telex operates. Telex Europe's revenue in 1977 was about $39 million. Memorex' international revenues were about $118 million. R. J. Braun, vice president and general manager of Memorex' Europe, Middle East and Africa group, will become president of the combined European operation. D.C. Cornwall, president of Telex Europe, will be vice president.

New in Microcomputers: Advanced Micro Computers, a new company jointly owned by Siemens A.G. and Advanced Micro Devices, will produce a full line of microcomputer systems and related products from headquarters in California and Munich. The firm is 60% owned by Siemens and 40% by Advanced Micro Devices. The formation agreement included an $18 million purchase of 400,000 shares of AMD stock by Siemens. It also includes a technological exchange program covering the design and manufacture of integrated circuits and a marketing agreement that allows each party to market selected products of the other party.

Joseph J. Wasserman: Computer auditing and edp security specialist Joseph J. Wasserman died last month at his home in West Orange, N.J., of a heart attack at the age of 45. He was president of Joseph J. Wasserman Associates, which provided consulting and training services in auditing, control of information, security of the computer center, privacy, and fraud detection and prevention. Prior to forming his own consulting firm, Wasserman was founder and president of Computer Audit Systems, Inc. He lectured extensively on edp auditing and security and was the developer of CARS (Computer Audit Retrieval), a software package widely used throughout the world.

Spin-off at the Low End: Computer Automation has split the high and low ends of its Naked Mini Div. and will move the low-end operation to Richardson, Texas, within two months. General manager George Dashiel said the LSI 4/10, the division's smallest and lowest cost computer, will be the base of the new operation which ultimately will produce even smaller and lower cost products. Frank Marshall, formerly manager of computer development at CA headquarters in Irvine, Calif., will head the new group's development activities. The division's Irvine operation will concentrate on the high performance end of the line, full-card processors, memories, and system software.

Transamerica in POS: Transamerica Computer Corp. is getting into point-of-sale. The company said it will market a Japanese manufactured, microprocessor-based electronic cash register in this country through a network of independent dealers. The family will be called Northstar and the first unit, designed for grocery stores, will be offered for $2,495. General Corp., Kawasaki, Japan, will build the ECR's, using a Rockwell microprocessor.

Modcomp Sells 25%: Directors of Modular Computer Systems have agreed to sell 25% of the company to General Electric Co. Ltd. of the U.K. for approximately $10 million. The arrangement includes joint research and development and European marketing efforts. ✲

Now-Remote Printing and Plotting:$8180!*

You could pay more for a printer alone. But now you can have remote print stations with plotting capability . . . for no extra cost. A new opportunity that should interest you . . . more than remotely.

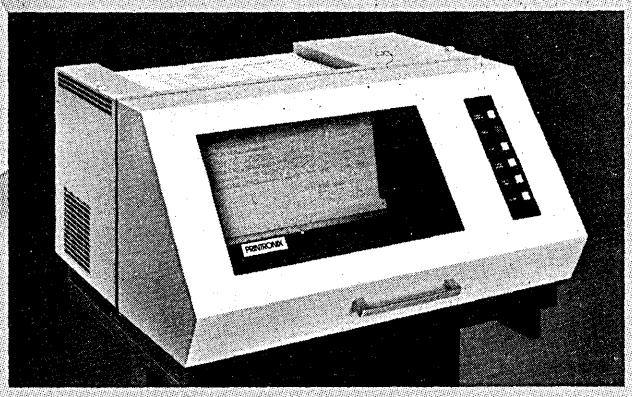
The Printronix 300 lpm impact matrix line printer is the one that offers you several advantages. Like print quality on six-part forms other printers can't match. Or a 160 character capacity that gives you a standard 96 character set plus another 64 characters, such as OCR-A, large block characters, Farsi and many others. And the capability to plot bar codes, charts, graphs, and anything else that can be displayed on a CRT . . . at the price of a printer alone.

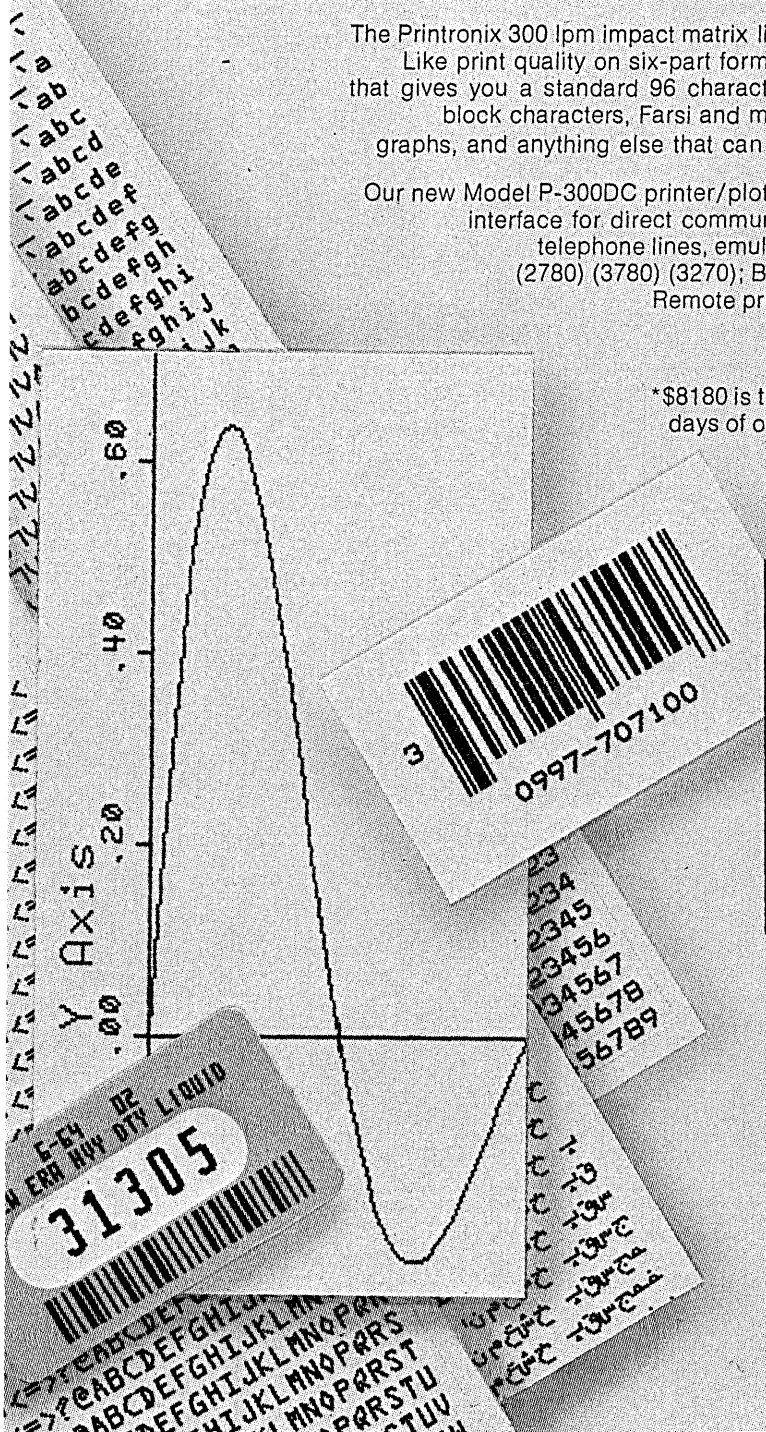
Our new Model P-300DC printer/plotter has an integral microprocessor data communication interface for direct communication with your host computer over switched or private telephone lines, emulating any one of the following line protocols: IBM BISYNC (2780) (3780) (3270); Burroughs; Honeywell (VIP-7700); or UNIVAC (DCT-1000). Remote printing. Remote plotting. Anywhere. Anytime. For $8180.

If you order one today, we'll ship it tomorrow.

*$8180 is the domestic U.S. price, which includes installation and 90 days of on-site service. No "extra" costs. Just extra performance.

Printronix, Inc., 17421 Derian, Irvine, California 92714.
Call us at (714) 549-8272.





PRINTRONIX...

More than a remote possibility!

See us at Booth 918 . . .
INTERFACE 78

CIRCLE 57 ON READER CARD

LOOK AHEAD

(Continued from page 18)

AN OFFER TO XEROX?

Scientific Data Systems still lives. That was the name of the fabulously successful Santa Monica computer company of the '60s that Xerox bought for more than $900 million only to drop it in 1975 after horrendous losses. It's now the name for a newly formed Los Angeles microcomputer manufacturer, headed by Jack Mitchell who left Packard Bell in the early '60s to form SDS with Max Palevsky and others. He calls the new company Scientific Data Systems, Inc., and his first product, a $8,500 microcomputer dedicated to inventory control, is called the SDS 220 -- a reference to SDS' old 920. The next product will be called the SDS 210 after the SDS 910.

Mitchell retired from SDS in 1966 and later acquired a Xerox Sigma II which he used to develop the system software for his new product. He said records at the California state secretary's office show that the name over the years has been owned by four groups, including a former SDS employee, Dick Duley, who was the most recent owner until Mitchell acquired rights to it for $6. Quips Mitchell: "I told Max Palevsky that my goal with the new company is to develop something valuable and then sell it to Xerox."

A LETTER TO JUDGE EDELSTEIN

If you're planning to drop by at the IBM antitrust case, don't wear a white shirt, a dark tie, and a vest. That's how Martin Simpson, president of Martin Simpson Research Associates, was attired when he stopped at the U.S. courthouse in New York City's Foley Square to see how the case was progressing. Something about Simpson irked Judge David N. Edelstein, however, and the judge lambasted the visitor, calling him a discredit to whomever he represented.

Simpson beat a hasty retreat, later that day firing off an angry letter to Edelstein with carbons to U.S. Attorney General Bell and President Carter, among others. "I am not used to being pilloried in public for my mien," Simpson snapped. His parting shot at the judge: "I do not subscribe to the view that judges have been elevated to a position where they can capriciously ride roughshod on the public at their whim."

The reason for Edelstein's outburst? Simpson speculates the white shirt and vest might have made the judge believe his visitor was an IBM legal type not behaving with decorum befitting a defendant's counsel.

RUMORS AND RAW RANDOM DATA

The National Commission on New Technological Uses of Copyright (CONTU) was expected at a full commission meeting scheduled for Feb. 16 and 17 in New York City, to adopt subcommittee recommendations that the new copyright law (effective Jan. 1 this year) be extended to specifically cover computer programs...Iddy Bitty Market may become the latest hokey translation for IBM, since the giant reportedly is planning to open 21 retail stores nationally to sell its 5110s and follow-ons. It's supposed to be backed by a massive ad campaign rather than the traditional door-to-door (or president-to-president) selling. Experts think that IBM will use these stores to enter markets that previously were too costly for its style -- such as portable electric typewriters, low priced word processing systems, and 1401s.

Getting and keeping timeshare business:

Remote computing services and batch service bureaus face a number of problems.

Problems which, if not solved, could mean the beginning of the end for most of them.

Maybe even your company.

Batch, but only batch.
There's no denying the demand for on-line services. (Look how some of the remote computing services have prospered.)

So there's the problem of adding a timeshare capability. At low cost, so you can offer a low-cost service. But with the capability to grow with your business.

There's the problem of security for proprietary software and data. The problem of delegating control of system resources, without losing overall control. The problem of accounting for system use—especially use of added-value software. And the problem of knowing what is happening anywhere in the system, at any time.

Solving these problems could make you successful in timeshare as well as batch.

Remote, but losing business.
For remote computing services, keeping customers is often the biggest problem.

After a time, many customers begin to feel they're putting out too much money for your service. They check out your competitors. Or think about an in-house system.

Finding a way to extend your services downward in cost could turn your biggest problems into even better customers.

Small, or just starting out.
You may already have a small timesharing company. Or you're planning to start one. Your first problem is finding a computer you can afford. One that's also a real timesharing computer. With the management features the big timeshare computers offer.

Solving this problem could make your small company a big success.

Problems solved here.
These problems you're facing in your firm, timeshare or batch, large or small, can be solved with the computer made by us:

Basic Timesharing, Inc. We're the computer manufacturer with timeshare experience. We understand the unique problems of your business.

And that's what has helped us produce a computer so uniquely right for the timesharing business.

The BTI 4000 Interactive Timesharing System.

A remote computer's computer.
The BTI 4000 was built from the drawing board up for timesharing. To maximize operational capabilities. To minimize operating costs. To give you more.

You can start for just $35,950. For that you get a ready-to-go system with 10 megabytes of storage and 8 ports—just add terminals.

You also get BASIC-X, an unusually powerful extension of the BASIC user language, enhanced for business programming.

You get hierarchal account organization, allowing you to "sublet" portions of the system. Which lets you earn income without overhead, while still maintaining total control.

You get protection for your proprietary software that allows *you* to sell systems with your software on them—and still keep your software proprietary.

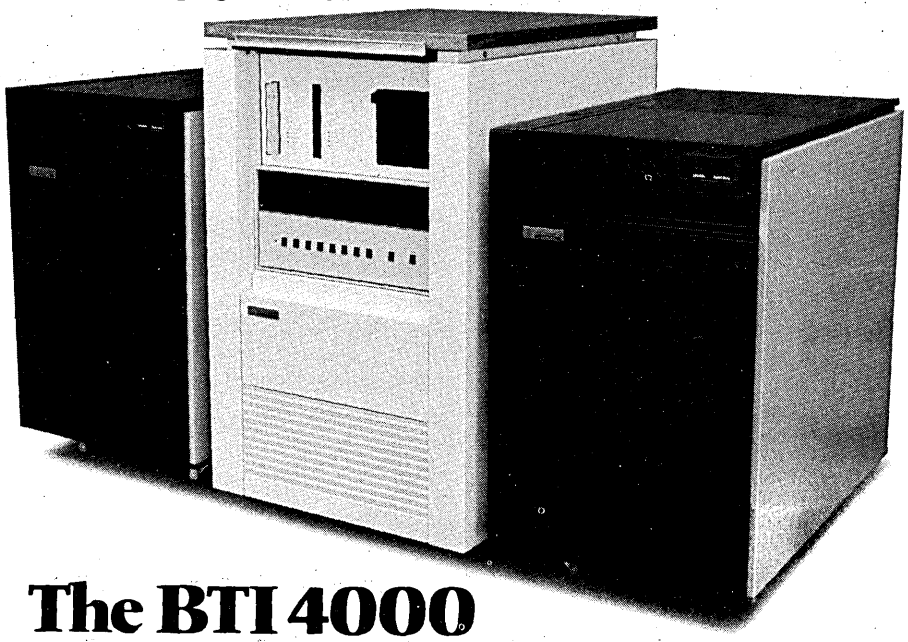
You get continuous system availability, because software housekeeping can be performed with users on-line.

You get room to grow, because the BTI 4000 is a modularly-expandable system. Add disk storage to 400 megabytes; expand user capacity to 32 ports; add peripherals like industry-compatible magnetic tape and a line printer.

And you get around-the-clock, on-line support for all your systems, no matter where they're installed.

The BTI 4000. To help you get more timeshare business, and keep the business you have.

Get the complete details today.



The BTI 4000 Means Business.

Basic Timesharing Inc., 870 W. Maude Ave., Sunnyvale, CA 94086. Sales Offices: East: Cherry Hill, NJ (609) 662-1122; Midwest: Minneapolis, MN (612) 854-1122, Chicago, IL (312) 298-1177; South: Dallas, TX (214) 630-2431; West: Sunnyvale, CA (408) 733-1122, Anaheim, CA (714) 533-7161

hardware

Off-line

The Texas Instruments Programmer calculator (June 1977), that handy little pocket unit that does arithmetic in hexadecimal, octal, and decimal, had such a strong showing in its initial direct mail marketing test, that TI has begun marketing the unit through retail outlets. Suggested retail price: $60.

GTE Sylvania Inc., has recommended that the Navy use fiber optics as one means to upgrade its communications. Several reasons cited include: optical fibers are immune to natural and man-made electrical interference, they're reliable and easy to maintain, and it's virtually impossible to tap an optical link without making the tap known.

In the world of semiconductor technology, a Japanese consortium of five companies says it has developed a single-stroke electron beam process for building VLSI (very large-scale integration) circuits. Prior to this advance, multiple strokes usually were required.

Rockwell International's Electronic Devices Div. says it has broken the commonly-accepted 1/2-micron lower limit for fabricating field effect transistors (FETs). The electron beam process has allowed Rockwell to produce a 1/4-micron FET, believed to be the world's smallest NMOS transistor.

The 8080A microprocessor, developed by Intel, has been added to the Qualified Products List (QPL) by the Defense Electronics Supply Center, making it the first microprocessor to win approval as a military standard device.

Speaking of 8080s, National Semiconductor, a second source, has dropped its 100-up prices from $10.80 to $7.10. In quantities of one to 24, National now sells the chip for $9.98, the first time the chip has been offered for less than $10 in such quantities.

Tandem, the Cupertino, Calif. manufacturer of multiple processor systems, says it has shipped its largest unit to date: a 10 processor system went to the Ohio College Library Center. This is the first system with more than five processors that the company has shipped. It sold for $1.9 million.

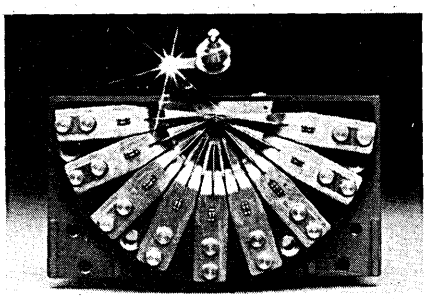
Data Acquisition

If the problem is gathering data from instruments supporting BCD interfaces, then this may be the answer: this vendor has packaged its model 97 programmable calculator with a BCD interface, dubbing the new package the model 97S I/O calculator. It doesn't support the IEEE-488 interface, but then it's intended as an inexpensive solution to collecting data from inexpensive instruments. The 97S can collect data, manipulate it, and print hard-copy reports. Programs may contain as many as 224 merged steps, and they can be stored on magnetic cards. The BCD interface, which is TTL compatible, consists of 10 input lines and four output lines (for instrument control). A basic 97S system sells for $1,375; OEM discounts are available. HEWLETT-PACKARD CO., Palo Alto, Calif.

FOR DATA CIRCLE 246 ON READER CARD

Printer

Perhaps the most interesting part of the 4540 serial printer is its printhead: instead of solinoid-actuated needles or wires, it uses spring-loaded hammers, which are held back by electromagnets. Release the magnet and the hammer snaps forward printing a point.



The vendor guarantees the head for 500 million characters. Getting down to basics, the 4540 can be had with a choice of 12 character sets, including OCR-A numerics and Katakana. Characters are formed on a 9 by 7 or 9 by 9 dot matrix. Print speed is 250 cps. Parallel, RS232, and Centronix interfaces are offered. Single unit pricing starts at $3,600, with OEM discounts available. FACIT-ADDO, INC., Greenwich, Conn.

FOR DATA CIRCLE 248 ON READER CARD

Soft Plotter

Designed for use with minicomputers, the Universal Soft Plotter is intended to allow users to preview plots before committing them to hard copy. By previewing, a user can avoid wasting plotter time for a plot of garbage caused by a program bug or bad data. Contained on a single printed circuit board, the unit connects to a mini via a standard hard copy plotter interface. To the computer it looks like a standard 6-bit incremental plotter, so software for similar plotters from the likes of Calcomp and Houston Instruments can drive the unit. It generates RS170 video output, displaying plots on standard video monitors. Plotting speed is in excess of 6,000 points per second. A unit with 256 by 256 resolution sells for $1,900. For 512 by 512 resolution the price goes to $2,900. A standard black and white monitor sells for roughly $250. LEXIDATA CORP., Burlington, Mass.

FOR DATA CIRCLE 247 ON READER CARD

Terminal Systems

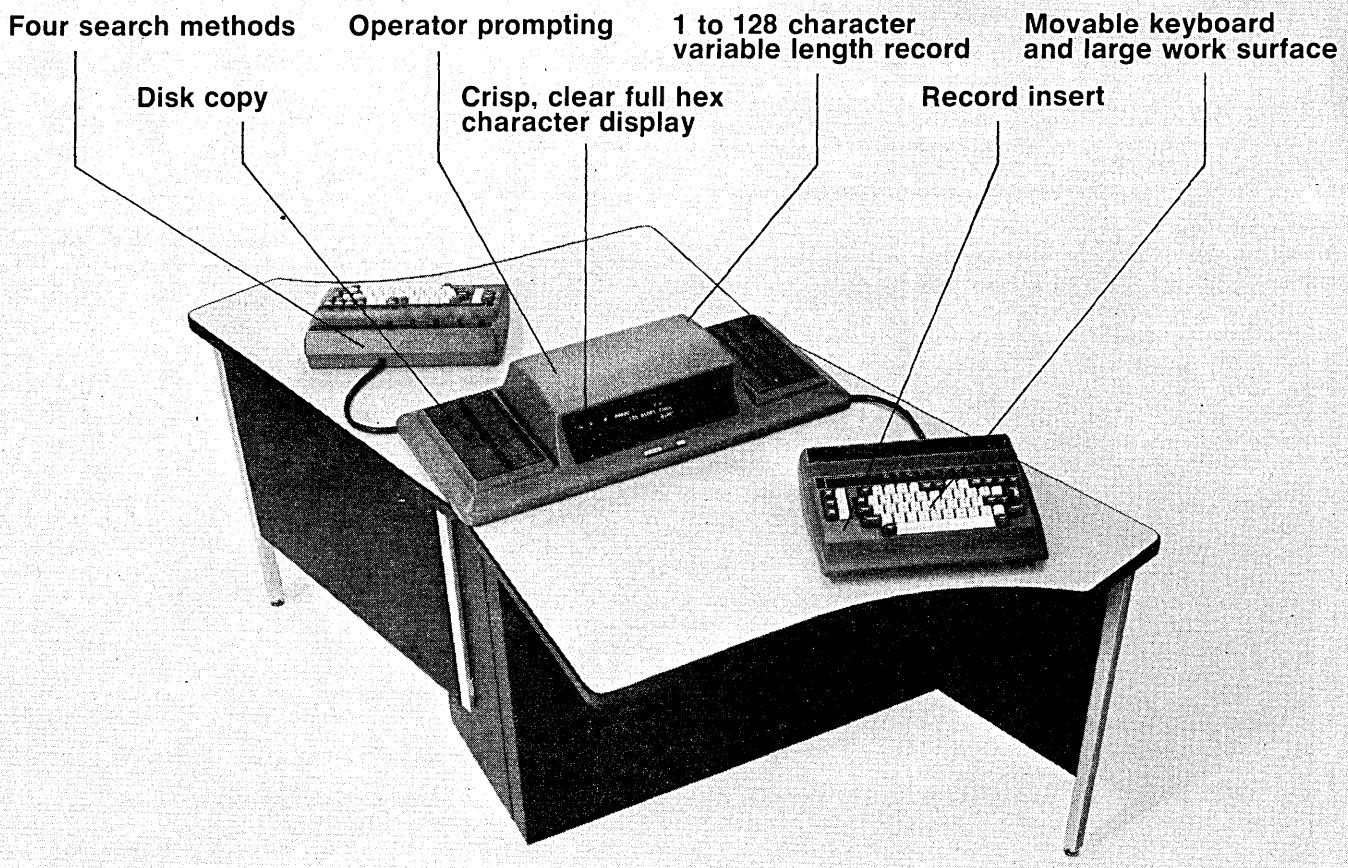
This vendor has expanded its offerings of terminal equipment with the announcement of Advanced Terminal Controllers (ATCs) for use with IBM mainframes. ATCs are available for local use within the computer site, as well as remote use over telecommunications facilities. One remote version can support eight displays or printers, and another, available in both remote and local versions, can support as many as 32 devices. Remote units are compatible with IBM's 3274 model 1C control unit, communicating in bisynchronous or SNA/SDLC protocol. Local versions operate in both SNA or IBM 3272 environments. A new display terminal added to the 270 line provides 3,440 character positions on its screen. At the bottom of the screen, a status line displays messages about terminal status and errors. The 270 line, with ATCs, is compatible with IBM's 3270 series. A ten display system, including two printers and a locally attached ATC, sells for roughly $45,000. On a 3-year lease it goes for $1,150 per month. A small remote ATC, seven display terminals, and one printer goes for approximately $24,000 or $650 per month on lease. COURIER TERMINAL SYSTEMS, INC., Tempe, Ariz.

FOR DATA CIRCLE 249 ON READER CARD

New Tab System 700-

Best price/performance yet in key to diskette entry!

The New Dual Station 702 Has These Standard Features At No Extra Cost



Additional Exclusive Standard Features Assure Better Performance

- **High-speed diskette data searches**
- **Constants from memory and character insert/delete save keystrokes**
- **Operator productivity enhanced with six display lines**
- **Teleprocessing and optional interfaces provide for a wide range of attachments**

Tab's System 700 Will Deliver Increased Throughput for your Dollar

The new TAB 700 System, single or dual station, is designed for operator efficiency and maximum data entry throughput. Our movable keyboard allows operators to select their most comfortable and productive positions. The CRT displays up to 240 characters to each operator, thereby allowing prompting and a complete display of the full 128 character record. In addition, the System 700 features extra large display characters for easy viewing and reference. The tabletop provides space for even the largest of source documents.

Exclusive Uninterrupted Data Keying

With 10 program levels and 84 characters of constants per station, the 702 allows each operator uninterrupted data keying. A data record can be located and displayed in less than sixty seconds. Our field-installable options provide the capability of attaching magnetic tape, printers, and our TAB 501 Microprocessor Punch-Verifier.

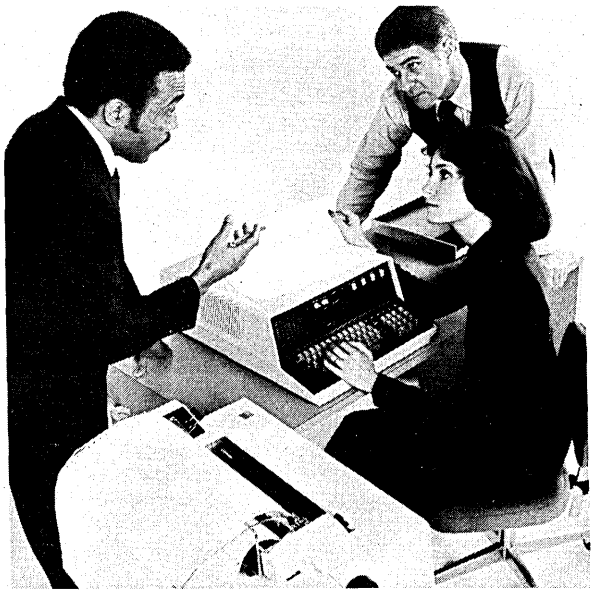
Whether your needs are distributed or central, local or remote, TAB offers you a complete key-to-diskette system. Want to know more? Call your Tab representative, or write Tab Products Company, 2690 Hanover Street, Palo Alto, California 94304.

TAB
PRODUCTS CO

CIRCLE 41 ON READER CARD

hardware

product spotlight



Desktop Computer

Nearly two and a half years after the debut of the 5100 desktop computer, IBM's Peach Tree State division has launched another in the series: the 5110. Unlike its predecessor, which many saw as limited due to its lack of support for random access mass memory, 5110s support floppies from day one. And what floppies: the model 5114 drives provide 1.2MB on each diskette. On the other hand, where the 5100 had an integral cartridge tape drive, the 5110 supports a cartridge only as a peripheral.

One of the new model's most important features is the capability to operate as an intelligent terminal, and that ability is enhanced with optional bisynch communications. Another interface, a parallel one, allows for the connection of card and paper tape gear, plotters, and lab instruments. And so that interface isn't idle, new printers and tape units have been announced.

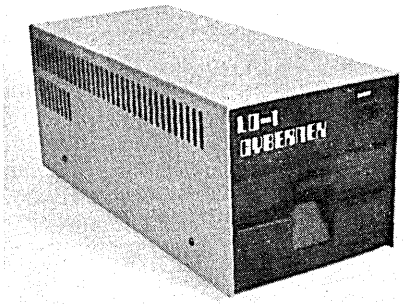
APL and BASIC—separately or together—remain the programming languages, and the BASIC has been enhanced to support formatted output. An optional *hardware* Sort puts both secondary and primary fields into either ascending or descending order. Commercial application packages will be available in September; among them: general ledger ($75/month), accounts payable ($75/month), and a report generator ($50/month). All three are paid up in 12 months.

The 5110 is offered in two models: Model 1 with support for tape and disc, Model 2 with diskette only. Memory sizes range from 16K to 64K in 16K chunks; and read-only memory is packaged on dense 72Kbit and 92Kbit boards (instead of being spread over two boards).

Prices range from $9,875 for a barebones model to $32,925 for a full-blown system. Existing 5100s may be partially upgraded (no bisync and no parallel I/O) for $3,800 to $5,800, depending on the 5100 model. INTERNATIONAL BUSINESS MACHINES CORP., GENERAL SYSTEMS DIV., Atlanta, Ga.
FOR DATA CIRCLE 245 ON READER CARD

Intelligent Floppy

The LD-1, an off-line storage and editing system, stores as much as 60KB on a minidiskette. Based on a 6800 microprocessor, the unit provides editing capabilities, including character or line insertion or deletion, pointer movement, and string searching. The unit is designed to sit between a terminal and its modem, allowing off-line preparation of data for subsequent transmission to a remote computer. An 8-bit



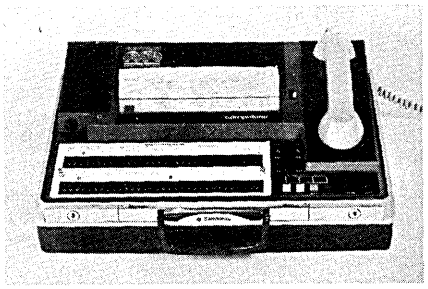
parallel port is provided for the attachment of a local printer. With an optional memory expansion, the unit becomes a stand-alone microcomputer. With the memory expansion comes software: 12K extended BASIC, a disc operating system and assembler/editor package. The basic LD-1 sells for $1,295; the memory expansion is $895, including software. CYBERNEX LIMITED, Mississauga, Ontario, Canada.

FOR DATA CIRCLE 250 ON READER CARD

Talking Terminal

Although this isn't a general purpose terminal, it is said that more than 5,000 of its predecessors currently are in use today. Designed for use in specific businesses, notably life underwriting, insurance counseling, and financial planning, the unit is intended to communicate primarily with the vendor's central computer (via a toll-free number). The modular, microprocessor-based Micro-VIP, consists of a bank of thumb-wheel switches and a voice-response unit (not a synthesizer, but audio equipment to present vocal output from the vendor's centrally located 96-word speech response unit).

Options include a built-in 30cps printer and a plug-in keyboard. A financial planner, visiting a potential client at home, overlays the thumb-wheel switches with a template designed for the problem at hand. The switches then are set to the input parameters, a call to the computer is placed, and the computer reads the switches. The solution is then presented vocally, and printed if desired. Using the optional keyboard allows the planner to enter data into 3KB of available RAM for subsequent transmission. The system can be used for applications other than financial planning; feed salesmen use it (with a linear programming package) to develop least-cost feed mixtures. And the vendor says other applications can be developed for other industries. Micro-VIP prices start at $1,795 for voice-only, a printer brings the price to $2,695, and



the plug-in keyboard adds another $200. Time on the central computer goes for 75¢ per minute. COMPUTONE SYSTEMS, INC., Atlanta, Ga.

FOR DATA CIRCLE 251 ON READER CARD

IEEE 488 Interface

The D1488 is said to allow any digital instrument to join the conversation on an IEEE 488-1975 general purpose instrument bus. The unit can function as a 10-digit talk and/or listen device interface, and may include simple control functions eliminating the need for an external controller. The transfer rate between the D1488 and the computer can exceed 30K bps. Options include remote data accumulation with an RS232 line to a remote computer, and double buffered outputs. Pricing begins at $800, with deliveries quoted

at 12 weeks. DALTEC SYSTEMS, INC., Syracuse, N.Y.
FOR DATA CIRCLE 252 ON READER CARD

Computers

As a manufacturer of peripherals and computer enhancement products, this vendor has run ads for cpus from other sources. Soon, however, it will start running ads for its own processors: it has announced a "clan" of computers which resurrect out-of-production computers from Lockheed, General Electric, and Xerox. The TCP-16, which runs programs written for Lockheed's MAC-16 and LEC-16, is available now at an entry level price of $9,000. It is said the TPC-16 is speeded up to the point that context switching takes 1.6 usec, as opposed to 6 usec for the original. More DMA channels and a multiported memory system have been added. The TCP-24, which emulates the GE-400, will become available in the fourth quarter of this year with an entry level price of $199,000. Operating system support will include GECOS and DAPS. And the TCP-32, which is said to start where the Xerox Sigma 9 left off, is slated for third quarter deliveries at an entry level price of $199,000. Its software support will include CPR and CP5. The TCP-24 and TCP-32 are both said to offer a four to one performance improvement. TELEFILE COMPUTER PRODUCTS, INC., Irvine, Calif.
FOR DATA CIRCLE 253 ON READER CARD

Floppy Drive

The model 552 dual-headed floppy disc drive complements the vendor's model 550 and provides twice the storage capacity while maintaining an 80% parts commonality. Integrating 552s into systems already using 550s is a rather simple task because they have the same interface characteristics and physical dimensions. The 552 can store 492KB on a diskette in IBM 4964 format, or as much as 1.6MB unformatted. With an appropriate controller the 552 can operate in double density mode, with a data transfer rate of 500K bps. OEM quantity (100) prices are $585. MEMOREX CORP., Santa Clara, Calif.
FOR DATA CIRCLE 254 ON READER CARD

Packaged System

A smaller, lower cost system has been added to the low end of this vendor's Datasystem series. Based on the PDP-8 video data processor, the Datasystem 308 is intended to fit the needs of small businesses which require only one terminal. A typical configuration includes a 32KB processor, dual floppies, and a minidesk. Two line printers, the LA78 serial line printer with 180cps speed, and the LQP78, a 132-column, letter-quality printer, are optional.

Software support includes a commercial operating system, COS 310, already in use on other members of the Datasystem family, and DIBOL, a business-oriented language. A word processing package also is offered. Pricing ranges from $12,600 to $18,000, with deliveries scheduled for this spring. DIGITAL EQUIPMENT CORP., Maynard, Mass.
FOR DATA CIRCLE 256 ON READER CARD

Static Micro Memory

Designed to plug into an S-100 bus, this 16KB static memory uses 2114 memory chips. It will work with DMA systems, such as the 16-bit Alpha Microsystems AM-100; it will also run at 4Mhz on Z-80-based systems. The

hardware

board is divided into individually addressable 4KB blocks, with software write protection for 4KB blocks, and a paging or block select feature. The block select feature allows memory expansion beyond 64KB. The socketed board requires a single 8 volt power supply. As a kit, the board sells for $525; for $595 it comes assembled and tested. DIGITAL MICRO SYSTEMS, Orem, Utah.
FOR DATA CIRCLE 255 ON READER CARD

44-Column Printer

The MP-44 Miniprinter can print two 44-character lines per second on 2⅜-inch wide aluminized paper. A 5 by 7 dot matrix is used to form characters. Printer, paper supply, and interface board are all housed in the MP-44's cabinet. An 8-bit parallel output word from the host microcomputer controls the motor and print electrodes; timing signals are put on two input lines. The interface uses TTL logic levels. The

host micro controls all writing and timing functions; necessary software is explained in a structured form, said to be easy to implement in any computer language. Assembly language code is provided for both 6800 and 8080 microprocessors. A 40 volt dc, one amp power supply must be provided for the interface board. The MP-44 sells for $275. ELECTRONIC PRODUCT ASSOCIATES, INC., San Diego, Calif.
FOR DATA CIRCLE 257 ON READER CARD

Portable Terminal

The microprocessor-based Cassetterm II includes an acoustic coupler and minicassette transport. The cassette media looks like the cassettes used in pocket dictating machines but uses computer-grade tape to store as much as 40KB per cassette. The acoustic coupler can operate at 110bps and 300bps; it's compatible with Bell 103 modems. The 5½-pound terminal has a 32-character display panel. The unit operates with ASCII characters. Power is supplied by rechargeable batteries. Options include a direct RS232 interface and AC line operation. The basic

Cassetterm II sells for $1,995. MICON INDUSTRIES, Oakland, Calif.
FOR DATA CIRCLE 258 ON READER CARD

Cartridge Tape Transport

An optical tachometer helps maintain a constant 30ips read/write speed on the model 650 cartridge tape drive. The unit uses the 3M Company's DC300A data cartridge. Recording at 1600bpi, the unit provides nearly 3MB of storage on each cartridge. Additional features include a belt-driven capstan (for reduced effective mass) and a rewind/search speed of 90ips. The unit monitors its power supply: if any circuit loses power, write operations are inhibited. The model 650 sells for $920. The bare electromechanical transport, sans servo/data card and control/housekeeping electronics, sells for $475. An RS232 interface sells for $1,195. NORTH ATLANTIC INDUSTRIES, INC., Qantex Div., Plainview, N.Y.
FOR DATA CIRCLE 259 ON READER CARD

Printer/Plotters

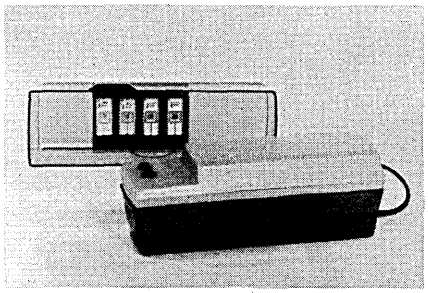
Designed for OEM systems, hostile environments, and mobile operation, the 3000-series of electrostatic printer/plotters comprises 12 rack-mountable and desktop units. The units offer a choice of resolution (100 or 200 dots per inch), printing speed (500 or 1000 lpm), plot speed (one or two ips). Roll paper—500′ long by 11″ wide—is used by all units; fanfold paper is optional. Interfaces are offered for all popular computers, digital video sources, and crts. Crts supported include the Tektronix 4000 series and Hewlett-Packard 2640 series; RS170, 330, 343, 375, or 412 video sources also are supported. For printing in a 132 column format the 96 character ASCII set is standard. Optional fonts include a 124 character scientific/engineering set and a 128 character typesetting set. Pricing on desktop models ranges from $8,550 to $11,400; OEM discounts are available. VERSATEC, Santa Clara, Calif.
FOR DATA CIRCLE 260 ON READER CARD

Floppy Drive

Another variation on a theme from this manufacturer: 143KB minifloppy drives, with prices starting at $695. Designed for use with S-100 bus microcomputers, the MacroFloppy, model 1041 includes software and S-100 compatible controller. It's intended for integration into a microcomputer. The model 1042, a desk-top unit, adds power supply and dc regulators; it also adds $100 to the price. Software includes a disc operating system and extended BASIC. Both are written for 8080A and Z-80 based microcomputers; the operating system, which includes an assembler, file management routines, and utilities, requires at least 16KB of main memory; BASIC needs at least 24KB. MICROPOLIS CORP., Canoga Park, Calif.
FOR DATA CIRCLE 262 ON READER CARD

EPROM Eraser

We've written of EPROM (erasable programmable read only memory) programmers in previous issues, so now it's only fair that we write of a UV lamp for erasing EPROMS. The UVS-11E short-wave lamp, designed and priced for personal computer users, can erase four UV-erasable EPROMS in 14 minutes. To guard the user against acci-



dental exposure to ultra violet light, the unit has an interlock which prevents it from operating if the EPROM holding tray is not seated properly. The holding tray also positions the EPROMs at the right distance from the UV source. A unit for 115V operation sells for $59.50. ULTRA-VIOLET PRODUCTS, INC., San Gabriel, Calif.
FOR DATA CIRCLE 263 ON READER CARD

Disc Cleaner

The Clean Machine is a portable disc cartridge cleaner. It's available in two models: a top-loader, for 5440-type media, and a front-loader for 2315-type media. The unit uses cleaning pads, which are packaged in pairs, and pre-soaked in cleaning solution. It has a 24 second cycle time, sells for $995, and will be available for delivery next month. DATA DEVICES INTERNATIONAL, Woodland Hills, Calif.
FOR DATA CIRCLE 264 ON READER CARD

Cassette Eraser

The QM-230, a cassette bulk eraser, is a hand-held unit consisting of a woodgrain case and ceramic magnets. All the user need do is pass a cassette through it, *et voila,* the cassette is blank. But why erase a cassette when

hardware

rewriting does the same thing? Two reasons are cited: it ensures maximum clarity of new recorded data, and it can be used as a security measure (it also erases tapes containing dictation). The

QM-230 has a suggested retail price of $24; it's available through retail outlets. NORTRONICS CO., INC., Minnesota, Minn.
FOR DATA CIRCLE 261 ON READER CARD

Magnetic Cards

These aren't the cards used with word processing systems, they're for use with the vendor's programmable calculators, models 67 and 97. A lot of people call them "gum sticks" because they're roughly the size of a piece of Juicy-fruit. If you have quite a few of these calculators in your office, lab, or shop, you may want to bite off a 1000-pac at the vendor's lowest price to date, 19.5¢ per card, or $195 per 1000-pac. Sorry, card holders are not included. HEWLETT-PACKARD CO., Palo Alto, Calif.
FOR DATA CIRCLE 265 ON READER CARD

Terminal

The 1641, an IBM 2741-compatible terminal, can print three times faster than the 2741. It uses this vendor's daisywheel print mechanism, and in addition to 2741 compatibility it offers compatibility with the ASCII protocol used with the vendor's 1610 and 1620 terminals. With its integral buffer it can operate at data rates ranging from 134.5 bps to 1200 bps, although the printer averages 45 cps. The printer also has graphics capabilities; it can step horizontally in 1/60-inch increments and vertically in 1/48-inch steps. It comes with an RS232C interface; a current loop interface is optional. Graphics software, APL-compatibility, and a forms tractor are available as options, as are a handful of bells and whistles too numerous to list. In quantities of 100, the 1641 sells for $2,665. DIABLO SYSTEMS, INC., Sunnyvale, Calif.
FOR DATA CIRCLE 267 ON READER CARD

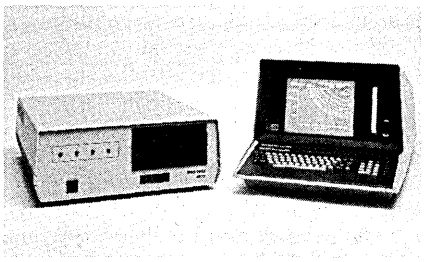
Desktop Computer

Known as the Attaché, this 8080-based microcomputer has a built-in

upper/lower case ASCII keyboard and a 75 ohm video output jack. Inside the cabinet there's a 10-slot, S-100 bus mother board, making it compatible with a wide range of peripherals from this manufacturer and many others. The basic configuration, which retails for $1,449, uses three motherboard slots, one each for the cpu, video output, and turnkey monitor boards. Front-panel LEDs indicate on/off and system status, while the video output can generate 16 lines of 64 characters on a television monitor. The basic unit comes with a monitor in PROM and 1KB of RAM. Maximum memory size is 64KB. Options available from this vendor include additional memory, an audio cassette recorder board, floppy disc systems and software, and a 16K ROM BASIC board. PERTEC COMPUTER CORP., Microsystems Div., Woodland Hills, Calif.
FOR DATA CIRCLE 266 ON READER CARD

Diskette Subsystem

Random access files have come to this vendor's 4051 personal computer in the form of the 4907 flexible disc drive. The 4907 comes in single, double, and triple drive configurations, with an on-line capacity of 630KB per drive. BASIC language support for diskette files is provided by a ROM pack for the 4051. Nine files may be open at



a given time; password protection for file access is provided. File expansion is dynamic. The 4907 itself is microprocessor-based and can execute commands, such as CLOSE, INIT, or CREATE, issued from the 4051 keyboard or an executing BASIC program. A single-drive 4907 sells for $3,900. TEKTRONIX, INC., Beaverton, Ore.

FOR DATA CIRCLE 268 ON READER CARD

Microcomputer Modules

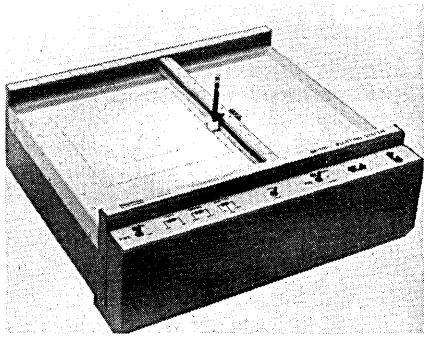
The LSI-11/2 is software-compatible with the existing LSI-11, but is half the size. It also is the first time this company has offered a cpu independent of memory. Mounted on a 5 x 8½-inch module (as are all other modules in this family), the LSI11/2 cpu remains bus-compatible with existing LSI-11 products. The processor, known as the KD11-HA, sells for $495 in lots of 50. Fifty-unit price for an LSI-11/2 microcomputer including 16KB of RAM is $851. Additional modules include memory in 8KB, 16KB, 32KB, and 64KB increments, a "foundation" kit for interfacing and control applications, and a serial line interface card sporting four RS422/423 independently programmable channels. RS422 is said to offer significant benefits over RS232 in terms of data rate and data link length; RS423 offers a growth path into RS422 while maintaining compatibility with existing RS232 devices. Software support includes RunTime-11, a subset of the RT-11 operating system. In 100 unit lots, its license is $97. DIGITAL EQUIPMENT CORP., Marlborough, Mass.

FOR DATA CIRCLE 269 ON READER CARD

Plotter

Said to be well-suited for time-sharing use, the DP-101 attaches to an RS232 interface and can accept data at 110 bps, 300 bps, or 1200 bps. It also can be driven off-line by floppy disc or cassette tape units. A built-in microprocessor can generate vectors, characters, arcs, circles, and special symbols. A 960-character buffer also is included.

The unit's effective plotting area measures 10 x 15 inches on 11 x 17 inch paper. The plotter steps in 0.005-



inch increments and can make 400 steps per second. The DP-101 sells for $3,495. HOUSTON INSTRUMENT, Austin, Texas.

FOR DATA CIRCLE 270 ON READER CARD

Diskette Storage

The Clean Room diskette cabinet maintains a positive pressure of filtered air to prevent dust from entering when either of its file drawers are opened. Each drawer in the 29 x 36 x 19-inch cabinet can hold 150 diskettes. Available in black, off-white, and gray, the unit sells for $295 plus shipping and applicable sales taxes. MINICOMPUTER ACCESSORIES, Palo Alto, Calif.

FOR DATA CIRCLE 271 ON READER CARD ❋

software & services

Updates

A "defense data base" including all information on product-related activities from design to marketplace can become a key weapon for a company's attorneys and insurance underwriters in the event of legal actions related to products, according to a paper by Lawrence H. Berul, executive vice president of Aspen Systems Corp., a subsidiary of American Can Co. The data base can help head off threatened litigation, and in the event a suit is filed, the data base can help in the defense. Such a data base has four major benefits: it can aid in compliance with government regulations by providing information on product experience; it keeps track of vital information which might otherwise get lost in departmental files; it provides an early warning system for detecting problems that affect product liability exposure; and it captures data as it comes into existence, expediting the problem of finding the information if a suit ever is filed. Breul's paper was published in the November issue of Management Review, published by the American Management Association.

And, speaking of data bases, New York State Assemblyman Edward Abramson is trying to assemble a Statewide Compiled Information and Data (CID) directory. When compiled and printed, the CID will be distributed to firms, professionals, students and interested people throughout the state. The CID will include descriptions of systems and data bases available to outside users. More information is available from the assemblyman's office at 90-50 Parsons Blvd., Jamaica, N.Y. 11432.

Reports of progress toward FORTRAN 77 standardization are included in the For-Word FORTRAN Newsletter, vol. 3., no. 4, available from Loren P. Meissner, 50B 3239, Lawrence Berkeley Laboratory, Berkeley, Calif., 94720. ANSI, ISO, and USA Federal Information Processing standard efforts are discussed.

The Univ. of Toronto Library Automation Systems is adding 200MB discs which will allow a major system upgrade in the first half of this year. By 1 July all National Source files will be maintained on-line in their entirety.

File Inversion

IOSYS, this vendor's ISAM/VSAM replacement (May 1977, p280), now has file inversion as an option. Inversion allows access to data records based on keys other than the record's primary index. A separate index file is created for each inversion; this file contains only the inverted keys and the associated record's primary key. Inversion may be contingent on fields within the data record, for example a personnel file keyed on social security number might be inverted by employee name only for exempt employees. Inversion keys also may be created by concatenating non-contiguous fields. Multiple inversions on the same file are possible; inversions may be deleted upon request. The inversion option goes for $5,000. JEFFREY L. WALKER & CO., Mill Valley, Calif.
FOR DATA CIRCLE 221 ON READER CARD

RPG Pre-compiler

Written for IBM System/3 and System/32, this RPG II pre-compiler converts free-form statements to RPG calculation specifications. Other RPG specifications must be written in standard RPG. As an example of a pre-compiler statement the vendor cites ADD AMOUNT TO TOTAL, which generates an RPG instruction with ADD for the operation field, AMOUNT for factor 2, and TOTAL for both factor 1 and result. Longer, more descriptive names may be given to fields, and the pre-compiler will convert them to fit RPG specification format. To make programs more readable, the pre-compiler statements are included as comments in the generated RPG program. The pre-compiler carries a license fee of $99 per year; paid-up licenses are available. A 30-day free-trial also is offered. STANDARD SOFTWARE CO., Silver Spring, Maryland.
FOR DATA CIRCLE 222 ON READER CARD

VTOC Listing

DOS and DOS/VS users can obtain additional information in their VTOC listings by using Westoc instead of IBM's software. For any disc packs, Westoc can print a VTOC listing sorted by file name or extent number. In addition, the utility can search each extent for an end-of-file record and print this location on the report. Westoc runs on 360s and 370s with the decimal instruction set. It requires 8KB plus enough memory to sort all 140B Format-1 labels in the VTOC. A 15-day free-trial is offered. The package is priced at $600. WESTINGHOUSE ELECTRIC CORP., Pittsburgh, Penn.
FOR DATA CIRCLE 223 ON READER CARD

Communications Service

Telenet, the packet-switched communications carrier, is expanding its 1200 bps service to include support of the recently introduced Bell 212 full-duplex modem. Subscribers may now choose between the Vadic 3400 (supported since 1976) and Bell 212 modems for private dial access in 81 cities across the country. Private dial access means each user has a private phone number to gain access to the network. Public dial access via the Bell modem will begin in Chicago, Los Angeles, New York, San Francisco, and Washington in the early part of this year when the tariffs for Bell's modem receive necessary state approvals. Telenet says 300bps communications run up average charges of $3 per hour, while 1200bps service typically costs $4.40 per hour. TELENET COMMUNICATIONS CORP., Washington, D.C.
FOR DATA CIRCLE 224 ON READER CARD

RPG and Sort/Merge

Model 74 Keybatch and model 78 remote processing systems from this vendor can now provide stand-alone processing using RPG II and an associated sort/merge package. RPG for the model 74 supports Keybatch-generated disc files, while Disc RPG II for the model 78 supports sequential, indexed, direct, and Keybatch-generated files. Both have communications capabilities compatible with IBM 2780 and 3780 line protocols. The sort/merge package is used with both RPG versions. Keybatch files may be sorted as groups of records (documents) or as single records. Either RPG version has a one-time installation fee of $50 and a monthly maintenance charge of $25. The sort/merge package has identical pricing. DATA 100 CORP., Minneapolis, Minn.
FOR DATA CIRCLE 225 ON READER CARD

Spooler

A spooler utility, written in Business BASIC for Data General Novas and Eclipses, is said to increase printer efficiency by leveling demand and reducing forms changes. The utility allows printing on printers other than the system printer and it supports multiple printers connected to the terminal multiplexor. Multiple copies can be printed under program control or through a control program. The spooler has a license fee of $500 which includes the programs on mag tape and printed operator instructions. TECHNICAL ANALYSIS CORP., Atlanta, Georgia.
FOR DATA CIRCLE 226 ON READER CARD

IMS and TOTAL USERS

YOUR DATA BASE & ASI-ST GO TOGETHER

More IMS and TOTAL installations have chosen the ASI-ST Data Management and Reporting System to implement data base applications than any other product. ASI-ST's dominance in data base environments is easily explained:

- Operates under all IBM 360/370 versions of DOS, DOS/VS, OS and OS/VS.
- Fully supports all TOTAL, IMS and DL/1 features including TOTAL 7 and secondary indexing under IMS/VS.
- Permits creating and updating TOTAL and IMS data bases as well as retrieval.
- Allows concurrent processing of conventional data files with IMS or TOTAL data bases.
- Supported in both batch and on-line environments.

IMS users such as *American Airlines, Dow Chemical, TWA, American Can, The Hartford, Union Carbide;* and TOTAL users like *Combustion Engineering, Northwestern Mutual Life, Anheuser-Busch, Corning Glass Works, Eli Lilly* and *Holiday Inns* are a few who agree ASI-ST and data base belong together. In addition, ASI-ST provides an unequalled return on investment by maximizing the productivity of both man and machine. Since ASI-ST fully supports conventional data files as well as complex data bases, these benefits are not restricted to IMS and TOTAL users. To obtain more information contact:

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(213) 542-4381

software spotlight

Program Security

Does the source program in the auditor's hands really go with the object code in the executable program library? Did the test version of the new payroll system get run instead of the existing production version? Who deleted half of accounts payable? Panexec aims to prevent these questions from arising, or, if they do arise, to provide their answers.

Written for IBM 360s and 370s running OS or DOS, Panexec protects programs residing in a central Panexec library. This library is said to make more efficient use of disc space than PDS's or CIL's; disc space in the library is dynamically allocated, removing the need for frequent disc reorganizations. A multi-level (up to five) password security system protects programs from unauthorized access or modification. Only a manager with the proper access code may delete a production program, while programmers with the correct access codes may work on programs under development; this division between management and programming staff provides the philosophical basis to Panexec. Additionally, once an executable program is committed to production status, it cannot be modified. The only way such a program may be changed is through deletion and subsequent replacement, a job for the manager. And, for auditability, Panexec provides cross-reference reporting between source and executable modules.

The format of Panexec's program library differs from that of IBM's PDS's, although the two may coexist. For this reason, a set of utilities—including linkage editor, single-step initiator, and transparent loader—come with Panexec. The loader can handle both Panexec executable programs and code in a CIL or PDS library. It is said to provide features from both the OS and DOS loader supplied by IBM.

A management report generating facility is another feature of Panexec. More than 150 different kinds of information are available for reports. This includes data on date and time of last program access, data on attempted security violations, and information on Panexec library reorganization. (Library reorganization is automatic, requiring no manual intervention.)

Additionally, Panexec offers device and operating system independence, and DASD error handling. The OS version of Panexec is available now, the DOS version is scheduled for release in June. Marketed on a lease basis, the package goes for between $500 and $1,000 per month, or on a perpetual basis for 33 times the rental. PANSOPHIC SYSTEMS, INC., Oak Brook, Ill.
FOR DATA CIRCLE 220 ON READER CARD

Mailing List Maintenance

Mailsave II is an unduplicating system for finding similar or duplicate names on single or multiple mailing lists. The package is said to be able to find duplicates with wide variations in spellings and addresses; it accounts for phonetics, keying and zip code errors, and rural address variations. Mailsave II can recognize the name and address of Daniel Niddel, 2754 5th Ave., Elmsford, N.Y. 10523 as a duplicate for D. Middel, 2745 Fifth Ave., Elmsford, N.Y. 10513, according to the vendor. The package makes a list of duplicates (useful for auditing or welfare fraud detection), and can retain one or none of the duplicates. The option to totally reject duplicates allows a user to compare his in-house list to rented lists. Mailsave runs on 360s and 370s and carries a perpetual license fee of roughly $50,000, or it's available as a service for $2 to $3 per 1,000 names compared. MATHEMATICAL APPLICATIONS GROUP, INC., Elmsford, N.Y.
FOR DATA CIRCLE 227 ON READER CARD

Accounts Payable

Written in RPG II, this basic accounts payable package runs on IBM's System/3 (all models) and System/32. Consisting of 10 programs and various utilities, the package handles everything from edits to vendor master file maintenance. In addition to writing checks, the package can prepare reports, including open payables, check register, and expense distribution. The package comes as RPG source, and OCL on diskette, with documentation. The price is $200. KATWIL INTERNATIONAL. Warrenville, Ill.
FOR DATA CIRCLE 230 ON READER CARD

CAI Language

Version 2 of DECAL (Digital Equipment CAI Author Language), a package for creating computer-assisted-instructional dialogs, contains an extension that allows creation of simulation and gaming exercises. Lesson branching and student response checking also have been enhanced. Instructors with little or no programming experience are said to be able to use DECAL to create, modify, and administer CAI

The Sinclair Cambridge Programmable with library of 290 programs. A mere $34.95.

How pocket calculators grew up

A couple of years ago, calculators took a step forward. Programmability transformed the slick slide-rule calculator into an advance scientific machine.

Sadly, it also transformed an inexpensive aid into a $100–$200 capital investment.

Now the Sinclair Cambridge Programmable puts programmability where it belongs; in the palm of your hand, for less than $35.

The features of the Sinclair Cambridge Programmable

The Cambridge Programmable is genuinely pocketable. A mere 4-1/2" x 2", it weighs about 2 oz. and operates on a 9 volt battery (available anywhere).

Yet there is absolutely no compromise in the package of functions it offers.

Because the Cambridge Programmable is both a scientific calculator with memory, algebraic logic and brackets (which means you enter a calculation exactly as you write it), and a programmable calculator which offers simple, flexible through-the-keyboard program entry and operation.

The Cambridge Programmable has a 36-step program memory, and features conditional and unconditional branching (go to and go if negative).

There is also a step facility, which allows you to step through the program to check that it has been entered correctly. If there is any programming error, the learn key allows you to correct single steps without destroying any of the remainder of the program.

To achieve this, each program keystroke has an identifying code, or 'check symbol'. (The symbols for the digit keys are the digits themselves, while the symbols for the operator keys are letters printed beside the keys.)

The check symbol for ⊟, for example, is F. So if, as you step through the program, the display shows

it means that ⊟ is programmed as step 26. If step 26 should have been ⊞, all you have to do is press

puts machine into 'learn' mode. **the correct step**

It's as simple as that!

These facilities make the Cambridge Programmable exceptionally powerful, whether it's running programs you devise or programs already available to you through the 290 Program Library included when you purchase the calculator.

You can use the 290-program library to tailor the machine to your own specialty

Like a full-size computer – and unlike far more expensive specialist calculators – the Sinclair Cambridge Programmable can be programmed to handle calculations concerned with any specialty. In fact, once it's programmed, figures can be produced by an operator who need not understand the program!

To save you time, and to help inexperienced programmers, Sinclair has produced a library of 290 programs ready to be entered straight into the calculator.

Using these standard programs, the Cambridge Programmable solves problems from quadratic equations (where the program gives both real and imaginary roots) to twin-T filter design, and from linear regression to bond yields. It even plays a lunar landing game!

Why the Cambridge Programmable costs so little

The Sinclair Cambridge Programmable uses the Sinclair talent for miniaturization to the fullest – as you'd expect from the company that pioneered the truly pocketable pocket calculator, and recently introduced the world's first pocket TV.

Chip and circuitry design are unique to Sinclair. Shipped direct, and sold to you direct, the Cambridge Programmable accumulates no middleman's profits on the way.

The result is a pocket programmable calculator of advanced design, sold by Sinclair with a Sinclair 1-year complete guarantee, at a price unmatched by any comparable calculator.

10-day no-obligation offer

There's a lot more to this remarkable calculator than a brief written description can cover.

You need to see it and handle it . . . to program it yourself in a few seconds to save you hours . . . to check its performance against tables and graphs . . . to test the full range of programs available . . . to evaluate. An excellent engineering tool. Also can be used as an educational aid in developing a student's computer understanding.

Send your check or money order with the order form below, and you'll receive a calculator direct. Use it for 10 days, and if you don't feel it's the finest $34.95 you've ever invested, send it back for refund.

There's nothing to lose, and so much calculating power to gain.

Mail your order today.

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New York, N.Y. 10022
Tel: (212) 355-5005

DA 2

To: Sinclair Radionics Inc., Galleria, 115 East 57th Street, New York, N.Y. 10022, USA.

Enclosed is check/MO payable to Sinclair Radionics Inc.

Please send me _____ (qty) Sinclair Cambridge Programmable(s) at $34.95 each, including full instructions, and complete library of 290 programs. $_____

_____ (qty) AC line adaptor(s) at $4.95 $_____

Sales tax (NY resident) $_____

Post and packing $ 2.50

Total $_____

Name _____

Address _____

City _____

State _____

Zip _____

(PLEASE PRINT)

I understand that you will refund purchase price in full if I return calculator(s) and accessories in same condition as received within 10 days of receipt.

Signature _____

Seldom do notices of two such complementary products arrive within the same month, let alone on the same day.

Performance Modeling

Originally developed for this firm's internal use during consulting projects, Best/1, a computer system performance modeling tool, now is available to outside users with the advent of release 4.0. Improvements over release 3.1, which has seen limited usage among end users, include improvements in human engineering, and improvements in modeling MVS systems, particularly in the areas of priorities and shared domains.

Best/1 is a predictive tool. It considers hardware configurations, system software, and workloads, and generates predictions of system performance. Parameter driven, Best/1 can model a variety of machines, pinpointing bottlenecks, or indicating that the system will be outgrown in a matter of months. It is said that in one consulting job the vendor spared a customer the cost of upgrading a PDP-11/40 to an 11/70 by identifying the system bottleneck as a poorly designed piece of code. Best/1 answers "what if" questions, and it is said that when the PDP-11 code was rewritten the system performed as predicted.

Written in FORTRAN for portability, Best/1 runs on various IBM mainframes. It also has been installed on machines from Univac, ICL, Data General, and Interdata. A perpetual software license for Best/1 goes for $15,000, which includes installation and tuning, and the first year's maintenance. Subsequent maintenance charges are 10% of purchase per year. BGS SYSTEMS, INC., Lincoln, Mass.

FOR DATA CIRCLE 233 ON READER CARD

Communications Modeling

After a development cycle paralleling that of Best/1, the Modular Interactive Network Designer, MIND, also is being released to the general dp-public. MIND helps designers of data communications networks by predicting performance, costs and reliability. Comprising three basic modules, MIND includes human engineered features to help the user designing a centralized network. The network editor, EDIT, helps the user build a data base describing his network. The editor accepts locations in the form of area codes and exchanges, automatically converting this data to the vertical and horizontal coordinates (defined by AT&T) for use with the tariff submodule. Design work is performed by TOPO, the topological optimization module. TOPO automatically designs a centralized multipoint line layout (at the lowest cost, based on AT&T's interstate private line tariffs) when given node locations, performance constraints, and the operating characteristics of lines and network devices. The user may supply his own operating characteristics or use the system's default values. The default line protocol is bisync; SDLC and virtually any other protocol can be described by user supplied parameters. TOPO also includes a network reliability module. The third basic module, MLSS (multipoint line simulation system) predicts network performance based on terminals-per-line, traffic load, line speed, and other parameters. MIND can be accessed on Bolt, Beranek and Newman's timesharing system via Telenet. Pricing is $4,000 per six months (plus $1,000 start-up) plus 20% of the timesharing charges. Written in FORTRAN for a DEC System 10, MIND also can be had for a perpetual license fee of roughly $20,000. NETWORK ANALYSIS CORP., Great Neck, N.Y.

FOR DATA CIRCLE 234 ON READER CARD

Software & Services

lessons and tests. DECAL maintains records of student activity and test results. Dialog authors have access to 52 variables and may use BASIC-Plus statements for added flexibility. Developed in cooperation with Purdue Univ. Computing Center, DECAL runs on PDP-11s under the RSTS/E operating system. New users may license DECAL, with full support, for $1,000; existing DECAL users may get version 2 upgrades for the cost of the distribution media. DIGITAL EQUIPMENT CORP., Maynard, Mass.

FOR DATA CIRCLE 231 ON READER CARD

Report Writer

Release 4.0 of DYL-260, a report writer and extended utility, has several features in which existing and potential users may be interested. A copy facility, similar to those in COBOL and assembler, allows commonly used parameter statements, and arithmetic and logic statements to be saved on a partitioned data set (OS) or source statement library (DOS) for use when needed. Support for 3350 discs and 3540 diskettes also has been added, as has the capability to support eight input and eight output files in addition to the report file. The package rents for

$98 per month. DYLAKOR SOFTWARE SYSTEMS, INC., Encino, Calif.
FOR DATA CIRCLE 232 ON READER CARD

Pascal

Written for DEC's popular PDP-11 family, the Pascal-SS compiler adheres closely to Jensen and Wirth's revised report of 1975. Language extensions and additional features have been added to make the language better for large scale system development in a production environment. The compiler has a macro expansion facility, object code optimization, and user-controlled overlaying of separately compiled programs and routines. Another nice touch is automatic formatting of source listings. The compiler runs on PDP-11/34 and larger processors with 32K words of memory. Separate versions are offered for RT-11, RSX-11, DOS, and UNIX operating systems. Single cpu pricing is $3,800, or $3,000 for non-profit educational users. Quantity discounts also are available. STRUCTURED SYSTEMS CORP., Palo Alto, Calif.
FOR DATA CIRCLE 229 ON READER CARD

3790 Emulation

A joint hardware and software approach marks this vendor's entry into the world of SNA. This emulation package, which makes the vendor's SYFA systems look like 3790 communications controllers to IBM mainframes, includes a microprocessor controller to implement SDLC line protocol, and a cpu-resident SNA-3790 software emulator. SYFA processors, in a multi-drop configuration, can communicate with a central mainframe in full-duplex mode at transmission speeds of up to 9600 bps. "Despite recent media reports that IBM users are slow in adopting SNA, we feel certain that IBM will prevail," said ex-IBMer Ivan Socher, general manager of the vendor's commercial systems div. The emulator can run concurrently with interactive, batch, and spooling programs. Pricing is divided evenly between the hardware and software components of this offering; both sell for $7,500. COMPUTER AUTOMATION, INC., Irvine, Calif.
FOR DATA CIRCLE 228 ON READER CARD ❋

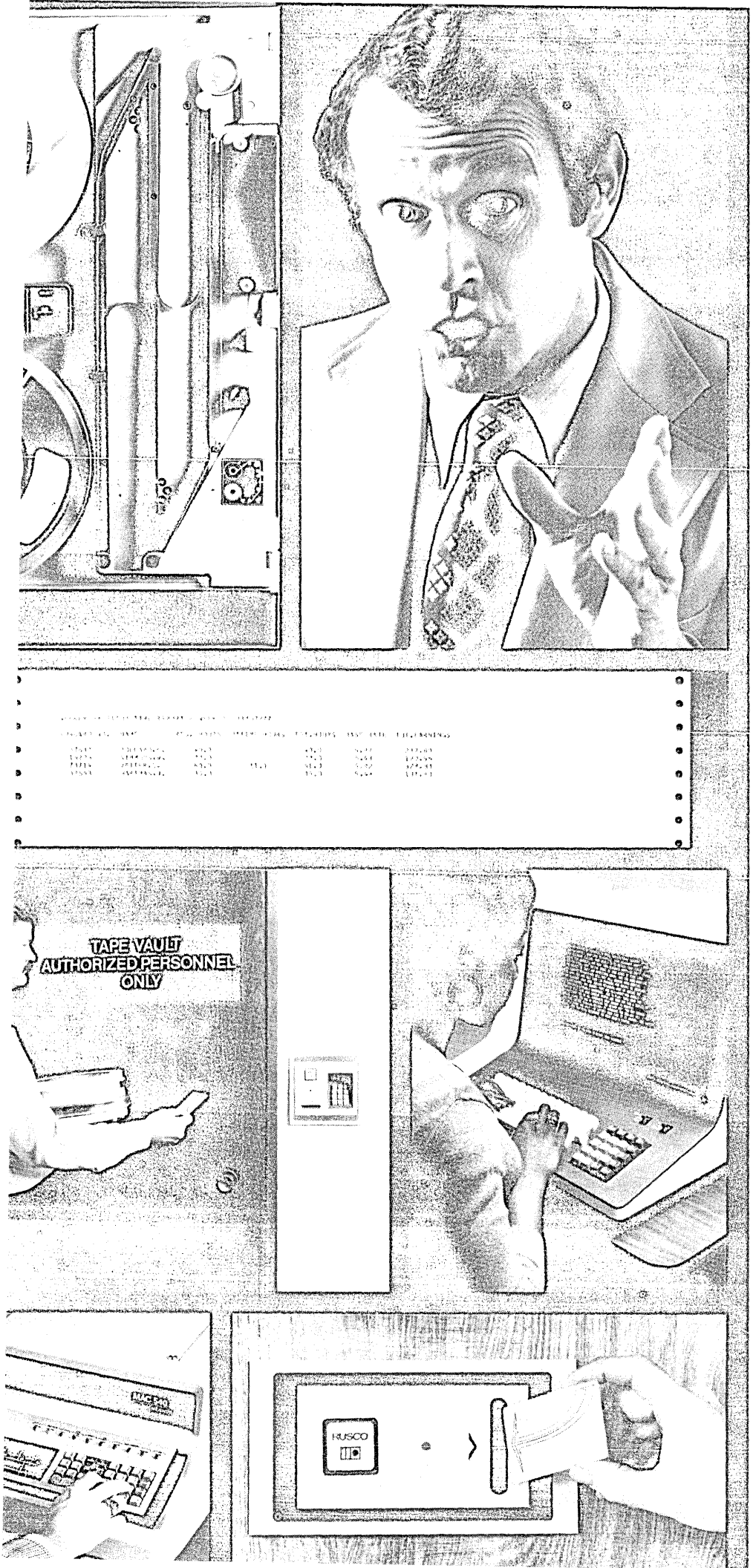
THE FIX

This minor change that we're to make
Allows us only one mistake.
But why do bosses never see
That bugs occur in groups of three?

I raise my hand to try to say,
"Can I come back another day?"
So many times I've tried to flee
This curse called modifiability.

Decision made, the boss now picks
The loser who must make the fix.
Dear God, I hope I'm not the one
Who has to make this program run.

John L. Salisbury



"Here's a hot tip for a hot topic--*CARDENTRY for computer security.*"

"Figure it out.

We've got a small fortune here in hardware alone.

And it'd be hard to put a price on all the information we store—especially if it fell into the wrong hands.

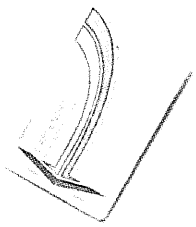
That's why I refuse to take chances with keys and locks to decide who goes where in this facility. Instead, I specified a Rusco CARDENTRY programmable access control system. It's not only far more secure—it's a lot more flexible, too.

For example, I can limit any employee's access to specified areas and time periods. After hours, I can make sure only the night shift supervisor can take the elevator to this floor. And I can key in commands to lock and unlock certain doors at preset times.

I even get a mag tape log of all comings and goings that plugs right into my payroll program to eliminate time cards! And if a power monitor or smoke detector trips, CARDENTRY sounds the alarm and pinpoints the location and time.

I really feel a lot more comfortable knowing CARDENTRY is on the job. Not just because it helps me manage better—I think of it as awfully cheap insurance for an awfully big investment!"

THE CARDENTRY COMPANY . . .



For a brochure detailing CARDENTRY's exciting capabilities call toll-free: **1-800-528-6050, Ext. 691**
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or write **Rusco Electronic Systems**
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CIRCLE 85 ON READER CARD

personal computing

Portia Isaacson, Contributing Editor

Most folks probably thought Dick Heiser was a little crazy when he opened the doors of the first retail computer store in July, 1975. Computers just were not sold in retail stores! Time has shown Dick to be a pioneer, a clever businessman, a bit of a prophet, and definitely not crazy.

There are now more than 500 retail computer stores in the United States and several in other countries. The retail computer store has emerged as an essential way of marketing and servicing low-cost computer equipment. Retail computer stores serve the computer hobbyist, and play a key role in bringing low-cost computer products to business and industry. The cost of sales and service is much lower in a retail setting.

The retail computer store is both a business phenomenon and a social phenomenon. As a business phenomenon it offers essential service and more

The computer store is both a business and social phenomenon.

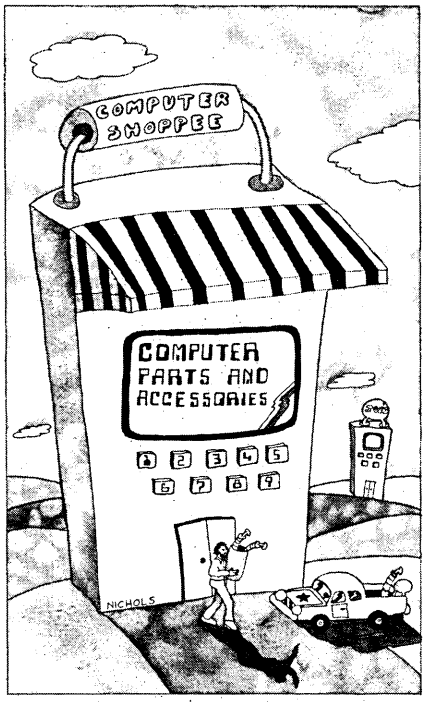
to its customers. The computer store not only stocks equipment and software for immediate delivery, but also demonstrates systems for test-driving, assists in configuration planning, provides repair service, answers myriad questions, and gives application assistance that may include programming.

Social phenomenon

As a social phenomenon, the computer store is having a definite impact on the public attitude toward computers. The stores provide a non-threatening environment in which the public can learn about computers. (In the past, universities, science museums, research establishments, and establishments such as People's Computer Company, held a near monopoly on such learning environments.) Every Saturday brings its share of casual passersby into the computer store. And every computer store has its "regulars" who use the computer store to meet and talk with other computer buffs. Some of the regulars are kids—some play games and some are programming; all learn about computers. In fact, there may be more computer education for kids going on in computer stores than there is in most schools.

What exactly does a computer store do? The answer is different for different stores.

All computer stores offer computer hardware including microprocessor-based computers and associated boards such as memory and I/O interfaces, disks, terminals, and printers. Many items are available in assembled or kit form. Ideally, the computer store has a reasonable inventory; however, due to capitalization problems, sometimes stores are reduced to order-taking. In the typical store, several manufacturers are represented. Each store must make



its own decision regarding the number of manufacturers carried versus the depth of inventory.

Computer stores offer some software and would like to offer more; usually they stock the software offered by the computer manufacturers they represent. Typically, this includes ready to run software such as BASIC assemblers, text editors, games, and business applications—usually in object form with user documentation. Software published as source listings in books is also common.

Some stores also have developed their own software for particular business applications. Several stores do custom software for customers on a contract basis; or, at least, refer customers to consultants who will do the software. In the future, I expect software to become much more important as a computer store product.

Configuration planning

Configuration planning assistance is one of the essential services offered by the computer store. In an industry plagued by premature and vague advertising and with little, if any, help available from manufacturers, the information necessary to configure a working system from the many components available is at a premium. Most computer stores offer configuration planning as a free service; however, a few stores are charging as much as 15% of the total system price. To many customers, the assurance that the pieces he buys will work together as a total system is well worth an added charge.

Degrees of service

Service on personal computers is available through the mail from the manufacturer or from computer stores. Stores vary in the degree and quality of service they provide. For kit purchases some stores will actually guarantee that the kit will be made to work after assembly at no cost to the customer (except for damaged components). In this case, the customer assembles the kit, and brings it to the store which finds the bugs! introduced in the assembly process. Some stores do charge at an hourly rate.

Warranty service typically consists of replacing defective parts. Most stores will at least service the equipment that they sell; some will also service equipment purchased elsewhere or through the mail although service is usually limited to the brands carried by the store. Service is often charged at $10 to $20 per hour. Other charging methods include a fixed percentage of board cost or a fixed price for each type of board. Nearly all stores require that equipment be brought into the store for service. However, some stores will make service calls to selected customers.

Although I know of no store offering a fixed fee maintenance contract covering all necessary service, the development of the small business market may require such arrangements.

The service provided by a store varies with the system component. Cpu's, memory, I/O boards and crt

terminals are usually serviced by store personnel; printers and hard-copy terminals are referred to appropriate service organizations; discs are sent back to the manufacturer for service. The disc service situation can make the customer very unhappy. For that reason, many stores loan discs to customers while theirs is being repaired—perhaps a rental service is the long-range answer.

Some computer store owners have been overheard to say that they are really running a book store. Although that's an exaggeration, stores do sell substantial numbers of books and magazines. At a minimum, stores carry the personal and hobby computing magazines such as: *Byte, Kilobaud, Interface Age, SCCS Interface, Personal Computing, ROM, Creative Computing, People's Computer Company,* and *Dr. Dobb's Journal.* Stores usually have many back issues of these magazines or, at least, books of selected reprints. Some stores also carry traditional computer industry periodicals such as *IEEE Computer Magazine,* and DATAMATION. There are introductory books on computing, personal computing, BASIC programming, and assembly language programming. Then there are the more hardware oriented books covering such subjects as electronics, digital design, microprocessors, and even integrated circuit specifications. Software books that provide listings and documentation for programs are very popular. Some stores carry computer science books, a few with very complete offerings including all the major publishers. Books and magazines are good business for computer stores since the margins run as high as fifty percent.

Computer stores offer information and some form of education in the form of literature libraries, catalogs, free product literature, public bulletin boards, and answers to questions both in the store and on the telephone. Some of these are about product availability or function; others are of the "Why doesn't my system or program work?" category. Usually the customer's problem is a bug in his program or a misunderstanding of the system operation. Some stores go still further and provide formal classes in such subjects as computer introduction, assembly language, and BASIC programming.

"Why doesn't my program work?"

Other services may include audio cassette tape duplication, PROM programming, paper tape copying, custom digital design, hard copy printing, and use or rental of test equipment.

Computer stores come in several flavors. Most are independent and carry several manufacturers products, but MITS stores, Byte shops, and Computerland stores are rapidly increasing in number. The recent entry of Radio Shack and Health greatly expands the number of retail outlets offering computers. Tandy's pilot computer store not only offers Radio Shack computers but also the products of most personal computer manufacturers. At least two major department stores are carrying computers: Neiman Marcus' Washington D. C. store now carries the Digital Group computer and Foleys in Houston offers the MITS computer.

Computer stores tend to specialize in certain market segments, choosing one or more of the following: hobby, small business, industrial process control, or home. The specialty of the store is revealed by its products and by the orientation of its salespeople. In the future we can expect to see stores become even further differentiated in the markets they serve.

Stores have problems

Although a computer store can be a good investment, many are plagued with myriad problems and some go out of business.

Front money	$ 10,000
Demonstration systems	10,000
Furniture and fixtures	10,000
Inventory	40,000
Accounts receivable	20,000
Operating expenses	10,000
	$100,000

Fig. 1. The minimum computer store investment, not a shoestring operation.

The most common problem is undercapitalization. Fig. 1 shows the most common uses for the capital required to start a computer store. If the store doesn't have sufficient capital, the accounts receivable is sacrificed and inventory cut to the bone. Lack of inventory reduces the store to an order-taking establishment and the customer goes elsewhere. In addition, the inability to afford an accounts receivable means that the store can't do business

"Is there enough float in the bank to cover today's C.O.D.?"

with some customers such as universities and certain companies, a serious problem since these customers potentially offer some of the best business. In most parts of the country, competition between computer stores is so fierce that lack of adequate start-up money usually spells doom for the store.

Many manufacturers require a deposit and will ship merchandise only on a prepaid or C.O.D. basis, a particular problem for new stores which have not yet established credit. Older stores with established credit can get 30 day terms from some, but by no means all, manufacturers.

Products are often advertised before they are ready. The store must then explain to customers why they don't have a product that has been advertised for several months. A more severe problem is that the store has not the foggiest notion when an ordered product will arrive. Often orders must be placed months in advance with no product sales history for guidance; a big surprise awaits the store owner with each day's UPS delivery. The surprise would be more fun if the received shipments weren't often unexpected, C.O.D., and for large amounts. In my store we call this game C.O.D. roulette. The big question for most stores every day is, "Is there enough float in the bank to cover today's C.O.D.?"

Margins on most computer products run around 25%, although they range from 20% to 40%. Computer stores need a 40%-50% margin to operate comparably to other retail businesses. Manufacturers are beginning to understand this problem as well as the importance of the retail computer store and are adjusting their margins accordingly, especially for dealers willing to make firm purchase commitments.

Many stores are suffering from a lack of correct market identification. They assumed a hobbyist market and staffed their store with hobbyists as salespeople. Now they are having trouble serving the small business and industrial markets—markets which are potentially much larger than the hobby market.

Some parts of the country have too many stores. Not all will survive.

Money, the biggest problem, will be eased to some extent when stores find it easier to borrow. In time, banks will look more favorably on stores when personal computing is not such a new and unusual business.

Margins are improving as manufacturers become more aware of the needs of the stores and as stores make product selection decisions more and more often on the basis of margin and manufacturer service. As products become more plentiful, stores can exert more pressure on manufacturers to offer better margins.

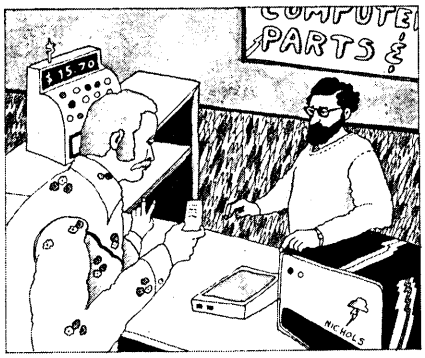
To expand the market for the prod-

ucts offered by the computer store, considerably more software is needed, particularly for small business applications and the home user. The big problem is to work out a means for the producers of this software to market it without widespread theft by individuals or computer stores.

The future for computer stores

The future of the computer store as a business institution in the computer industry is secure because the store offers a reasonable and economical way to market and service low-end computer products to individuals and businesses. Mini manufacturers are already experimenting with marketing through computer stores. The IBM computer store may be just around the corner.

There will be many, possibly too many, computer stores. Stores will tend to specialize in different market segments including home, hobby, business, and industrial process control. Some stores will be service oriented, others will have their own application software, still others will discount their products.



A new role

In general, computer stores will move away from their past role of simply selling the hardware, to a new service-oriented role where their main products will be software and repair service. In fact, software could well become the primary product for many computer stores of the future.

Up to now the computer store owner was something of a pioneer, a primary participant in the Great Computer Revolution, when computers finally reached the people. But now the computer store is entering a new phase, emerging as a proven business enterprise, requiring not so much pioneering spirit as sound business practices. ✲

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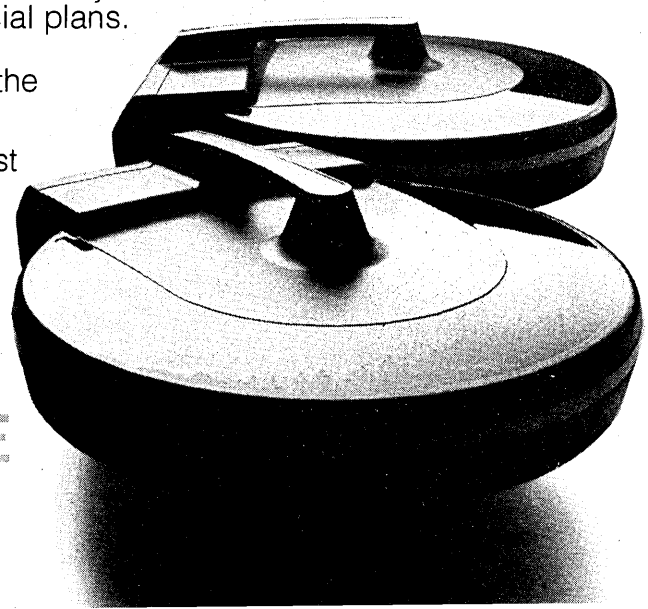

MEMOREXCELLENCE

CIRCLE 92 ON READER CARD

letters

(Continued from page 26)

system. All this will prove is that the system does what it was designed to do, that it "works" in some abstract way. However, whether the system actually does what the user wanted in the first place is very much left open to question. . . .

Ultimately, the only true test of a system's acceptability is to allow the naive user to attempt to use the system in a real world situation. And the only kind of test a user can perform is one which is directly derived from his/her initial expectations of the system.

LOIS A. ROSE, CDP
Senior Staff Consultant
Yourdon inc.
New York, New York

The author replies: I agree that the ultimate system test prior to final acceptance is to let a naive user try it in a real world situation. However, this more unstructured, random testing usually occurs in a later phase than the "system test." System testing is exactly that predictable, precise testing which must be completed prior to letting the user "have at it." Thus, my objective is to discuss what can be predicted and scientifically tested, as opposed to the trial and error process you describe.

Testing with respect to design? No —and yes. You have mentioned a common problem, that of having a system evolve away from expectations and objectives through several design iterations. Some of these changes occur through error, oversight, neglect, or misinterpretation, and must be detected. For this, the key document has proven to be the functional specifications.

I have seldom seen a system that did not change, intentionally, during design. . . . In that functional specifications do document user expectations, I agree that analysts can begin to identify categories of test cases sooner than the design phase. But until procedures, files, screens, reports, transaction types, controls, and user responsibilities have been defined, I do not feel I can develop an explicit test plan.

Company correction

We at MSI Data Corp. were very pleased to read the article in your October 1977 issue of the highly effective use Ralphs Grocery Co. is making of our portable data entry terminals ("Business First Technology Second," p. 29).

However, we did notice our Source 2200 was referred to as an MST 2200. This actually is a product of MSI, the leader in portable data entry with over 65,000 terminals shipped to date.

WILLIAM B. PATTON
Vice President, Marketing
MSI Data Corporation
Santa Ana, California

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We're offering one of the most sophisticated hand-held programmable calculators available to selected professionals in exchange for their resumes and the opportunity to talk about our client's programs in state-of-the-art systems. The Sinclair Cambridge Programmable is both a scientific calculator with memory, algebraic logic and brackets (which means you can enter a calculation exactly as you write it) and a programmable calculator designed to accept through-the-keyboard program entry and operation. Just like a full-sized computer, the Sinclair Cambridge Programmable can be programmed to accept calculations concerned with any specialty and comes complete with 12 sample programs, four program library books that will instruct you on entering your own custom programs and an AC adapter.

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We're Raymarc and we represent a leader in the design and development of major software systems for the most advanced state-of-the-art programs. Our reputation has been built upon our ability to introduce the highly skilled professional to new and exciting programs that challenge the mind and enhance careers. Our client is anxious to offer the experienced person an opportunity for dramatic advancement.

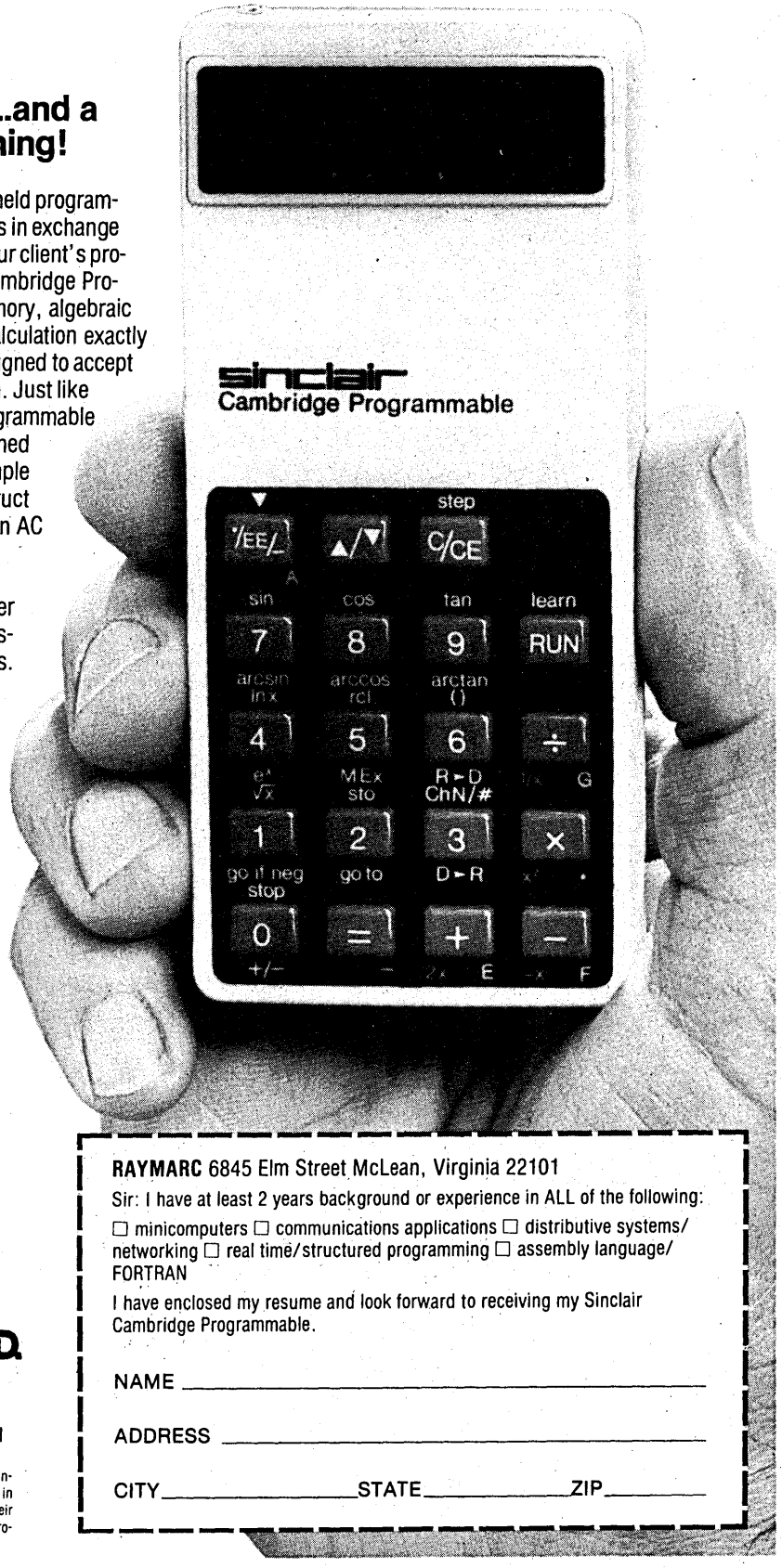
If you have two or more years experience in ALL of the following, be certain to send us your resume and the coupon below:

☐ minicomputers ☐ communications applications ☐ distributive systems/networking ☐ real time/structured programming ☐ assembly language or FORTRAN

So along with your calculator, you receive a unique opportunity to move yourself and your career a jump ahead.

Simply clip the coupon and attach it to your resume.

If you don't qualify, pass this ad on to a friend!



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Quantities are limited. Raymarc reserves the right to determine whether or not an individual's resume represents adequate background in the qualifications specified in this advertisement. Offer is not open to Raymarc employees, members of their families, employees of Raymarc clients or members of their families. Void where prohibited. Offer expires May 31, 1978.

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The Marketplace...

advertisers' index

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CIRCLE 155 ON READER CARD

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A comprehensive accounting system designed to help you keep your system at maximum efficiency.

The new Westinghouse Job Monitor/II provides job accounting information for DOS or DOS/VS users running with or without POWER/VS. Captured information is compiled for comprehensive reports useful in systems, operations, and management decision-making.

Job Monitor Features:

- User defined Processing Day
- Daily Job Stream and Partition Activity Report
- Graphic analyses of resource usage
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The complete package is provided requiring no special education or additional programming and no dedication of hardware units.

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FOR THE FIFTH STRAIGHT YEAR —DATAPRO HONOR ROLL!

This product provides a fast, reliable, and easy-to-use means of backing up or copying disk files, libraries, and data bases, either tape or disk. The programs can dump multiple disk volumes and/or files of different organizational structure to tape, can selectively restore any file or volume dumped to tape and can copy complete volumes and/or files from disk to disk.

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CIRCLE 165 ON READER CARD

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CIRCLE 163 ON READER CARD

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THE ONLY TP INTERFACE THAT MADE IT AGAIN.

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WESTI provides a low overhead, easy-to-use system for 3270, 2260, and teletype (33/35) display terminals or equivalents operating in a DOS or DOS/VS environment.

- Complete Management of Terminals and Application Programs
- Cobol, Assembler and PL/1 Language Support
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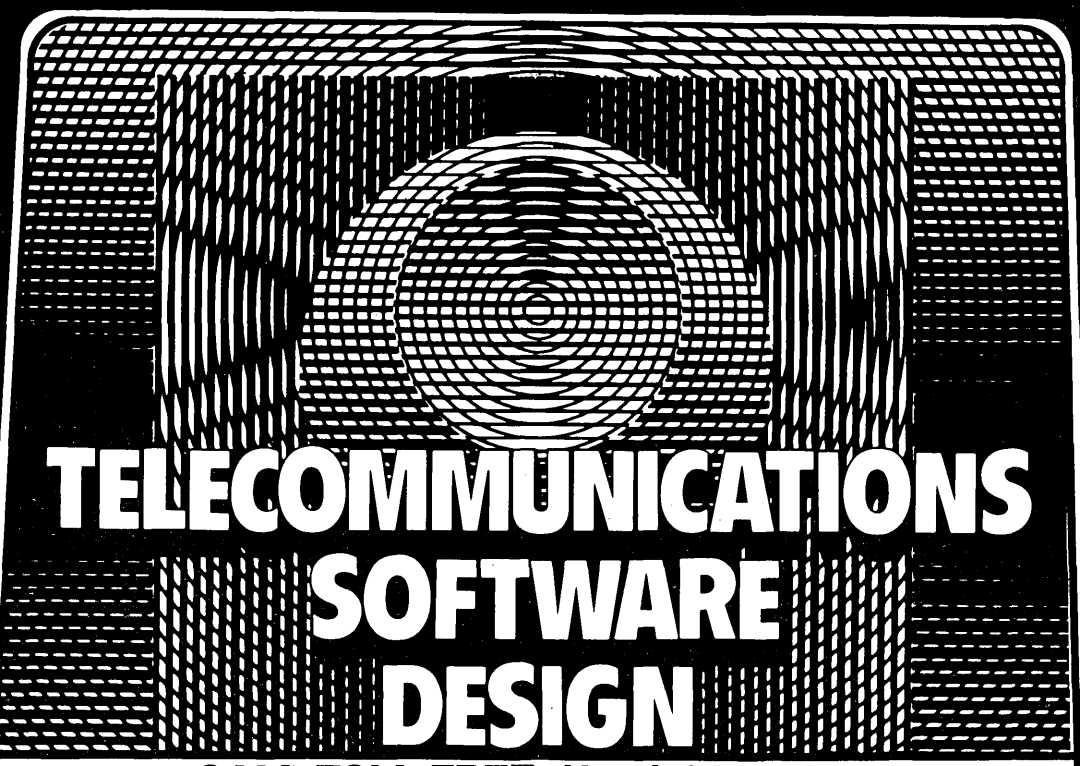

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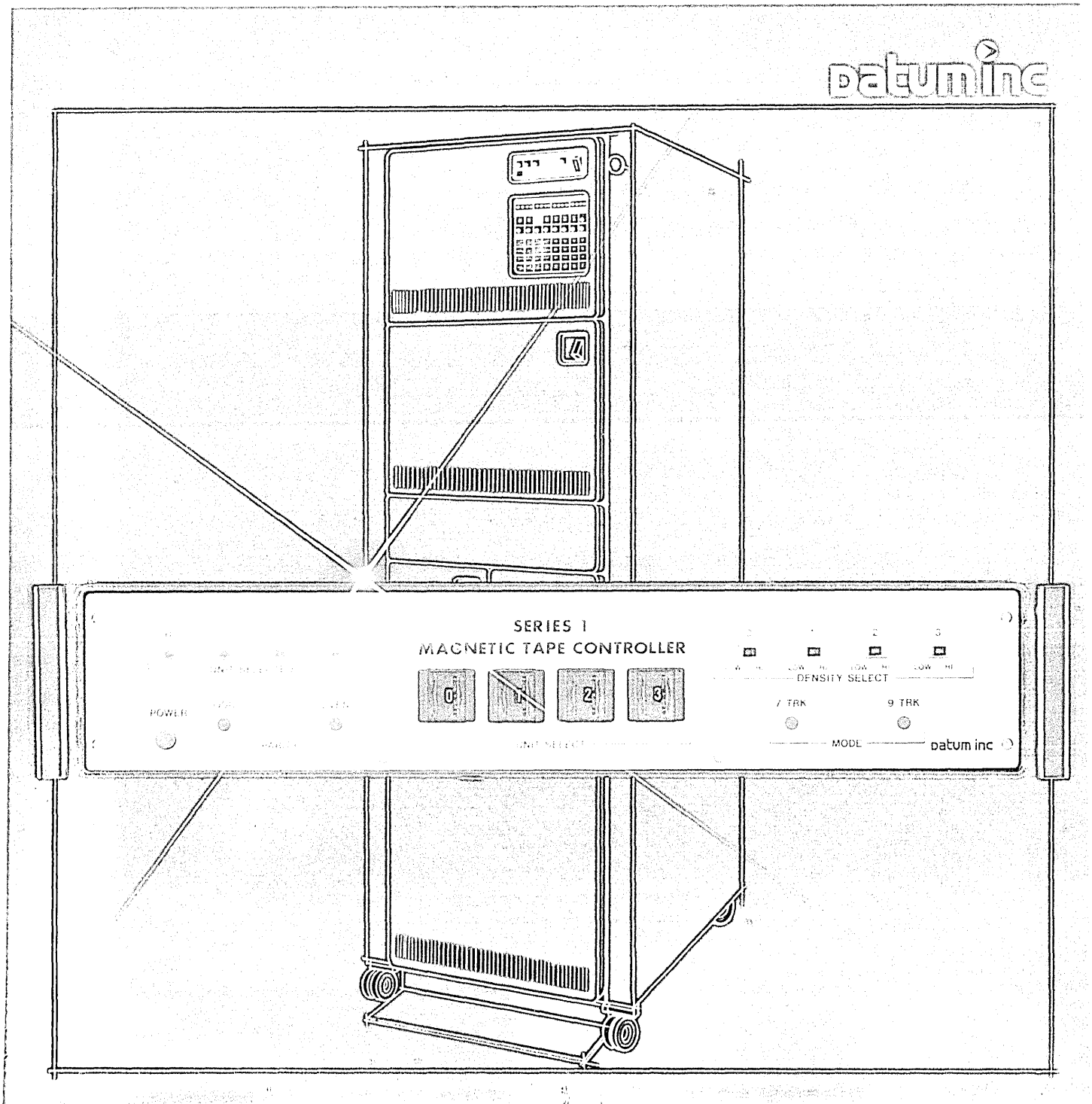

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