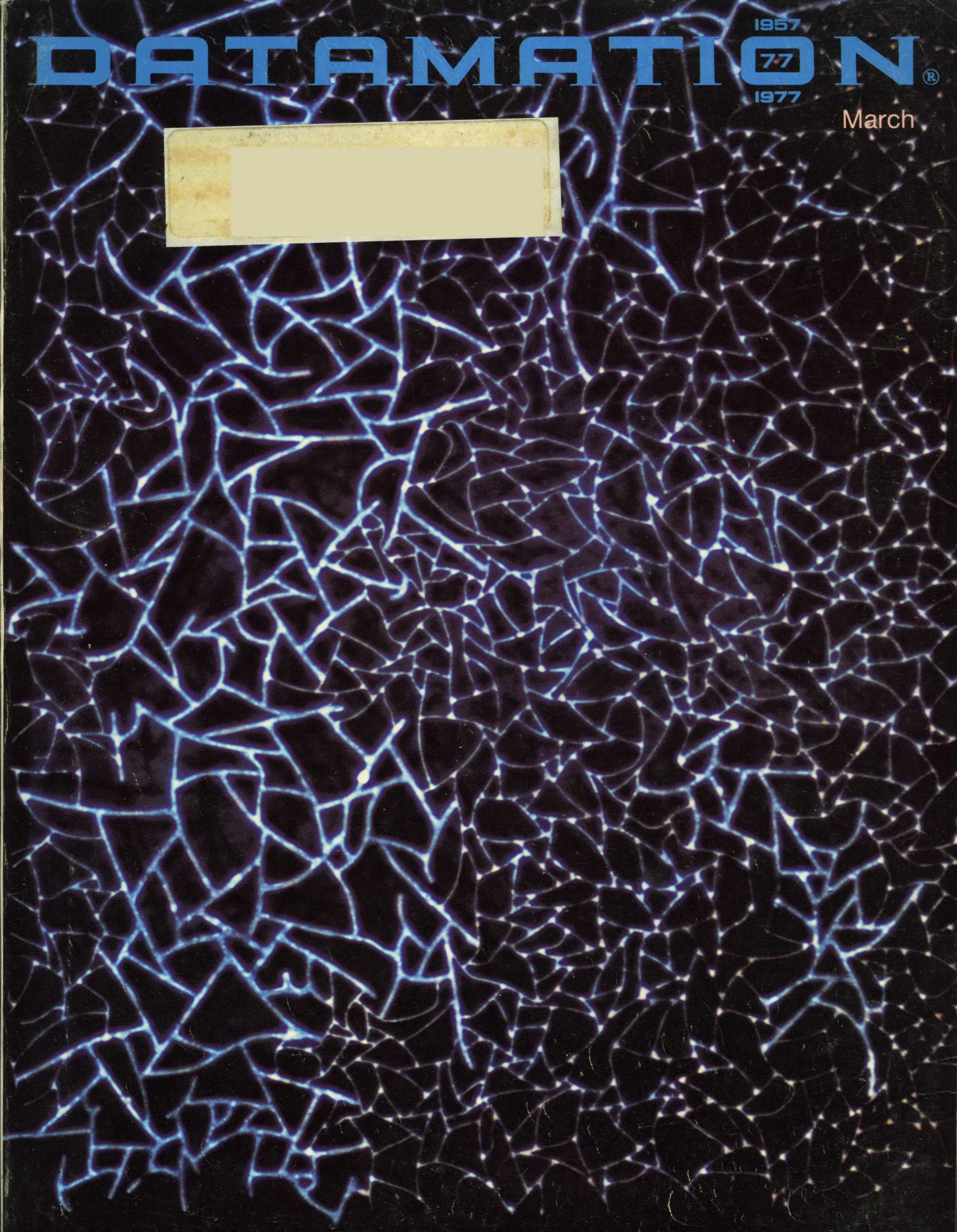
DATAMATION®

1957 77 1977

March



DATA COMMUNICATIONS: Bell vs. Justice, SNA, and a major modem survey.
Also, Bell bill issues, throwaway code, and programmer self-test...

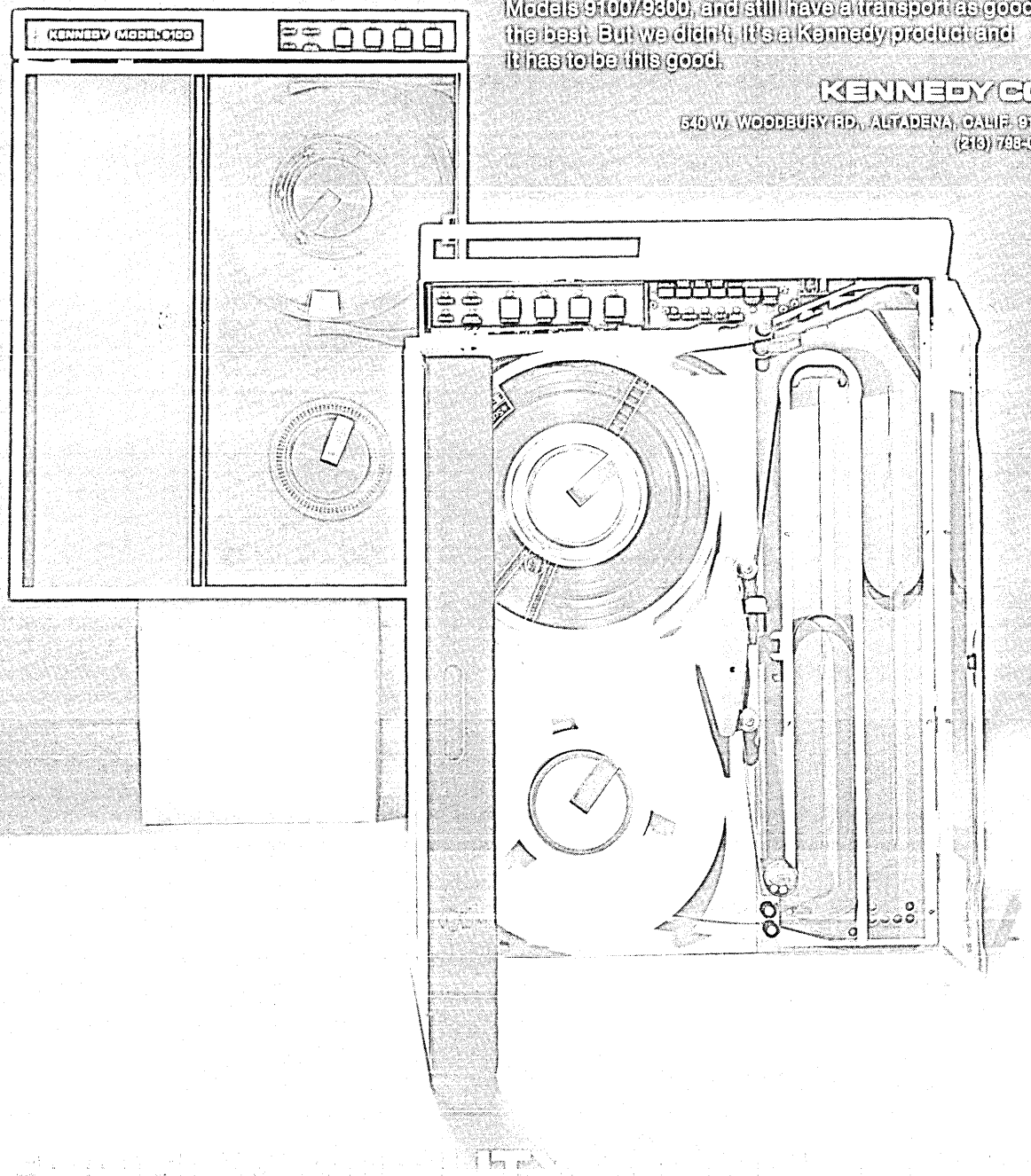
Models 9100/9300 Vacuum Column Tape Transports. We didn't have to make them this good.

Kennedy vacuum column digital tape transports have been the standard of the industry from their introduction. Some companies would have stopped and relaxed. We didn't. We added features such as our capacitive tape-location detector, for improved tape life, air bearings and tribaloy coated read-after-write heads to reduce tape wear and improve data integrity, and we've achieved the lowest noise level in the industry.

Performance is just as impressive, with tape speeds to 125 ips (75 ips on Model 9100) and operating features such as crystal controlled timing, read threshold scanning, read-after-write shortened skew gate, front-accessible test panel, quick-release hubs and simplified tape loading.

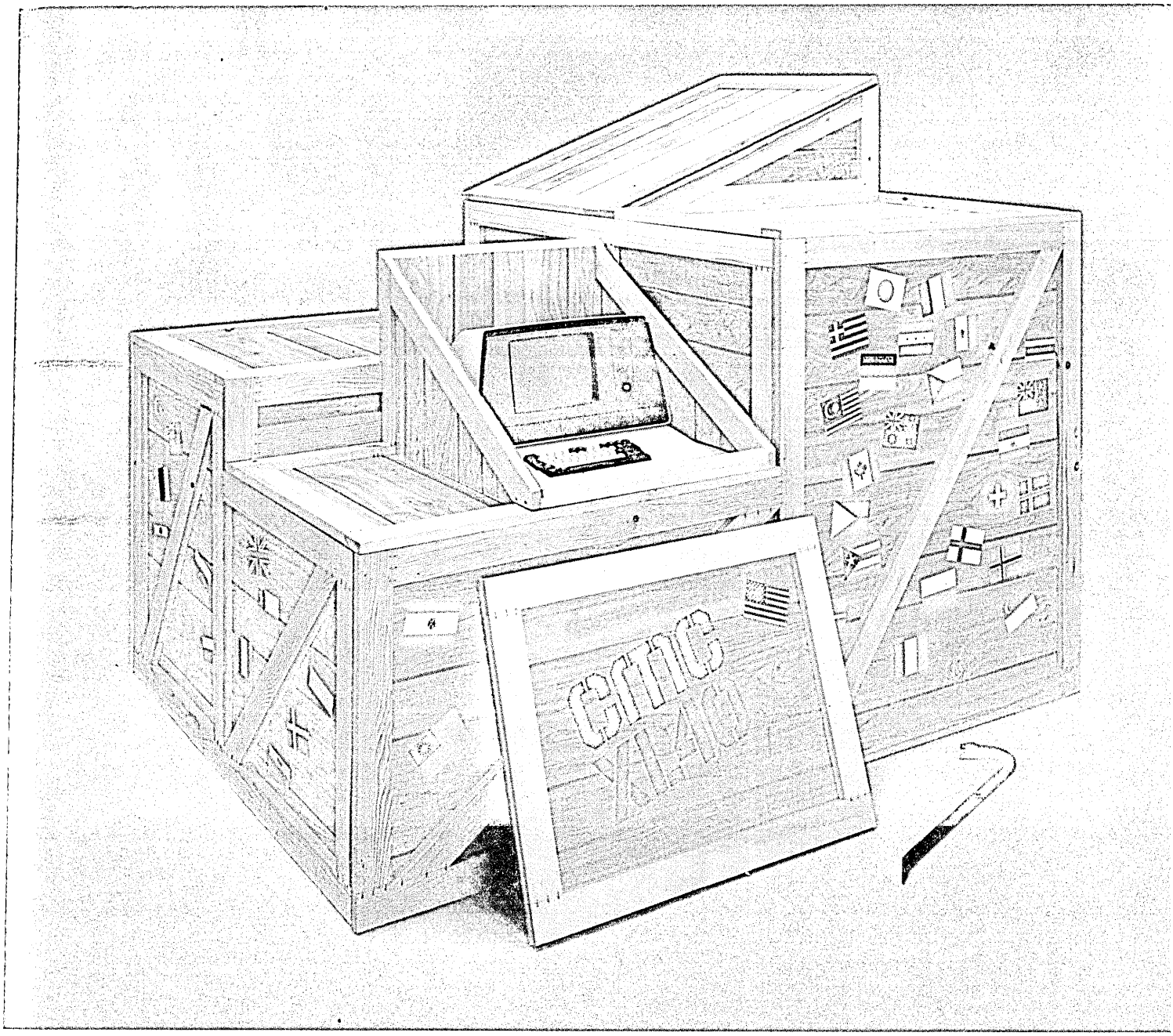
Data densities are 200/556 cpi or 556/800 on our 7-track unit and 800 cpi, 1600 cpi or 800/1600 cpi on the 9-track transport. The format is NRZI/PE.

We could have eliminated some of the features of Models 9100/9300, and still have a transport as good as the best. But we didn't. It's a Kennedy product and it has to be this good.



KENNEDY CO.
540 W. WOODBURY RD., ALTADENA, CALIF. 91001
(213) 798-0953

CIRCLE 1 ON READER CARD



The DREAM Machine

CMC introduces the all new XL40 Distributed KeyProcessing System.

Blending Data Retrieval, Entry And Management, the XL40 combines the newest distributed processing and data entry technology with an exceptional file retrieval capability. *Distributed KeyProcessing* means data is entered, validated, and managed at the source—where it originates—by people who really know what the information represents. Distributed KeyProcessing reduces your data processing costs by detecting and correcting errors before they reach the mainframe, providing local preprocessing, and optimizing the management of your organization's data.

First in a family of CMC Distributed KeyProcessing Systems, the XL40 is available with one to seven keystations in a choice of keypunch-style keyboard or typewriter style with numeric pad, and features expandable disk capacity from 4.4 to 35.2 megabytes. Using a variety of industry-standard protocols, including HASP workstation, the XL40 communicates with your mainframe wherever it's located.

Your software dreams come true with a fully compatible subset of ANSI COBOL and XL/OS, an automatic and dynamic multi-task operating system specially designed for the XL family. XL/OS provides disk and memory allocation, ensures data and system integrity, and controls all system resources. The XL40's information retrieval package, COSAM (COBOL Shared Access Method) features indexed files which you can retrieve and update on the spot, ensuring instantaneous response at the source.

Don't just dream about it, call or write today for our brochure on the XL40 Distributed KeyProcessing System, The DREAM Machine for Data Retrieval, Entry And Management. With the XL40, just as with dreams... the possibilities are unlimited.

KeyProcessing is a trademark of

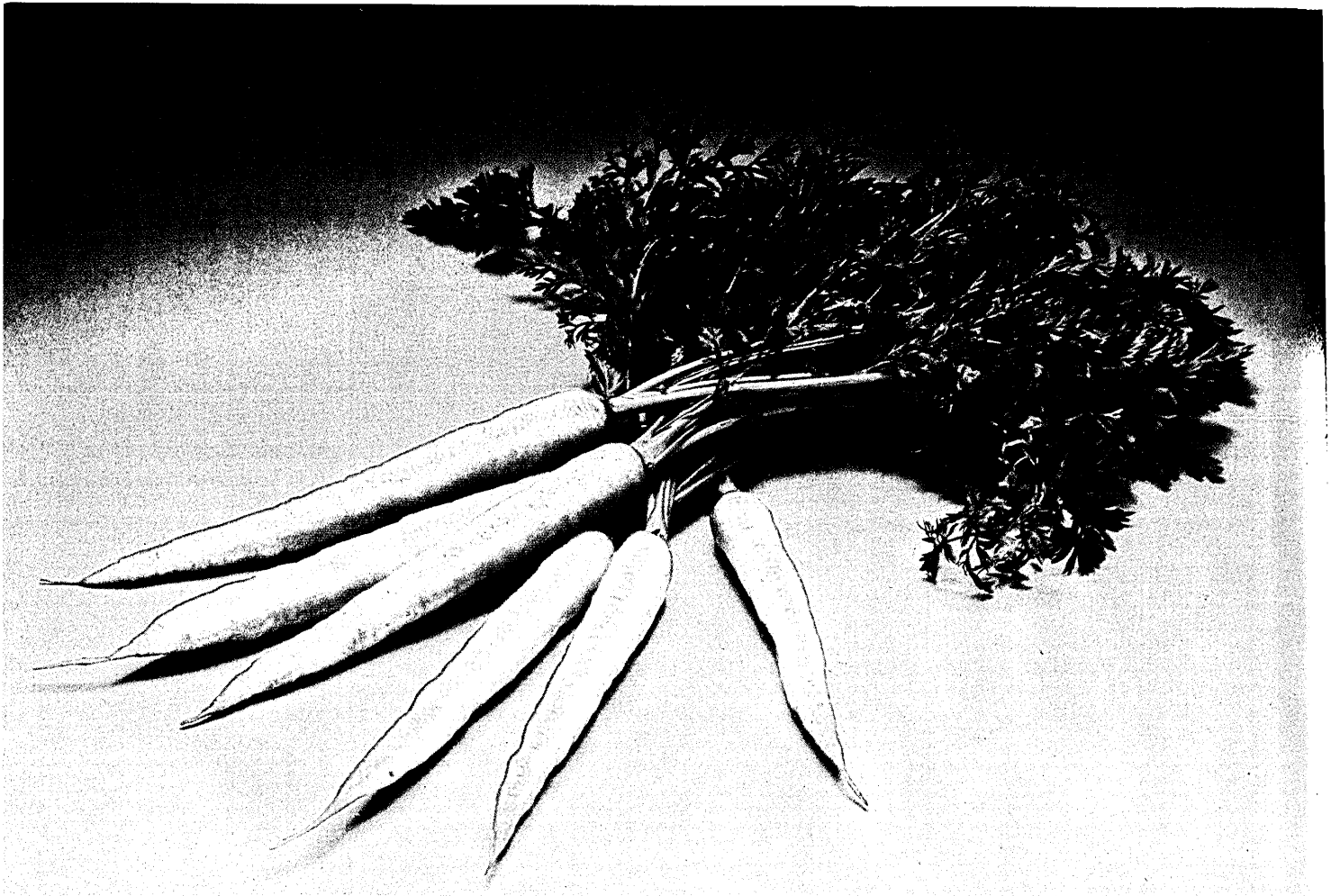
CMC

a division of Pertec Computer Corporation

12910 Culver Boulevard, P.O. Box 92300, Los Angeles, CA 90009
Telephone (213) 822-9914, TWX (910) 343-6451

CIRCLE 4 ON READER CARD

In Europe the XL40 is marketed under other brand names through a network of independent distributors and licensees.

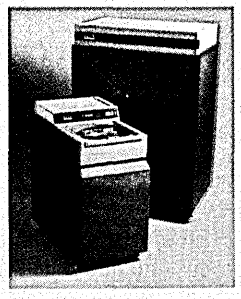


Itel Disk Drives.

Now you can pick one and get the whole bunch.

That's right. Our 7330-10, 7330-11 and 7330-12 disk drives are field upgradable from the smallest to the largest system. So when you have one, you really have them all. For example, when you upgrade our 7330-10 to a 7330-12, it's like going from an IBM 3330-1 to a 3350—without giving up media interchangeability. When you're ready to upgrade, all you need to do is call one of our field engineers. And Itel has the largest independent field engineering service in the country.

In addition, Itel now offers you another alternative in disk drives—our new 7350, which is compatible with IBM's 3350 and includes the Fixed Head feature. Of course, all our disk drives have the exclusive Dual-Port feature plus Itel's patented Advanced Function Capability. Add the fastest access time currently available, and you can increase throughput up to 25%.



Like all Itel data products, our disk drives and control units are plug-compatible, offering you superior performance at a lower cost. After all, reliable, economical alternatives are what Itel is all about. Not only in computer peripherals, but in field engineering, in financial packaging, in systems and software, in total computer capability.

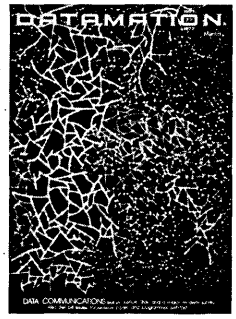
Choose one of Itel's alternatives today—and later, you may want the whole bunch.

ITEL
CORPORATION
Data Products Group
One Embarcadero Center
San Francisco, California 94111
Telephone (415) 983-0000

CIRCLE 55 ON READER CARD

DATAMATION®
1957 77 1977
VOLUME 23 NUMBER 3 This issue 144,662 MARCH 1977

FEATURES



NEWS IN PERSPECTIVE

DEPARTMENTS

About the Cover
"Never Ending Screen" expresses the intricate and expanding world of data communications. This wire and welded sculpture is the work of artist Claire Falkenstein, who is represented internationally in museums and private collections, and who currently lives and works in Venice, California.

DATAMATION.

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CIRCLE 184 ON READER CARD

Life of Georgia Depends on ADR's ROSCOE® For Faster Job Turnaround, Faster Maintenance and Expanded System Access

Two years ago, Life Insurance Company of Georgia installed ROSCOE, ADR's on-line conversational programming system. It was initially installed to speed computer program development, but Life of Georgia quickly found that ROSCOE also expanded direct computer access. Interactive procedures made the system easy to use without extensive training so that virtually any department could enter and update data through their own terminals. Self-prompting routines, using ROSPROCs, could direct users through even complex systems one step at a time. Information could be entered without keying-in locations or other detailed instructions, and corrections could be easily entered right over the old information, without re-keying whole data.

Today, nine ROSCOE equipped terminals are located throughout the company, giving many departments direct on-line access to 3400 operating programs. System specialists no longer wait in line to do a routine job.

Program development goes faster, too. With data-set recall, programmers call up the information they need, key-in required changes, and send it back again—without handling cards or paging through listings. "The greatest time savings comes from compiling COBOL programs," noted Earl Ryan. "ROSCOE asks the user what he wants to do and then tells him to enter the changes he wants to apply. As a result, turnaround time has been reduced at least 30%. And we have virtually eliminated JCL type errors."

"If we were to put our programmers back on the old keypunch system, we would have a real morale problem. It would be very difficult to take ROSCOE away now," Earl Ryan added.

Each ADR product is not just a program but a complete package with full documentation and on-site support. ADR is the only software company with 50 branch offices and representatives in over 30 countries—each staffed with ADR-trained technicians.

"It would be very difficult to take ROSCOE away now . . .," Life of Georgia Technical Analyst, Earl Ryan, speaking about ADR's on-line conversational programming system.

For more information on what ADR software can do for you, call or write

APPLIED DATA RESEARCH on-line THE SOFTWARE BUILDERS®

Route 206 Center, Princeton, N.J. 08540, Phone: 609-924-9100.

ADR software products: in use at over 5,000 installations worldwide.

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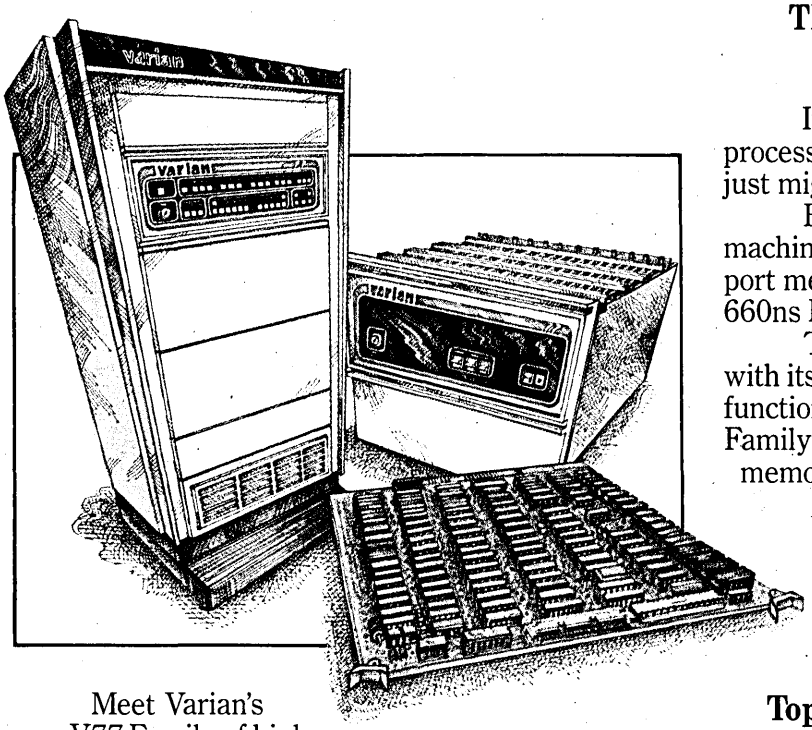
Introducing three new mini's that think like mainframes.



Meet Varian's new V77 Family of high-performance minicomputers.

Three distinctive new models. All fast. Each powerful. A family trio most mainframes can relate to. For help with almost any scientific, industrial, or data communications application.

The V77 Family delivers all the speed and performance you expect from Varian. Plus the unexpected, too. In the form of total family compatibility and shared memory capabilities. Up *and* down the family tree. For complete open-ended flexibility. In capacity and price.

The world's first mainframe-on-a-board. Our new V77-200.

Quite frankly, the new V77-200 delivers more computing power than any other computer-on-a-board you can buy. Handling up to 32K/16-bit words of 660ns MOS memory.

Big machine features include a fully micro-programmed architecture, an 8-register CPU, a 32-bit arithmetic capability, powerful set of 187 instructions, hardware multiply/divide, direct memory access, programmed I/O, real-time clock, and a teletype/CRT controller.

There's big machine performance, too. Example: multiplication functions handled in 4.9 microseconds—divide in just 8.

The new V77-200 means more cost-effective computing in many scientific, instrument control, or data communications environments.

The in-between that's a go-between. Our new V77-400.

If yours is a multiprocessing or distributed processing network application, our new V77-400 just might be "the tie that binds."

Because 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.)

The V77-400's dual port memory, working with its unique direct memory access system, functions as a bridge when linked to other V77 Family computers in closely coupled, shared memory multiprocessor arrangements.

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

Top-of-the-line performance for almost any application. Our new V77-600.

Varian's new V77-600 sets new standards for all would-be high-performance mini's.

First, with a long list of standard big machine features. Second, with up to 1024K/16-bit words of 660ns MOS memory. And third, with a host of performance enhancing options. Including Writable Control Store, a floating point processor, and special scientific and commercial firmware.

For the ultimate in performance enhancement, an optional high-speed cache memory is also offered—cutting the V77-600's average execution time in half.

How our mini's speak fluent mainframe.

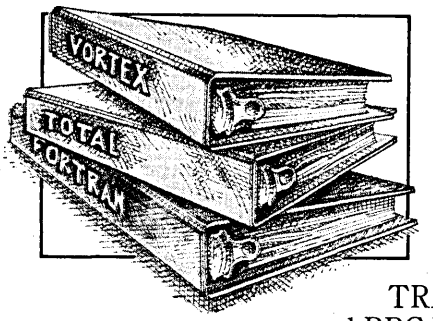
You won't waste any time or money training our new V77 Family how to communicate with your mainframe. Or developing your own control programs.

Because all V77 Family members utilize Varian's VORTEX (or VORTEX II) operating

system—two of the world's best real-time systems.

Both systems permit concurrent job execution by allocating priorities. And help tailor other subsystems to fit scientific to commercial, real-time to batch, and stand-alone to data communications environments.

TOTAL, a highly efficient, network-type data base management system, is now available as a VORTEX II subsystem.

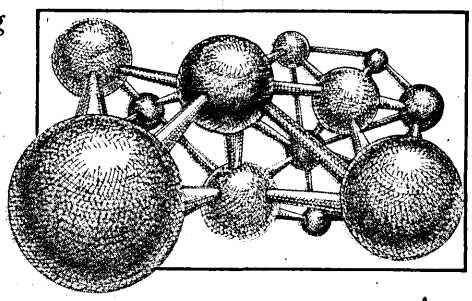


Usually found on only larger computers, TOTAL allows you to define and access your data base with powerful, high-level language processors like COBOL, FORTRAN IV Level G, and RPG-II. Opening the door to large libraries of already developed applications programs.

The benefits of a well-structured family.

Our new V77 Family represents more than just a continuing commitment to total hardware and software compatibility. Because it's a commitment to solving basic price/performance needs on several different levels.

For those needing more computing power, there's a V77 that's an affordable, high-performance solution.



For those wanting less wasted overhead, there's a less expensive, high-performance alternative.

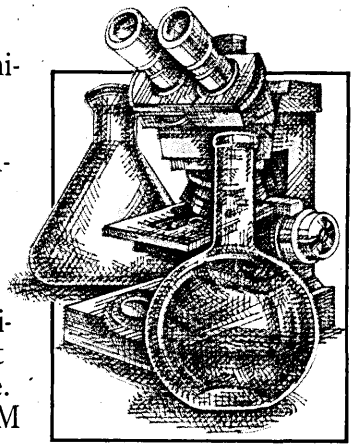
Plus an attractive new V77 discount plan designed to give even modest-volume OEM buyers a big break.

Finally, for those with special multiprocessing or distributed data processing requirements, there's an entire V77 Family. Specifically engineered to work well together—through shared memories, intercomputer I/O bus lines, and shared communications channels—as new cost-effective replacements for typical "patchwork" systems.

Varian. A commitment to innovation.

Varian Data Machines has played a significant role in the evolution of digital minicomputers for almost a decade now.

Consistently producing innovations not only meaningful to the industry, but to the end-user as well. A look at just the last five years tells the story...



In 1972, VDM developed the first minicomputer operating system with all the multi-task and file handling capabilities of a large computer.

A year later, VDM created the first microprogrammed minicomputer with a 65-bit Writable Control Store.

In 1975, two VDM firsts: a minicomputer with a data base management system equivalent to those for large computers, and, the first 64K word semiconductor memory package on a single board.

Today, it's the whole new V77 Family. Well-structured and ready. Breaking new ground in terms of Varian size, compatibility, and price/performance. Three new mini's that really do think like mainframes.

For additional V77 Family planning literature, contact any of the 38 Varian offices listed below, or Varian Data Machines, 2722 Michelson Drive, P.O. Box C-19504, Irvine, California 92713, (714) 833-2400. In Europe, contact Varian Associates Ltd., Molesey Road, Walton-on-Thames, Surrey, England, Telephone 28971.

varian

Mini's that think like mainframes.

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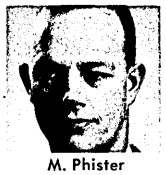
Looking Back in DATAMATION.

On our 20th anniversary

March-April, 1958


W. H. Ware


M. Phister

The 6th annual Western Joint Computer Conference was expected to draw 2000 engineers and scientists to Los Angeles. The field was exploding. Conference chairman Willis Ware commented ". . . we are confronted with a vast and . . . confusing array of alternatives." Attempting to bring order out of chaos, technical chairman Montgomery Phister of Ramo Wooldridge scheduled sessions ranging from the RCA 501 to Ramac. Among the exhibits, show goers saw the Teletype model 28, Datafile "bins" from Electrodata, and a 10 lps printer from Potter Instruments.

A survey article on dp salaries pegged the data processing division head's salary at an average $1150/month; senior programmers made $750; and key punch operators earned $330.

March 1967


H. Bromberg

Fun-loving Share members invaded topless San Francisco "with no winner declared." PL/1 was hot; commented one critic, "PL/1 isn't dead, it's being tortured by os." Continued speculation about the Justice Department's interest in IBM's activities led off the news section. Controversy continued to mount over AT&T's introduction of Telpak communications services for high-speed data and facsimile transmission. And, in the face of Bell proposed rate hikes, users were taking a hard look at private microwave transmission.

Howard Bromberg, in the article "The Cobol Conclusion" concluded that the COBOL experiment had ended. It exists, it works, and it grows, he said . . . and "from this point on there should be no more 'why' articles . . . now they should all be 'how'."

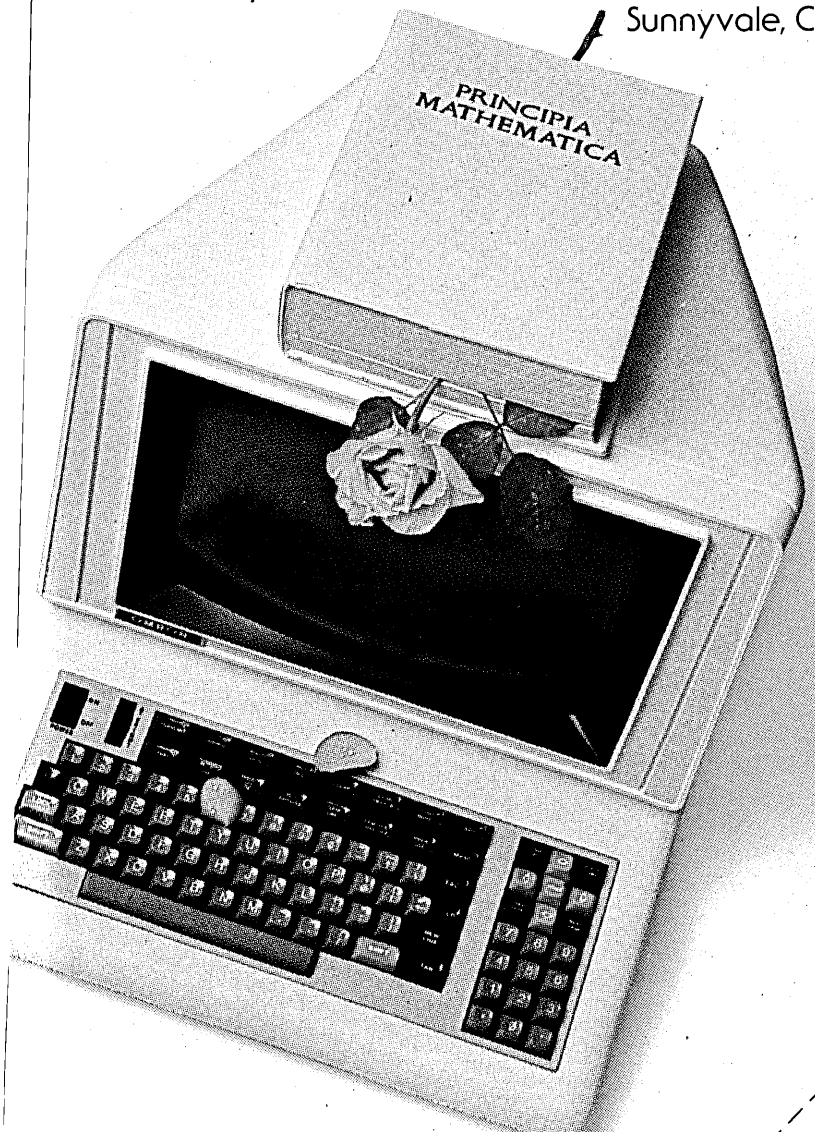
Finally, Air Force major John Humphries concluded that fluidic computers "have a definite place in the ever-expanding array of data processing techniques." Fortunately fluidics never flew or in this winter of 1977 you might be reading a Datamation article titled "The Day My System Froze."

BAUDY, BRIGHT, AND WHAT A MEMORY.

Two to ten pages of total recall—now available on our "beauty with brains"—the Omron 8030 CRT Terminal. The 8030's multi page refresh memory option will store and retrieve up to 19,200 characters for instant operator access. Put it to work reducing line connect time and host handshaking in applications requiring store and forward and large file inquiry.

And don't overlook the 8030's other features. It's 8080 based and 9600 BAUD—smart and fast enough for the most demanding requirements. A big 15 inch diagonal screen with effective 14 x 9 dot matrix makes it very easy to look at, and with an 8000 hour MTBF you know the 8030 will be operating when you need it.

So when you're specifying CRT Terminals, remember Omron. OMRON Corporation of America, Information Products Division, 432 Toyama Drive, Sunnyvale, California 94086 (408) 734-8400.



OMRON

CIRCLE 64 ON READER CARD

Love at first sight

OMRON CORPORATION OF AMERICA, INFORMATION PRODUCTS DIVISION
432 Toyoma Drive, Sunnyvale, CA 94086.
Please send full information on Omron's 8000 Series CRT Terminals.

Name

Company

Address

City State Zip


Pastel compastel

Show this Intertel ad to your Milgo rep.

And relive the 1960s with him.

The 1960s. A face. A smile. And buy, buy, buy.
Remember the 1960s? What a time! See it. Buy it. Do it. It was the sixties.

You could take some starstruck kid from Kankakee. Dress her up like a fashion model. Hand her a tube of toothpaste. And every time she smiled, cash registers all over America would start to chime.

It wasn't just toothpaste, either. Automobiles. Shaving cream. Breakfast cereal. Everything was sold that way. Even modems.

Take the folks at Milgo, for example. They sold modems that way. A lot of modems.

What ever happened to the 1960s?
But, all of a sudden, the sixties were gone. And, the 1970s rolled in like a wave.

People discovered they had networks. Not just modems and terminals. (They also discovered that women weren't sex objects, but that's another story).

Suddenly, the whole world was into networks. On-line networks. Real-time networks. Networks that begged to be managed.

And along with these new networks came new managers. Managers who wanted to get inside their networks. Get involved. Interact. Diagnose. Managers who relied on Intertel and the Intertel Network Control System to help them.

And what ever happened to Milgo?
While Intertel was busy building network control systems, Milgo kept right on building modems. And when they finally introduced a network control product, they sold it like toothpaste. They pointed at it. They smiled. And they waited for the orders to roll in.

While they were waiting, Intertel introduced them to the rough and tumble world of marketing in the 1970s.

It's not the 1960s anymore.
If anyone tries to sell you network control with a smile and a stage routine, don't just sit there. Ask questions. Challenge them. Here are five questions that really separate the men from the boys (and the women from the girls).

1. What is it exactly you're trying to sell me? (Beware, if he or she stumbles on this one.)
2. How many of these systems of yours are installed?
3. Where can I see your system operating on-line in a large data network?
4. Does your product have diagnostics and transmission line restoral at all speeds from 1200bps–9600bps?
5. Why didn't your company answer the Intertel challenge?

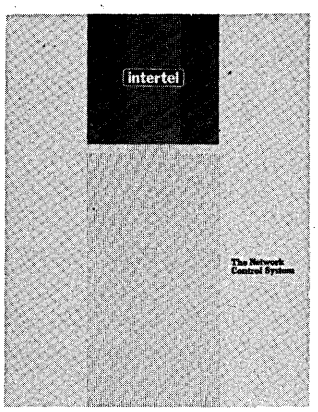
Our NCS4000 is the first Network Control System for distributed processing.

Call the experts at Intertel.
Now call Intertel. Ask the same questions. Throw in a few tough ones of your own. We'll be happy to answer them all.

We've had plenty of experience. Intertel has installed more than 100 Network Control Systems. For banks, airlines, and Fortune 500 companies. All over the world.

Right now, management people just like you are using Intertel Network Control Systems to get inside their networks. To manage. To diagnose. To interact. To save money and time.

Call us and ask about them. Or, if you want to know more about the new Intertel NCS4000 Network Control System, send for our free brochure.



We're realists. After all, it's the 1970s.
We're realists. We know you're going to compare all the other network control systems to our Intertel system. Good. We like competition.

But remember one thing. When it's 8:30 on Monday morning and no one knows what the hell is wrong with your network, you're the person who's going to be on the firing line. You're the one on the hot seat. You're the one with the whole company on your back.

That's a bad time to realize you bought a network control system for the same reason you used to buy toothpaste.

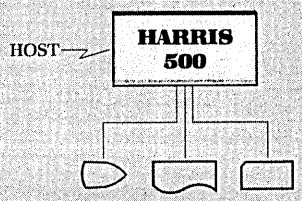
intertel

6 Vine Brook Park
Burlington,
Massachusetts 01803
Tel. (617) 273-0950

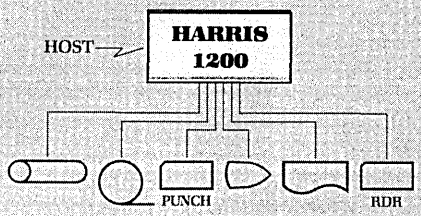
#1 in network control

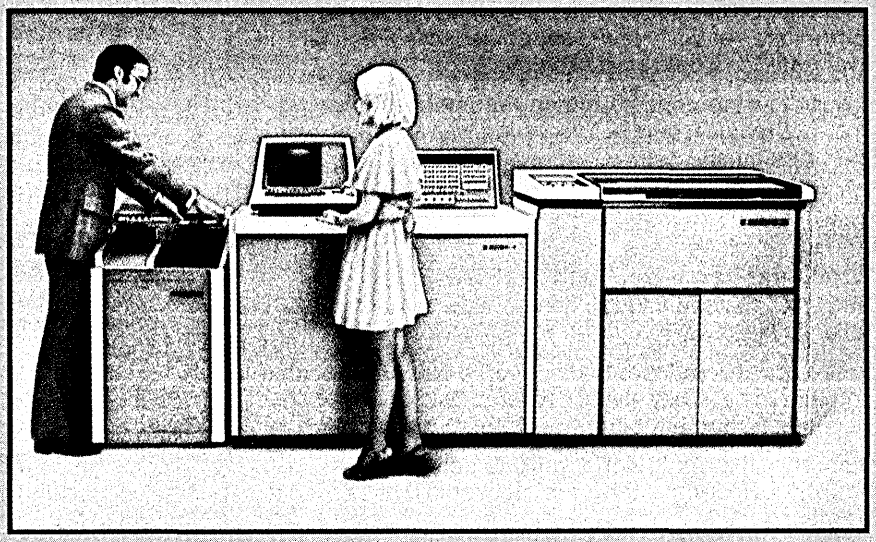
CIRCLE 56 ON READER CARD

Harris 500
Intelligent Remote Batch Terminal

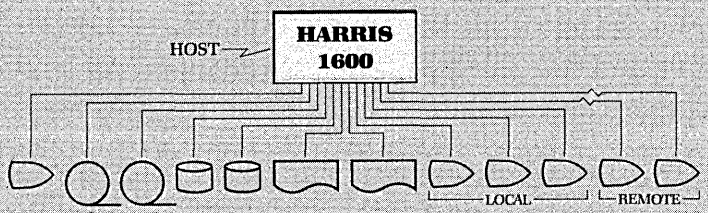


Expanded Harris 1200 Remote Batch Terminal supporting multiple peripherals into mainframes such as IBM, CDC, UNIVAC and Honeywell.





Interactive processing from local or remote CRT terminals combines with concurrent remote batch to a host computer providing optimal balance of processing power to each location.



Look at Harris now.

You've spent a lot of time looking at data communications hardware, software and services. Everybody has. But now you've looked far enough. Whatever your requirements, you'll find Harris provides the remote batch terminals, remote communications processors, distributed processing systems, peripherals, maintenance and software support you need . . . for entry-level, medium- or high-function applications. Read on for a close look at Harris now. It's a sure way to make things look up for you!

Look at Harris
Remote Batch Terminals

Harris has two product families designed to fill the needs of remote batch terminal users: the entry-level Harris 500 and the high-function Harris 1200. Both families are structured around powerful minicomputers, enabling you to configure the exact system you require for specific applications . . . choosing from families of proven peripherals. Data communication rates of up to 50K bps can be achieved. Maximum throughput rates are possible with full-duplex communications to central computers supported by a Harris communications controller.

Look at Harris
Remote Communications Processors

The Harris 1600 family is designed for users needing expanded capabilities in remote communications and processing. Harris provides you with a transitional bridge to distributed processing functions via the Harris 1610 or 1620 remote batch systems.

You can begin with a Harris 1610 RBT supporting a line printer, card reader and optional card punch and go on from there to a Harris 1620 remote communications processor with multiple printers, tape drives and other peripherals supporting multiple concurrent emulation into as many as four mainframes *simultaneously*. This Harris innovation means you can access your in-house computer system, for example, at the same time you access an outside computer utility — from one 1600! It's made possible by the operating system designed into our advanced terminals.

Look at Harris
Systems for Distributed Processing

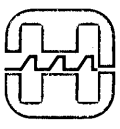
For emerging distributed processing applications requiring interactive source-document entry, inquiry/response and file manipulation . . . such as systems for order entry, inventory control and personnel record search/update, Harris offers enhancements to the 1600 including microprocessor-based CRTs, disk resident software, a simple interactive language (REGAL) and COBOL.

Look Behind Harris Products at a Great Company

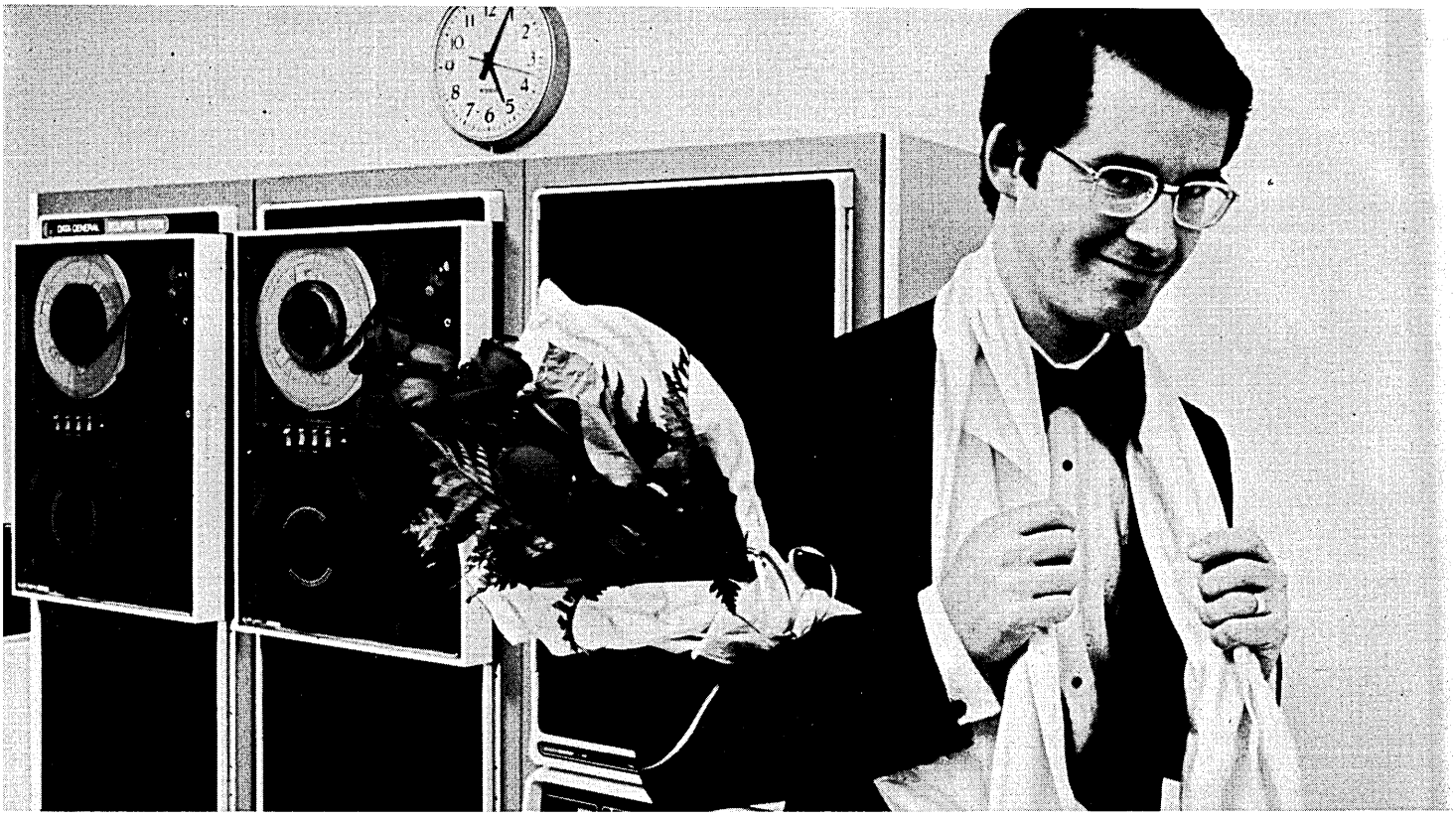
Harris Corporation is a half-billion dollar high-technology company operating worldwide to supply a broad range of equipment and services for the communications and information handling markets.

Data Communications, a major division of Harris Corporation, pioneered the development of products for remote computing, beginning with the industry's first full-duplex terminals in the late 1960s. We've been expanding ever since, offering front-end communication controllers, communication network control systems, conversational keyboard terminals and our state-of-the-art 1600 systems as well as associated peripherals. And Harris backs up its products with complete software resources and full maintenance by our own Field Engineering Department with offices throughout the U.S. and worldwide.

For a more detailed look at what Harris can do for you, contact your local Harris sales office or Harris Corporation, Data Communications Division, 11262 Indian Trail, P.O. Box 44076, Dallas, Texas 75234, (214) 620-4400.



HARRIS
COMMUNICATIONS AND INFORMATION HANDLING



Commercial ECLIPSE Systems. Because you've got better ways to spend your nights.

Your nights should be your own. But if you're constantly forced to work into the night, it probably means that your computer can't work fast enough during the day. Data General has some timely advice: Commercial ECLIPSE Systems.

These are high performance, real-time data management systems that speed processing along, all along the line. A typical batch COBOL program, for instance, can be run faster on a Commercial ECLIPSE system than other small computers. One reason is because our compiler uses our commercial instruction set. And that makes processing fast. Plus it's high-level Ansi '74. Which suits business applications perfectly. And your programmers as well.

Other unique Data General software, such as Idea and INFOS, contribute to the high performance and throughput of Commercial ECLIPSE systems. INFOS has an index structure which results in faster data access. While Idea, with its special screen development package, can access files built by COBOL programs. In addition, these systems include peripherals, such as our 600 line per minute printer, that can keep up with the rest of the system.

There's one other thing about Data General Commercial ECLIPSE systems that will keep you from losing sleep. As your processing needs grow, our systems can grow with them.

The commercial ECLIPSE systems. They get you out on time. Send for our booklet before another day passes.

Mail to: Data General, Westboro, MA 01581

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CIRCLE 48 ON READER CARD

LOOK AHEAD

ONE MAN STAND AGAINST SOFTWARE TAXES

When Bob Sherrin, youthful president of Nova Computing, a Miami, Fla., 20-man software and keypunching firm, was assessed by the State of Florida for some $45,000 in software sales taxes, retroactive over a three year period, he didn't quietly settle up as did some other firms in the state. He took the matter to court and won a decision that software is intangible and therefore not taxable.

Sherrin feels his decision, coupled with a similar decision by the Tennessee Supreme Court early last year (Sept. 1976, p. 17), will have far reaching implications nationally. In fact, he based his case, in part, on a national decision in a case brought by Texas Instruments Inc. against the Internal Revenue Service. "The IRS argued our case for us. TI had sought an investment tax credit for information on mag tape. The IRS said this was intangible and won its point." Sherrin handled the case himself under the Administrative Procedures Act, which he says allows an individual to argue his own case at the administrative level in an Administrative Court. He calls this "the only way to go."

UNIVAC RAIDS RIVALS FOR SALES PERSONS

In a major effort to bolster its aggressiveness in the marketplace, Sperry Univac is conducting large scale raids on the sales staffs of rival firms. The company plans to add some 400 mainframe sales persons by the end of 1978 and is reportedly paying top dollar to attract experienced personnel from Burroughs, NCR, and other vendors. In addition Univac has already hired about 180 sales persons, many of whom came from Digital Equipment and other mini manufacturers to market the recently announced BC/7 small business system. It hopes to triple the size of the sales and support staff this year. The BC/7 hiring and training effort which is being honchoed by J. A. Bertch, director of business systems marketing for Univac, and a former NCR executive himself, could cost Univac as much as $4 million, a source close to the firm estimates. The budget for beefing up the mainframe sales force may run almost twice that amount.

DELIVERY POSITIONS ON 138-148 DRAW HUGE PRICES

Planning to cancel your order for an IBM 370/138 or 148? Stop! You may be able to sell your delivery position for up to $40,000 or $50,000. For example, right now a 148 position for May could bring $35,000 to $40,000 from third party lessors, dealers, and brokers, according to International Computer Negotiations, Inc., of Winter Park, Fla.

For a 138 position, the bid rate is about $15,000 to $20,000 less. The big game is to hold on as long as one can; an August delivery may not be going for much right now, but its value will climb as delivery gets closer.

This "future" trading is a result of an IBM job too well done. When the 138 and 148 were announced, IBM salesmen reportedly told users to hurry up: first day signers would get first quarter of 1977 delivery; second day--second quarter. The orders flew so thick that first day signers had to be spread across 1977, pushing the rest into 1978. We hear IBM has sold out the 148 production for the next three years. Normally, lots of these orders would be cancelled, but with the position selling, that's not happening.

ICN describes the situation in a new newsletter about to hit the streets, CN Reports, and warns that leasing companies are passing that premium on to the lessee. This newsletter, all about contracting and negotiating, advises the user to get his financial package broken down

in detail so he can negotiate each charge. (For CN Reports, write P. O. Box 264, Winter Park, Fla., subscription $125 or $225 a year.)

QANTEL TO ANNOUNCE COMMON SENSE

Qantel Corp., Hayward, Calif., this month will announce first to its distributors and then to the rest of the world what it is calling its "Common Sense" approach to the small business computer market (Feb., p. 16). Included in the announcement is a new small business system, Model 1400, incorporating a Memorex Winchester disc with 25 megabytes of storage, a 45 ips tape unit, and Teletype's 300 lines per minute printer. The system is in the $50,000 to $100,000 price range depending upon options taken. Also in the offering, provided as part of the operating system, is a program generator, purported to afford major reductions in applications programming time, and a report generator.

SERIES/1: A LOSS LEADER?

Since P. T. Barnum told all, sales has been a suspect science, and while it's obviously unfair to judge a product by the marketing flair that attends it, Span Management Systems of Providence, R.I., has been raising eyebrows among systems house pros with circulars offering a 17% commission on IBM Series/1 hardware--along with a 25% commission on applications software--to potential distributors of its SPAN Series/1 business operating system. Last month, this column reported Span's mysterious "no comment" on a newspaper ad seeking Series/1 salesmen; we fared little better this month when we contacted Span marketing v.p. Edward F. Murphy seeking clarification of letters sent out to systems houses and computer hardware distributors offering IBM Series/1 commissions off list price. Murphy refused to give any specs on Span's Series/1 Turnkey System--apparently the first Series/1 operating system for business applications--or its complementary hardware. "I don't like to talk business over the phone," he said.

Since IBM sells Series/1 with no discounts, the mystery is why Span is pricing its package to give the illusion of a hardware discount while obviously taking the hardware commission out of slack in its software pricing. Loss-leader advertising is nothing new in consumer marketing. The question is whether such patently artificial pricing offers advantages in a professional industry.

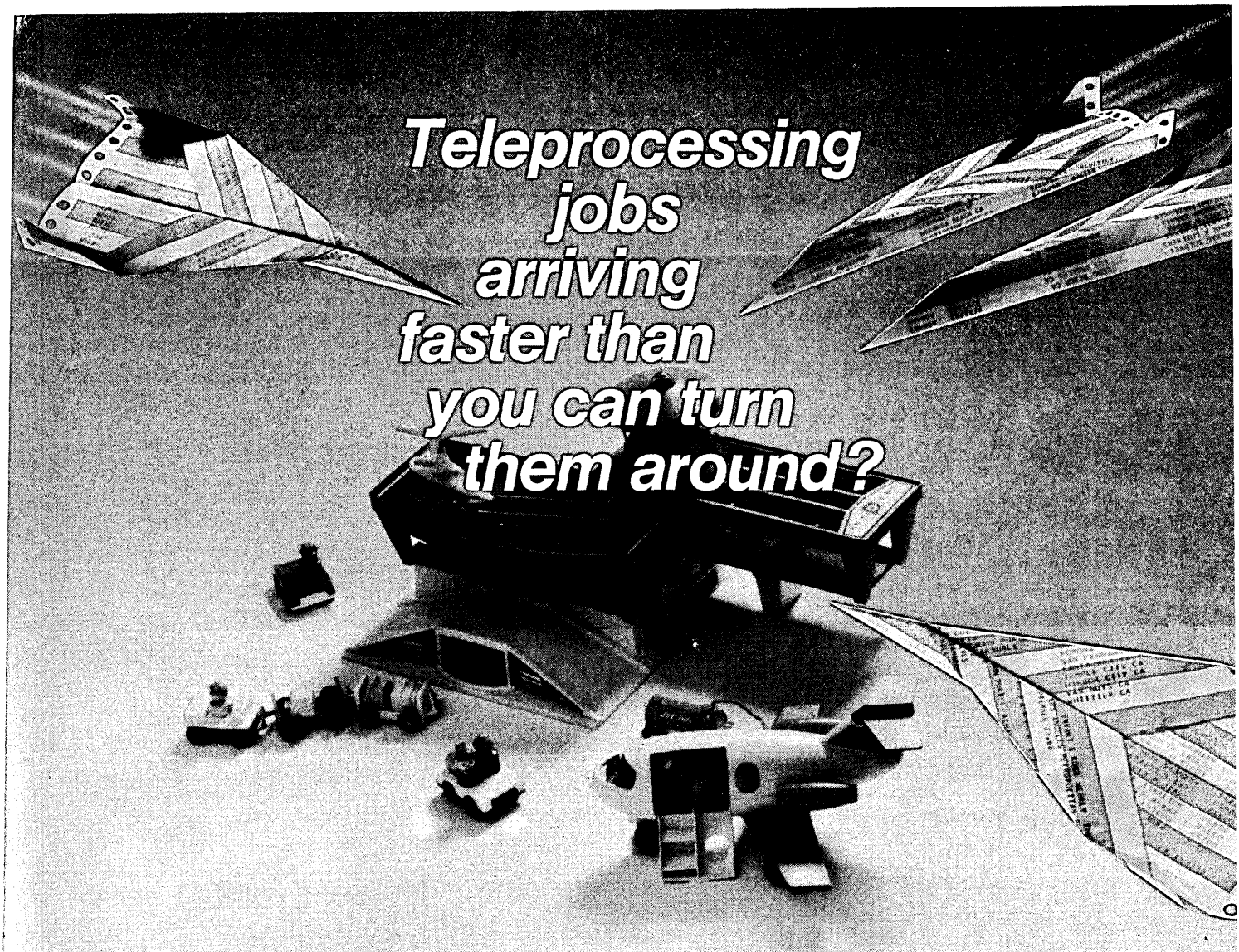
PUT ON A HAPPY FACE?

When Addressograph Multigraph put its Amcat terminal line on the block (p. 176) it put a crimp into Honest Face. Honest Face is a check verification/guarantee program operated by the First National Bank of Atlanta which uses 380 Amcat terminals. Bob Creekmore, a First National v.p., thinks Amcat "is probably the best terminal available for our purposes," and doesn't think anything else on the market can do the job. The bank has placed the terminals in supermarkets and retail stores, which Creekmore said insist that they be shopper operated "because they don't want to pay their clerks to operate them." The Honest Face Program has 410,000 card holders and handles 316,000 transactions a week. Creekmore said terminal availability to customers is running at 98.7%. He feels sure A-M will maintain the equipment for its useful life "but we're expanding." He's hoping the right kind of company will buy the line for a happy ending for Honest Face.

MA BELL STALLING FOR TIME IN MCI SUIT

AT&T legal strategists have come up with a tried and true tactic to wield against their competitive nemesis, MCI Communications Corp.

(Continued on page 178)



Maybe you need a new departure in control software.

Because we knew no single teleprocessing monitor could meet the needs of all 360/370 users, we developed three. And they're running at over 300 installations worldwide — everything from 24K DOS users with a few local terminals to large systems with hundreds of on-line terminals spread over thousands of miles. *One* of our teleprocessing monitors can help maximize the throughput and efficiency of your on-line applications.

MINICOMM is designed to get smaller DOS and DOS/VS users on-line fast. It supports application programs in Cobol, BAL, PL/1, and RPG, requires no hardware upgrades, and offers a whole list of features not available in other teleprocessing systems.

For DOS and DOS/VS users who want the ultimate in teleprocessing flexibility, there's BETACOMM — a fully queued, multi-threaded system that provides multitasking for application programs as well as the monitor. A comprehensive file handler allows all standard access modes, with support for popular data base systems. BAL, Cobol, and RPG II interfaces are available.

INTERCOMM, designed for OS and OS/VS users, is the most sophisticated teleprocessing system available anywhere. Its advanced features are far too numerous to list here, but include device-independent support of over 30 terminal types, comprehensive error recovery with integrated checkpoint, message, queue, file and data base recovery, restart, a large repertoire of pre-programmed utility functions, and a unique feature that provides program isolation. Over 150 INTERCOMM users attest to its superiority.

Despite their differences, MINICOMM, BETACOMM and INTERCOMM have one thing in common — the total capabilities support of the Informatics organization around the country and around the world. We're the world's largest independent software product vendor, and we got that way by producing sophisticated, reliable systems that help you turn out more work faster, with far less programming effort. That includes a full array of back-up services — over 1,800 systems specialists, extensive documentation, professional instruction and videotape courses.

Whichever of our three teleprocessing monitors fits your particular environment, you're assured of a uniquely designed system that is stable, efficient and release independent of the operating system.

Want to hear more about MINICOMM, BETACOMM or INTERCOMM? Contact us today. We'll be happy to send complete system literature by return mail or arrange a personal presentation at your site.

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Informatics Inc., Software Products, Dept. D377
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I want to hear more. Send me literature on
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Address_____ Tel._____

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Computer_____ Operating System_____

CIRCLE 26 ON READER CARD

The 36-bit DEC

Lots of people outgrow minicomputers. Nobody outgrows Digital.

You can outgrow minicomputers without outgrowing the world's leading minicomputer company.

Because Digital Equipment Corporation also makes big computers.

The mighty, 36-bit DECsystem-10's.

The new 36-bit DECSYSTEM-20's.

And, thanks to the DECSYSTEM-20, your first step into big computers doesn't have to be a big step any more.

You can have one for a total systems cost starting at under $10,000 a month.

The key to this amazing price-performance is that the DECSYSTEM-20 combines the high performance hardware and economy of our famous minis with the powerful, dependable software of our pioneering DECsystem-10's.

With that as a base, we went on to give you other great things.

Virtual memory so you can run programs up to a million bytes long without running out of core.

Some really fast hardware for truly mammoth throughput. ECL logic for the mainframe and 160 nanosecond cache memory. Both of which are made practical thanks to our exclusive Computer Controller Operation (CCO) — a built-in minicomputer that handles all the unit record peripherals, terminals, communications, system monitoring, remote diagnostics, and allows system changes to be made on-line.

Streamlined versions of all the DECsystem-10 database software and compilers for COBOL, FORTRAN, APL (both Large and Small), a P/L I subset, BASIC PLUS 2, and ALGOL.

Concurrent multi-stream batch and interactive operation for up to 128 users.

Software that's totally compatible with our larger DECsystem-10's.

The 36-bit DECSYSTEM-20.

Digital takes you all the way.

☐ Please send more information.
☐ Have a salesman call too.

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Company _____

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Send to:
Digital Equipment Corporation,
200 Forest Street, Marlborough, MA 01752.
Phone: 617-481-9511, Ext. 6885.

MR1-1 M/55 D-3-77

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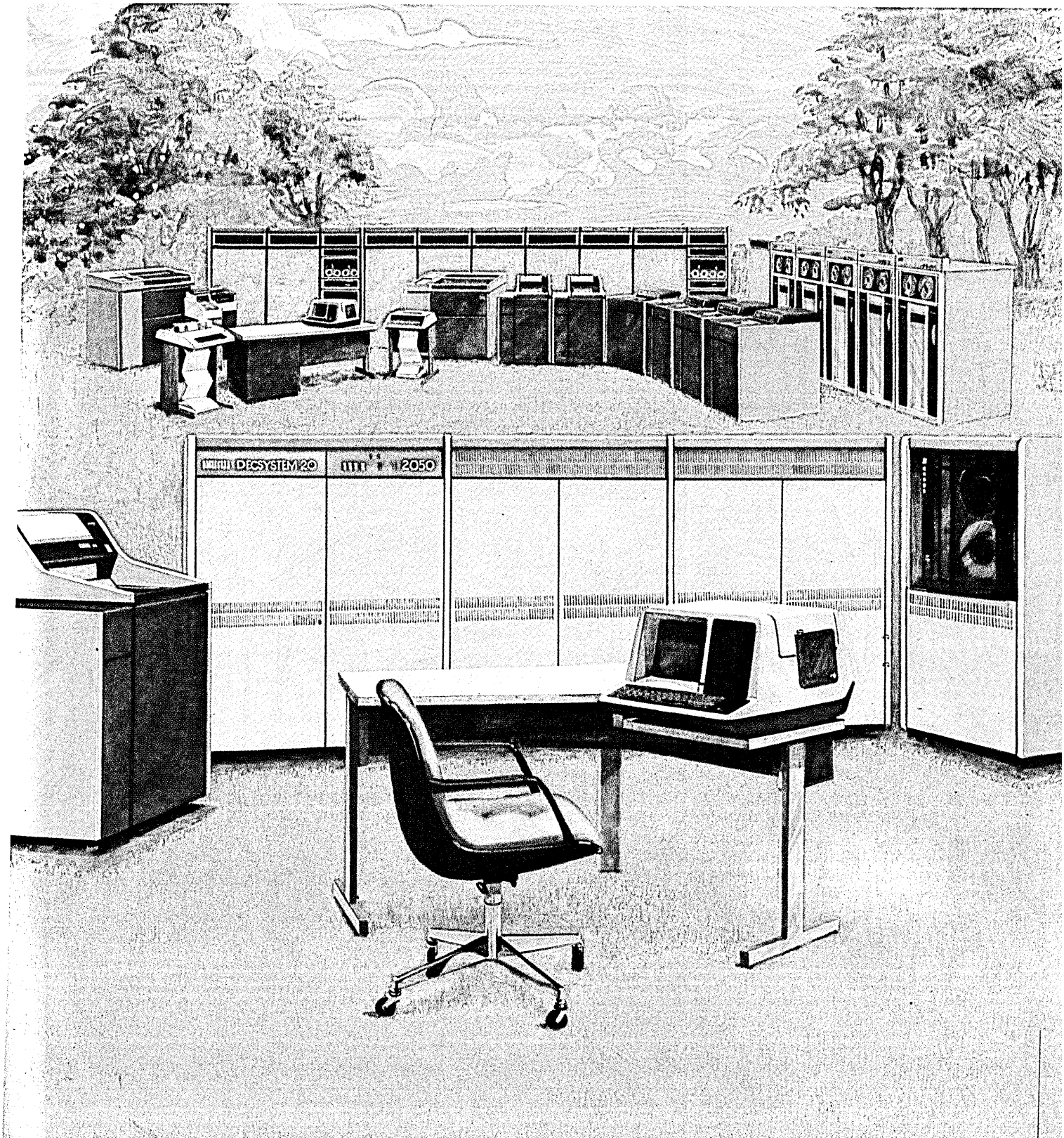
LARGE COMPUTER GROUP

SYSTEM-20.



Your system depends on its printer. Why gamble?

Buy Centronics.

We have more than 80,000 proven reliable printers in use. So, if you're planning to add on to, or buy, a system from Univac, NCR, Wang or DEC—or a CRT system such as Hazeltine, ADDS, NCR or LSI . . . buy a Centronics printer.

Centronics printers are completely performance-proven *before* they're shipped. Then they're backed by the strongest "on-the-spot" customer service in the industry . . . with more than 100 professionally staffed service offices worldwide . . . a unique, central on-line diagnostic test center . . . a central dispatch operation—with toll-free phone contact for immediate service. Our maintenance contracts are so attractively priced you'll want one for all your Centronics printers.

You *know* your printer choice is critical so why gamble? Buy Centronics. Don't wait. Call Jack Williams today at 1-603-883-0111. He'll give you all the details on the right printer for you. Or write Centronics Data Computer Corp., Hudson, N.H. 03051, or Centronics offices throughout the world.

CENTRONICS® PRINTERS
Simply Better

letters

Author, author

Your exhaustive salary survey failed to include any mention of writer salaries or typical job descriptions, and Mr. Liu's article "Software Maintenance" (November 1976) stated that "technical writers are neither dp-oriented nor user-oriented." The general feeling seems to be that technical writers are professional writers rather than computer professionals . . .

Many of the same skills are required (for a writer and programmer), and some writers also continue to do programming work in an effort to keep skills sharp and to use the product being described.

The classic notion that programmers cannot write and that writers cannot program is becoming less and less true. You can still exclude technical writers from your salary survey on the basis of too small a sample size, but technical writers are computer professionals and should be represented as such.

WILLIAM LIBBY
Control Data Corp
Peripheral Systems Group
Minneapolis, Minnesota

As you might expect, we agree that dp writers are important. However, the data base we tapped for our information just did not include that position.

Sort system

Baker and Jefferies ("A Computerized Librarian") and Miller and Ostrom ("Source Program Management") discuss comparatively simple and inexpensive ways to keep track of source program, program in progress, and the like (December 1976). Such fairly simple, home-made systems frequently work where an expensive and elaborate one does not.

A somewhat analogous problem is that of keeping documentation for a moderately large program in progress with 20 to 200 subroutines or modules, some still stubs, some still moving in and out of the program, or undergoing significant changes. A solution I have used is the following: require that each subroutine contain a comment block (4 to 7 cards) giving its name, calling sequence, summary purpose, and status (stub, trial version, accepted). Make these comments easily machine-locatable (in FORTRAN begin the starting card CS and ending card CE). Include a program which reads the source deck in the library, extracts the comment block from each module, makes a module of the comments, includes it in the library, and prints the comment blocks dating the output. This gives a quick, up to date, programmer's guide to the current program version.

If the modules occur in alphabetical or functional order in the library, no sort step may be needed for the documentary summary produced. If the library system in use cannot itself order the subroutines in a helpful way, an index number can be provided in the comments for each module, and the documenting program can sort on that basis.

EDWARD T. ORDMAN
Memphis State University
Memphis, Tennessee

Where Weksel went

We were all delighted with the piece on Bill Weksel and Information Displays (December 1976), with one exception—the company used to be in Mount Kisco, but for nearly two years has been in beautiful quarters in Elmsford.

SHARLYNE T. PALACIO
Jacobson, Altman Associates
New York, New York

RIAD—Welcome to the '60s

Bohdan Szuprowicz's recent litany ("Computers from Communist Countries," September 1976, p. 79) of the successes in dp development in communist countries hardly seems an objective article for DATAMATION. And it is remarkable that he bestows such respect and praise on developments in computing machinery and technique in COMECON countries. Take for example the claim that "four [computer manufacturing plants] are already involved in production of RIAD processors." Consider that. In late 1976, with almost as many years of experience in computing as the West, with one of the largest and allegedly most scientifically advanced economies in the world, the Soviet Union has all of four plants producing processors (how many?!) equivalent to machines available in quantity in the West nearly 10 years ago. In fact, RIAD development is so far behind Soviet projections that they are still producing second generation machines.

As a second example, consider his statement that on "June 8, a Minsk radio broadcast in Byelorussian announced that the Ordzhonikidze Computer Equipment Plant began production of the RIAD ES-1060, which is the largest and fastest COMECON computer to date." On the basis of a radio announcement, Szuprowicz claims production of a machine comparable to the IBM 360/75. In light of past Soviet performance, the real question is when will this machine be operational; i.e. when will a reasonable number of these computers be built, tested, delivered, uncrated, loaded with some respectable software, and staffed by people who know how to use them effectively? We already have an indication of what is to come. This machine was originally projected to perform at 3 million operations per second, it is "going into production" rated at 1.5 million. What will its actual, on-the-job performance be?

Such examples can be multiplied, but is probably as important to note what Szuprowicz did not say. What about time-sharing or microcomputers? What about the problem of a service structure to keep machines running? And what of the complaints of shortages of trained personnel for even the limited numbers of existing machines and the inadequacy of software, complaints which sometimes reach the pages of Pravda? The COMECON countries simply do not have dp production, distribution, or service operations comparable to anything now available in the West.

Szuprowicz has probably surveyed the market in COMECON countries correctly; there will be little in the way of a long term, substantial market for western dp hardware and software. But his implication that these countries can compete in exports, except through tied foreign aid packages, is most questionable. And his general marketing, even advocacy, of COMECON successes is hardly an objective evaluation of the state of the art in that part of the world. We doubt DATAMATION serves its readers well with such articles.

F. V. CARSTENSEN
S. E. GOODMAN
Center for Russian and East European Studies
University of Virginia
Charlottesville, Virginia

Mr. Szuprowicz replies: My article appears to have confused Mr. Carstensen and Mr. Goodman as to its actual message.

When approached by DATAMATION to comment on COMECON computer industries I was specifically asked to discuss the growth and expansion of COMECON foreign trade organizations and industrial enterprises involved in production and marketing of computers. COMECON's lag in this industry is already such an old hat to all of us that it just isn't newsworthy anymore.

By outlining the magnitude of various COMECON efforts I tried to explain why Western attempts to penetrate those backward markets have shown such relatively meager results. DATAMATION performed a real service by publishing the article and I am curious to know why Mr. Carstensen and Mr. Goodman would like to withhold such useful information from many of those who often unwittingly wasted a lot of time and millions of dollars engaging in technological merry-go-rounds with COMECON state monopolies unaware that only negligible sales may result in the end.

The Minsk radio broadcast, announcing the start of production in 1976 of a RIAD ES-1060 comparable

letters

only to an IBM 360/75, by itself so eloquently underscores the technology gap that it needs no comment. Its real importance lies in the fact that it provides ammunition to various COMECON "anti-import committees" with which they can put pressure on COMECOM prospects to demand still more advanced Western equipment and software proposals and further relaxation of our Export Controls as conditions for making a sale. This seems to have escaped the notice of the Virginia Sovietologists completely.

COMECON exports are certainly no threat today to Western manufacturers in most markets and I hope we will keep it that way in the future. But even those few RIAD computers installed in the West are already being exploited to demonstrate to COMECON and third country users that COMECON equipment is "acceptable" even in highly industrialized countries.

Yet only yesterday such annoyances did not exist. Nor was it that long ago when our learned Sovietologists assured us that nuclear weapons, sophisticated missiles, and large navies were out of reach by COMECON for a long time to come. Those who do not have to face the adversary out in the field often forget that underestimating your competition is simply bad business at best.

In my article I have clearly stated in conclusion that until COMECON develops competitive hardware and software and sufficient hardware production their threat will not be serious. On the other hand COMECON countries have already begun competing in Western markets with Western-licensed products disregarding shortages of such products in their own countries. Soviet and Polish-made Fiat automobiles are a good example.

If Mr. Carstensen and Mr. Goodman are professional collectors of detrimental data about COMECON as their letter seems to suggest, they may also want to look at my eminently objective "Soviet Bloc Computer Industry and Market 1971-1975" study published in 1972. Computer industry problems sections for each COMECON country in that study consist of superlitanies of horror stories, inefficiencies and delays in production and installation.

But even a recent RAND Corporation study (R-1642-PR) which identifies 10 computer plants in the Soviet Union alone, concludes that despite all the shortcomings the rate of development of Soviet computer technology is high and the start of serial production of RIAD devices "marks a very substantial advance."

All these facts put together and the absence of significantly increasing sales of Western equipment make me believe that in the long run the West will do much better to secure its present markets and leave the COMECON to byte their own bits as best they can.

. . . and is replied to

We are delighted that Bohdan Szuprowicz has clarified his article that began with 13 columns of rapid-fire enumeration of the achievements of the COMECON computer industry. The achievements are presented without any explicit or implicit comparison with developments in the west, and the style of writing emphasizes success and rapid progress. Perhaps Szuprowicz was writing this all tongue-in-cheek, but if so he did himself and his readers a disservice. Only in his last two columns does he begin to make the points that he now claims he was trying to make in the whole article. As to that principal message, that there never was nor ever will be a large dp market in COMECON countries for western manufacturers, we generally agree, and said so in our earlier letter.

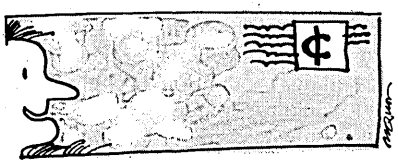
We also feel constrained to respond to Szuprowicz's accusations against us. We were not interested in withholding information; our complaint was precisely the opposite, that Szuprowicz's original article was misleading and inadequate, and we intended to suggest that fact to interested readers.

Lastly, we hope that someday Szuprowicz might undertake to explore what he leaves essentially untouched (despite his claim to the contrary) in his original article and only hints at in his letter—i.e., the implications of COMECON "anti-import" committees and the process of political negotiation over acquisitions of western high-technology.

Messrs. Carstensen and Goodman

Debate on urban transit

As an expert in the field of Personal Rapid Transit I feel that I must comment on the misleading statements of David M. Weiss printed in The Forum of September 1976. (p. 237). Mr. Weiss was commenting on an article by Harry Carroll, "Next Steps in Urban Transit," which was published in the February '76 issue of DATAMATION.



First, I would like to point out that the PRT guideway shown in the photographs in Carroll's article is not cartoon artistry. In the case of Rohr Industries' Las Vegas proposal, the guideway was structurally engineered, wind-tunnel tested, built, tested, and demonstrated to the public at TRANSPO '72, a transportation exhibition held at Dulles Airport, near Washington, D.C., in 1972.

Second, I choose to confine my remaining comment to an area where I have had papers published: Personal Rapid Transit Controls. "Serious problems exist in attempting to transmit and receive signals between vehicles and central control at very short headways . . . these problems are real" is a misleading statement, for in some designs virtually no communication is required, and in some other designs the ordinary engineering problems have demonstrated working solutions. The fact that some transit systems have had communication problems is more a testimony to the fallibility of man than technology. It is no surprise that our society has incompetent doctors, lawyers, and transportation engineers.

The fact that "transit vehicles do not possess the precision of a rocket to the moon" is another misleading statement, for it has been demonstrated in West Germany, Japan, and the United States that PRT vehicles can be more precise than moon rockets. At ordinary transit speeds it has been shown that these vehicles, with their controls, can maintain planned position within inches.

I do not mean to imply that all technical problems have been resolved for all applications of Personal Rapid Transit. I do feel that anyone interested in this exciting new field should review the large amount of literature available before deciding that a problem is "serious."

R. MORSE WADE
Secretary
Advanced Transit Association, Inc.

Mr. Weiss Replies:

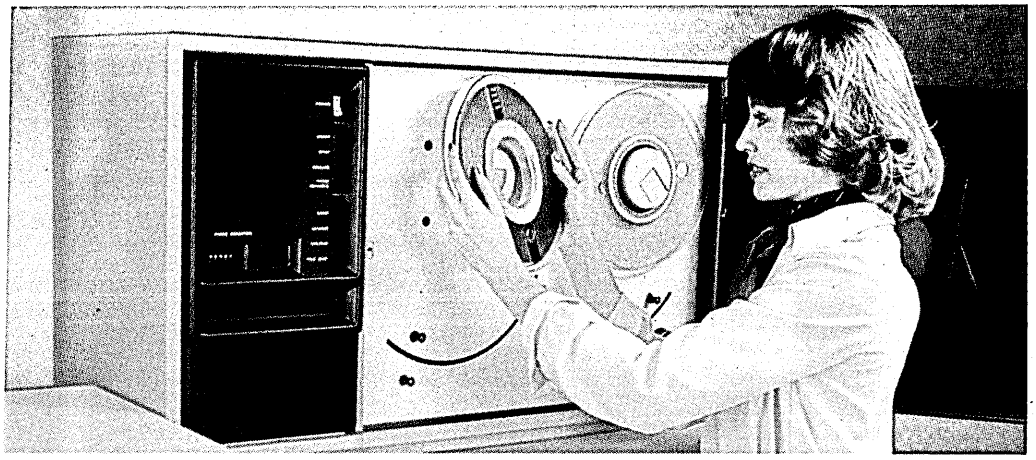
Mr. Wade's credentials as an expert derive in large part from a number of papers he has written proposing a 500-mile PRT for lower Manhattan. Thus, he is one of the irresponsible "no-sky" boys my article complained about. As a researcher he may be an expert, but as a professional, he is too quick to foist unproven technology on the urban public.

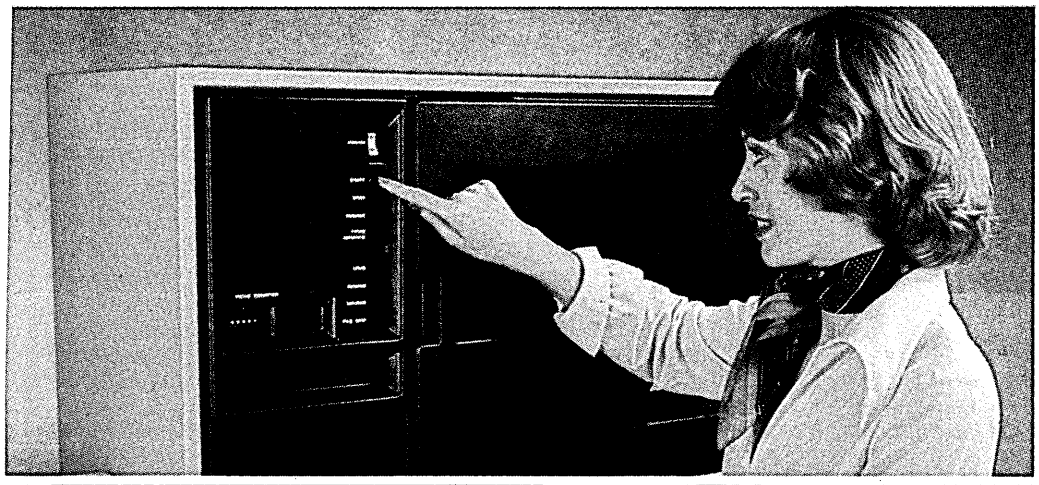
Regarding the "cartoon" description of Mr. Carroll's pictures, I need only point out that he calls them "artist's conception" and "photomontage." An examination of most papers on PRT systems will turn up even more fanciful systems than Mr. Carroll's.

With the possibility of 60,000 vehicles on the system at one time, I am confident that any responsible PRT design will allow for the unpleasant possibility that some vehicles may be more than a few inches from their ideal positions. Signals and communications of some sort will then be required to make central control aware of the deviations so that vehicles can be rescheduled as necessary. Since I foresee neither an imminent change in the fallibility of man nor in his ability to apply advanced technology perfectly, provisions for failure should continue.

Another point that Mr. Wade is missing is that PRT demonstrations to which he refers are just that. Transit systems must operate for decades, not days. How long could those carefully-nurtured prototypes remain more precise than a rocket in an actual transit environment?

Finally, I agree with the 1975 study **Automated Guideway Transit** by the U.S. Congress Office of Technology Assessment which stated: "With few exceptions the engineers and manufacturers who have made serious studies of the PRT concept find that there are numerous technical problems that must be solved before PRT systems can be deployed." Until then, PRT belongs in the laboratory and on such proving grounds as our amusement parks. ❋





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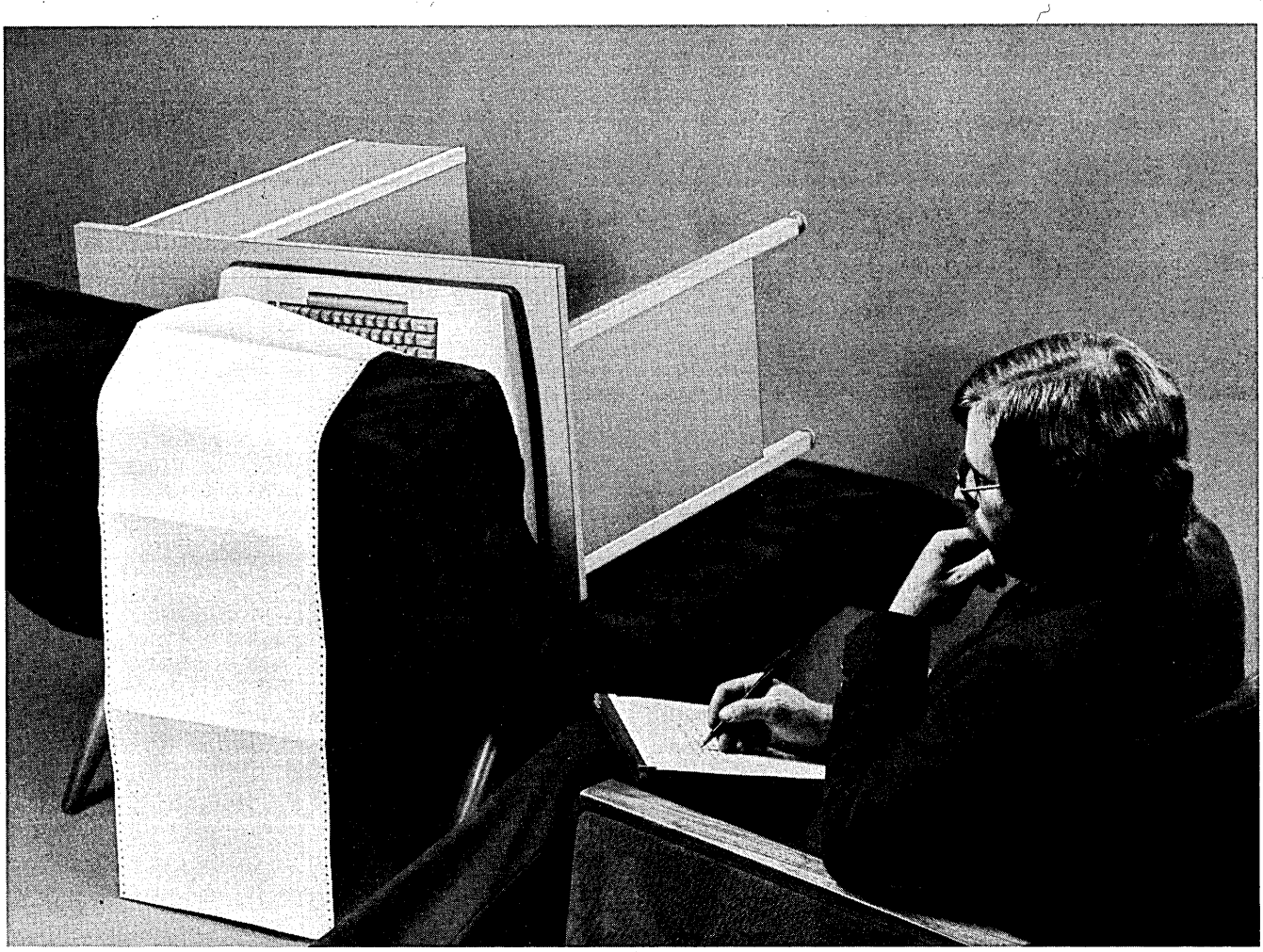

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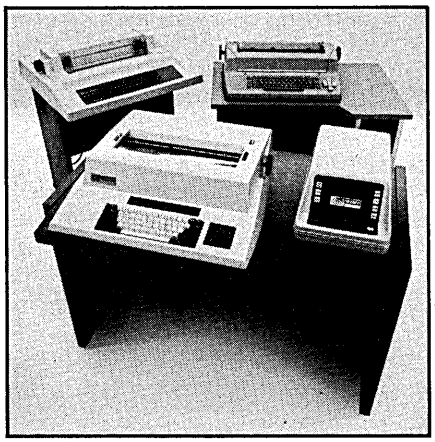

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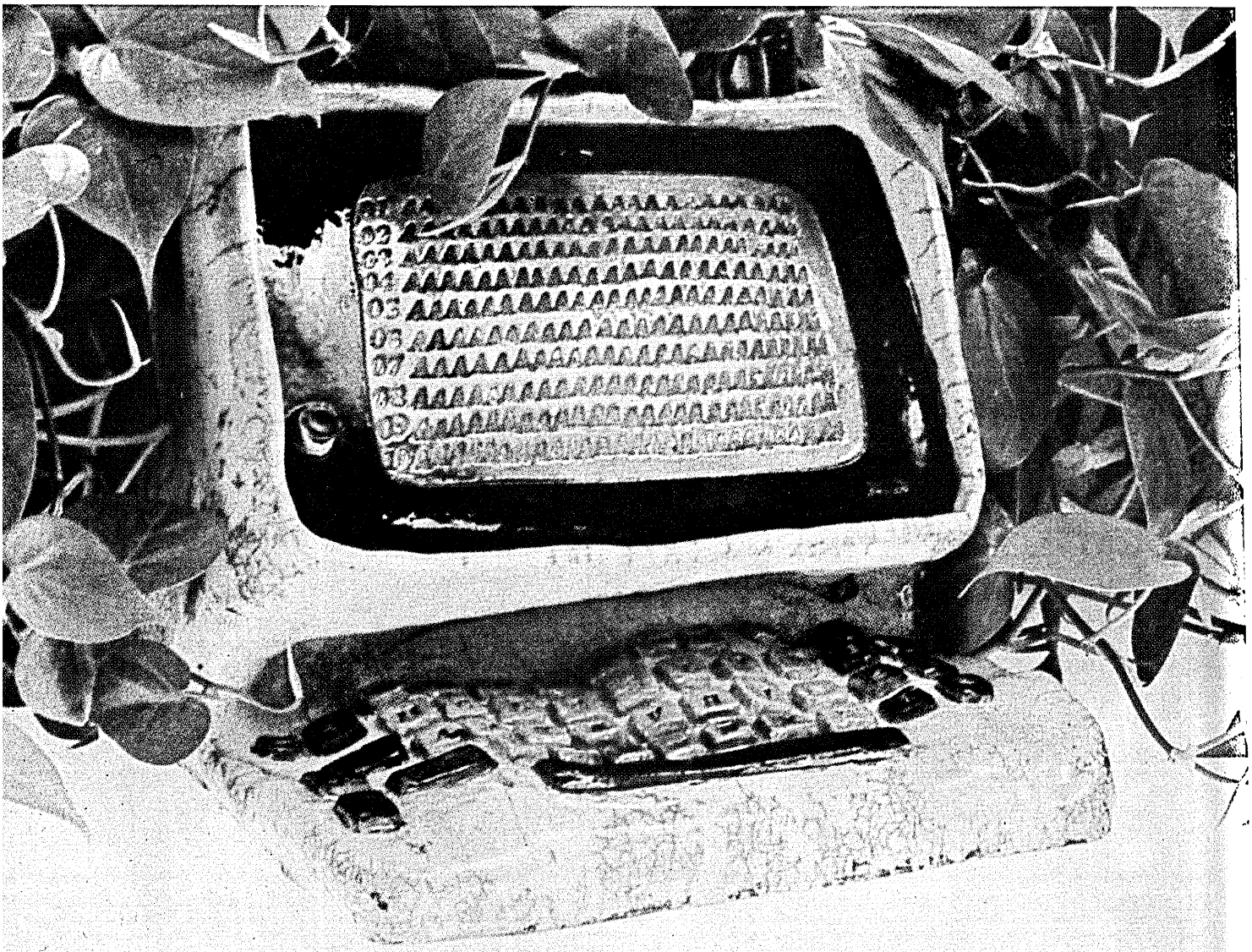

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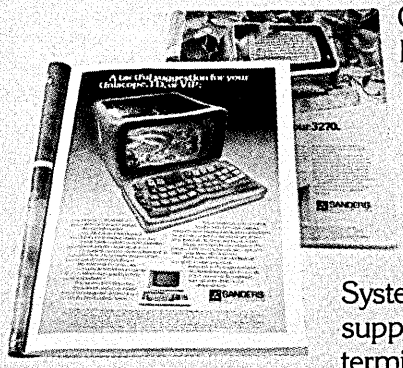

On January 28, Harris Corporation acquired Sanders Data Systems.

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Sanders Data Systems is a leading supplier of intelligent terminals for interactive and distributed processing networks. Harris Corporation's Data Communications Division, on the other hand, is a leader in remote job entry terminals, front-end controllers, and remote communication processors.

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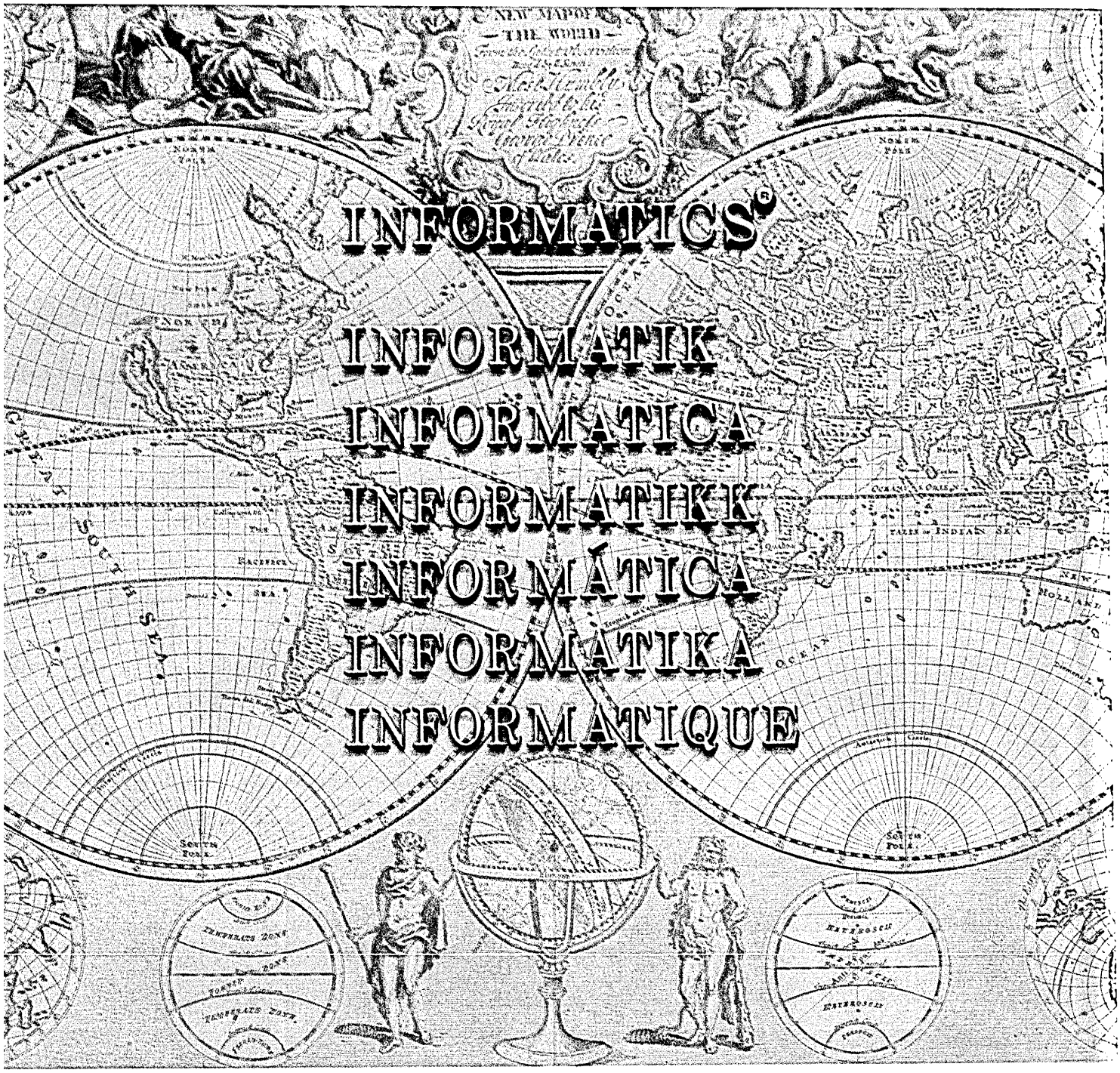

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people

Smart Enough and Dumb Enough

When the New York and American Stock Exchanges were setting up SIAC (Securities Industry Automation Corp.) in 1972, they initially had problems finding the right executive to fill the top position. "Word was," SIAC's chairman and president Robert C. Hall says with a grin, "they couldn't find someone who was smart enough to run it and dumb enough to take the job."

The problem: SIAC, a firm owned jointly by the exchanges, was created to plan, develop, and operate key computer and service facilities for Wall Street. That meant it had to meet the extensive processing requirements of the exchanges, interface with the host of brokerage firms whose systems feed into the exchanges, and be careful not to tread on the toes of the powerful group of stock specialists who saw automation as a threat to their livelihoods. Jimmy the Greek probably would have given 8 to 5 SIAC would never make it.

Why then did the 45 year old Hall agree to take the SIAC helm? "I was intrigued with the unique opportunity the company had," he explains. "It was a chance to apply dp technology to a fundamental industry, and it gave me senior level exposure in a totally open arena. You can be the greatest quarterback in the world, but if you're playing in the minor leagues, nobody knows you."

Not that Hall was playing in the minor leagues. Far from it. After graduating with a B.S. in Mechanical Engineering from Iowa State in 1955, he logged some time as a production and design engineer in the automotive and aviation industries, joined Control Data in 1961, moved quickly up the ladder, and nine years later was vice president and group executive for computer systems with 10,000 people under him and responsibility for $300 million a year in revenues.

In successfully reorganizing a number of divisions at Control Data, Hall had gained a reputation for running a tight ship and being able to achieve major savings. At SIAC he inherited separate sets of personnel and hardware from the days when both stock exchanges had done their own data processing. His first task was to combine the hardware (the N.Y. Exchange had been strictly an IBM shop while Amex bought from a variety of vendors) and staffs into a single efficient unit.

The next problem was to deal with the individual brokerage houses, many of which had installed expensive, highly sophisticated systems during the market heydays of the late '60s. "We could have said each of these divergent systems had to interface with us," Hall explains. "But that would have meant massive software changes on their part. Instead, we decided to take messages in their own individual formats and convert it ourselves to a standard. That was a key decision in gaining the respect and cooperation of the member firms."

Since Hall got SIAC off the ground, the company has installed 12 new systems to streamline trading execution and cut costs. The SIAC-designed Clearance and Settlement system alone has saved the exchanges millions, Hall estimates. And DOT, a recently installed online system for expediting small stock order trading has been so successful that 19 specialist and brokerage firms are now using it.

Hall spends much of his time working with the exchanges, the Securities Exchange Commission in Washington, and the member firms in gaining approval for new systems and ensuring existing service continues to be satisfactory. "I function as a link between the policy makers," he says. "In that role I've got to thoroughly understand the policy questions and be able to find a common thread when people view the same question from different sides."

Hall has also appeared before Congress endorsing open competition in the data communications field, a position that's key to SIAC's continued success. The firm has become one of the largest data communications users in the country, relying on a variety of carriers including AT&T, Southern Pacific, and MCI for efficient, low cost transmission facilities.

Now, as SIAC approaches its fifth birthday, Hall believes the organization has achieved its major goals. "We've got an annual budget of $44 million and 900 employees, and we've developed into a highly professional data processing organization that's looked on with confidence."

ROBERT C. HALL
Not the minor leagues

Still, there are those nightmare high volume trading days when SIAC's computers go down—though far fewer than in the past. And Hall must contend with those brokerage firms who inevitably contend SIAC's systems people are giving too much attention to rival firms and not enough to them. And, of course, the old guard who view SIAC and what it stands for as a vehicle that's going to destroy Wall Street are still in evidence, though considerably less vocal.

In effect, then, Hall has bucked the odds and made SIAC a highly viable operation. When he relaxes with his eight children and wife Joan, putters around the house or plays an occasional game of tennis, he can look back on the decision to move into SIAC's top slot with satisfaction. He was dumb all right. Dumb like a fox.

people

On the Roll of the Dice...

Serious research into the game known far and wide as "bar dice" apparently is rare. When Gil Jacobs began writing a book compiling rules for more than 70 different bar dice games, he was unable to find any written source of information.

Jacobs' book, *Come Up*, was written both for the serious bar dice advocate and for the dilettante. In 124 pages, he describes games played in the San Francisco Bay area which he considers "virtually the world capital of a game played around the country."

Jacobs, branch manager of the Northern California office of Xerox Computer Services (XCS), has made an advocation of bar dice. He plays regularly in the bay area, but also has played in many other parts of the world.

GIL JACOBS
"There are winning strategies."

In his book, Jacobs not only details the rules for the games he covers but recommends playing strategies based on computerized odds—odds he says showed that he, himself, had been following the wrong seat-of-the-pants strategies in many situations. "There are definite winning strategies," he says.

Lest XCS management suspect that Jacobs has filched some free machine time from his employer, it must be noted that the computing was done by Stanford Univ. mathematician Howie Franklin on a Digital Equipment Corp. PDP-8 at the Peoples Computer Center in Menlo Park, Calif. Jacobs had to explain the rules of bar dice games to Dr. Franklin who now may know them better than anyone else.

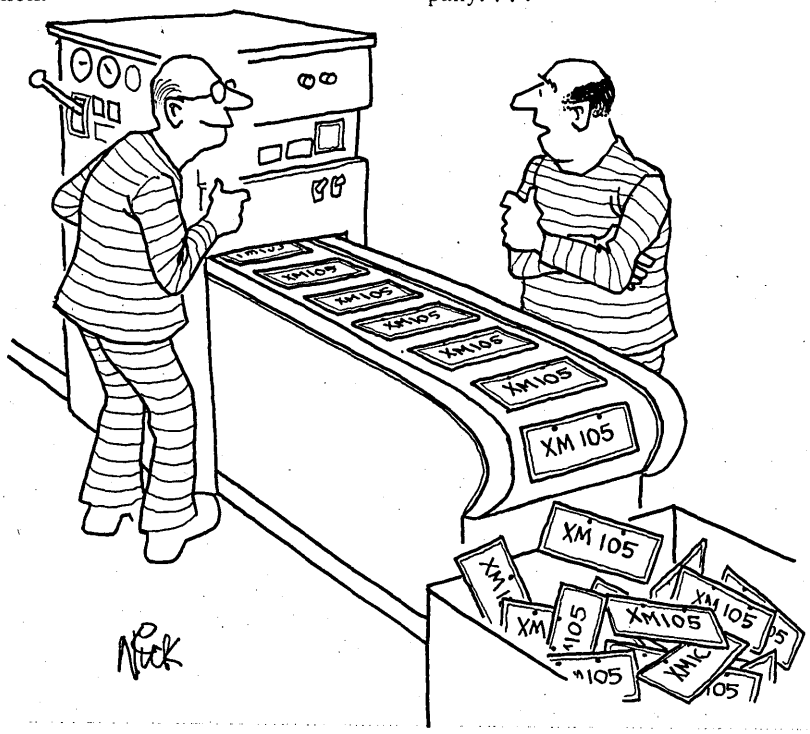
Jacobs began cataloging bar dice games when he found there was no other source for such information. The idea for the book came some six years after he was transferred to the San Francisco area by IBM. He got serious about it three years ago when he was hospitalized with a twisted knee from touch football. The title, *Come Up* comes from a standard challenge used by bar dice players.

In the week following the book's publication (by Dixon Press, P.O. Box 23, Cupertino, Calif. 95014, $4.95), the author personally sold 500 copies. Now he has begun packaging what he calls the San Francisco Dice Box which, for less than $20, includes two professional dice cups, 10 dice, and his book. Anyone who has priced good dice cups lately—generally $12 each—might agree with Jacobs who considers his offering a bargain. "Each cup contains as much good leather as a shoe which sells for a lot more," he says.

Jacobs has a bachelors' degree in economics from the Univ. of Cincinnati. He joined IBM following graduation in 1958, and for 13 years held a variety of marketing and management positions with that firm in such places as Grand Rapids, Mich., Detroit, Los Angeles, and San Francisco. He joined Xerox in 1971 to open XCS' San Francisco office which now has 55 employees, more than 100 customers, and had billings last year of more than $5 million.

In New Posts

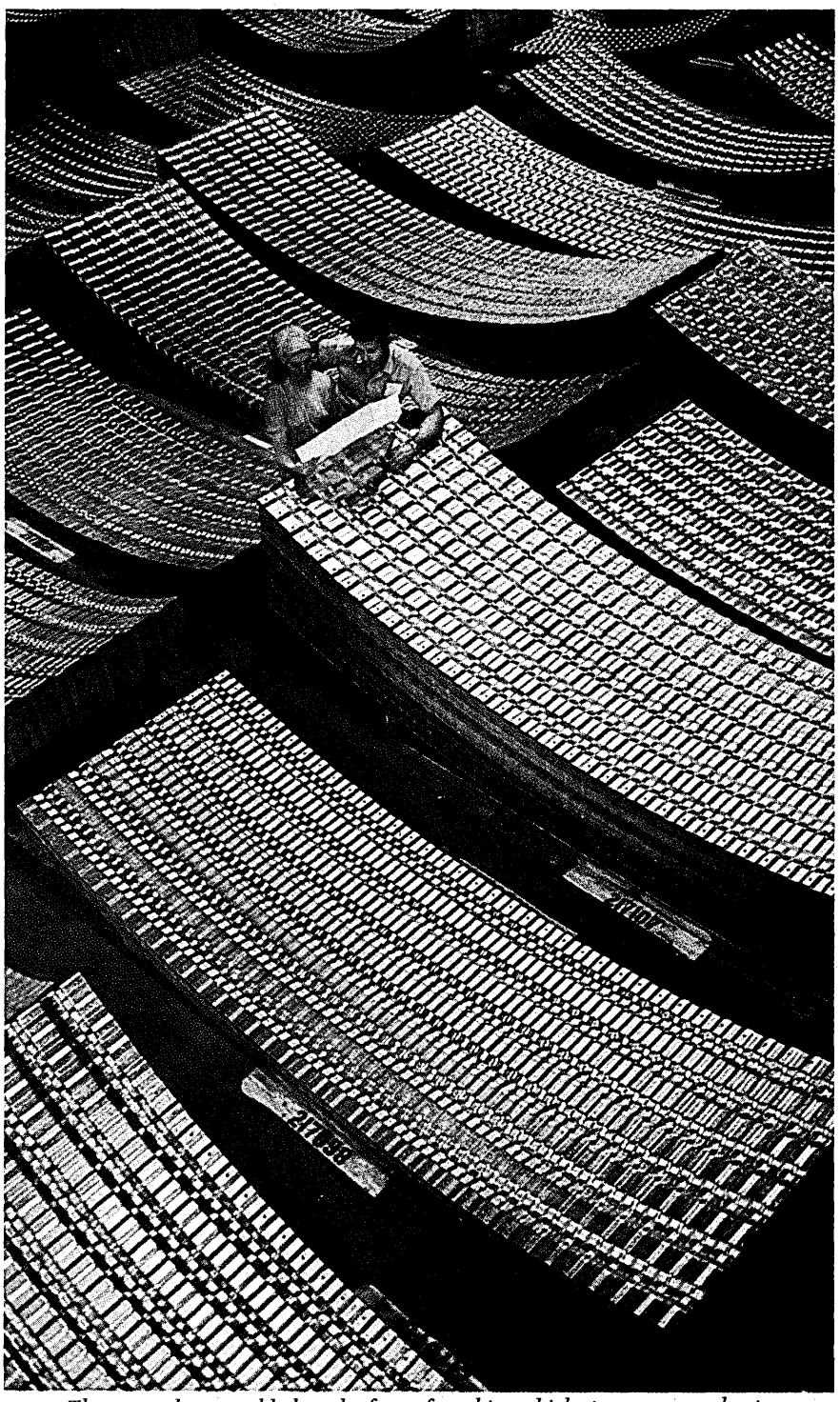
DAVID E. REA was promoted to Manager of Information Systems for the Bag Div. of Union Camp, Wayne, N.J. . . . ROBERT L. CHIODO was appointed corporate manager of information systems for the Tappan Co., Mansfield, O. . . . E. J. BUECHE joined Morrison Inc., Mobile, Ala. as director of management information systems. . . . IBM vice president, CHARLES P. BIGGAR, was named president of the company's field engineering division. . . . JAMES A. LENEHAN was promoted to systems development officer for FIS (Financial Industry Systems), Hartford National Bank's limited partnership with Martin Marietta which provides data processing resource management to banks, insurance companies, and other financial institutions. . . . LAWRENCE D. SAULT was named vice president of industry operations for the Commercial Div. of Computer Sciences Corp. . . . JEROME T. LOEB was promoted to senior vice president—control operations of The May Department Stores. . . . JEROME KORNBLUTH was named a vice president of Informatics Inc., PMI Eastern Div. . . . DR. ROBERT H. ANDERSON was named head of the information sciences department of The Rand Corp. . . . WILLIAM F. SULLIVAN was appointed vice president of the Financial Data Services Div. of Automatic Data Processing, Inc. . . . JOANNA HWANG was named vice president of EDM Computer Services, a Memphis-based computer management service company. . . . ✲



"You're in for forgery, right?"

DP Dialogue

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



These panels, assembled on the farm, form bins which store corn or wheat. Behlen Manufacturing Company makes agricultural equipment. The complete manufacturing control system is processed remotely on a System/370 Model 158 at the Wickes Corporation data center in Chicago.

Centralizing DP Spreads Benefits for Wickes

At Behlen Manufacturing Company, a new manufacturing control system has enabled inventory reductions of 15 percent below projected levels and elimination of most backorders.

"Sales people can commit to delivery dates with confidence," says Warren Rood, director of manufacturing for the Columbus, Nebraska division of San Diego-based Wickes Corporation. "We are meeting our customer schedules like clockwork. Management can query any aspect of shop or inventory status, and the progress of any customer's order can be queried from terminals in Columbus."

"When we decided to set up an online system in Nebraska, we looked at the options," adds Nick Fergadis, director of management information systems for the parent company. "We could install a larger computer and staff up to implement the application. Or we could install terminals and draw on our corporate resources for both computing power and systems expertise.

"With similar decisions looming in other divisions of the company, we decided to centralize. We wanted the economies of supporting the corporation with one data center, using one IBM System/370, and with the professional talent we can assemble in a corporate group.

"Clearly, we could do a lot of things for our divisions that they couldn't afford individually."

Behlen makes prefabricated buildings, a wide variety of storage, handling and processing equipment for farms, and hydraulic machinery.

"About 30 percent of our production is job-shop work," says Rood, "either made to order or built to customer specifications, and this fabrication is fully integrated into the manufacture of our standard products. At any one time, we have about 14,000 shop orders open, and we control a total of 47,000 inventory items.

"Computer control is a must in an

(Continued on third page)

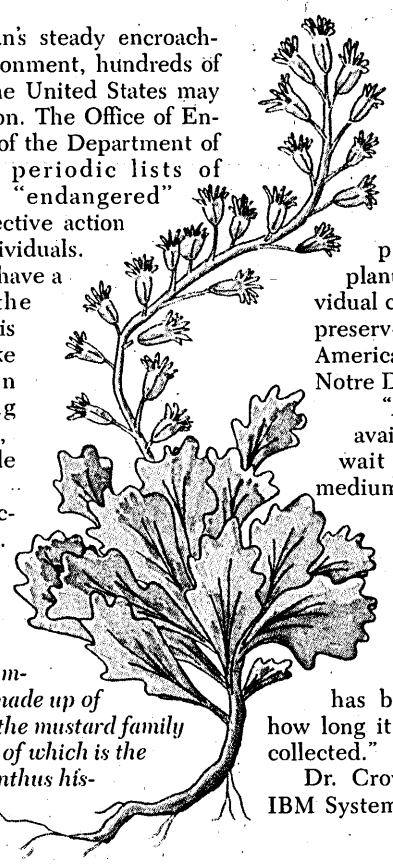
Advertisement

Endangered Plants Get Help from the Computer

Because of man's steady encroachment on the environment, hundreds of plant species in the United States may face early extinction. The Office of Endangered Species of the Department of Interior issues periodic lists of "threatened" or "endangered" species. But protective action is largely up to individuals.

Now botanists have a natural ally in the computer, which is being used to make existing data on plants, including endangered ones, far more accessible and useful.

Under the direction of Theodore J. Crovello, professor of biology at the University of Notre Dame near South Bend, Indiana, data on over 100 species of the mustard family found in the U.S. has been entered into the computer. This is one of the first attempts to computerize a monograph on plants. Data on over 35,000 individual collections of mustard plants preserved in museums across North America has been captured in the Notre Dame data bank.



The Notre Dame computer data base is made up of over 100 species of the mustard family found in U. S., one of which is the threatened Streptanthus hispidus shown here.

"Although this data has been available for decades, we had to wait for the computer as the medium through which we could rearrange and analyze it efficiently," says Dr. Crovello. "Now we can determine in seconds the counties of the U.S. in which a supposedly threatened species has been known to occur, and how long it has been since it was last collected."

Dr. Crovello points out that "the IBM System/370 Model 158 can swiftly print maps of the entire U.S., or of a particular state, according to selected criteria, such as the relative similarity among the counties of the species' distribution. And it can answer questions such as, 'At what time of year is this species in flower?'

"There are an estimated 250,000 species of vascular plants in the world, 20,000 of them in the United States," Dr. Crovello points out. "Modern classification of these plants has been going on since the 18th century, with the resulting data accumulating in collections and catalogs scattered all over the world.

"Inevitably, such data varies greatly in precision and completeness, presenting real difficulties of nomenclature and missing information. Nevertheless, the development of large computerized plant data banks is now demonstrably feasible as shown in several projects. It represents a major breakthrough in plant systematics and related fields, permitting comparative studies of plant life on a scale not hitherto practicable.

"And it might possibly help to preserve some of the many rare species of plants now in danger of vanishing from the earth."

MVS: Real Muscle for Large Systems

Processing a complex job stream makes unique demands on operating system software. And in a communications-oriented environment, the system must be able to handle large volumes of work in an unpredictable mix of batch tasks and terminal transactions.

Typically, a large system supports the mainstream operations of a company. To meet extremely high standards of availability, the system control program must be reliable and thoroughly tested. It must be flexible to permit frequent enhancements and revisions. Error recovery facilities must be complete and sophisticated.

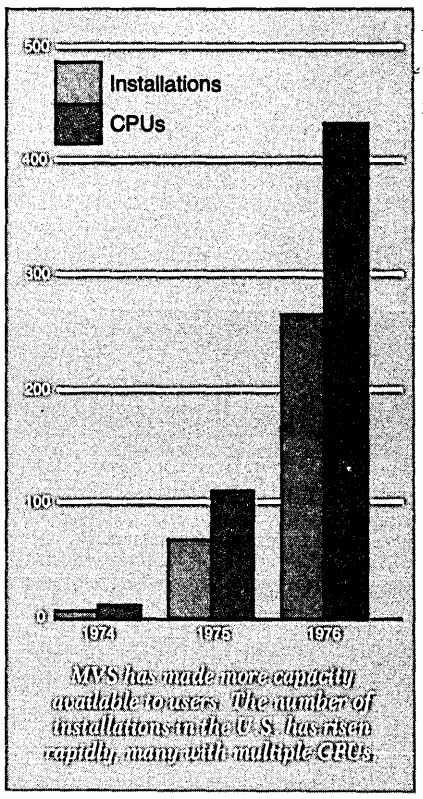
OS/Multiple Virtual Storage (MVS) is the IBM system control program designed to meet these requirements. By providing a separate 16-megabyte virtual address space for each user, it presents a simplified environment and insures that no application can adversely affect any other. Error recovery facilities automatically accommodate most errors without involving the operator.

Users have found conversion from OS/VS1, OS/MVT, or OS/VS2(SVS) relatively smooth and efficient. And now a pregenerated system, the Installation Productivity Option (IPO) reduces the manpower and machine resources required for conversion. IBM has prepared a brochure, *The IBM Installation Productivity Option*, available by request to the address in the box on the opposite page.

MVS has made more capacity available to users by enhancing throughput. In use in over 430 CPUs in the U.S., it permits growth in smooth, simple steps in any direction. Users include Cummins Engine Company, Sikorsky Aircraft and the Mellon Bank.

And the Attached Processor system is now proving its ability to significantly increase system throughput in such companies as John Hancock Mutual Life Insurance Company.

In Attached Processor and Multi-Processor configurations, MVS dispatches work on the basis of maximum efficiency and user-selected priorities. To the operator, the system is a single high-capacity processor. And the control program in a Multi-Processor configuration can isolate any portion of the system for maintenance—processor, memory segment, or peripheral—without affecting the rest of the system.



MVS has made more capacity available to users. The number of installations in the U.S. has risen rapidly, many with multiple CPUs.

Superfast Printer Aids Woolworth Marketers

Until a few months ago, the Central Accounting Office. of F.W. Woolworth Company had to keep six high-speed printers running at top speed more than 20 hours a day.

This constant production was required to provide a wide range of reports used throughout the company.

Now one IBM 3800 Printing Subsystem prints most of Woolworth's reports—at a top speed of 13,360 lines per minute, using laser and electrophotographic technology.

The Central Accounting Office in Milwaukee produces a multitude of major weekly and monthly reports for the Woolworth and Woolco retail stores, as well as for regional offices and corporate executives. Some reports must be produced in many different versions for different recipients; a printing run can involve multiple pages for each of the 1,800 stores.

The office also pays over a million invoices a month, bills over one million credit card accounts a month, and handles capital accounting, tax accounting, and other reporting functions—for which the 3800 prints the output.

Formerly, just scheduling output through six printers — two 1,100-line-per-minute and four 600-line-per-minute units—had been quite a difficult challenge, says Patrick J. Nelis, division manager of data processing. "And this is perishable information: store managers need it in time to make operating decisions.

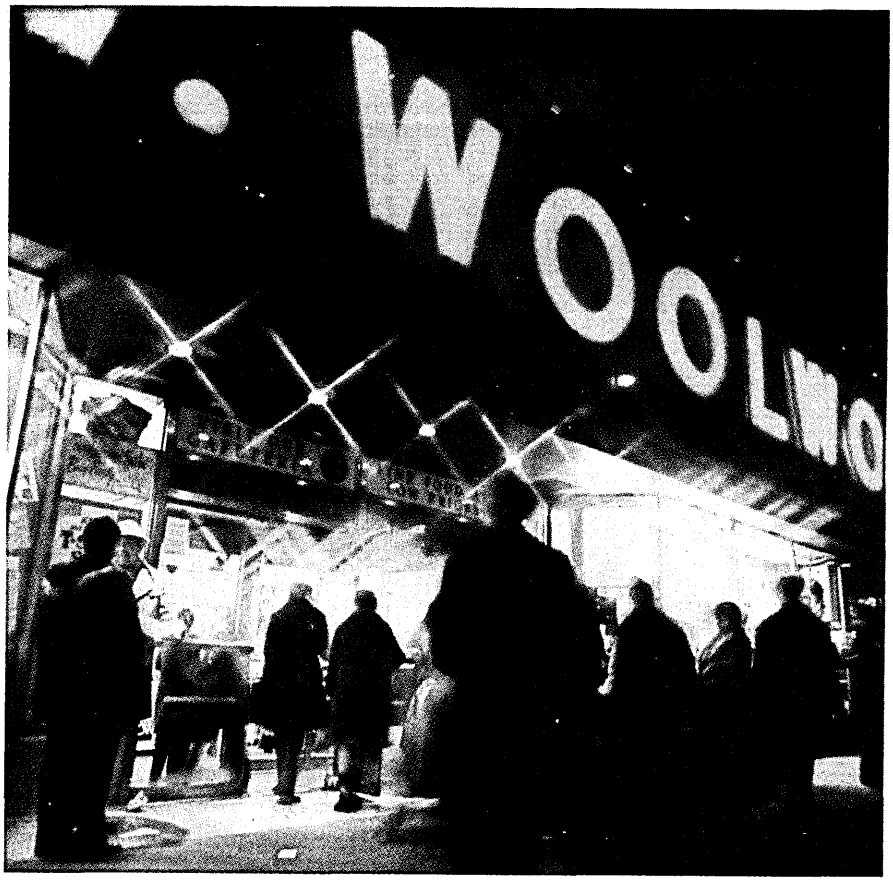
"Some reports took 8 to 10 hours to print. Switching forms from, say, two-part to four-part paper took time. And then we had to deleave and burst, and sometimes collate the output of two or three printers to assemble one report.

"But the 3800 is so fast that multipart paper and carbon paper can be eliminated. A report required in multiple copies is simply printed the required number of times. This also eliminates the time and additional cost of deleaving and handling carbon waste, and everyone now gets an original.

"We paid as much for carbon paper as for printing paper," Nelis says. "Two-part forms cost approximately three times as much as single-part forms. All told, our paper cost savings are running more than 16 percent.

"In addition, we've reduced our forms-changing operations, our printer scheduling headaches, and much of the effort of separating and assembling reports after printing."

With one special character set, the laser prints straight horizontal and vertical lines. "Some of our report forms change as new requirements emerge," says Nelis. "With this capability of the 3800, we can meet these needs without printing new forms and discarding supplies of old ones."



F.W. Woolworth operates some 1,800 retail stores across the U.S. Now one IBM 3800 Printing Subsystem helps to speed sales, merchandising and accounting reports to store managers and regional offices.

Wickes...

(Continued from first page)

environment like this. We had a good bill of materials processing system and basic production control. But we wanted much more function—in particular, an online order entry and inquiry system to improve our responsiveness to the needs of our customers."

Today, Behlen uses the System/370 Model 158 at Wickes data center in Chicago, accessed by seven terminals at the plant in Columbus, Nebraska: six IBM 3277 Display Stations and a diskette-oriented IBM 3776 Communication Terminal for entering batch work.

"Now," Rood says, "we're getting into some new areas of payoff, made possible by the centralized manufacturing control system. We are running studies of inventory movements, to see which older items we can take out of the product line. And the computer is helping us in physical distribution, guiding us in staging delivery items for optimum truck loading."

"For Wickes at the corporate level," Fergadis says, "one benefit has been a gain of in-house expertise in material requirements planning which can be transferred to other divisions."

DP Dialogue is designed to provide you with useful information about data processing applications, concepts and techniques. For more information about IBM products or services, contact your local IBM branch office, or write Editor, DP Dialogue, IBM Data Processing Division, White Plains, N.Y. 10604.

IBM®
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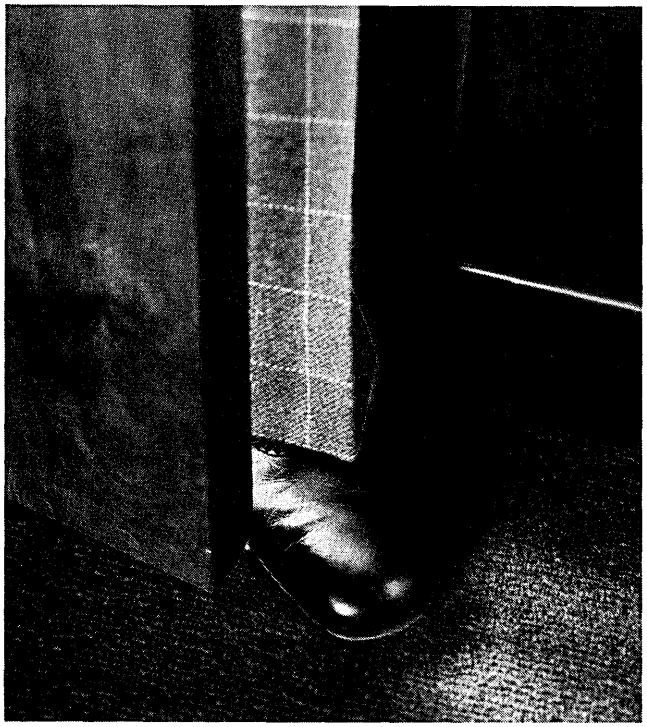
Getting and keeping timeshare business:



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.

Basic Timesharing Inc., 870 West Maude Avenue, Sunnyvale, California 94086. Sales offices: East: Cherry Hill, New Jersey (609) 662-1122;

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.

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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 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 7.5 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 "sub-let" 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.

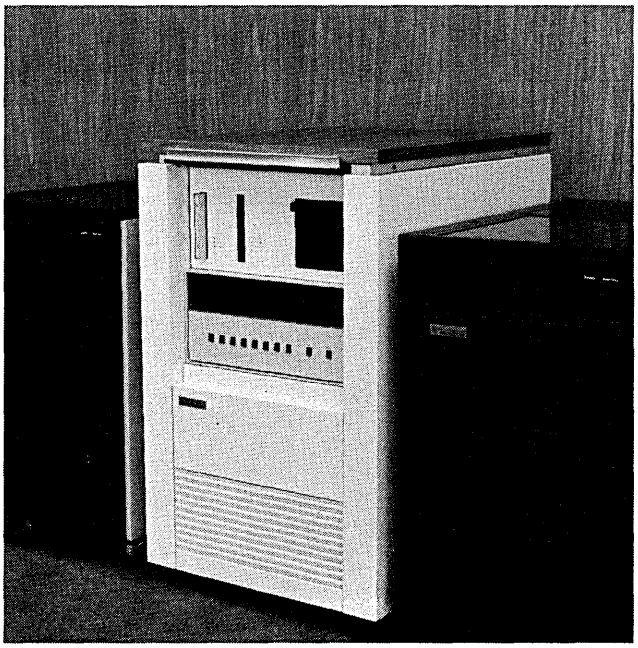
You get continuous system availability, because software housekeeping can be performed with users on-line.

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.

Southeast: Atlanta, Georgia (404) 433-0900; Midwest: Minneapolis, Minnesota (612) 854-1122; West: Sunnyvale, California (408) 733-1122

calendar

MARCH

Personal Computing Shows, March 19-20, Los Angeles. Also held in Philadelphia, April 30-May 1; and Boston, June 18-19, these shows will feature exhibits of new microcomputers for homes, schools, and small businesses. A personal computer can teach, calculate income tax, play games, or act as a burglar alarm. Three seminars will be held to show the average person how to program a personal computer, and one will teach how to build a computer from a kit. For the more advanced, there will be six intensive courses on microprocessors. Fee: $10.00, two days; $6.00, one day. Contact: Personal Computing, 401 Louisiana S.E., Albuquerque, N.M. 87108 (505) 266-1173.

Computer Designers' Forum, March 29-31, San Francisco. Designing microprocessor systems will be one of the main focal points for case studies during the conference program scheduled in five major cities beginning March 29. Each day will begin with a tutorial based on a daily theme, such as "Evaluating and Using Microprocessors." The forums will be held in Los Angeles, April 5-7; Chicago, May 3-5; New York, May 10-12; and Boston, June 7-9. Contact: Edward Bride, Computer Caravan, 797 Washington St., Newton, Mass. 02160 (617) 965-5800.

System 2000 Users for Technical Exchange, March 30-April 1, Austin, Tx. This three day conference will have over 20 presentations covering such topics as: computer assisted retrieval system; introduction to data base technology; support of large data bases; and use of the System 2000 report writer to extend the capabilities of natural language. The keynote speech will be "People and Machines: Is the Gap Closing?" The conference is not restricted to ASTUTE members and is open to anyone wishing to learn more about data base management. Contact: Ken Wilton, Ontario Hydro, 700 University Ave., MS M-1C10, Toronto, Ontario, M5G 1X6 (416) 592-6834.

APRIL

Microcomputer '77, April 6-8, Oklahoma City. Co-sponsored by the IEEE, this conference concerns microcomputer systems, a survey of the range of current applications, and exploration of potential areas for future development. It includes data acquisition, control, communication, and instrumentation, with emphasis on exhibits and papers presented in the technical sessions. Contact: Dr. S. C. Lee, School of Electrical Engineering, Univ. of Oklahoma, Norman, Ok. 73019.

Update '77: A Growth Experience, April 13-15, Vancouver, Canada. This conference, sponsored by the Vancouver chapter of DPMA, is structured on three tracks to be of interest on management and technical levels. Workshop topics include: Evaluation and Selection of Minicomputers; Managing the Data Entry Operation; Data Base Management Systems; Structured Programming; and The People Side of Systems Management. Contact: Elan Data Makers, 826 Homer St., Vancouver, B.C. V6B 2W5 Canada.

Symposium on High Speed Computer and Algorithm Organization, April 13-15, Champaign, Ill. This symposium will bring together people involved with machine organization, software, and algorithms for high speed computation, and will present papers on the subject of computer organization (parallel, pipe-line, or multi-processors), compilers, languages, and operating systems. Experts will present a picture of current computational capabilities, an assessment of the successes and failures of high speed systems in recent years, and an indication of future needs and directions. Fee: $50. Contact: David Kuck, Dept. of Computer Science, Univ. of Illinois, Urbana, Ill. 61801 (217) 333-3373.

Information Industry Conference and Exposition, April 18-21, Washington D.C. "The Emerging Information Manager: Bridging the Information Gap" is the theme of this conference. In three days of workshops, panel discussions, case studies, and exhibits, it will focus on the problems information managers encounter and will explore available solutions. Highlights include: management seminars reviewing new technology, "hot topic" workshops designed to update the manager's staff, and career advancement seminars geared to specific opportunities in the information field. Contact: IIA, 4720 Montgomery Lane, Bethesda, Md. 20014 (301) 654-4150.

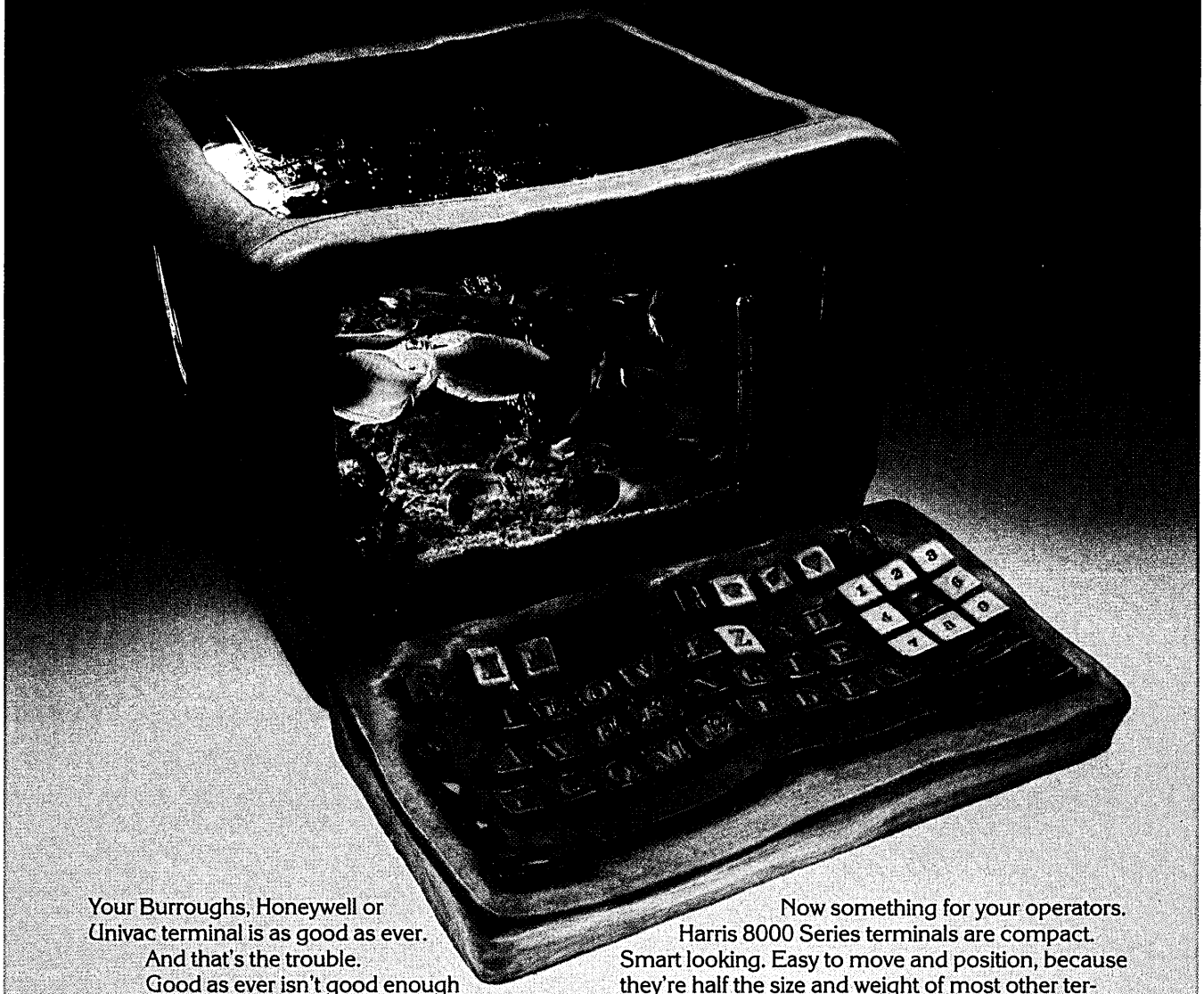
EDP Auditors Association, April 21-22, Los Angeles. Covering functional areas of data processing and the responsibility of the edp auditor in those areas, "The Changing Role of the Auditor in the EDP Environment" is directed toward data processing management, consultants, audit managers, and edp auditors. Fee: $65, members; $80, non-members. Contact: Ms. Renee Miller, Price Waterhouse, 606 S. Olive St., Los Angeles, Calif. 90014 (213) 625-4584.

Computers in Banking, April 27-29, Paris, France. The sixth annual international banking seminar has a theme of Cost and Profit Control in Banking. Administration productivity, reduction of non-productive costs, and evaluation of banking organizations will be subjects for discussions, with Michel Durafour, French Minister of Finance, presiding. Contact: Patrice de Cassini, INSIG, 5 rue Quentin-Bauchart, 75008 Paris, France.

ON THE AGENDA

Interface '77, March 28-30, Atlanta (800) 225-4620. **Simulation Symposium, March 16-18,** Tampa, Fla. **Data Processing Technology: 1977-1981, March 23-25,** New York (213) 450-0500. **Computer Architecture Symposium, March 23-25,** College Park, Md. (202) 767-2903. **Corporate-to-Corporate EFTS Conference, March 20-23,** New York (312) 693-7300. **1977 Northwest Computer Expo, March 29-31,** San Francisco (617) 965-5800. **West Coast Computer Faire, April 15-17,** San Francisco (415) 851-7075.

A tactful suggestion for your Uniscope,† TD, or VIP:



Your Burroughs, Honeywell or Univac terminal is as good as ever.

And that's the trouble.

Good as ever isn't good enough when there's a terminal that's better than ever.

It's the Harris* Interactive 8000. Emulates your terminal and does more. Much more.

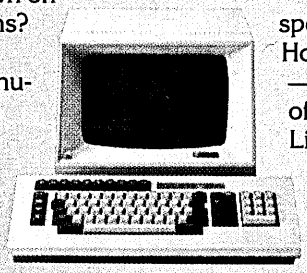
For example, does your terminal have built-in diagnostics? Can it help you cut down on downtime by quickly isolating problems?

The Harris 8000 Series can.

Does your terminal have a communications monitoring capability to help you debug software?

The Harris 8000 Series has.

If you want to replace or add terminals, will you get fast delivery? You will with the Harris 8000 Series.



Now something for your operators.

Harris 8000 Series terminals are compact. Smart looking. Easy to move and position, because they're half the size and weight of most other terminals. And they keep cool and quiet.

Finally, something for your treasurer. The Harris 8000 Series is priced lower—up to 25% lower—than those other terminals.

The Harris 8000, from the terminal specialists. It makes your Univac, Honeywell, or Burroughs outdated—which can leave you with a fine kettle of fish, unless you do something.

Like call us for details and a demonstration. **Harris Corporation, Data Communications Division, P.O. Box 1408, Nashua, NH 03061. (603) 885-6685.**

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†Trademark of Sperry Rand Corporation
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Our Newest Pets and

A few months ago we predicted that our CAROUSEL printer with its forms-handling capabilities was going to be an instant success. We were right.

We told you then that there was more to come. That we were starting to build "the most comprehensive line of terminals ever offered by a single manufacturer."

We didn't want to keep you waiting. This week we're unveiling the first two new products in our CRT line: the FOX-1100, a low-cost, not-so-dumb CRT; and the OWL-1200, an editing terminal that's remarkably easy to program. A different breed of terminal. With a different kind of service.

Other manufacturers offer "worldwide service." We go a lot further. At PERKIN-ELMER we offer No Hassle service. All our terminals come equipped with our No Hassle, 800 toll-free service phone number. One call does it. We give you service where you need it, when you need it. We're there. Not just "worldwide," but wherever you are.

A better terminal means better service. PERKIN-ELMER DATA SYSTEMS means both.

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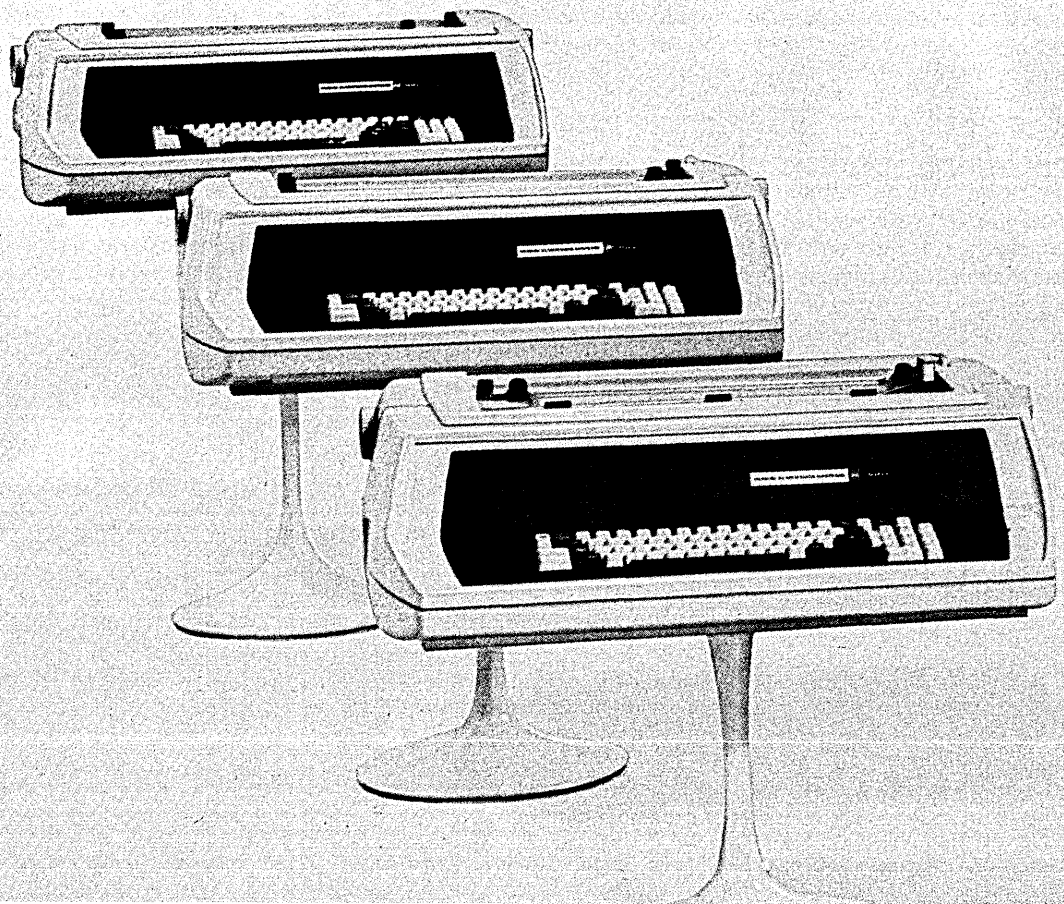


How We Care for Them

CIRCLE 78 ON READER CARD

A $971* Pet That's Dum

A low-cost display doesn't have to be dumb. Not if it's smart like our new FOX-1100. Our FOX gives you a full 24 line by 80 character display, a unique 9 by 12 character matrix for super legible characters, full cursor addressing, complete tabbing capability, and Typamatic repeat on all keys. Plus a lot more. All for just $971 in quantities of 25.

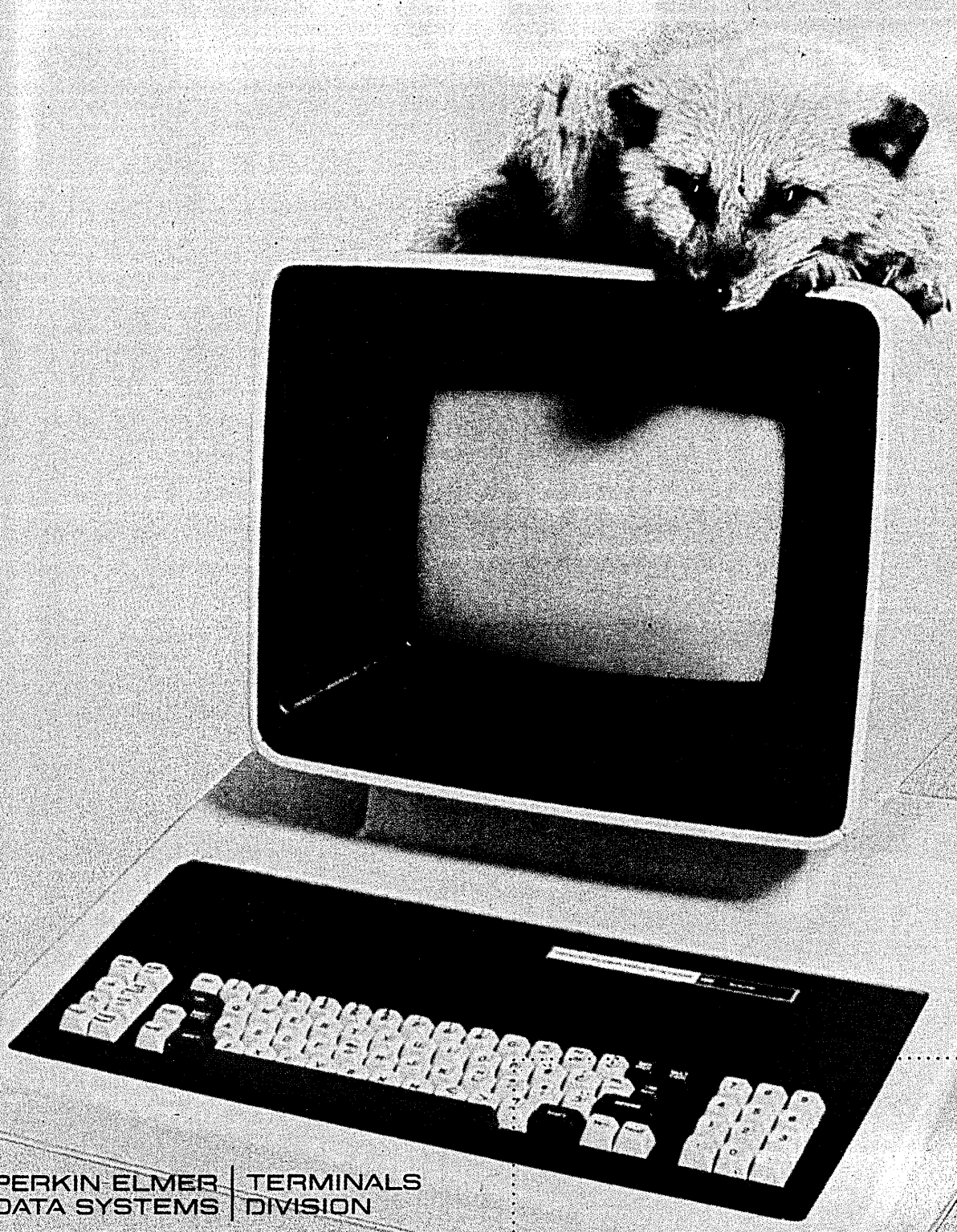
And a smart terminal at the right price isn't all you get with an 1100. Our FOX is designed to interface with people. Human engineering features like a hooded eye-level display and an easy-to-work-with, powerful keyboard make it an operator's pet.

Check the comparison chart to see the reasons why the FOX-1100 is the only low-cost CRT with smarts.

CUSTOMER NEED	FEATURES	PERKIN-ELMER FOX-1100	ADDS 520	LEAR SIEGLER ADM-3	DEC VT-52
Easy-to- Read Display	9 X 12 Matrix for highly legible characters	Yes	No	No	No
	Black on white or white on black display	Yes	No	No	No
	Display at eye level	Yes	No	No	No
	Display set deep in hood to reduce glare	Yes	No	No	Yes
	Full 24 X 80 display	Yes	Yes	Option	Yes
	Full 96 character set, upper and lower case	Yes	No	Option	Yes
	Easy-to-find block cursor	Yes	No	Option	No
Ability to Enter Data Anywhere on Screen	Complete cursor addressing and control	Yes	Yes	Option	Yes
High Operator Throughput	Tab stops that can be set to any column	Yes	No	No	No
	Tab key.	Yes	No	No	Yes
Low Operator Fatigue	Backtab key	Yes	No	No	No
	Shiftlock key	Yes	No	No	No
	Typamatic repeat on all keys	Yes	No	No	No
	Separate print key	Yes	Yes	No	No
	Backspace key	Yes	Yes	No	Yes
Convenient Switching Local/On Line	Local-remote mode key	Yes	Yes	No	No
Simplified Interfacing to Printer	Fully buffered port to make printer speed independent of CRT speed	Yes	No	No	No
Easily Accessible Mode Controls	New line enable key	Yes	No	No	No
	Autoline feed key	Yes	Yes	No	No
	Scroll enable key	Yes	Yes	No	Yes
High Speed Numeric Input	Integral numeric pad	Option	No	Option	Yes
Simplified Program Debugging	Transparent mode and displayable control characters	Yes	No	No	No
Cost Effectiveness	OEM price in quantities of 25 for basic unit with 24 X 80 display	$971	$1195	$1080	$1476

*In quantities of 25.

b like a Fox



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Please send me more information on the FOX 1100.

Attach your business card here.

CIRCLE 79 ON READER CARD

An Editing Pet Tha

The perfect editing terminal for transaction processing must be more than a little bit smart. It has to be wise like our OWL-1200. With features that assure high accuracy source data entry, fast data editing, simplified host computer programming, and reduced host computer loading.

Our OWL gives you all the human engineering features you get with our FOX-1100, plus a lot more. And the price is right. Just $1496 in quantities of 25.

Check the comparison chart of editing terminals to see all the reasons why the OWL-1200 is simply "incomparable."

USER REQUIREMENT	FEATURES	PERKIN-ELMER OWL-1200	HAZEL-TINE MOD. 1 EDITING	LEAR SIEGLER ADM-1A	LEAR SIEGLER ADM-2	ADDS 980
High Operator Data Entry Accuracy	Protected fields	Yes	Yes	Yes	Yes	Yes
	Low-intensity fields	Yes	Yes	Partial	Partial	Partial
	Numeric only fields	Yes	Yes	No	No	No
	Inverse video fields	Yes	Yes	No	No	No
	Blink fields	Yes	Yes	No	Yes	Yes
	Line drawing capability	Yes	No	No	No	Yes
Simple, Fast Editing of Data	Insert/delete character	Yes	Yes	Partial[1]	Yes	Yes
	Insert/delete line	Yes	Yes	Partial[1]	Yes	Yes
Minimized Loading on Host Computer	Host programmable send keys: send all data, send only unprotected data, send only data modified by operator, send only a "request to send" header.	Yes	No	No	No	No
Simplified Programming	Ability of host CPU to read device status	Yes	No	No	No	No
	Ability of host CPU to read device mode key settings and communication option straps	Yes	No	No	No	No
	Program override on mode key settings	Yes	No	No	Yes	No
Simplified Program Debugging	Transparent mode permits all characters to be displayed	Yes	No	No	No	No
Cost Effectiveness	OEM price in quantities of 25*	$1496	$1670	$1795	$2395	$1995

*When unit includes editing capabilities, 24 x 80 display, numeric pad, and upper/lower case characters.

[1]No Key. Requires Two Key Code.

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t's Wise as an Owl

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Attach your business card here.

CIRCLE 80 ON READER CARD

source data

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

books

The Phone Book
by J. Edward Hyde
Henry Regnery Company, 180 N. Michigan Ave., Chicago, Ill. 60601 (1976)
170 pp. $7.95

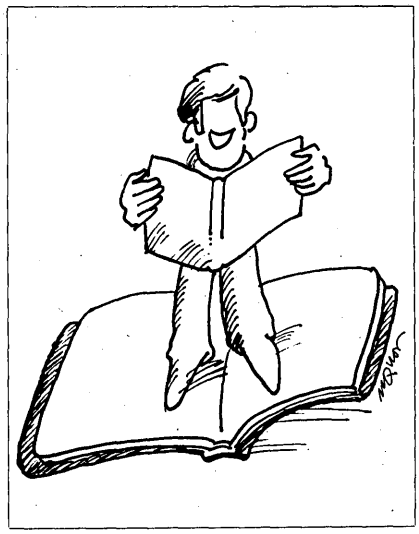
The subtitle on the jacket cover tells you that inside is "What the telephone company would rather you not know." A rather seductive invitation, really. Much like "everything you always wanted to know about sex, but were afraid to ask." Well, not exactly.

However, the telephone company for its size and influence (as the data processing industry is beginning to understand) is still an enigma to the average American. Since Joseph Goulden's *Monopoly* (Putnam, 1968) there is yet to be a serious, in depth explanation of the internal machinations of Ma Bell. Even *Telephone* by John Brooks (Harper & Row, 1975), purportedly commissioned sans editorial oversight by the telephone company, while a scholarly work, lacked the vigor and intensity of analysis that was Goulden's.

Unfortunately, *The Phone Book* fails on both counts: it is neither a serious analysis of the Bell system's workings, nor discloses very much of what we might really want to know about the telephone company. The book does not answer why Bell filed the Consumer Communications Reform Act, or go into any of the history of the 1956 Consent Decree, or the terms and conditions which presently preclude AT&T from entering the data processing markets.

Few aspects of the present controversy are mentioned, with the exception of a few references to the Interconnect industry and how much the 1600 telephone companies "whose infighting sometimes becomes embarrassing to watch (can) band together with the fervor of religious fanatics to defeat a common enemy." Hyde does speculate on Bell's enlightened marketing approach, but "wonders why it took an act of competition to force the company to do these things. If these products were available prior to the Carterfone decision—as most of them were—then the matter becomes a powerful indictment of the company's 'public be damned' attitude. Score one for Hyde.

In fairness, the author does arrive at one interesting conclusion, albeit with little documentation or support, that the phone company should get out of the telephone market which, he says, would be good for the competition and the customers. "If the phone company did take this giant step, he reasons, it would lose about half of its annual income and two-thirds of its overhead." "By getting away from equipment sales, the company's profit would be less, but the margin would be higher." But, Hyde says, the telephone companies are not "geared to thinking along such lines"; so it is unlikely to happen.



J. Edward Hyde, it should be noted, is a *nom de plume*, and was reportedly a former middle management employee of the phone company, now a magazine editor, teacher, and freelance writer. Thus, this book is held out to be an insider's view of the telephone world as seen from someone in a position to know. In fact, Charles W. Saults, Hyde's real name, only worked for the telephone company (Southwestern Bell, according to Bell sources) from 1970 to 1973, and then not in a management capacity but as a sales-service representative in the marketing department—hardly the perspective to speak broadly or with any authority about very much of the company's practices, operations, philosophy, whatever. This inexperience comes through as "Hyde" or if you will, "Saults," discusses the corporate environment, service concepts, public relations policies, etc. Hyde is also dead wrong on other matters, such as claiming Bell uses its responsibility to collect excise taxes to make a profit of $26.4 million in 1974 (peanuts for Bell).

Hyde has done some of his homework, or course. And the chapters on "Ripoffs, Robberies, Blue Boxes, and Fraud" and the Appendix on "Sickies, Salesmen, and Other Weird Calls" can be amusing, if not edifying. Likewise his attempts to portray the size of Bell with such trivia as; the telephone company uses enough "wire to reach from the earth to the sun and back again three times with several million miles to spare" and "Bell's reported uncollectable debts of $150 million were more than the annual profits of RCA, Philips Petroleum, Boeing, International Harvester, Firestone, or Litton" are interesting.

Short of that, *The Phone Book* is nothing more than a contribution to J. Edward Hyde, excuse me, Charles Saults', pocketbook, and a lesser contribution to the information wasteland.

—John M. Eger

Former acting director of the Office of Telecommunications Policy, Mr. Eger is an attorney with the Washington, D.C., firm of Lamb, Eastman & Keats. He is also an advisor to the White House office of Science and Technology policy, and a Datamation Contributing Editor.

COBOL With Style: Programming Proverbs
by Louis J. Chimura and Henry F. Ledgard
Hayden Books, Rochelle Park, N.J., 1976
148 pp., paperback, $5.45

Programming Proverbs
by Henry Ledgard
Hayden Books, 1975
144 pp., paperback, $6.50

Programming Proverbs for FORTRAN Programmers
by Henry Ledgard
Hayden Books, 1975
144 pp., paperback, $6.50

COBOL With Style is the long awaited COBOL volume in Hayden's series on programming style. Louis Chimura has joined with Henry Ledgard to address the stylistic issues peculiar to COBOL and to supply material on programming style not mentioned in the earlier volumes in the series.

All three books begin with an extensive set of "proverbs"—guidelines for programmers covering program design, e.g., "Define the Problem Completely" and "Proceed Top-Down"; program structure, e.g., "Use Procedures" and "Plan for Change," and program un-

derstandability, e.g., "Avoid Tricks" and "Use Good Mnemonic Names." Extensive though sometimes contrived examples illustrate these proverbs. These examples, and sometimes the proverbs themselves illustrate the application of the rules to the language being considered. In *COBOL With Style,* for example, "Use Procedures" becomes "Use PERFORM and CALL" and deals with the place of each of these constructs in modular COBOL.

Following the proverbs is an extensive discussion of program design by stepwise refinement of pseudo code. Unfortunately the authors never quite define the control structures used in the pseudo code, nor do they explain how these structures may be realized in COBOL or FORTRAN. Top down design is illustrated by showing the design and implementation of a medium size program. While the other two books present a Kriegspiel checkers referee, *COBOL With Style* presents a payroll example typical of COBOL programs. It also has added a welcome new section on creating functional specifications of problems.

Another feature new to the COBOL books is a chapter on program standards suitable for adoption by a programming group. These standards encourage consistency, as well as style among programmers. For example, one standard suggests that a standard set of user-defined names be chosen for frequently referenced items, e.g., that all programs use PAGE-NUM for page numbers and QTY-IN-STOCK for quantity on hand. Another requires validation of all input data. While it is easy to disagree with some of the standards or to think of additional ones, this section provides excellent guidelines. It would be a pleasure to see similar sections added to the other two books.

The final chapter in each book covers an assortment of topics. The COBOL book has interesting new sections on "The Overconcern with Micro-Efficiency" and "The Case Against Program Flowcharts," but it has omitted the section on "Debugging Techniques" found in the other two books. This is indicative of a major weakness in all three books: program design and style are presented well but there is almost no material on debugging and testing. Of course we should write error-free programs, but it is still necessary to demonstrate correctness.

Despite a few weaknesses, *COBOL With Style* belongs in the library of every COBOL programmer. A great deal of its material on COBOL style, previously available only in scattered articles, is now conveniently accessible in book form. FORTRAN programmers will find similar material in *Programming Proverbs for FORTRAN Programmers,* and PL/1 and ALGOL programmers in *Programming Proverbs,* although these books lack some of the material in *COBOL With Style.* All three books are suitable as texts in programming courses at various levels. All provide an assortment of problems ranging from easy to quite difficult.

—Nadine E. Malcolm

Ms. Malcolm is assistant professor of Computer Science at California State Univ. at Northridge. She received her B.S. in Math from MIT, and an M.S. in Computer Science from the Univ. of Southern California.

Sorting and Sort Systems

Harold Lorin
Addison-Wesley Publishing Co., 1975
460 pp. $16.95

Ordering—sorting into piles and sequences—is not only one of the most pervasive of data processing functions but a most expensive one if done improperly. This is true whether the sorting is being done to make some computational procedure possible or more efficient or whether it is done to organize output for human understanding. In this book, Lorin examines a number of sort procedures in terms of their efficiency factors (the number of comparisons, the number of exchanges and the use of storage) and the data characteristics that influence these (list size, key length and com-

plexity, key mode, key distribution, record size and variability, intent of the sort, and the characteristics of the system upon which the sort is performed).

Part 1 of the book covers internal sorts; Part 2 covers external sorts; and Part 3 discusses generalized sorting systems and special system considerations such as multiprocessing and virtual storage. The book is capped off by an appendix of algorithms for the various sorts, largely from Communications of the ACM, but several in PL/1. The discussion of sort techniques is straightforward without extensive attempts to develop mathematical bases, but presenting approximate formulae for estimating comparisons and exchanges. The exact functioning of sorts, pass by pass, is frequently diagrammed in detail so that one can see exactly how the sort works.

The crux of internal sorts is summarized in Chapter 11 with a performance study using lists of three lengths (100, 1000, 5000) and several initial orderings (random, ordered, interleaved, etc.). Performance was found to be profoundly influenced by initial distribution so that a slight bias in distribution and permutation leads to considerable variance from the expected comparisons and exchanges. The same may be said for programming style as shown by the performance of variations on the quicksorts and shell sorts included in the tests. Although the quicksorts were generally most efficient and the shuttlesort (sifting) the least for random data, treesorts and shellsorts have other advantages. While the shuttlesort should be avoided for any disarranged list, if there is reason to believe that the list is already ordered, as an input file might be, and all one wanted to do were to verify the order, the simple sift is far and away the best sort to use. Hence, the best sort to use depends on the situation and the discovery of a better sorting method cannot be ruled out. Combinations of sorts, such as a sift to check for ordered lists and quicksort to do the sorting, may also yield advantages.

> . . . the best sort to use depends on the situation, and the discovery of a better sorting method cannot be ruled out.

Chapters 17 (tape merges) and 18 (random access device merges) summarize considerations for external sorts—or rather merges since the ordering of subblocks is done by one of the internal sorts. Performance for tape merges is usually judged by the number of phases, the effective order of the merge, and the amounts of data moved, each of which may consume variable amounts of time. Data characteristics include the volume of data, data structure, the relative dispersion of the data, and pre-knowledge about the number of strings and the data structure. Hardware factors such as the memory size and the number of tapes and channels available also affect tape merge efficiency. Lorin presents a table for calculating polyphase, cascade, oscillating and balanced merge behavior. Random access device merges are dominated by seek time and rotational delay and the way these are handled. The number of storage units and channels are other considerations. Block sizing, merge ordering, interleaving, buffering, read scheduling, and directory creation are techniques to be considered. Lorin covers these considerations but not nearly in as great detail as he has covered internal sorts and serial devices, but, of course, much of the preceding development applies to random access device merges and these are merely added considerations.

Chapter 19 discusses generalized sort systems, how they are used, strategies for implementing a sort at compile time, load time, and run time and the loss of efficiency with the degree of

generalization. Interactions with the hardware and the operating system are discussed, including multiprogramming considerations. Language factors are also considered, as are timing calculations and sort simulations as approaches to selecting an optimum sort for an application.

Chapter 20 discusses such special system factors as relocation and virtual memory and multiprocessors. Certainly paging and memory management will influence sort efficiency. The impacts of both memory management and multiprocessing on some standard sorts is discussed.

All in all, the book seems to be a valuable tool for the programmer interested in improving the efficiency of sort applications. Certainly most of us are too prone to ignore these considerations, taking the sort that is available or that we know without much investigation of the factors that might make the choice good or bad. Other books on sorting have focused on the technical details of the sorts without much emphasis on evaluation. This is a thoughtful book, one meriting consideration by the serious software engineer. Efficiency and improving software performance is largely the architect's responsibility. That the book's development of many sort algorithms is valuable to the programmer goes without saying.

—N. E. "Gus" 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 currently a member of the ACM Committee on Self-Assessment Testing and the AFIPS committees on job descriptions for programmers and system analysts.

reports & references

Minicomputer Guide

The Buyer's Guide to Business Minicomputer Systems includes over 400-pages of product reports and in-depth analyses of 58 leading systems, from both domestic and foreign manufacturers, currently marketed in the U.S. To aid selection or analysis, each report offers a management oriented overview, competitive product information, hardware and software specifications, end user reactions, and configuration guidelines. Search charts are included to compare features and capabilities of many systems. Also include is a directory of suppliers—including addresses and phone numbers!

Intended primarily for business users, potential users, analysts, and manufacturers of business systems, novices may benefit from the introduction, which offers a tutorial on the several classes of business minis and provides a guide to their applications. Price: $59. AUERBACH PUBLISHERS, INC., 6560 North Park Dr., Pennsauken, N.J. 08109.

Software Survey

The *Fourth Annual Survey of Performance Related Software Packages* covers 233 software products offered by 94 vendors. The packages are listed under 13 general categories including communications, data management, job accounting, software monitors, and simulation. Information about each product includes the vendor's name, system on which the package is operational, price, and a description of the product. There is also a vendor index. This software survey issue of the *EDP Performance Review* is available to non-subscribers for $5. Contact: ACR, 8808 N. Central Ave., Phoenix, Ariz. 85020.

Consultant Survey

The busiest consultants are not the lowest priced. The second annual PATCA survey of consulting rates indi-

source data

cates that the busiest 40% of the consultants contacted actually received 21% more for their services than the others. It also shows the rates charged by consultants under varying circumstances, the degree to which consultants pass on expenses to clients, the background of participating consultants, and types of clients served. New in this year's report is a profile of the busiest consultants in the business in terms of time billed to clients. Responses from PATCA members and nonmembers are included in the survey. Price: $5; Calif. residents add sales tax. Prepaid orders go to PATCA, P.O. Box 4523, Mountain View, Calif. 94040.

Security Checklist

A new 113-point computer system security checklist recently has been published. The checklist covers such critical areas as fire prevention, access control, flood, housekeeping, electric power, personnel aspects, hardware and software factors, resource sharing exposures, and contingency planning. There is also a specialized security bibliography, and a briefing on the application of risk management methods in determining facility protection requirements. Price: $5. REYMONT ASSOCIATES, 29 Reymont Ave., Rye, N.Y. 10580.

Datamation Subject Index

The 1976 subject index for Vol 22, Nos. 1-12 of DATAMATION is now available without charge to our readers. The index includes references to feature articles, conference reports, book reviews, News in Perspective, Editor's Readout, and the Forum. DATAMATION, Los Angeles, Calif.

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Series/1 Market Study

IBM will have captured 7% of the minicomputer market by the end of this year, having shipped about 6,000 Series/1 minis, and will have 20% of the market by the end of 1983, according to a new market research report being published this month by Small Business Systems, publisher of the monthly *Small Business Systems Industry Report*. IBM's mini shipments worldwide by '83 will represent sales of $2.5 billion. The study also includes configuration, economic, technological, application, and competitive analyses of the Series/1. Price: $750. SMALL BUSINESS SYSTEMS, 701 Welch Rd., Suite 1119, Palo Alto, Calif. 94304.

Salary Survey

The *1976-77 Wage and Salary Survey* is now available from ADAPSO. The survey is based on data received from software, data center, time-sharing, and facility management companies in all revenue brackets throughout the U.S. The 108-page report contains a study of salaries by job classifications, and examines vacation and pension plans, sick benefits, educational allowances, and medical payment plans. Price: $25, non-members. ADAPSO, 210 Summit Ave., Montvale, N.J. 07645.

Reducing Costs

A 16-page information portfolio *54 Ways to Reduce DP Costs* is now available. The portfolio includes cost-cutting measures for forms, input, output, personnel, and equipment which have been instituted by dp installations throughout the country, compiled as a result of a recent survey. Taken from the Auerbach information service for managers of data processing and data communications, the portfolio is free from AUERBACH PUBLISHERS, INC., 6560 N. Park Dr., Pennsauken, N.J. 08109.

Computer Club Directory

The *Directory of U.S. Computer Clubs* contains five cross-indexed sections including a club profile, geographic loca-

tor, special application interest groups, equipment available to each club, and a users' guide. Interested persons may use the directory to find out how others are using their computers, reach others with the same interests, and find solutions to computer problems that others have already solved. Clubs are listed free. Price: $35; includes basic edition plus two updates. LASTIQUE PUBLISHING CO., P.O. Box 1691, Austin, Tex. 78767.

Lab-log

Lab-Log includes a description of seven computer programs, SYMAP, GRID, CALFORM, SYMVU, POLYVERT, INPOM, and ASPEX, used in the graphical display of spatial data by line printer, line plotter, and crt. A variety of cartographic (x-y coordinate) data bases are also described. There is a list of publications available on automated cartography, theoretical cartography, and theoretical geography. Price: $1; must accompany order. LABORATORY FOR COMPUTER GRAPHICS AND SPATIAL ANALYSIS, Harvard Univ., 520 Gund Hall, 48 Quincy St., Cambridge, Mass. 02138.

vendor literature

Auerbach Reports

Normally available only by subscription to their service, this vendor is now offering two reports at no charge to our readers. The Auerbach report on Communications Test Equipment contains an overview, classifications, audio testers, digital testers, software simulations and monitor testers, tech control, and selection guidelines. The report on Short Haul Modems contains an overview, implementation guide, and a section on options and features. AUERBACH PUBLISHERS, INC., Pennsauken, N.J.

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Easy Audit 1977

This volume is 82-pages of updated applications for computer auditors built around EASYTRIEVE, a utility software compatible with IBM 360/370. There are 32 basic programs divided into information reporting, exception reporting, statistical analysis, statistical sampling, and computer job accounting. Also included is a section on this vendor's program management and data security system, which may recommend ways of establishing standards for management control of data and security for sensitive data sets. PANSOPHIC SYSTEMS INC., Oak Brook, Ill.

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Telecommunications Products

Every major product in this company's line of video, voice, and data transmission systems are described in this 36-page booklet. Listing over 70 products, the booklet is divided into sections covering microwave radio transmitter-receivers, microwave radio subsystems, coaxial cable transmission systems, multiplex, FDM cable carrier, PCM cable carrier, subscriber carrier, data transmission, supervisory and control systems, N-type repeatered line, PCM digital multiplex, PCM repeatered line, VF and signaling equipment, and auxiliary data equipment. Technical specifications, illustrations of each item, and reference sources are included. GTE LENKURT, INC., San Carlos, Calif.

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Micrographic Systems

For application in commerical banking, finance, utilities, medical and education systems, among others, the "On-Line Systems" integrate micrographic and crt displays into an automated on-line minicomputer controlled system designed to provide an alternative to

source data

large scale, mass storage, digital computer systems. This vendor's 8-page brochure compares this system with paper/fiche file systems and mass storage digital systems. Specific subjects covered are: cost of data base conversion, actual data base on-line, large scale vs. minicomputers, data communications, data base storage, and software complexity. One illustration shows how large paper, film, and COM data bases are converted and updated, and there are examples of operator station configurations. MICROFORM DATA SYSTEMS, INC., Mountain View, Calif.
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Data Communications
A new short form catalog describes this vendor's line of equipment and systems which monitor, control, and test data communications systems. The 12-panel folder highlights the Datascope series of diagnostic equipment and its accessories, but also includes details and photos of modem related accessories designed to increase system utility, switching and patching equipment, and tech control centers. SPECTRON CORP., Mt. Laurel, N.J.
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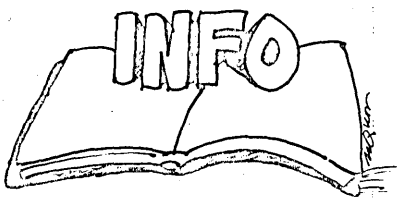
System/370 Security
The protection of information from unauthorized disclosure, modification, or destruction has always been a concern of the dp manager, and *Management Memorandum: Security Features of IBM System/370* is designed to assist managers in planning security for a particular dp environment. Features



listed include IBM's terminal access methods, data base management programs, communications terminals, magnetic storage units, and system control programming. The booklet also lists 27 IBM data security publications that can be ordered through IBM sales offices. IBM CORP., White Plains, N.Y.
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Data Acquisition
A new family of data acquisition systems is described in this 8-page brochure. The System 2000 is microcomputer based and is designed for a variety of industrial applications, including process and test monitoring, scanning, alarming trend reporting, analysis and control. The literature describes the adaptability of the system, which offers a variety of configurations from smaller satellite systems to large scale versions of 2000 or more inputs, and a large selection of features. FX SYSTEMS CORP., Kingston, N.Y.
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Microprocessor
Adapted from this vendor's self-teaching Bugbook series, this 8-page brochure describes this 8080A-based microprocessor, the Mini-Micro Designer (MMD-1), and its accessories. The illustrated brochure contains descriptions and block diagrams of the MMD-1 and its add-on memory interface board, and catalogs the optional plug-in accessories for expanded capability. In addition, the topics covered by the microcomputer programming and interfacing course option are listed. E&L INSTRUMENTS, INC., Derby, Conn.
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Signal Processing
This 8-page brochure describes the concepts and approaches to memory architecture for improved signal processing which led to the evolution of the Compass system. Structured around an informal conversation with

the company president, the brochure claims the system is a revolutionary approach to memory architecture, arrived at by arranging multiple processors around an efficient memory capable of handling double buffers and ring buffers. Also included are specifications of a typical Compass configuration. SIGNAL PROCESSING SYSTEMS INC., Waltham, Mass.
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courses

DBMS Courses

A series of courses offered by Infosystems Technology is scheduled for four cities in the next two months. Each 2-day presentation of *Data Base Management Systems Planning and Analysis* will be followed by two 3-day presentations of *Data Base Management Systems Design and Implementation* in the same city. The Design and Implementation course is divided into two areas: course A for end user systems—ADABAS, DATA COM/DB, INQUIRE, MODEL 2-4, and SYSTEM/2000—and course B for designer systems—IMS, TOTAL, and CODASYL-type systems. Courses are scheduled for Los Angeles (March 28-April 1), Miami (April 4-8), Washington (May 9-13), and New York (May 23-27). Fee: $295, 2-day course; $395, 3-day course. Price includes instructional materials and luncheons. INFOSYSTEMS TECHNOLOGY, INC., 7700 Leesburg Pike, McLean, Va. 22043.

Mini Applications

A 3-day course, *Minicomputers: the Applications Explosion,* has been designed to promote effective minicomputer applications by attendees. Experience in applications and "lessons learned" by users will be presented in overviews and case study workshops. Concurrent workshops will present in-depth case studies of successful applications. Presentations will be followed by panel discussions involving additional user executives and conference participants. Fee: $295; teams $195. AIIE SEMINARS, Dept. DTM, P.O. Box 3727, Santa Monica, Calif., 90403.

Project Management Seminars

A 2-day course for systems and programming managers is being offered in several cities. The seminar will stress the practical aspects of systems design and development, estimation, management control, and documentation, and will examine and outline the essential principles and mechanics needed to build new dp systems. Seminars will be given in New York (March 28-29, May 23-24), Chicago (April 6-7), Honolulu (April 18-19), Cleveland (May 2-3), and Toronto (June 6-7). Price: (includes course materials and lunch) $175/day; discounts available for teams. J. TOELLNER AND ASSOCIATES, 4311 Wilshire Blvd., Los Angeles, Calif. 90010.

movies

EDSAC Film

In 1951 a film was made at Cambridge Univ. illustrating the operation of the EDSAC, which had then been working since May 1949. It is believed to be the first film describing a stored program computer. Among the computer pioneers taking part were A. S. Douglas, S. Gill, and E. N. Mutch. The 10-minute, color film has been reissued with a commentary by M. V. Wilkes. Price: $175. COMPUTER LABORATORY, Univ. of Cambridge, Corn Exchange St., Cambridge CB2 3QG, England. ❋

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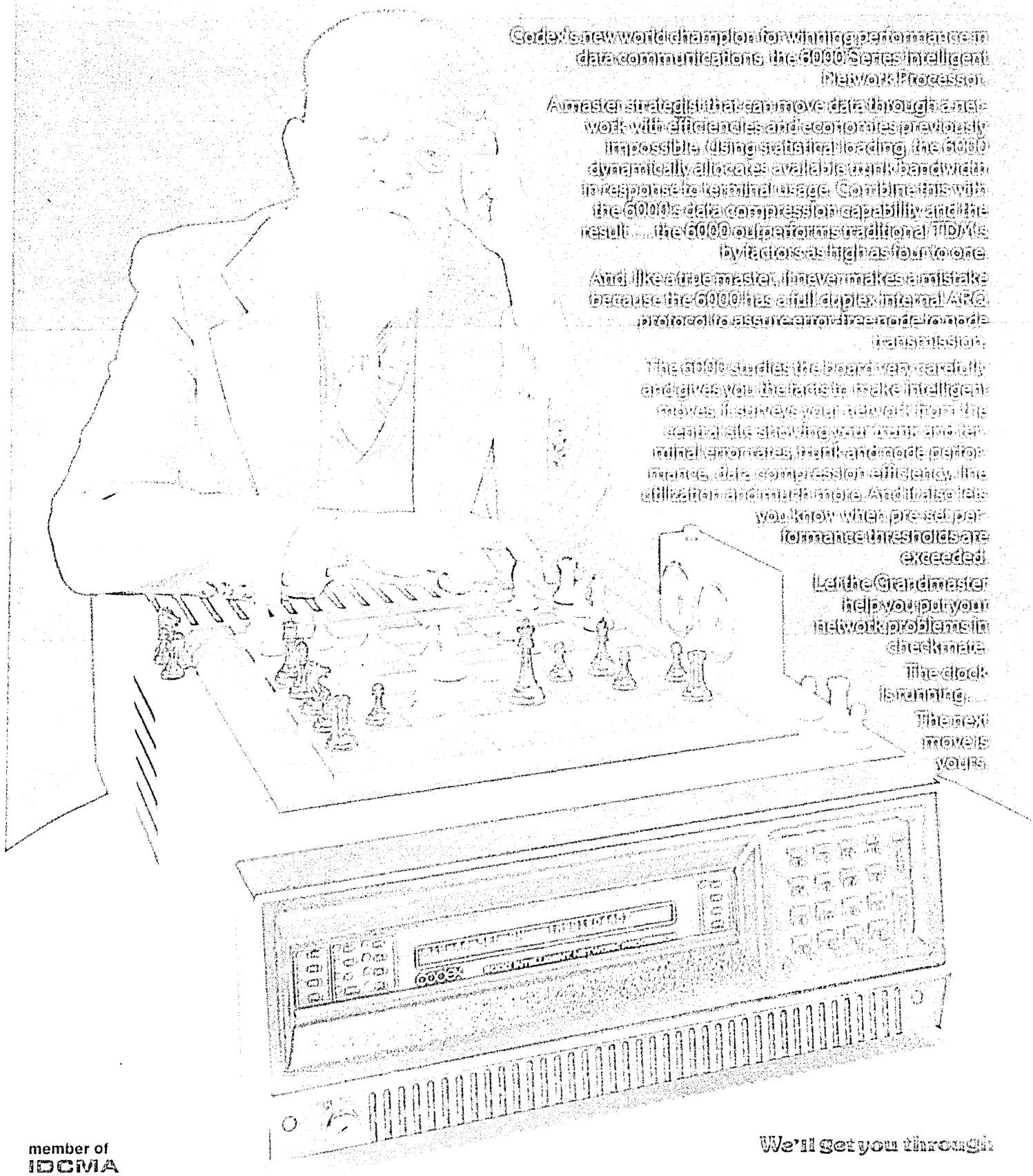

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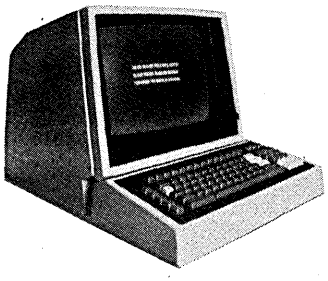

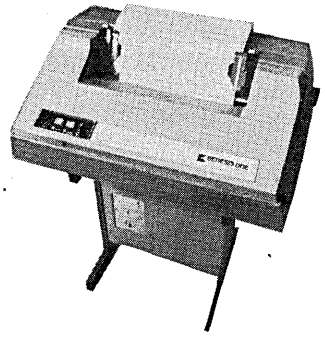

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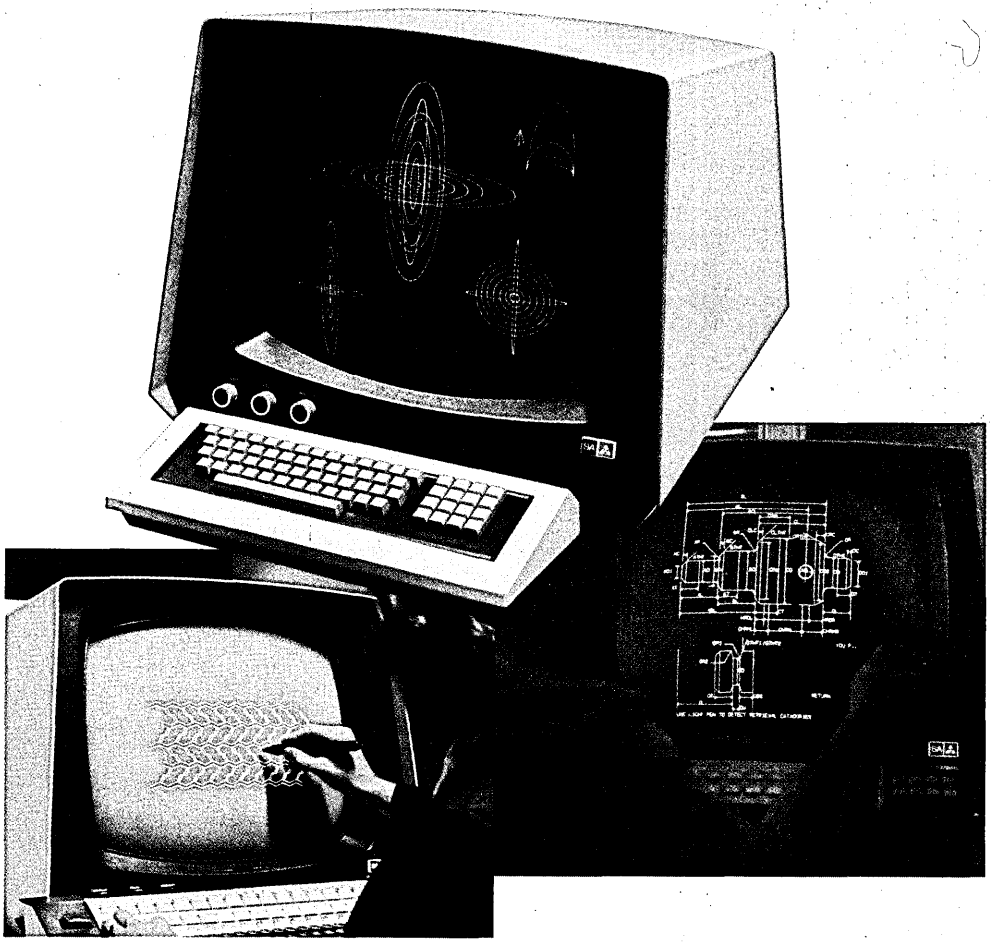

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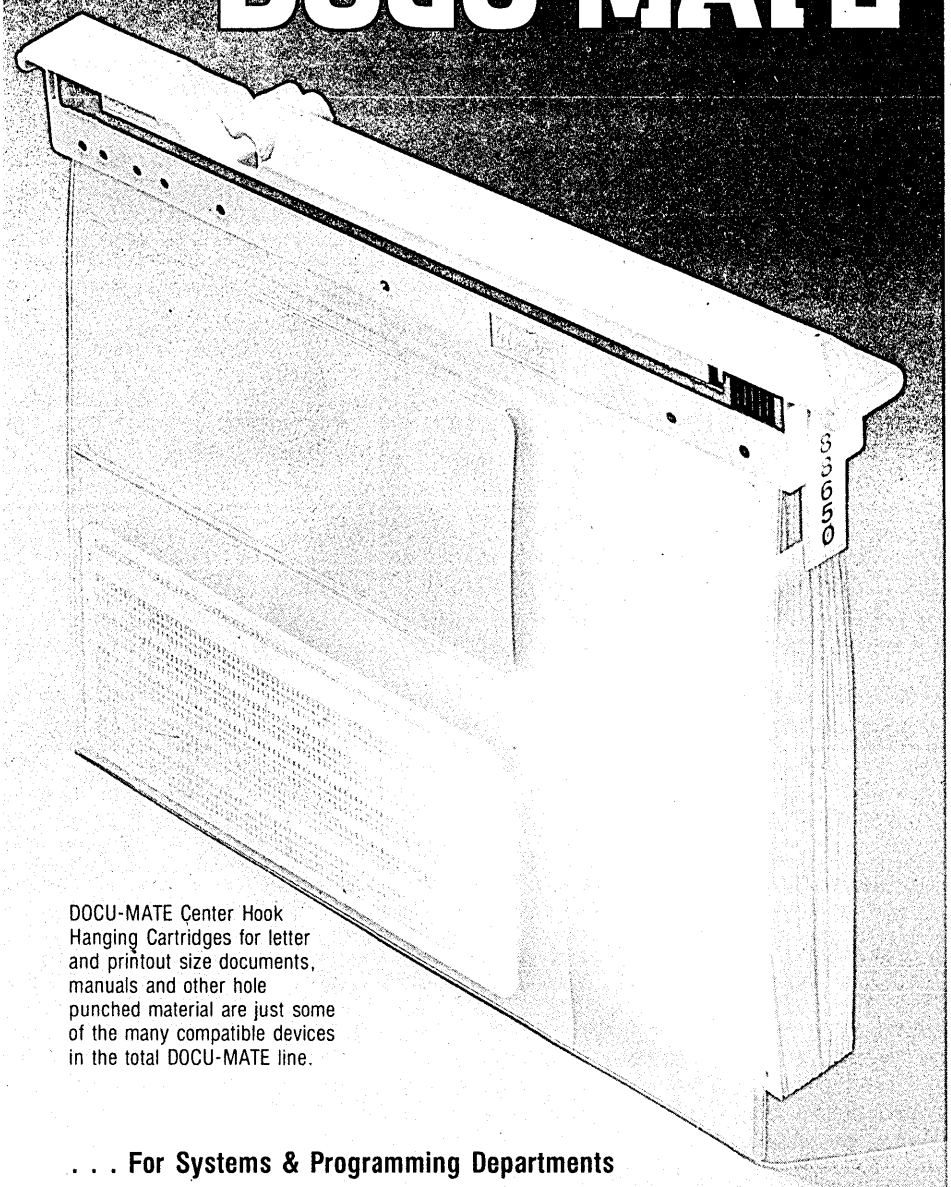

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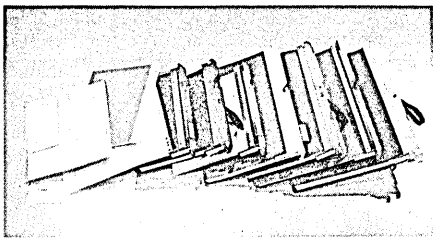

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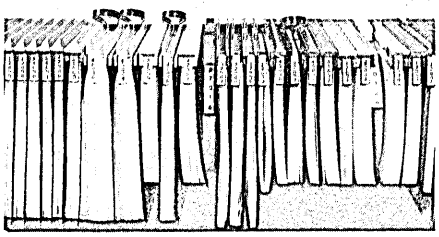

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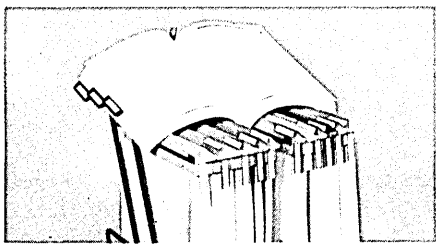

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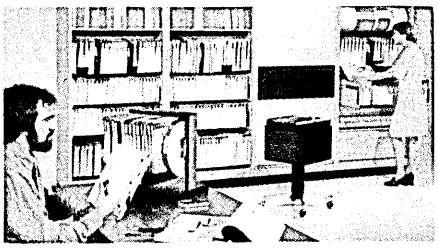

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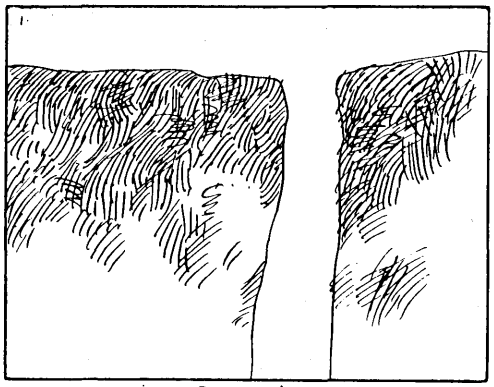
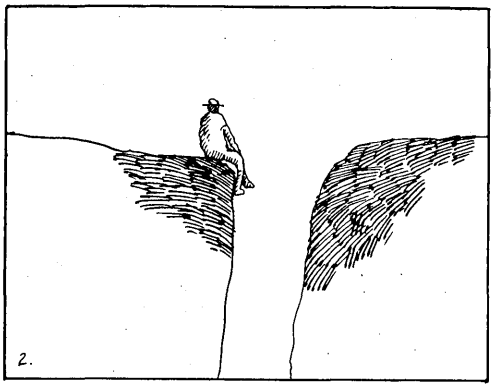
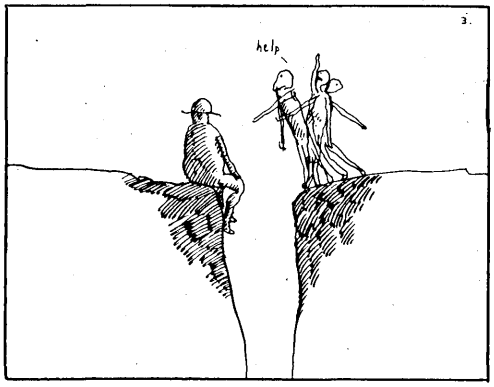
Editor's Readout

John L. Kirkley, Editor

The quiet Revolution







Over ten years ago AFIPS published a little booklet on computer history called "The Quiet Revolution." Although the Society has never been noted for prescience, the title could not have been more appropriate. Computer technology has proven to be a key factor in changes that are sweeping out the last remnants of the Industrial Revolution and moving us into a new age of information. At the same time, our economy is shifting its emphasis from manufacturing to services.

But all this change raises a disquieting question—how will the mass of people be affected?

There are some clues in the January issue of "New Scientist," the excellent British weekly magazine. They report on an IBM-sponsored seminar held in December in Belgium, an international gathering of scientists, engineers, and economists. The topic was productivity.

IBM's chief scientist, Dr. Lewis Branscomb, commenting on such Industrial Revolution innovations as steam, electric power, and assembly lines, said, "The potential of some of these techniques appears to be nearly exhausted. . . . Little additional productivity can be expected from further application of power or from piece-part assembly. On the other hand we have only just begun to realise the benefits from some other innovations—such as the use of computers for design automation, improved man-machine interaction, and process and assembly automation."

But Philip Sadler, principal of Ashbridge Management College, worried that these new technologies were bringing about the obsolescence of organizations, production systems, and skills—"things in which human beings have invested their lives, and entire human communities have invested their future."

These two comments, admittedly plucked out of context from the conference report, illustrate fundamental differences in attitude. Sadler worries about human dislocation; Branscomb optimistically looks toward increased productivity through automation.

But, as "New Scientist" technology editor Nicholas Valéry points out, "Productivity is a dark angel." He notes that 1.6 million are unemployed in Britain, and cites an argument that six million are actually unemployed, most working in "pretend" jobs—jobs that contribute nothing to the national well-being, but are there because of politics, unions, and management inefficiencies.

Our emphasis on productivity has other flaws as well.

Productivity is tied to consumption. In order to increase productivity and reduce costs we turn to automation—we wish to be capital intensive, not labor intensive. In other words, we lay off people and install machines.

But here's the dilemma; those same displaced people are the very customers that we rely on to consume the goods created by our increased productivity. An economic Catch-22.

Breaking this cycle will require far more than the palliatives proposed by government, labor, and industry: ineffectual attempts to retrain obsolescent workers, increased leisure, more pretend jobs, shorter work weeks, forced early retirement. All are patches on a badly worn tire.

Instead we need a basic restructuring of our conception of the purpose of work and production—a fresh look at modern economic theory and practice.

For example, there is the highly original thinking of economist E. F. Shumacher. His book, *Small is Beautiful* (subtitled "Economics as if People Really Mattered"), is a classic-particularly the essay "Buddhist Economics." In this essay Schumacher develops the notion mentioned before—that from the employer's viewpoint, human labor is a cost item to be reduced to a minimum or automated out of existence. But from the employees viewpoint, work is a sacrifice of one's

The winner cast

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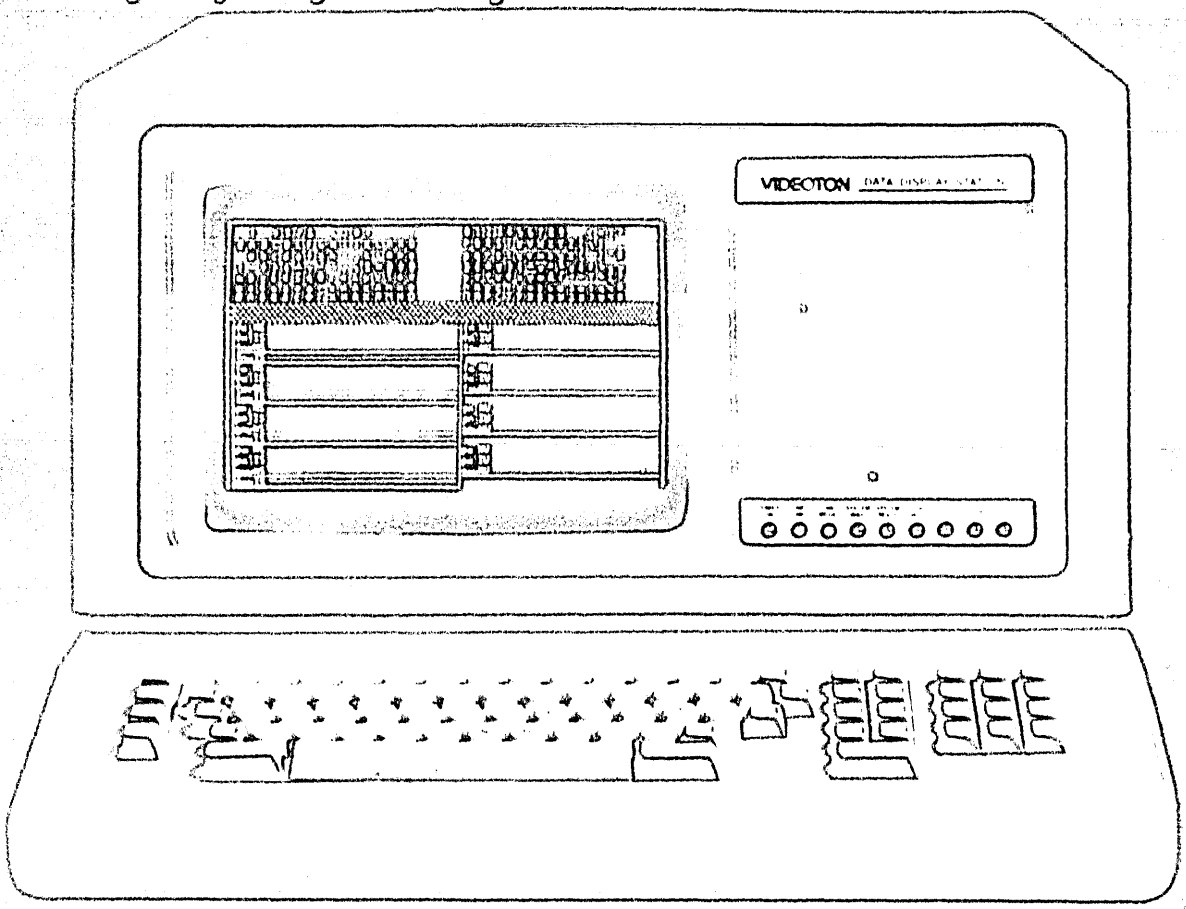
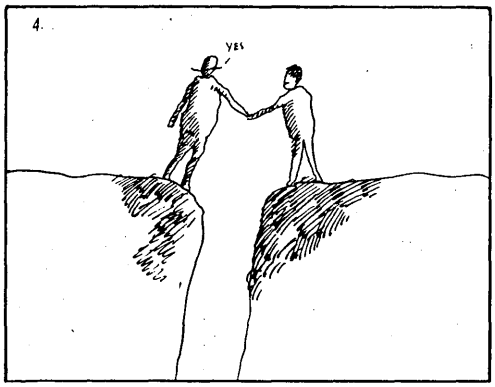
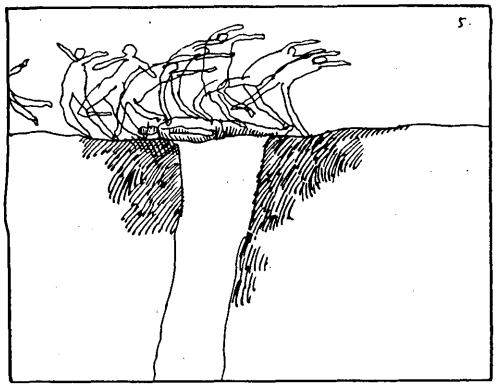
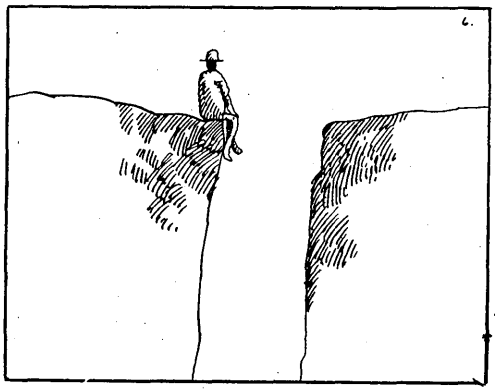


the quiet revolution







Sweet Buddha Fulfilling Destiny by Kind Acts Performed on the Brink of Disaster.

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leisure and comfort; wages are a compensation for this sacrifice.

Assembly lines and automation are a natural outgrowth of this fundamental attitude toward productivity. Success is measured in terms of increased productivity, inseparable from its correlative of more and more consumption. At the national level, economists compute the GNP, praying that the curve's upward climb never falters.

But, as Sadler observed at the Brussels conference, increasing productivity through the application of new technology brings about "new relationships between men and systems of production, and requirements for new skills and abilities." And, for the steadily mounting number of workers who find themselves victims of technological obsolescence, a consignment to the employment ash heap.

Shumacher's "Buddhist economics" takes a different tack. "The Buddhist point of view," he says, "takes the function of work to be at least threefold: to give man a chance to utilize and develop his faculties; to enable him to overcome his egocentredness by joining with other people in a common task; and to bring forth the goods and services needed for a becoming life."

Given this humanistic approach, the organization of work in such a way to be boring, repetitive, and meaningless would be "little short of criminal," an inhuman concern with goods rather than people. "Equally to strive for leisure as an alternative to work would be . . . a complete misunderstanding of one of the basic truths of human existence, namely that work and leisure are complementary parts of the same living process and cannot be separated without destroying the joy of work and the bliss of leisure."

An attitude such as this on the part of our government and our people would necessitate planning for full employment. It implies the development of technologies—especially in the computer field—that enhance a man's skill and power rather than making the man the machine's servant.

Our "standard of living" would need a new set of calibrations, turning away from the current measure that states that the more an individual consumes, the higher his standard. Instead we would strive for a maximum of human well-being with the minimum amount of consumption.

If, as Shumacher claims, modern economists (and he might have added government and business leaders) see the purpose of economic activity as maximizing consumption through an optimal pattern of production, the implications for modern society reach far beyond the boundaries of national borders.

Current concepts and practices—rooted in the Industrial Revolution—do not allow us to answer affirmatively the questions posed at the Brussels conference by Dr. Klaus-Heinrich Standke, United Nations director for science and technology:

"Can we realistically assume," asks Stanke, "that citizens of the industrialized countries will develop a feeling of global solidarity with their less privileged fellow citizens in distant parts of the world, especially when this means a reduction in one's own standard of living? Are governments in the developed countries prepared to accept a moderate (but higher than economically necessary) unemployment rate for their own populations in order to create jobs in other parts of the world? And, finally, can a voluntary reduction of consumption of energy and raw materials be expected from today's generation in favour of tomorrow's?"

Fundamental questions, warns "New Scientist's" Valéry, that cannot be swept under the carpet. "If we fail to deal with them correctly and before very long, they will surely explode in our faces when time is no longer on our side."

Perhaps a little applied Shumacher will help us weather the vast global changes that now confront us. With some exceptions, most people prefer their revolutions on the quiet side. ❋

Justice Takes on AT&T, Slowly

by Linda J. Flato, Associate Editor

The Justice Department's antitrust charges include exclusionary and unfair marketing, predatory and anticompetitive rate setting, secret surveillance, and destroying evidence

"One system, one policy, universal service." One hundred years ago American Telephone & Telegraph Co.'s insightful leader Theodore Vail coined this deceptively simplistic monopoly motto which has come to symbolize the giant communications company's one for all and all for one philosophy. Today, still touting the same line, AT&T's fiery standard-bearer John D. deButts proudly proclaims, "The system is the solution."

The message hasn't changed very much. And neither has its meaning. As Bell's current advertising campaign points out, "the world's largest communications company" is dedicated to "total communications systems problem solving." The emphasis is on the word "total"—total service and "total responsibility." And it's this total service concept that the government antitrusters are out to torpedo.

Without the aid of a slick ad campaign, the Justice Dept.'s trustbusting troops have set out to slay, or more accurately dismember, the communications giant. But so far there's been little bloodshed, only weak attempts to take superficial stabs at Ma Bell's well-defended flank.

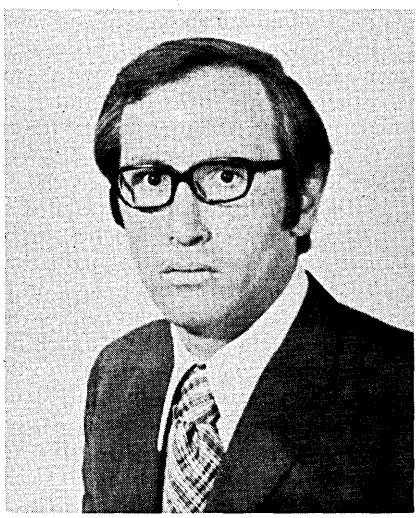
The government's mammoth AT&T antitrust suit, filed Nov. 20, 1974, seems to have gotten nowhere fast. After two years of haggling over jurisdictional problems, the presiding judge in the complicated case, Judge Joseph C. Waddy, finally ruled last November that his court, the U.S. District Court in Washington, could hear the case with a little help from the Federal Communications Commission.

But AT&T, which had contended all along that the case should be thrown out because primary jurisdiction rested with the FCC, was not satisfied with the district court's ruling. Back on the offensive in early January, the communications conglomerate tried to cover all the bases by appealing the jurisdictional decision to the Supreme Court and the District of Columbia Court of Appeals. These moves looked promising at the time, but have met with little success.

Defending this latest maneuver, AT&T v.p. and general counsel F. Mark Garlinghouse insisted the company was only "trying to avoid protracted delays of the type that have characterized other antitrust cases of this scope. Common sense," he argued, "requires that the question of antitrust jurisdiction be definitely settled before the case proceeds."

> If Bell wins this one, it could mean the end of the game for Justice.

So once again, the jurisdictional issue is a major stumbling block in the suit. But as one disheartened Justice observer quipped, "The case has so many problems, what's one more?" One more too many, according to a disgruntled Antitrust Dept. source who gloomily predicted that if Bell wins this one it could mean "the end of the game for Justice."



Thirty-two year old Philip L. Verveer leads the Justice Department's platoon against deButts' army.

Up until mid-December, the government's progress in the massive lawsuit had been slowed to a near standstill due to the jurisdictional kink which temporarily halted discovery proceedings. But the pace picked up again in December when Justice turned over to the court a voluminous document with a listing of specific allegations detailing how AT&T had allegedly used its monopoly leverage to keep down and kill off its telecommunications rivals.

The 570-page filing, which was in the form of Justice answers to 63 questions posed to the government by AT&T lawyers, was designed to flesh out the original set of very general allegations presented when the suit was filed. These current allegations, according to Justice spokesmen, are based largely on information gleaned from approximately 70,000 FCC, AT&T, and other source documents screened by Justice when the suit was filed. Augmenting these records, the government also had records of interviews with around 150 persons who voluntarily offered to give the agency information during the two year period when discovery was stayed in the case.

Exclusionary and unfair marketing

Chock-full of juicy abuse examples, the government brief pinpoints AT&T's extensive use of "exclusionary and unfair" marketing practices to bolster its central charge that the company has illegally monopolized the market for telecommunications services and related equipment.

The pro-competitive panacea pre-

scribed by the government calls for the break up of AT&T's long-cherished "integrated system." Specifically, Justice would like to see AT&T divest some powerful subsidiaries, including the Long Lines Dept. and Western Electric, AT&T's mighty manufacturing arm. Under the fed's tentative plan, Long Lines would be severed from some or all of the Bell operating companies. And WE would be completely cut off from AT&T and its operating company network.

A similar divestiture fate would be in store for Bell Laboratories, which would be sliced into two parts—one operating alone and the other joining forces with the independent Western Electric. Taken all together, the trustbusters believe these remedies "would reduce costs to telecommunications users."

But before telecommunications users can benefit from these purported lower costs, the antitrusters have to win their case by supporting their charges against the unrepentant communications giant. And the charges are as extensive as they are hard-hitting. In the lengthy response to the AT&T interrogatories, the agency zeroed in on the firm's alleged anticompetitive strategies.

These Machiavellian moves, Justice contended, began a long time ago. AT&T's "conspiracy to monopolize," the government claimed, "began within a few years after the issuance of Alexander Graham Bell's basic telephone patent and continues to the present." Tracing the evolution of this monopoly philosophy back to its roots, Justice pointed out that "as simple telephone service grew into more complex telecommunications" the company's "incentive to retain their monopolies remained, but advancing technology available to others required increasingly greater abuse of their monopoly positions."

> "AT&T's conspiracy to monopolize began within a few years after the issuance of Alexander Graham Bell's basic telephone patent. . . ."

Continuing their charges, Justice argued that since World War II, AT&T has "acted to maintain their monopoly in telecommunications service, opposing the emergence of new competitive alternatives and restricting competitors' access to their essential facilities. Where restrictions could not be maintained," the charges added, "access was provided on restrictive terms, drastically limiting the potential market of new competitors."

Having tried to establish the Bell System's anticompetitive motives, the government attempts to illustrate the company's modus operandi. Most of the key charges and back-up examples center around AT&T's alleged actions to quash telecommunications competition through various tried-and-true tactics.

The company's use of "exclusionary" and "unfair" marketing techniques is one of the more well-documented tactics, according to the Justice Dept. As examples of this, the agency cited AT&T's habit of making premature announcements of new prices and services. Also in the crucial area of pricing, the government charged that the firm's power over prices had spawned other abuses such as limit pricing, predatory pricing and cross-subsidization of its competitive and monopoly services and equipment.

The purchasing practices of the Bell operating companies were also hit hard by the antitrusters. Apparently adhering to corporate policy, the operating companies' refusal to buy "significant amounts" of telecommunications equipment from anyone other than WE has created "further barriers to entry and competition," Justice contended. Elaborating on this point, the agency noted that "AT&T and the Bell operating companies have delayed purchases of new equipment until Western Electric could produce its own version."

Another often used ploy, according to the government, is AT&T's exploitation of the conflict between state and federal regulators, which Justice claimed the company used effectively to stall the entry of new telecommunications competitors. The agency pointed to MCI, one of these, as an example of this practice. It also cited MCI to try to prove its interconnection arguments, which were based on claims that AT&T has made it extremely difficult for competitors to hook into Bell System facilities.

On another more controversial interconnection issue, Justice argued that Bell employees have "aided" the company's anticompetitive activities by attempting to intimidate firms that consider buying terminal gear from independent interconnect companies. AT&T, the agency alleged, was "well aware of such activities by their employees, but did little or nothing to stop them."

Squashing Datran

AT&T also played an effective game of catch up with the competition. Using the now-defunct Data Transmission Co. as an example, the government contended that AT&T, with loyal WE and Bell Labs, "have engaged in a systematic effort to exclude, restrict, and eliminate competition for intercity data transmission." To support this charge, Justice retraces the founding of Datran's all-digital switched communications network and AT&T's attempts to scuttle it.

Working through WE and Bell Labs, AT&T, according to the government document, brainstormed plans of its own to quickly come up with a "Datran-like system." The announcement of what has since come to be known as Dataphone Digital Service (DDS), the agency maintained, "was made well in advance" of the company's "ability to offer the service and before an application had been filed with the FCC."

To further forestall competition from the ill-fated specialized common carrier, AT&T also refused to provide the company with the local loops necessary for transmission of the digitally modulated signals, Justice said. AT&T also apparently tried to use its regulatory muscle to get what the government complained was an unfair advantage over Datran. "DDS rates," the agency insisted, "were knowingly based on assumptions that understated some costs, and overstated revenues so that unrealistically low rates could be justified and thus prevent Datran from acquiring significant market penetration."

> Realizing the program could have adverse legal implications, AT&T had made efforts to keep it secret.

Too late for Datran, the FCC early in January decided the DDS rates, initially proposed for five cities, were indeed "unjust and unreasonable." Upholding last year's ruling that found the rates predatory and anticompetitive, the commission said, "AT&T employed an unjustified market simulation methodology to forecast demand and revenues for DDS and underestimated the costs . . ."

Secret surveillance

The allegation brief also revealed a little-known surveillance scheme launched by AT&T to keep close tabs on its private line and terminal equipment rivals. As these firms "began service, AT&T began a comprehensive program of surveillance, tracking the activities of its competitors and surreptitiously interviewing each and every (potential customer)," the government claimed. To carry out this watchdog project, Justice said AT&T set up "a competitive information center and directed the operating companies to forward lists of all private line customers potentially vulnerable to competition."

According to Justice, AT&T garnered this sensitive information from public sources as well as internal records

available to them "as a result of their monopoly over local exchange service." A prime tracking target was MCI. Beginning in 1972, the government claimed that AT&T started producing "tracking reports" based on customer interviews conducted by "an outside company which would not reveal AT&T's sponsorship."

The information from these "expensive" reports was cautiously channeled "to all high operating company officers for competitive purposes." Realizing "the program could have adverse legal implications," AT&T had "made efforts to keep it secret," Justice noted. And apparently it was successful, for as the agency pointed out, "most of these documents (on the tracking program) no longer exist, and only the cover letters and memos escaped destruction."

Observers close to the case claim that such eradication of evidence by AT&T could seriously undermine the government's efforts to ferret out supporting documents, turning discovery into a costly and time-consuming hide-and-seek operation. To complicate things further, the company also has some unusual record retention practices. An AT&T spokesman indicated that the company's record retention "in most cases is only six months because," he added, "we would have to own every warehouse in the U.S. if there was no time limit." The Justice Dept., which is trying to get a handle on these record keeping requirements, said Bell retention practices vary tremendously according to the type of record.

As part of the initial discovery stipulation, neither AT&T nor the government is allowed to throw away any telecommunications-related information. This retention of relevant documents request was made by Justice in January 1975, two months after the suit was filed. AT&T, not to be outdone by the antitrusters, then turned around and saddled the government with the same record retention requirement.

So in theory at least, paper is piling up on both sides. And so are the costs. The telephone company has estimated that it will cost $300 million and take 10 years to satisfy Uncle Sam's disclosure demands, which it pegs at around 1.2 billion documents. In a recent interview, AT&T chairman deButts complained that this extensive discovery process would force the company to "go through every file drawer, in every office, in every town in the Bell System . . . And then after we get (the documents) out they've got to be duplicated. And then they're going to be turned over to the Justice Dept., and I don't know what it's going to cost them just to look at them. The costs of this case are going to be fantastic."

Ma Bell's army

The indefatigable chairman has also reportedly predicted AT&T would have to hire six floors of lawyers for discovery alone. And an AT&T spokesman confirmed that the company was already "adding a large number of lawyers for discovery." The company has also announced plans to put together a supplemental staff of 600 people for file searching. To handle the bulk of the case workload, AT&T has retained the high-powered Chicago law firm of Sidley & Austin. Another major unnamed law firm has also been brought on board, according to sources close to the case.

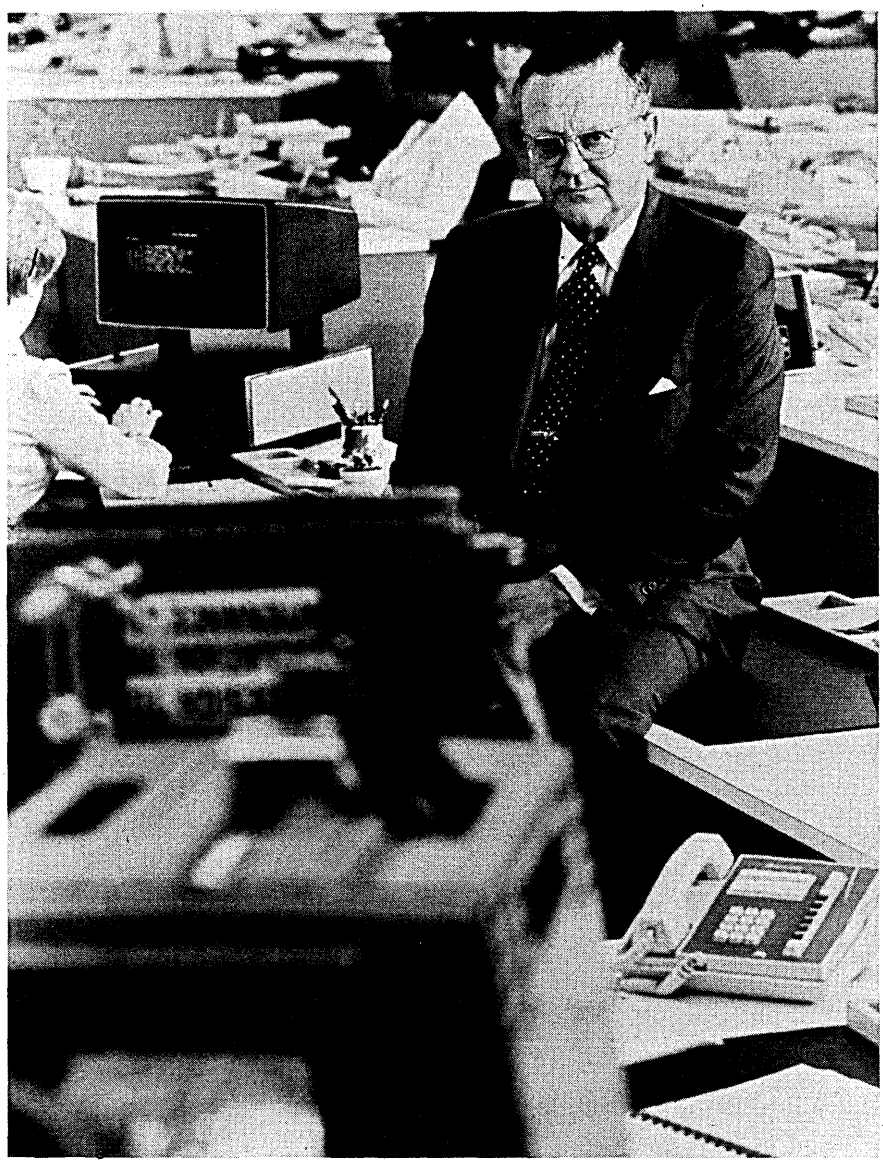
Most of the government's discovery efforts will range over the period immediately following the 1956 consent decree and overlapping into the '70s. In "some specific instances" Justice sources observed that this paper chase could lead them as far back as 1930.

This enormous discovery effort will be centered mostly in New York at AT&T's corporate headquarters, where all relevant files will be microfilmed for later review. Back in Washington, these documents will then be coded according to a subject index for entry into an on-line retrieval system.

The computer system will be a big help, said a Justice official who admitted the government is "going to be stretched thin." Once the case gets going, the AT&T antitrust force will further dwindle, he revealed, as Justice begins dispatching troops to the various telephone operating companies.

With half their ranks divided between New York and the operating companies, Justice will have to step up its staffing on the gigantic case. Right now, the staff on the suit comes from

(Continued on page 66)



AT&T chairman John deButts has made himself a multi-media advertising personality to sell his message that "the system is the solution."

HOW IT WORKS IN EUROPE

"Oh, They're Just Putting in a Phone for Somebody"

"You can have anything you want, so long as it's ours." That seems to be the prevailing message from the Post, Telephone, and Telegraph (PTT) administrations all over Europe.

A tradition built up over decades of government ownership, without commercial competition, adds its own inevitable postscript: "When you can have it and how much we will charge you for it are arbitrary decisions we will make when the time comes."

The telephone tradition is heavy handed and high minded in Europe. The business that grew up over the years was founded on 20 year plans, or even 50 year plans, not on the seven year computer generations or year-to-year changes of modern organizations, nor the lightning leaps of technology today. The attitudes of PTT's were further cast in concrete by the similarly frozen cultures of the two or at most three huge companies that supplied PTT administrations in each country.

So telephones themselves are less common in Europe than they are in the U.S., and PTT thinking has a ponderous flavor to it that would be unfamiliar to most Americans. An American marketing man came back from one trip to Europe somewhat aghast. "I was downtown in one German city at two in the afternoon," he recalled, "and I had to phone a taxi to get back to the plant, several miles away. But the Bundepost, which runs the German telephone system, decided it was going to work on the phone system that afternoon. So they pulled the power and eliminated phone service from one entire quadrant of the city so they could install some new wires. Their attitude is astounding! If Pacific Tel and Tel took out a quadrant of a California city they would hear about it for the next 10 years!"

The American adds that his local contacts took the event for granted, as a common occurrence. "Oh, they're just putting in a phone for somebody." It was a perfectly normal thing to shut off a quarter of a major city, for two hours at the peak of the business day.

Each country has its own rate structure, its own equipment preferences, its own vagaries. Any European could match the German story. Waiting for a telephone to be installed can take months. Siting a computer center for remote services, such as time-sharing, can depend as much on PTT whims as on business patterns. "We have lines here. None there." End of discussion.

The coming of computing has, of course, brought drastic change to this staid world of telecommunications, and considerable excitement in some of its technical corners.

Policies conflict

Computer policy and telecommunications policy often are conflicting in Europe. In Britain, for example, the Computing Services Association recently criticized the Post Office for dawdling in its certification of current products for telecomputing, as well as for major 1975 price changes that pushed users towards private lines rather than public network use. CSA wants the Post Office monopoly to end "at the end of the wire," while the Post Office demands that only its modems and the terminals it certifies be used—an approach that held up the development of commercial time-sharing in a number of European countries long after the U.S. was working effectively over the public network.

Some terminal vendors have gone out of business while waiting for PTT approvals. Most vendors and users could tell of modems that were cheaper and better than those officially permitted. Either they are entirely forbidden or the PTT's, when unable to offer comparable facilities, develop "gentlemen's agreements" to look the other way when they are used.

The fractured nature of the European map keeps PTT's focused on the problems among themselves, usually until user demand gets loud enough to force some useful development to their attention. Take networks for example. While the PTT's put off developments, the airlines set up their private SITA network. The banks have SWIFT nearly ready to go.

The PTT's have to allow an exception for SITA or SWIFT because they cannot provide such facilities themselves, but always the permission is temporary, liable to be withdrawn in the unlikely event that the PTT can offer the same service—a factor which dampens investment enthusiasm.

Still trying

They keep trying. The British Post Office has its Experimental Packet Switching System (EPSS) hooked to the ARPA (Advanced Research Projects Agency network) in the U.S. for demonstration, but the network isn't financially viable with just three nodes. The French PTT proposed Transpac when a private experimental network attracted attention and customers. Now the European Economic Community is funding for Europe's PTT's a network called Euronet, which will give users access through the PTT's to the major databases they can already reach through private networks—and now such vendors as Tymshare no longer have permission (at exorbitant PTT surcharges) to purvey third party database information to customers in European countries.

There are two main viewpoints, and they are diametrically opposed. On the one hand, politicians and union leaders in some countries believe the solution to telecommunications problems is to nationalize the vendors as well as the carriers. In November a major U.K. trade union, ASTMS, said it was concerned at the "running down of the U.K. telecommunications industry" and asked the government to create a publically owned company called British Telecommunications Ltd. made up of three British telecomm vendors.

On the other hand is the widely based view that protected environments sap commercial strength. The protected European computer manufacturers, for example, ran up a $1 billion trade gap in 1975 in computer systems. So while ASTMS was proposing yet another government-spawned merger, the fourth U.K. telecomm vendor, ITT's subsidiary STC, charged that the Post Office telecomm monopoly acts as a bar to development of modern computerized telephone exchanges.

The other three vendors heartily support this view in private, but dare not offend the single customer. One charge was that the Post Office's three year evaluation cycle stifles progress. Another is that whimsical and overtight specifications force the vendors to produce equipment that is not suited to export. Just as the computer industry discovered, each PTT believes its own protocols, methods, and specs are best, and does its best to keep the equipment from other countries out, with the result that the inventive people wither or go elsewhere, service deteriorates, and prices rise.

The circle of blame, charge, and countercharge takes its own toll, forcing yet more rigorous adherence to the letter of the law, with increasing bureaucracy and decreasing innovation.

—Nancy Foy

the Antitrust Division's Special Regulated Industries Section which was formed about a year ago. Lead counsel in the case is 32 year old Philip L. Verveer whose main legal experience since he's been at Justice has been in large bank merger cases.

Versus Verveer's platoon

Verveer's back-up staff includes seven lawyers, four public utility specialists, and eight document processors. "One reason the staff is so skeletal at the moment," a Justice spokesman confided, "is that there was an understandable reluctance to go out and hire a lot of people because of the jurisdictional controversy." To boost this work force, the government plans to add some more lawyers and extra people for document investigation. And if and when the case finally picks up steam, the agency will have to greatly expand its now lean staff. When the IBM case hit its peak, Justice had up to 70 full-time employees working on it.

Both Justice and AT&T agree that discovery shouldn't take more than three years. But an AT&T spokesman in Washington conceded that this three year timetable could be stretched out indefinitely. "We have a lot of amateurs in this antitrust business," he chortled, "and they have no conception of the size of these corporations."

Not true, said a Justice antitruster familiar with the case. The government, he commented, realizes AT&T is "not a 'Mom and Pop' operation that does business out of a shoe box." The government, he insisted, has also learned some valuable lessons from its other massive antitrust suit against IBM.

Because of its experience with the IBM suit, Justice is now claiming it's better able to conduct a large case. It hopes to narrow its discovery search, avoiding the "fishing expeditions" which netted the government seven million documents after five years of discovery in the IBM case.

Unlike the eight year old IBM litigation, the Bell suit, according to optimistic Justice sources, could be wrapped up in a short two years once discovery was completed. Under this stepped-up plan, the government hopes to spend a year analyzing its data and hammering out trial tactics, and another year trying the case in court. Other less optimistic observers, as well as AT&T, have predicted the case could drag on for 10 years or longer.

$Billions from public pockets

Such a long, drawn out litigation battle could wind up costing millions if not billions of dollars. AT&T currently calculates both sides will have to pour over $1 billion into the suit for discovery, depositions, and trial of the case. By comparison, IBM to date reportedly has shelled out $123 million for its lawsuit and the feds have laid out over $7 million.

Footing the bill for all the millions of dollars that could be funneled into the AT&T antitrust suit will be the public, who will be picking up both tabs through federal taxes and telephone bills. Conceivably, Bell could make it even rougher for its phone users by hiking rates if sometime it finds it can't absorb the escalating costs of defending itself against Uncle Sam.

The government of course hopes to minimize the sky-rocketing costs by speeding things up. Government personnel are encouraged by AT&T's cooperation so far. They see no signs of the pervasive animosity that they contend characterized the government's dealings with the mighty mainframer.

"They're not dragging their feet or attempting to be obstructionist," one government official observed. "We're encouraged by that, but we haven't been lulled into any sense of false optimism or wishful thinking. We're pleased. It's gone better than it might have."

It's also gone worse than it might have. Just a few days after the government was boasting of Bell's cooperation, the company turned around and stirred up the jurisdictional controversy again by seeking an appeal on the original decision from the Supreme Court and the sluggish D.C. Court of Appeals. AT&T also asked Justice to join them in their attempt to get an expedited review of the issues by the high court.

But the government balked, coming out on January 17 with an opposing stand on the appeal. In its filing with the Supreme Court, Justice recommended the appeal to be shoved back to the lower court. "Review of the present jurisdictional question," it pragmatically pointed out, "would be unlikely to resolve the entire question of jurisdiction, and would instead open the door to repeated interruption of orderly trial procedures. . . ."

AT&T currently calculates both sides will have to pour over $1 billion into the suit.

Later in January, the high court stepped in and denied AT&T's request for extraordinary direct review, throwing the jurisdictional appeal into the lap of the D.C. Court of Appeals. "Sorely disappointed" by this setback, AT&T has announced plans to pursue an expedited appeal in the lower court. The company's unswerving stand on the issue is clear: "Any suggestion that a case of this magnitude and importance should be tried before there is a determination of the jurisdiction of the trial court would be a judicial travesty."

The confused and complicated jurisdiction question has left many legal experts puzzled. Right now, legal observers say it's a toss-up whether the lower appeals court will even hear the case. The Justice Dept., which will probably be using its earlier opposition arguments before the Supreme Court to fight the appeal, lays the odds at 50/50. Other legal experts predict that if the court agrees to hear the appeal, the case could go to trial as early as this spring.

Predictions on the final outcome are equally speculative. Some lawyers tracking the case claim the appeals court could toss the case back to the FCC—a decision that would prompt a government appeal to the Supreme Court. On the other hand, if the court upholds the original jurisdiction ruling by Judge Waddy, AT&T could be the one to drive the case back to the high court. One way or another, the government is hoping to get over the jurisdictional hump as soon as possible.

Unfortunately, nothing happens "as soon as possible" in such complicated litigation. One unanticipated development, for example, further stalled the case in early February. In a surprise move, the appeals court—without yet deciding to review the case—stayed all discovery proceedings and ordered the government to file further arguments by March 7. The action was the worst setback to date for the disheartened Justice Dept.

And "no compromise"

And Bell has its plans too. "Confident" of success, AT&T's acerbic leader deButts has staunchly declared "there is no compromise here." He said that on network television the day the suit was filed over two years ago. A man of his word, he still stands by it today.

Back on tv again in the choicest of prime time slots, deButts plugs "the system" that he claims can satisfy everyones' telecommunications needs. But what he may really be plugging, speculates one anti-AT&Ter, is the telephone company's case against the government. "deButts is trying to soften public opinion for a compromise," he argues, "so that the antitrust suit will never be completed. This anti-antitrust ad campaign is clearly designed to gather sympathy for the integrity of the Bell System, and for the interlocking relationship between the various parts of that system that Justice wants to bust up because obviously, 'the system' is *not* the solution." ❋

Defining the Issues in Bell vs. Everyone

by Albert L. C. Chu

The conflict involves Bell, the Justice Dept., the FCC, specialized communications carriers, independent manufacturers, and the users. Here's what it's all about.

Much has been said in DATAMATION *and in the general and trade press about the conflict between* AT&T, *the* FCC, *and members of the computer industry. Having made little progress to settle the issue in their favor in either the courts or at the* FCC, AT&T *has now turned to the legislature, stepping up the pressure to pass the Computer Communications Reform Act, better known as the "Bell bill."*

In an exclusive report Albert Chu has helped to sift through the mass of information surrounding the conflict. As a part of that report he isolates the social, economic, legal, technological, and political issues in a concise and logical fashion. And, as a part of our continuing coverage of Ma Bell and the industry, we present Chu's analysis of the issues here:*

Social issues

1. *Should the state undertake to guarantee its citizenry "a phone in every home?" and, if the answer is "Yes," is it prepared to pay for it?*—Everyone agrees that there should be a phone in every home to provide basic voice telephone services. The question is who is going to pay for it. The telephone industry says that if it cannot keep all of the private line business to itself, it will have to raise the price for telephone services. The implication is that this may make it financially difficult for many people to have a telephone.

2. *Should some of the telephone network users be forced into subsidizing other users?*—There are two separate aspects to this issue. Business users of the voice telephone network are paying more than residential users for the same services, but few of them have raised the question. The second aspect is the so-called "cross subsidization,"—using revenues from one type of service to lower the cost of another type of service, making it more competitive. So far, the telephone industry has been doing so partly because it has been technically impossible to account for the cost of each individual service, partly based upon the national price averaging concept, and partly for a host of economic, political, and management reasons. Now with the computerized equipment, it is at least technically feasible to account for the cost of individual services. AT&T says business must subsidize residential users in some way, or rates for residential users will be sky high. The FCC contends that residential users are already subsidizing business services, not the other way around.

Economic Issues

1. *Should limited natural resources such as the radio spectrum be utilized to make profits for a few?*—In most other countries, telecommunications is a nationalized monopoly. A nationalized monopoly is supposed to operate for the good of the entire nation; this does not mean, however, that it can necessarily provide better services at a lower rate than if it were operated by a private, profit-making enterprise. This is not really an issue, but an answer to this question, one way or another, at this time will give us a clear idea as to where we stand.

2. *Is monopoly or free competition the better system for the delivery of telecommunications services? Or is there a half way measure?*—Monopoly has proved to be a workable system so far, but that does not mean it is the only workable way, or that it is still the better way under today's technological environment. Monopoly has its built-in weaknesses. Free competition, attractive as it may sound to some, is not without its drawbacks. It will certainly lead to a favorable condition for the big business users at the expense of the small business and non-business users. Besides, left to their own devices, few competitors to AT&T are likely to survive. The most likely solution would be some kind of combination between the two systems.

3. *Who is the public? Who are the consumers?*—In arguing their cases, every party claims to be in the public interest. We should realize that in this computer/telecommunications controversy there are many different publics; there are many different types of consumers. The interests of the residential consumers are quite different from those of the business users; and the interests of the small data users are quite different from those of large data users. Then, we must also consider the interests of large corporations such as AT&T and IBM which are different from those of their smaller competitors. AT&T's competitors claim they provide business data users an alternative, but AT&T claims that such "alternatives" for business data users would result in higher rates for residential users. Assuming that both claims are true, whose rights should take precedence?

*Albert L. C. Chu, "The Computer/Communications Controversy: Sorting Out the Issues," *Datacomm Awareness Report*, Vol. 2, No. 1, January, 1977 (a monthly publication of Management Information Corp., Cherry Hill, N.J., Albert L. C. Chu, editor).

BELL vs. EVERYONE

Legal issues

1. *Does the Communications Act of 1934 give* AT&T *monopoly to telecommunications services other than voice telephone services?*—AT&T says yes, the FCC and the court says no. Admittedly, the Act might not have foreseen the advent of data communications. Any new legislation must answer this question conclusively.

2. *Does the* FCC *exceed its authority in opening up the private line sector to competition?*—This is another way to state the previous issue. The FCC says it has such authority, and the court is in agreement. AT&T says the FCC does not have such authority.

3. *Does* AT&T *run afoul of antitrust laws by having the Long Lines Department tie together its various associated telephone companies, and by owning the Western Electric Company, which is the prime supplier of telephone equipment to all Bell System companies?*—AT&T says the Long Lines Department is part of its monopoly, and that having its own equipment manufacturing arm is necessary to maintain quality in its telephone services. The Department of Justice is seeking the divestiture of the Long Lines Department and Western Electric from AT&T.

4. *Should the provision of telecommunications services be regulated by government? If so, how much regulating is proper?*—The premise of regulating telecommunications services is to ensure that reasonable services be provided to the public at reasonable rates. There seems to be no argument against government regulating. The question is how much regulating should there be before it becomes counter-productive. This issue is a vital one when we consider the increasing convergence of data processing and telecommunications services.

Technological issues

1. *Is it possible, or advisable, to maintain separate network facilities for voice and data services? Or rather, should we further integrate the two types of services in the same network?*—We have been using the same telephone network for both voice and data services. The new digital transmission facilities and packet switching networks promise to provide data services at a much lower cost, but there is also a not-so-distant possibility of using digital facilities to transmit voice communications. Today, data services are used exclusively by computer users. It is conceivable, however, that residential users will be using data services in the future.

2. *Can and should data processing services be separated from data communications services by regulations?*—The FCC conducted a Computer Inquiry in 1970 and concluded that the same supplier should not offer both data processing and data communications services. Technological advances have made it much more difficult today then six years ago to distinguish the two types of services. The FCC is currently conducting a second Computer Inquiry to review the earlier decision. Late last year, four top telecommunications experts spoke at a conference in Washington, D.C., organized by the FCC and the American Federation of Information Processing Societies (AFIPS) on the question of how data processing services can be separated from data communications. Their unanimous answer was "don't."

3. *If it is inadvisable or unfeasible to separate data processing from data communications, then the question becomes how much regulation should be imposed on telecommunications, and who should be allowed to provide for such services.*—This is the biggest stake as far as both the telephone industry and the computer industry are concerned. AT&T is clearly positioning itself to provide data processing-related services, and IBM seeks to enter the communications arena by joining with Communications Satellite Company and Aetna Life Insurance Company in the Satellite Business System venture. Other major computer companies could conceivably join hands with some of the SCC's to get a piece of the action. Will then the telecommunications market turn into a gold mine for big businesses? Who will look out for the interests of the general business community and the general public?

4. *In today's technological environment, is the "grand system" as conceived by Bell the only way to provide adequate basic telephone service to the entire nation? Or is it possible to provide such service at a reasonable cost in a multinetwork environment* where standardized services and connection requirements make it possible for any user to switch back and forth among competing networks? Can this be done without making it financially unfeasible for all residential users to own a telephone?

5. *Does "foreign" equipment create harm to the basic telephone network? If so, can such harm be prevented?*—The FCC has instituted a program for the registration of modems. The program is now behind schedule, but is expected to proceed soon.

Political issues

1. *Should the* FCC *or state regulatory agencies be responsible for regulating telephone terminal equipment, that is if such equipment should indeed be regulated?*—Currently the responsibility splits between the FCC and state agencies, according to application, i.e., terminals used on intrastate services belong to state agencies, those on interstate services belong to FCC. AT&T proposed putting all terminals under state jurisdiction, presumably because it has more influence over state authorities than over the FCC.

2. *Should federal rights always take priority over state rights in telecommunications matters? If not, where should the line be drawn?* This issue must not be resolved solely on political ground, but should also be based on technological and economic reasons.

Up to the Congress

We have raised 17 separate issues that interrelate to form the current computer/communications controversy. There are undoubtedly others that we have missed. And we have not even gotten into the ripple effects of each issue upon the others. To further venture into their infinite ramifications would be beyond the scope of this article, but should be undertaken by Congress before a new legislation is drafted.

The Communications Act of 1934 is clearly out of date. The question is not whether it should be revised, but rather how we should formulate the new legislation to govern our telecommunications policy. In formulating the new legislation, Congress should train its sights on telecommunications' social consequences over the next several decades, rather than its near term effects.

If we may outline the major tasks facing the Congress, they are: 1. to determine whether we should keep the social overtone of the existing legislation (to put a *combination telephone/computer terminal* in every home?); 2. to find an acceptable middle ground between *monopoly and free competition;* 3. to outline the extent and to describe the various major segments of the *combined computer/communications market* for the next several decades; 4. to determine whether data processing and telecommunications services should be separately provided, and if so, how; and 5. to devise an equitable formula for dividing the future market among various types of suppliers in such a way as to ensure continuously improving services.

Fortunately or unfortunately, we have been caught in the computer/communications revolution. We are experiencing, to use a rather corny phrase, growing pains. But we are optimistic that the future holds enough promise to yield a good deal for everyone involved, if only we handle this controversy carefully, and promptly. ❋

The Lowly Modem

by George M. Dick

All right then, what is a "modulator-demodulator?"

In one form or another, modems have been in use for the past dozen years. We have seen them progress from bulky and slow novelty items to the present generation of compact, fast, reliable devices. Installing and maintaining them once required sophisticated technical expertise. Now we plug them in and expect them to work. We no longer consider a modem to be a novelty. As a link in our all-important communications chain, it is now essential to the operation of our business. We have come to take them for granted, so much so that many of us have little understanding of what they are and how they operate. What follows is "just enough" background for that understanding.

Modulation

Aren't you getting tired of being told that the term "modem" is a contraction of "modulator-demodulator" when you really don't know what a modulator is? The terms are not difficult to understand and are best explained by example. If a newscaster were to attempt to give the news by shouting to several million persons, the chances for success would not be very high. We use a radio broadcasting station to change the voice into a signal more suitable for long distance transmission. Among other things, the broadcasting station is acting as a modulator. Each radio is acting as a demodulator.

A similar problem occurs with computer data. Data processing equipment has been built to utilize electrical signals with a particular form. However, this form (digital) is totally unsuitable for transmission over the most commonly available media, telephone lines. Consequently, the data is modulated prior to transmission at one location and then demodulated prior to interpretation at the receiving location. Since, in most applications, data may travel in two directions, the equipment used must contain both a modulator section and a demodulator section, hence, "modem."

When discussing modulation, it's important to understand the term "carrier." A carrier is an electrical signal chosen because of its ability to travel through the transmission medium being utilized. In the case of data communications, the medium is a telephone line. Since telephone lines were designed and built for transmitting voice, an appropriate carrier is a signal that resembles voice. The modulation process consists of changing the carrier in such a way that, while still resembling voice, the carrier will (forgive the redundancy) "carry" the data.

The three basic types of modulation applied are: amplitude modulation, frequency modulation, and phase modulation. The first two terms are again directly parallel to those used in radio. These types can be understood quite easily by mentally constructing a very slow modem—a human being. This very slow modem operates at one bit per second. A message is to be sent that consists of one-zero-one-one. Our musically inclined human modem would whistle loudly for one second, softly for one second and, finally, loudly again for two seconds. This is amplitude modulation. If, however, the human modem whistled at the same volume but used two different musical pitches such as middle C for a "one" and one octave above middle C for a "zero," the modem would be using frequency modulation. In both cases, the "carrier" would be the whistling sound.

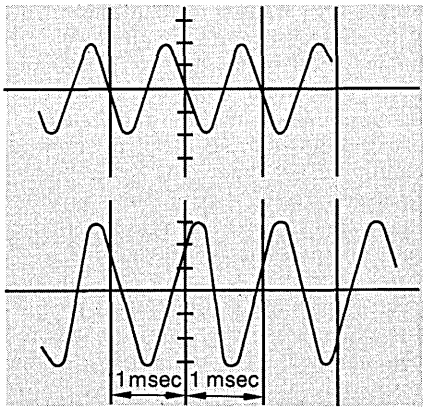


Fig. 1. The upper curve repeats itself every millisecond, and thus has a frequency of 1,000 Hz. The lower curve has a lower frequency but a higher amplitude.

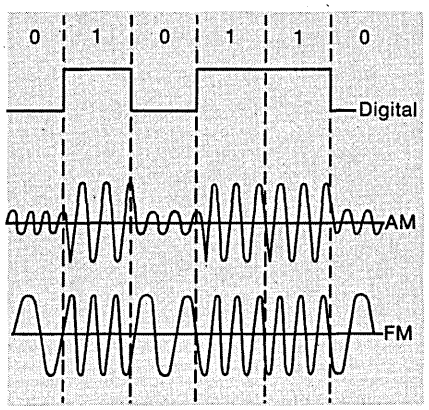


Fig. 2. To be transmitted over phone lines, digital signals can be translated into amplitude or frequency modulated audio signals.

Signals are generally shown on a graph-like presentation. The vertical of the graph represents signal strength ("loudness") while the horizontal represents time. If the signal being shown is audible sound, the graph will actually represent the physical motion of the vocal cords making the sound or the ear drum interpreting the sound.

Fig. 1 shows some examples of sine waves which, when applied to sound are the well known "pear-shaped" or pure tones. The figure on the top shows the signal repeating itself once every millisecond (1/1000th of a second). Each repetition is called a cycle and consequently there are 1,000 cycles per second. When applied to sine waves, cycles-per-second are called Hertz (Hz).

The lower graph in Fig. 1 shows a sine wave that repeats itself less frequently and thus has a lower "frequency" than the upper graph. Also, if the heights of the two figures are measured, it can be seen that the lower line has a greater amplitude and thus is louder than the upper example.

Fig. 2 shows examples of amplitude modulation and frequency modulation applied to the transmission of a digital signal.

Phase modulation is a little more difficult to grasp. Referring to Fig. 1 again, it can be seen that each point within the time of a given cycle can be uniquely identified and, therefore, each succeeding or preceding point can be determined. This identification refers to the "phase" of each cycle (where one full cycle = 360 degrees).

Just as the amplitude or frequency during a given time period can be used

to carry information, so can the phase. When phase modulation is used with computer (digital) data, it is more properly called phase shift keying (PSK) and it is common to use differential PSK, where the phase of the cycles in a particular time period is compared with the phase of the cycles in the previous time period. (In Fig. 3, a

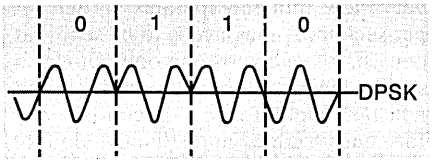


Fig. 3. In phase modulation, the wave form is shifted. Each change in line condition may represent a bit. (This version of PM is Differential Phase Shift Keying.)

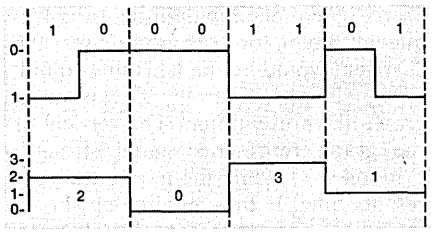


Fig. 4. Combinations of two bits (di-bits) or three bits (tri-bits) are commonly used for digital transmissions, where each combination is represented by a different amplitude of signal. In this example, the top 8-bit "message" converts to the four di-bit transmission below.

"one" bit is indicated by a phase change of 180° and a "zero" is indicated by lack of a phase change.)

Bps vs. baud

Notwithstanding frequent misuse, "baud" is *not* the same as "bits per second." In low speed modems, the values usually agree (although the definitions differ) but with high speed modems the values practically never agree. Baud rate is a figure indicating the number of times (per second) that a signal changes. Bits per second is a figure indicating the true bit data transfer rate. Modem manufacturers frequently use a particular telephone line condition (a signal) to represent a combination of two or three bits (di-bits and tri-bits respectively). In those cases, the baud rate would reflect the number of times that the telephone line signal changed conditions, and therefore would be one-half or one-third of the bits per second rate. See Fig. 4.

It is well known that telephone lines do not produce high fidelity sound. This is because some frequencies are transmitted better than others. Two octaves above middle C (1046.5Hz) is transmitted reasonably well. One octave above middle C (523.2Hz) is transmitted poorly and middle C itself (261.6Hz) is barely transmitted at all. Also, the third octave (2093.5Hz) is transmitted poorly and the fourth octave (4187.0Hz) is not transmitted at all.

These transmission limitations cause problems when computer data is to be transmitted at reasonably high speeds (above 1200bps). Assume for a moment that we are constructing a 9600bps modem. Assume also that we intend to use amplitude modulation (see Fig. 2). The problem, simply, is that insufficient time will be spent at each amplitude level to enable proper detection and interpretation of the data, less than 1/9600 for each bit.

It might seem that the problem could be solved by using a high frequency (high pitch) carrier, since that many more waves or cycles will go by in a given time, but remember that high frequencies are not transmitted by telephone lines. However, the time spend at each level can be increased simply by increasing the quantity of recognizable amplitude levels, making each level carry more than one bit of data. If, for example, eight levels of loudness were defined, with each representing a combination of three bits (a tri-bit combination), the time spent at each level would be tripled and the conditions or signals on the telephone line would change only one-third as many times. This would be a 9600bps modem operating at 3200 baud.

Of course, as the reader might suspect, things are not really that simple. In reducing one problem we have created another: eight levels are too much for practical application. The most popular practical solution at the present time is to create eight different conditions by use of two amplitude levels and four phase change possibilities. This combination of amplitude modulation and phase modulation is generally called quadrature amplitude modulation (QAM).

Equalization

Now, we're all set to do our modulating and demodulating. We build a system in a laboratory and it works fine until we try it on a telephone line. An important consideration has been neglected. We must now provide some type of modem "equalization." Equalization is essential because there is a tremendous variety of transmission

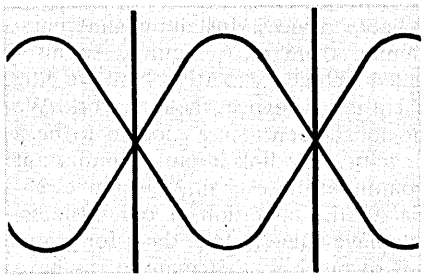
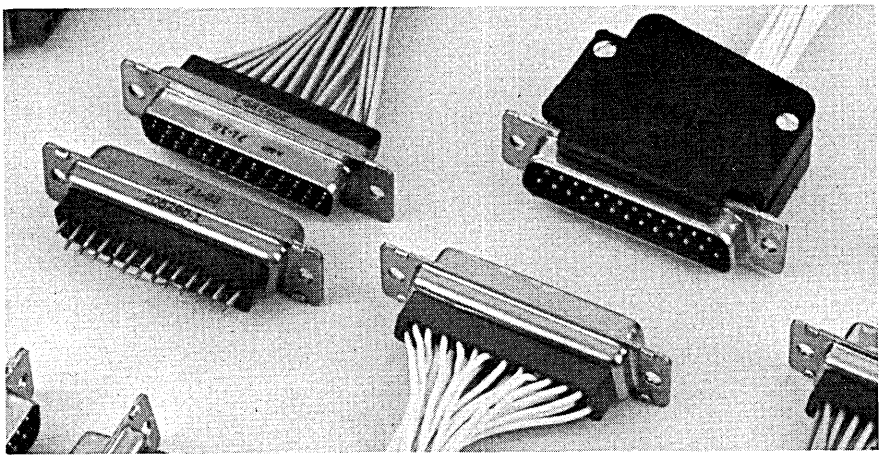


Fig. 5. Technicians once had to visually inspect these "eye" patterns to equalize modems before transmitting. This simple example is for a two level pattern.

characteristics that can exist on any given telephone line. For example, one telephone line might have characteristics that affect the modulation signal such that the result incorrectly appears as additional modulation of one type or another. Equalization consists of telling the modem how to compensate for the characteristics of a particular telephone line.

Years ago, equalization was performed by technical specialists who used oscilloscopes to monitor "eye" patterns (see Fig. 5). The industry then progressed through meters and dials and finally to fully automatic



The connectors used in joining terminals to modems and modems to computers have 25 wires. (The equipment side has pins, and the modems have sockets.) The functions of all 25 wires are defined by a U.S. standard called EIA RS232, or its international counterpart CCITT V.24. Typically only a half dozen of them are actually used, however. These samples are from AMP, Inc.

equalization.

For historical interest, the eye pattern is a display of the demodulated signal as it appears prior to shaping. A random pattern is transmitted and received and the received bits are superimposed upon each other. Even though the pattern is random, there are only a discrete number of states that should exist and the "eye's" cleanness gives an indication of the equalization quality. The example in Fig. 5 shows a two-level eye pattern. Four- and eight-level patterns also exist and are present in modems that utilize di-bits and tri-bits.

At any rate, the following generalities can be stated with regard to equalization. The higher the modem speed (in bps), the more critical equalization becomes. A change of or in a telephone line will generally result in the need to at least check equalization.

Scrambling

Many modem manufacturers make reference to the existence of a data scrambler. Under normal usage, data processing equipment occasionally produces data patterns (like a long string of ones) that can cause modem problems (usually in the clocking circuitry). The scrambler changes the data so that it appears to be a random pattern. A descrambler in the receiving modem changes the data back to its original pattern. Inasmuch as any given modem will correctly unscramble the data transmitted by another modem of the same model, the important thing to remember is that a modem scrambler does *not*, in any way, provide data security.

Duplex, half-duplex, and simplex

There is also much confusion regarding the terms "duplex," "half-duplex," and "simplex." Consider first that a telephone wire *pair* is needed for data transmission. In that light, there are four basic types of modems. A four-wire modem (two pairs of wires) is capable of simultaneous data transmission in both directions and is, therefore, a full-duplex modem.

A modem with a single wire pair that can transmit in both directions but not simultaneously is a half-duplex modem. Another two-wire modem that can transmit in only one direction is a simplex modem. The fourth modem type is a two wire modem that can transmit simultaneously in both directions with the primary direction being reasonably high speed and the secondary (or backward) direction being rather low speed. This is a simplex modem with backward channel.

It should be noted that it is frequently advisable to use a full-duplex modem even though the software protocol is only half-duplex. This is because the reduced turnaround time (more on that later) lowers the amount of dead time between transmissions.

Conditioning

Telephone line conditioning is another term that has been misunderstood more often than not. A basic telephone line has nominal electrical characteristics based on its ability to carry a voice-like signal. These characteristics (more correctly called "parameters") have tolerances associated with them. A tolerance is a statement regarding how "far" a particular telephone line can deviate from nominal and still be "within specification" (meaning "within the range the phone company specifies it will be.")

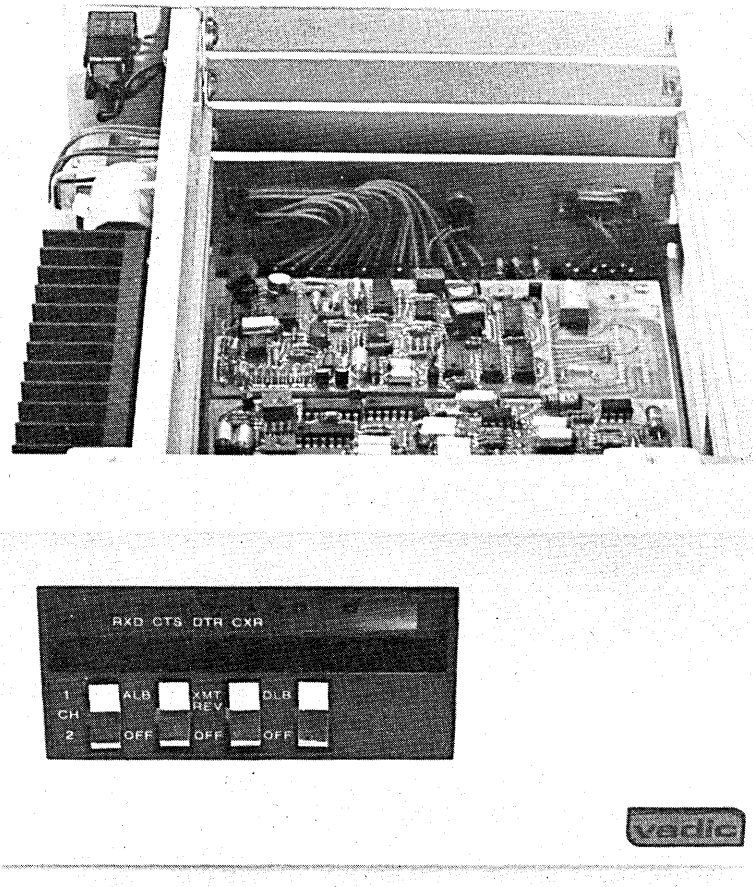
Higher levels of conditioning do not change the nominal values; they simply tighten the tolerances. As a result, a highly conditioned line will always meet the specifications for a less conditioned line and, depending on luck, an unconditioned line may actually equal or exceed the quality of a highly conditioned one. The purchase of conditioning is basically the purchase of better quality control on the part of the phone company.

Hardware protocol

Up to now, you may have had no real need to consider hardware protocol. If your data processing equipment was designed and built by one vendor, the software-hardware relationship is, by design, sufficiently interrelated to preclude a need to understand both aspects. With communications, however, your data will of necessity utilize equipment from several vendors and operate over telephone lines that were never intended for data, where the lines are merely being adapted for that usage. The need for equipment from more than one vendor and the adaptation of telephone lines for data gives rise to the need for a compatible way of connecting it all together, an interface protocol. The current U.S. industry standard is called EIA RS232C. The international standard is CCITT V24.

The actual hardware interfacing is performed by the modem electronics. However, for all practical purposes, the interfacing protocol occurs at the so-called EIA connector on the modem. An EIA cable connects your terminal to this EIA modem connector. The cable contains 25 wires (each identified by number) and the RS232C standard specifies the permissible function for each wire and corresponding connector pin.

No system uses all of the wires. The network designer determines which functions are important (based on the application) and the remaining wires



Inside a modem there is enough circuitry to rival a small minicomputer—with perhaps a few more discrete components. This one is Vadic's 3400, full-duplex, 2-wire, 1200-bps device; it uses quadrature amplitude modulation for data transmission.

are ignored. Any particular interface will typically use about a half-dozen of the functions actually available.

There are three basic types of functions or signals: control, clocking, and data. Control signals constitute the "conversation" that takes place between your terminal and the modem; these signals are either "On" or "Off." Clocking signals regulate the speed of the data transfer. Data signals are the serial representation of the data being transferred as described earlier.

We can take the space to describe some of the most commonly used functions here.

As everyone may be aware, electrical signals require two wires. At the EIA interface, all signals share a common second wire which is known as signal ground and is physically pin 7. The objective, of course, is to move data. Transmitted data is that data transmitted from your terminal to the modem for subsequent retransmission to another location; it appears on pin 2. Likewise, received data is that data received by your terminal and it appears on pin 3.

However, before data can be transmitted or received, certain conditions must be met. First, your terminal must place the Data Terminal Ready signal (pin 20) in the "On" state; this signal advises the modem that your terminal is powered up, has no known malfunction, and is not in a test mode. Similarly, the modem must place the Data Set Ready signal (pin 6) in the "On" state; this signal, obviously, advises your terminal that the modem is powered up, has no known malfunction, and is not in a test mode.

Note however, that Data Set Ready does not in any way imply that data can be passed! Depending on the particular telephone line (dial-up vs. leased and multipoint vs. point-to-point), the modem must do some more work before data can be passed. Similarly, Data Terminal Ready does not mean that the terminal is sending data; you might not be using the terminal

Part of What goes On In Responding To A Poll

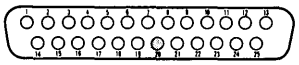
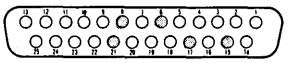
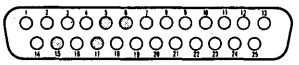
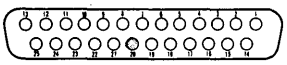
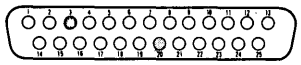
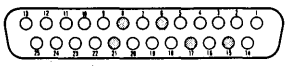
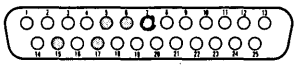
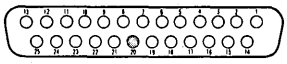
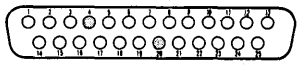
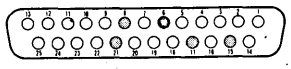
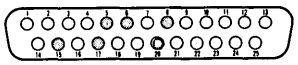
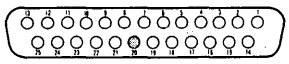
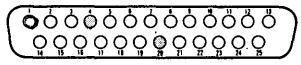
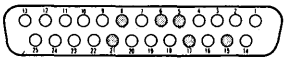
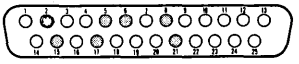
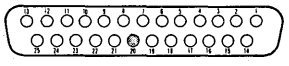
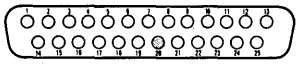
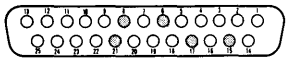
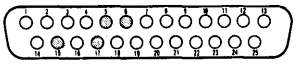
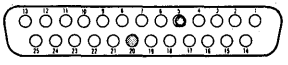
Remote Site		Host Site	
terminal male connector (pins)	modem female connector (sockets)	modem female connector (sockets)	processor male connector (pins)
			
The terminal will always have Data Terminal Ready (pin 20) turned on as long as it is powered up, has no known malfunction, and is not in test mode.	As long as there is a good quality telephone line, the terminal's modem will show Carrier Detect (8), Signal Quality (21), and of course Data Set Ready (6). In anticipation of receiving a transmission, it will always also send the terminal a Receive Clock signal (17) to be used in matching the terminal's receiving rate with the host's sending rate. Finally, the Transmit Clock (15) is always present.	Like the remote modem, the host's will always have Data Set Ready (5), Transmit Clock (15), and Receive Clock (17) — the latter of which, although present, cycles meaninglessly in the absence of a data transmission from the terminal. Unlike the remote modem, Clear to Send (5) is also always on.	Like the terminal, the host device — terminal, front-end, or cpu — will always have its Data Terminal Ready (20) turned on.
			
① If the terminal has received a poll, it turns on Request to Send (4).	② The modem recognizes the Request to Send and begins sending a carrier signal to the host modem over the telephone line.	③ The modem at the host site detects the remote modem's carrier, turns on Carrier Detect (8), adjusts eq ualization with the remote, and adjusts other receive timings to match the host's receiving rate with the terminal's sending rate.	Nothing happens at the host yet.
			
	④ After an appropriate pause, the remote site modem turns on Clear to Send (5) as a signal to the terminal.	⑤ The host modem turns on Signal Quality (21) if the line is good.	
			
⑥ The terminal transmits its message (which it passes to the modem on 2).	⑦ The modem forwards the message to the host site via the carrier on the telephone line.	⑧ The host modem passes the message to the host (on 3).	⑨ The host receives the terminal's transmission.
			
⑩ After the terminal transmits an end of message character, it turns off Request to Send (4).	⑪ The modem recognizes that Request to Send is now off, and responds by stopping its carrier transmission and turning off Clear to Send (5).	⑫ The host modem turns off Carrier Detect (8) and Signal Quality (21).	When the host detects the end of message character, it turns on Request to Send (4) in the first stage of preparing to send out another poll (on 2). This poll may or may not be to the same terminal.

Fig. 6. In the absence of a data transmission, the conditions at the plug interfaces (terminal/modem and modem/host) are as in the first row of figures above. The steps involved in responding to a poll with a message are numbered 1 through 12.

Though actually more complicated than this illustration shows, the entire process is done very quickly. If two modems on opposite sides of the U.S. were connected by a 4800bps line, going through all these steps to send back a very short message might take only a little more than one-tenth of a second.

and there is simply no data to send.

At any rate, assuming that both Ready functions are on, there are two other functions that must also be on before data is passed. When you depress the "enter" key on your terminal, the terminal turns on the Request to Send signal (pin 4) and thus advises the modem that it wishes to transmit data as soon as possible. The modem then performs whatever work is necessary (more on that later) and, upon completion of that work, turns on the Clear to Send signal (pin 5) which advises the terminal that it has permission to begin transmitting data.

The Transmit Clock signal, which can be supplied by either the modem (pin 15) or the terminal (pin 24), assures that the modem is processing the data at precisely the same rate at which the terminal is sending it. Another signal for timing, Receive Timing, appears on modem pin 17; it is used to more precisely match the terminal's data reception with the actual transmission of the host—a kind of "fine tuning."

Taking it step-by-step

Now, before we discuss other functions, let's take what we've discussed so far and construct an example. (See Fig. 6.) Assume that a particular user has chosen a leased multipoint telephone circuit. A leased line or circuit is one with permanent physical connections; dialing simply does not exist. Multipoint is like a multiple location conference call. In this example, a single host processor communicates with several remote terminals. A single modem exists at the host site and, although this is *not* technically accurate, you can imagine phone wires twisted together at a phone company facility enabling the multipoint configuration.

This user has chosen a so-called four wire telephone circuit, that is, one wire pair is used for data traveling in one direction and the other wire pair is used for the other direction. Assume no direct terminal-to-terminal communication; all data goes to or from the host site.

Now, the first problem is to make sure that only one terminal transmits at any given time. If more than one did so, the host processor would be in the position of an instructor trying to listen to several students simultaneously. By means of polling, the user places the terminals in a "speak only when spoken to" mode. While all terminals will "see" any given poll, only one will respond to it.

But there is an additional problem: even though the "wrong" terminals will not attempt to send data to their respective modems, we do not want the modems to transmit any energy whatever; an idle code can interfere with data as well as other data can. The *terminal* must, therefore, be capable of telling the modem "Shut up until I tell you otherwise." This is a "controlled carrier" environment. Presence or absence of a "carrier" simply refers to presence or absence of transmitted energy. The "control" is the ability of the terminal to tell the modem when to transmit energy and when not to.

Now, say a poll has been sent and the correct terminal has recognized it. This terminal then turns Request to Send on.

The modem recognizes that signal and immediately turns on its carrier and starts a timer. This carrier contains a special pattern (code) determined by the modem designer.

The modem at the host site, upon seeing this carrier, adjusts its equalization, receive clock, and other receive electronics as necessary.

The remote modem knows how long this should take and, upon expiration of that time, turns on the Clear to Send signal.

Finally, the terminal begins transmitting its message. Upon completion of that message, the terminal turns Request to Send off. The modem responds by shutting up and turning Clear to Send off.

When the host processor senses an end of message character, it sends out another poll which may or may not be to the same terminal.

While the above protocol (or handshaking) is taking place, the modem at the host site provides control signals which, at the user option, may or may not be utilized. Data Carrier Detect (pin 8) is, when on, the modem saying that a carrier (energy) of sufficient power is present on its receive wire pair. Signal Quality Detect (pin 21) is, when on, the modem saying that it sees a carrier of suitable quality.

Now, when the transmission is over, the protocol described at the remote site is unnecessary and undesirable (since it wastes time) at the host site. Since it does not matter if all terminals "hear" the host transmissions simultaneously, the host modem is set up to provide Clear to Send at all times that Data Set Ready is on. Between polls, the remote terminals see, simply, an Idle code coming in. In the absence of telephone line problems, the remote modems would have both Data Carrier Detect and Signal Quality Detect on continuously.

Turnaround time

In many applications the *system* turnaround time is important. Many protocols are of the "stop and wait" variety. This means that a message will not be sent until the receiving station has confirmed proper receipt of the previous message. The turnaround time therefore is dead time as far as data transmission is concerned. But what factors enter into total turnaround time? One of the more obvious ones is the time spent traveling through the telephone network. This can be estimated at 1msec per 100 miles (don't forget that the receiving station's acknowledgement must make a return trip).

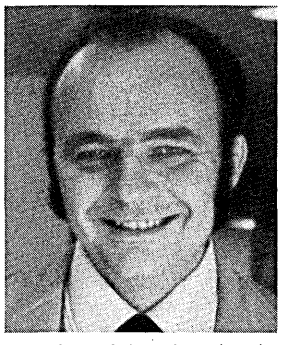
Another factor is the time spent traveling through the modem electronics. Depending on modem design, this can range from 5 to 10msec for one direction through one modem. Since the message must travel through two modems (transmitting and receiving) and the acknowledgement must do the same, this delay should be multiplied by four.

Another contributing item is the time duration of the message itself. This can be calculated by considering the bit size of the message and the bps speed of the communications system.

Modem manufacturers frequently quote only one contributing factor as the "turnaround time." This factor is the Request to Send/Clear to Send delay described in the protocol section. This delay can occur at either or both ends of a communications link and, while it is important, it is in no way the sole contributing factor.

That's enough

We've seen that a modem is certainly not a magic device. And taken piece by piece, the various aspects are not all that exotic. It is hoped that, through this article, the reader now knows enough to ask questions. ❊



Now employed by Auerbach Publishers Inc., Mr. Dick is responsible for preparing reports on communications testing and for developing plans for seminars on that subject for Auerbach subscribers. Prior to joining the company, he was employed by Datran, where he was responsible for providing technical support to field engineers in six states.

His earlier experience was with INA Corp., where he was responsible for maintaining a large network, and in the aerospace industry (RCA, Boeing, and NASA) where he worked in hardware evaluation.

Another Look at SNA

by P. D. Moulton and Ronald C. Sander

The user is forced to continue dealing in uncertainties as IBM dribbles out portions of its Systems Network Architecture piecemeal.

IBM's Systems Network Architecture (SNA) may become the model for most teleprocessing systems and telecommunications networks implemented in the next five to ten years. The architecture's importance stems from IBM's announcement in 1974 to use it as the framework for new hardware and software products. As the company has stated, SNA is intended to provide a common method of support for a wide range of communications activities sharing one communications network.

When a giant speaks, everybody listens. IBM's market dominance alone will cause many organizations to consider implementing SNA. Some parts of SNA may even become industry standards.

SNA has both positive and not-so-positive aspects. The only thing certain about it is that it will strongly impact IBM users with existing on-line systems.

SNA incorporates both hardware and software components, some of them announced as early as 1973 and others as recently as November 1976. It is composed of four elements as shown in Fig. 1.

1. *ACF/VTAM* (Advanced Communications Function/Virtual Telecommunications Access Method): a major new software product that resides in the 370 mainframe. ACF/VTAM's function is to interface to a single network all of the teleprocessing programs that reside in separate partitions of a 370. In this way it acts like a funnel for data. ACF/VTAM, with a little help from ACF/NCP/VS and TCAM, performs all of the necessary communications control functions previously performed by BTAM, QTAM, et al.

2. *ACF/NCP/VS* (Advanced Communications Function/Network Control Program/Virtual System): a new program that is executed in the IBM 3705 Communication Controller. Under the direction of ACF/VTAM, it causes the 3705 to perform more communications control functions than before.

3. *SDLC* (Synchronous Data Link Control): a new communications control protocol that is a set of detailed procedures for exchanging data over communications lines.

4. *New and upgraded terminals:* ones that are more intelligent and that receive/transmit data over a communication line according to the rules of SNA and SDLC.

IBM presents this mix of components as an integrated structure of equipment and programs. The more significant benefits of this structure are related to be:

1. Developing application software for terminal systems will be simplified. Device dependency is minimized, and network changes are virtually transparent to the application programmer.

2. Terminals and other network resources can be shared by application programs. This reduces the need for dedicated terminals and dedicated networks for each application.

3. Different types of terminals can be attached to the same communications line, thereby reducing communication line costs.

4. Two-way message flow is facilitated by SDLC, thus making possible the more effective use of duplex communications facilities. Faster response times, as compared to pre-SNA networks, may result.

5. Functional capabilities can be dispersed, moving processing power closer to the terminal user and easing the processing load on the host system.

6. Application programs and data bases can be distributed across multiple 370s in multiple data centers.

The first two benefits result from SNA's use of ACE/VTAM in one 370 partition and ACF/NCP/VS in the 3705. The application software in the different partitions can then interface the network through one common access program, ACF/VTAM, which with ACF/NCP/VS can provide all of the communications housekeeping and hardware interfacing functions. This common access path is what will force greater standardization in programming telecommunications applications, make applications development less complex, reduce the applications dependency on hardware, and allow different applications in a 370 to support the same terminals and the same network.

VTAM users should expect increased complexity, system processing overhead, and memory.

A key element of SNA is Synchronous Data Link Control, bit-oriented synchronous communications control methodology. ACF/VTAM, ACF/NCP/VS, and the design structure of SDLC will allow several different types of SDLC terminals to share the same communications line. SDLC provides full-duplex exchange of information, better use of communication channel capacity, and the potential for shorter response time when compared to binary synchronous and start-stop protocols.

The fifth benefit presented above results from SNA's use of intelligent terminals at the user's site and ACF/NCP/VS in the 3705. Some of the communications workload previously performed by the host processor now can be performed by the programmable 3705 front-end. Similarly, some of the applications processing previously performed by the host processor now can be performed by the terminal.

In November 1976 IBM announced the Advanced Communications Function (ACF) which extends SNA's capabilities. The principal enhancements introduced are in three areas: 3705 performance, networking of multiple 370s, and job entry processing within a network. These new capabilities will be provided by a set of new software products for the 370 and 3705 communications controller, and by some new hardware for the 3705.

IBM's published technical literature presents these benefits in more detail. And these benefits can be realized by many SNA users. However, in the real world, these SNA benefits may be offset by other not-so-positive characteristics of SNA.

The overall impact on existing teleprocessing systems can be seen by examining how SNA will impact the system's: 370 central processor, 3705 communications controller, network, terminals, and data processing budget.

Impact on the cpu

SNA requires an IBM 370, a virtual operating system, and VTAM. VTAM, like VSAM and other IBM systems software, is large, complex, and sophisticated. In fact, VTAM is more complex and sophisticated than BTAM, TCAM, or QTAM which it replaces because VTAM has been designed to operate across multiple partitions. With the recently an-

nounced ACF, one copy of VTAM now also operates in conjunction with other copies in other 370s, which even further adds to its complexity.

VTAM users should expect that this increased complexity will introduce more 370 system processing overhead and require more memory. As an example, one public utility made a study of the number of transactions their dedicated 370/158-3 could process per second. Throughputs were 14.2 transactions/sec using DOS/EXTM, 12.6 transactions/sec using DOS/VTAM, and only 11.1 transactions/sec using OS/VS1/VTAM.

IBM manuals estimate that a small network of four asynchronous lines and one SDLC line will require over 800KB of virtual memory for VTAM. Several users, who each later abandoned their interest in VTAM, found they really needed about one million bytes of virtual memory and 200 to 300KB of real memory for networks of that size.

Also VTAM might actually aggravate bottleneck and contention problems in the 370, due to its additional overhead. System fine turning and performance measurement hardware will become even more important to users wishing to overcome these problem areas.

Users of VS operating systems, CICS, IMS, and VSAM have seen hardware resource requirements creep up with new IBM software products and new software release levels. IBM has responded with cache memories, attached processors, dual processors, high speed buffer storage, and other new 370 processor speed-up features to offset the increased memory and processing demands. In the continuing escalation, the SNA user might eventually find he wants and needs a larger or more powerful 370 processor, as well.

Impact on the 370X

As part of the distributed processing thrust, IBM has transferred some of the communications control functions from the 370 mainframe to the 370X communications controller. Unfortunately, the functions IBM has transferred aren't the major source of the familiar cpu communications overhead burden, so communications overhead problems in the host 370 will continue. In fact, one 3705 NCP/VS user, the Midwest Stock Exchange, has reported that the total off-loading benefits of installing the 3705 with NCP/VS probably amounted to less than 5%.

In spite of the fact that some functions have been transferred under SNA, the network is still controlled and managed by 370 Software, which perhaps is best illustrated by the lack of an operator-oriented control console on the 370X Communications Controller.

The memory requirements and cost of the 370X are substantially increased by SNA's and NCP/VS's need to buffer blocks of data. NCP/VS also cuts the 370X's throughput capacity significantly unless the user installs the recently announced channel adapter type 4 on the 3705-370 interface. For instance, a 3705-I or II supporting 20 asynchronous lines plus 20 binary synchronous (BSC) lines and operating as a 270X emulator may now be a 16KB unit renting for about $2,200 per month. If its user moves to SNA and converts 10 of those BSC lines to SDLC lines, he will need an 80KB 3705. His 3705-II costs will jump about 70% to around $3,700 monthly. If he previously used a 3705-I, costs could increase to nearly $5,000 per month.

Consequently, users will see an increase in their 370X hardware requirements and expenditures even though most 370Xs function as little more than 270X hardwired controllers.

Also, the new ACF features announced have totally ignored the 3704 communications controller. This leaves significant doubt as to the 3704's future role in SNA.

Impact on the network

SNA has the potential to provide users with significant cost savings in communications lines. VTAM provides a single, common path to a communications line for all application software residing in the teleprocessing partitions of a single 370. Terminals attached to a VTAM controlled communications line will be able to access any of the applications in partitions that interface to that 370's VTAM. The ACF products announced in November 1976 further expand accessibility from one 370 to any other 370 in the user's network.

SNA terminals and communications lines will therefore be more versatile and multi-functional than before. This is a major improvement. No longer will a remote office need a terminal, modem, and communication line for CICS-based applications, another terminal, modem, and line for IMS, etc.

Unfortunately though, there are some limitations and restrictions that may reduce the value a user can realize from SNA's network sharing capability. The potential user should remember that:

1) The SNA remote job entry user will be required to use IBM's JES package. If he chooses to retain HASP, a separate network will be needed to support his HASP workstations because IBM has not announced VTAM support

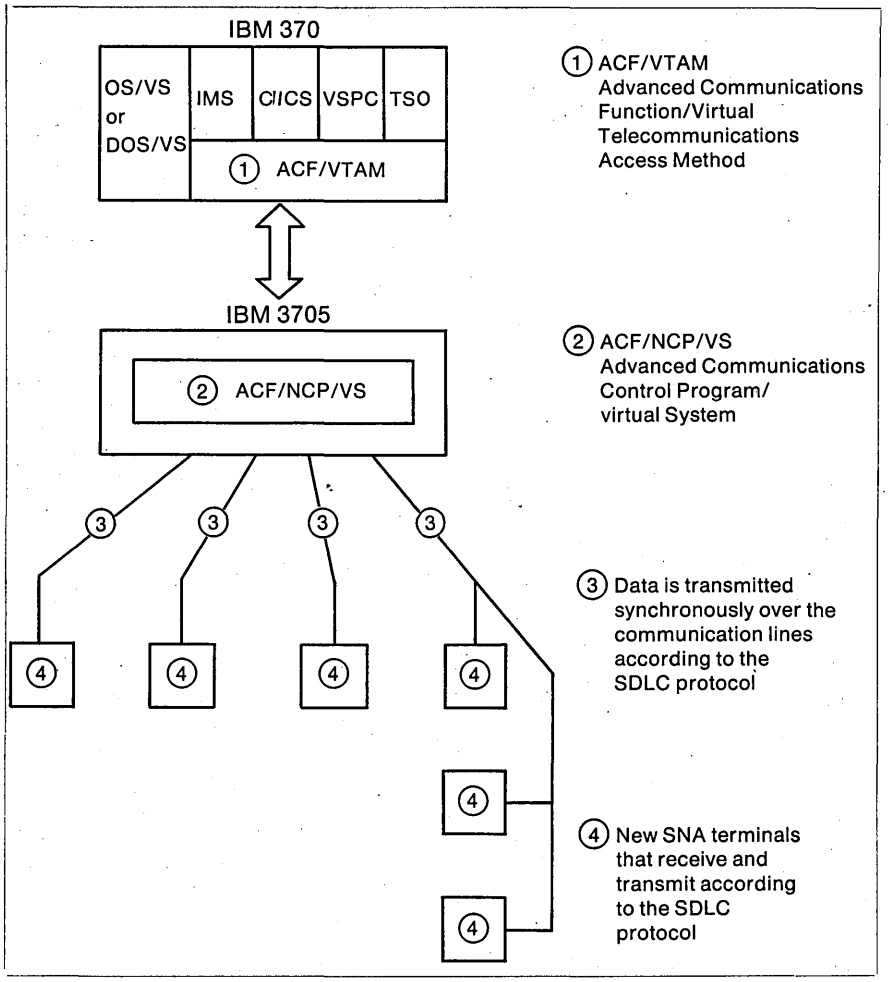


Fig. 1. The four principal components of Systems Network Architecture.

12 tough questions about your access control system.

Does your access control system . . .

YES	NO	
☐	☐	permit positive control of both entry and exit?
☐	☐	ensure that only one person will pass through an open entrance?
☐	☐	permit entry only during authorized periods?
☐	☐	permit visitor control?
☐	☐	detect use of a lost I.D. card or key?
☐	☐	permit identification by comparing user to badge photo?
☐	☐	protect security personnel?
☐	☐	process up to 150 people in 15 minutes?
☐	☐	permit package inspection?
☐	☐	provide 2-way voice communication?
☐	☐	provide improved security at reduced costs?
☐	☐	provide 24-hour-a-day, 365-day-a-year reliability?

A perfect score is 12 "yes" answers. If your personnel access control system is the Mardix Videoguard® (VG-300), you answered "yes" to all of the above questions. With any other system you had to answer "no," at least part of the time. Unfortunately, anything less than a perfect score means that your access control system is not as effective as it could be.

Mardix Videoguard (VG-300) will cut security costs by increasing security without increasing manpower. Your savings will pay back the cost of the VG-300 in less than a year. The VG-300 can monitor and control many access points from a single location through a patented* system of closed circuit TV and secured multiple-door enclosures. A number of other Videoguard systems are available to economically serve your specific security needs.

For more answers to tough questions, call us today . . . toll free *(800)* 227-1464, Extension 8150; or from California, *(800)* 772-3909, Extension 8150.

Mardix Incorporated, 900 Stierlin Road, Mountain View, CA 94043 415/961-3030

*Patents No. 3,564,132 and No. 4,006,459.

for HASP.

2) Asynchronous, binary synchronous, and SDLC terminals cannot be attached to the same communications line.

3) A user who has teleprocessing applications and VTAM in more than one IBM 370 at a central site must move to avoid operating a separate SNA network for each 370. There are three ways he can go. First, he can bear the expense and effort of operating his 370s in a multiprocessor configuration. Second, he can install the ACF products at a cost of about $1,000/month per 370. Finally, he can use a 370X-compatible communications controller that will interface multiple IBM 370/360 cpu's simultaneously over a single nonredundant SNA network.

Additional restrictions exist on the second alternative, IBM's ACF multisystem networking facility. Multisystem switching can only be performed for SNA terminals, lines, and applications. Further, switching of dedicated lines can occur only if the involved 370s are operating. Fig. 2 shows the components of an SNA network with multiple 370s in two data centers tied together with ACF's Multisystem Networking Facility with an SNA terminal before, during, and after it has switched over from accessing an application in 370 "A" to an application in 370 "C." The switchover never could have occurred if 370 "A" had crashed, and therefore won't work if the switchover is desired *because* system "A" crashed. The terminal would have been left hanging attached to none of the 370s until 370 "A" was restored to operation. The switch over action depends on the initial 370 being operational.

SNA will permit users to attach different types of SDLC terminals to a single communication line *providing* that all of the terminals operate at the same synchronous speed and use the SDLC protocol. Such terminals will share the communications line's capacity. With SNA's line sharing capability a user can reduce the number of communications lines he needs. (Alternately he could use multiplexers, split-stream modems, fast-poll modems, or concentrators.)

Consider a typical IBM user who has, at a remote site, a remote batch terminal and several on-line interactive crt's. Many users would bear the expense of two communications lines to the remote site, one line for the batch terminal and one for the crt's. SNA can in fact eliminate the need for one of those communication lines. (On the other hand, the user could eliminate one of the communications lines by using split-stream modems instead. Further, a split-stream modem configuration does not require SNA, any terminal changes, or any changes in the software of the central computer or the communications controller.)

The full-duplex nature of SDLC does permit a user to simultaneously send and receive data over a single communications line, thus allowing him to get more value from his communications dollar, but SDLC and SNA could also improve responses times by making better use of the information carrying capacity of a communications line.

Potential SNA users must remember that remote batch terminals and interactive crt's have different transmission loads and load characteristics, which sometimes makes it difficult to take advantage of promised benefits. One discrete event simulation, comparing SDLC and BSC for long transactions at 4800bps, showed that the imbalance between inbound and outbound message sizes compromised SDLC performance benefits. SDLC transaction rates exceeded BSC rates by only about 20% in this case. Clearly, SDLC won't fully benefit a SNA user unless the in-bound and out-bound data volumes on his communications line are about equal and occur simultaneously. Few networks can be designed to meet these criteria.

Another real advantage of SNA's SDLC equipment is that it performs error recovery. This is good because it spares the 370 some disruptions and overhead. In the event of a transmission error, the equipment automatically causes the transmitting device to retransmit the block of data.

But SDLC, as it is presently defined by IBM, has some shortcomings in this regard. When a transmission error occurs, the transmitting equipment may retransmit up to seven blocks of data even though only one block was received with an error in it. This contrasts with other full duplex protocols which cause only the "bad block" to be retransmitted. SDLC permits no more than seven blocks of data to be sent before an acknowledgement is received either. And this limitation may also introduce response time delays not found with other link protocols which can operate with up to 32 blocks of data in transit. Of course, IBM can correct these shortcomings if it chooses.

Finally, the SNA user should also expect to spend more money on modems because SDLC requires synchronous modems. Limited distance modems or modem sharing devices might be useful and cost effective.

Impact on terminals

SNA terminals are new, more intelligent, programmable, more versatile, and will be (with few exceptions) SDLC compatible. In them, the SDLC protocol will be handled by special microprocessor hardware. For example, SDLC uses a unique character code called a flag character to separate information frames. Special line interface microprocessor hardware ensures that the flag code does not by chance occur within an information frame. This interface microprocessor hardware stuffs an extra "zero" bit into the data stream whenever five "one" bits appear in sequence.

SNA terminals and the communications controller must have this special interface harware which unfortunately cannot be readily incorporated into most existing terminals including some newer intelligent terminals. True, an intelligent terminal could rely upon software to perform the requisite bit stuffing (and unstuffing), but that terminal would experience a loss of processing power which in turn would reduce its operating capabilities.

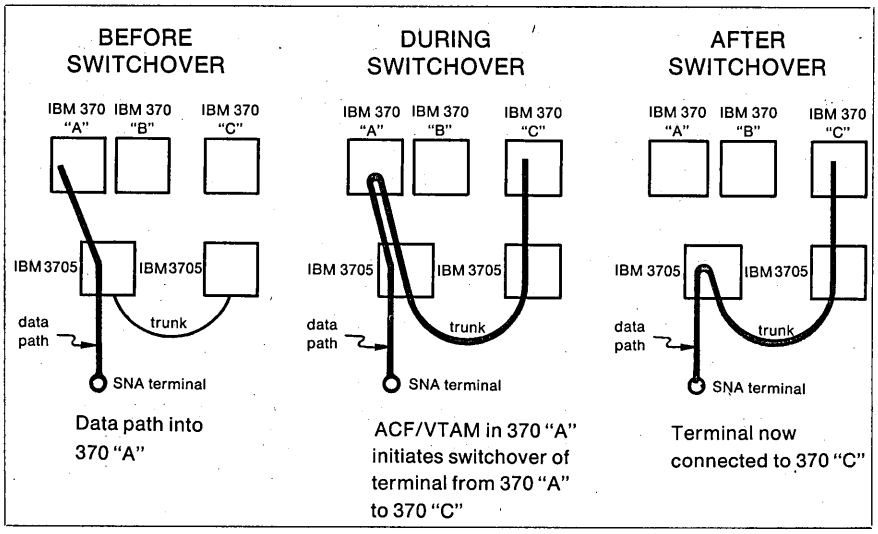
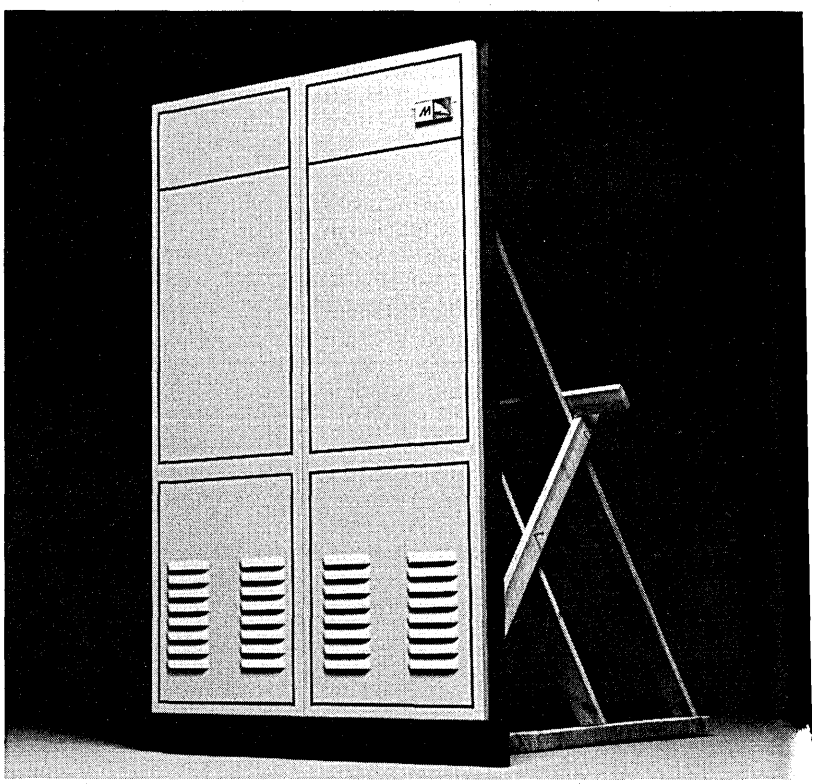


Fig. 2. The Multisystem Network Facility does allow a terminal to switch from an application in one IBM 370 to an application in another, but only if **both** 370s are operating at the time.

BEFORE YOU BUY OR LEASE AN ADD-ON MEMORY, FIND OUT WHO STANDS BEHIND IT.



When you buy or lease an add-on memory, you're also buying or leasing the company that delivers and installs it, services it, updates it, and stands behind it if the darn thing breaks down.

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In short, most SNA users will probably have to replace their existing terminals with SDLC compatible terminals. When they do, they will find that SDLC terminal control units cost about 40% more than binary synchronous terminal control units.

Unfortunately, independent manufacturers of IBM-compatible terminals will have difficulty delivering SDLC compatible terminals until IBM finally discloses the meaning of the bit patterns assigned for each type of SDLC terminal.

Fortunately, because IBM has stepped back from its previous position and now has agreed to support some non-SDLC terminals, users will not be forced to switch immediately.

IBM still provides software support for asynchronous, binary synchronous, and non-intelligent terminals. So long as IBM continues this support users can delay installating SDLC terminals until the independent manufacturers are able to deliver them. However, this support is tenuous. Only a few years ago IBM tried to put an end to standard software support for the thousands of installed IBM 2260/2265 terminals that users had purchased from IBM. (The firm later reversed its position when faced with legal action, but many users were left with a basic feeling of insecurity.)

The new IBM SNA terminals will be programmable and intelligent. Terminal intelligence is an effective means of providing increased versatility while reducing hardware development and manufacturing costs. However, users may find that many SNA terminals are difficult to program to the user's requirements. (A similar situation continues to exists for IBM 370X users.) Some users feel that IBM restricts programming on its intelligent terminals, and this could limit the adaptability of SNA terminals to unique user requirements.

Impact on the budget

In our opinion, SNA is an IBM marketing approach to telecommunications that's designed to sell IBM equipment. Our analysis leads us to believe that SNA requires a management commitment to spend a great deal more money on data processing. Yes, meaningful results can be obtained from SNA when the dp budget is increased. Some savings in communications line costs, for instance, can be realized. The time frame and perhaps the cost of developing application software should also decrease because SNA intends to simplify the development, but there is thus far insufficient user experience to prove this is so.

These savings will be offset by substantial increases in other cost areas. Equipment budgets must be increased for added mainframe resources and enhancements, bigger communications controllers, synchronous modems, and SDLC terminals.

Funding for the systems programming staff must also be increased. Systems programmers will become even more crucial and expensive than they are now because one very complex system (VTAM) replaces several less complex systems such as BTAM. By all indications to date, we feel users will not be able to reduce the size of systems programming staffs to compensate, either.

A user will need an experienced team of systems programmers, thoroughly trained in VTAM and NCP/VS, to get SNA off the ground. IBM has outlined a training program for teleprocessing-experienced systems programmers. It requires four weeks to complete and costs $2,000 per programmer in addition to per diem, salary, etc. Thus, the system programmers will need as much training as they needed for VS, CICS or IMS. Then, the money spent for the SNA equipment, training, conversion will be wasted unless these trained staff members are paid more to retain them, too. Ironically, there might not be much money left in the coffers for those salary increases after the additional money is spent on equipment and training.

> SNA's actual cost and performance will remain an uncertainty for several years.

All of these increased costs for SNA will be tough to sell to top management, especially if management is aware that there are less costly alternatives available. For instance, many users have successfully extended the useful lives of their 360/370 mainframes by installing file level front end processors. These processors make the application software independent of the network parameters by performing the functions of VTAM and NCP/VS. The file level front ends—or even programmable 370X replacements from independent manufacturers—and their associated networking software enable the users' currently installed bisynch and start-stop terminals to access multiple applications, multiple cpu's, and multiple data centers. (And their manufacturers will implement them on a turnkey basis.)

Similarly, users who have converted to hardware and software from independents already use terminals which share a common communications line or network. They already use powerful intelligent terminals—ones that really are programmable—to provide local processing and maintain local data bases. They have already off-loaded the communications burden from the 370 mainframe.

Benefits vs. costs

There is no quick and simple answer to whether SNA would benefit any given installation. It takes detailed analysis to determine what SNA will and won't do for a potential user. Which of the potential SNA benefits are real, realizable, and reliable when mapped against a user's future needs? The user must identify and quantify:

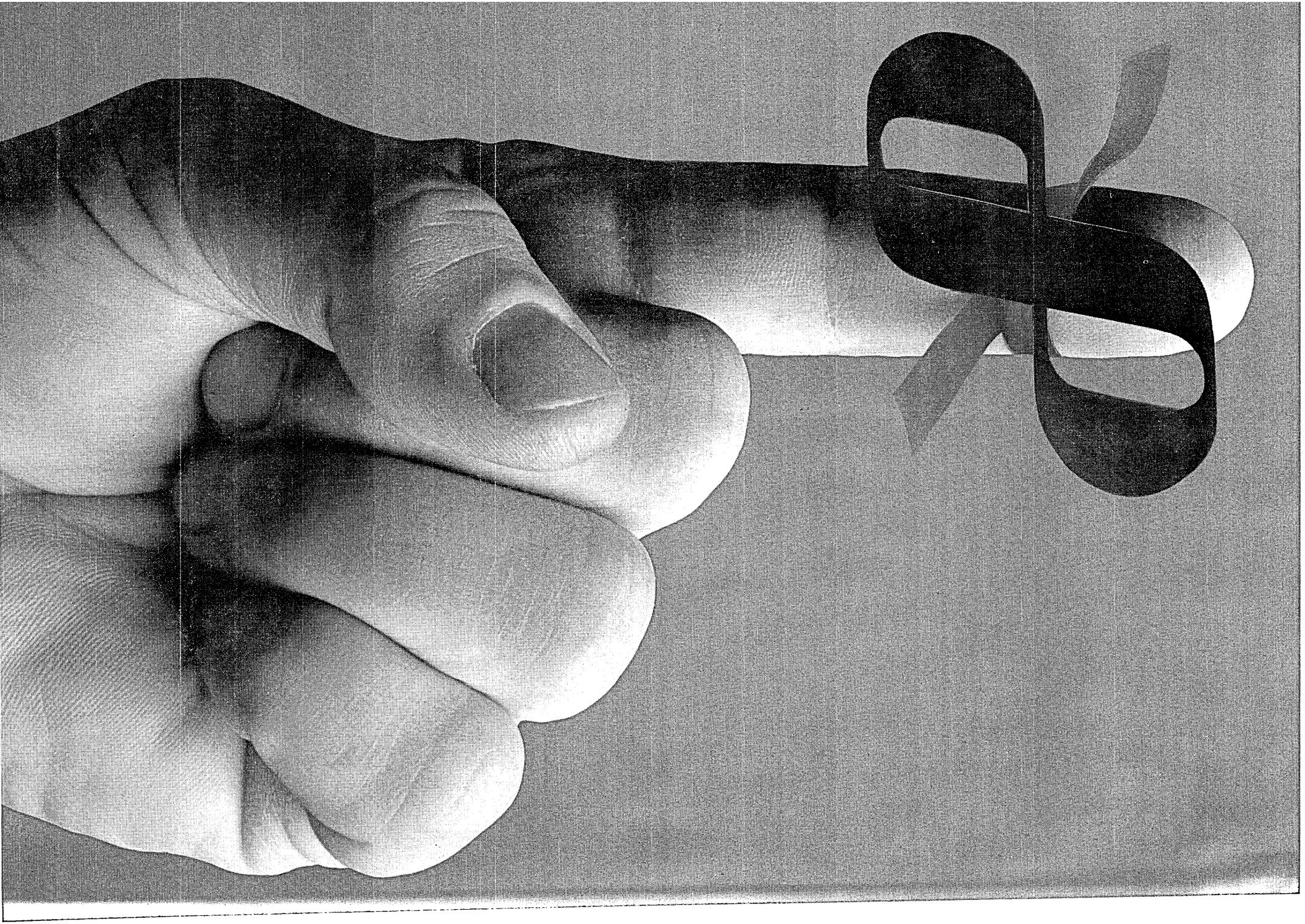
- the particular circumstances which must be present to realize the benefits of SNA
- the particular circumstances under which those benefits won't be attained
- the disadvantages, shortcomings, and limitations of SNA
- the increased capital, personnel, and equipment resources demanded by an SNA commitment
- the conversion and operating costs for SNA
- whether the availability, costs, and effectiveness of SNA products justify the conversion
- Alternative non-SNA methods to achieve SNA's benefits.

IBM is not in a position to guarantee —nor even determine to a high degree of confidence—critical SNA characteristics like host computer resource requirements, channel utilization, or terminal response times. If IBM won't, or can't, tell the user these things, how can the user justify paying IBM to be allowed to take the risk?

Further, even if the user's benefit/risk analysis shows that SNA is the best choice for him, he must then determine when to implement it—now or in several years when most SNA performance unknowns have been discovered?

IBM's Systems Network Architecture is the kind of a plan that is needed by the data processing community: IBM, the users, and the independent manufacturers. SNA's potential benefits are substantial, especially to users who have chosen to restrict themselves to only IBM products—users who have had to endure many problems that SNA intends to correct.

But SNA's actual cost and performance will remain an uncertainty for several years. IBM and the user community now need several dozen pioneering firms with large, high volume teleprocessing systems, as well as resources and patience, to discover and eliminate SNA's design and development shortcomings. Until that point is reached, other potential users cannot



Forget it.

If a line of line printers gave you dependable, economical operation and remarkably clear print quality, you could plug one into your system and forget it.

Dataproducts is that line.

Our 2200 family of Line Printers is worth remembering.

Forget the 2290.

If you want a cost efficient 900-LPM printer designed to meet the requirements of the new high-performance minicomputer based systems, remember to specify the Dataproducts 2290.

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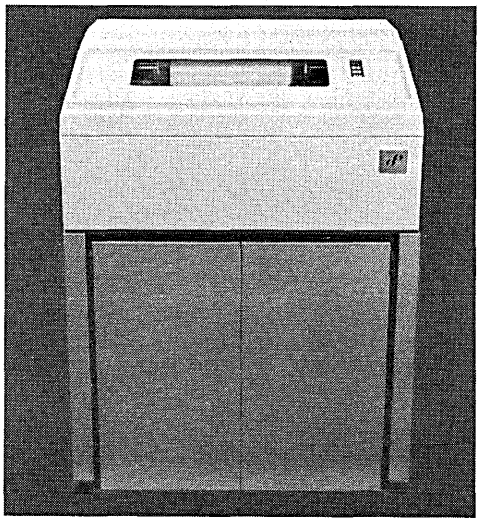

Forget the 2260.

If you want high-quality medium speed impact printing (600 LPM), ideally suited for small computer systems and terminals, you want our 2260.

Specify it by name.

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Forget the 2230.

If you want the industry standard low-to-medium speed (300 LPM) printer with the lowest life-cycle cost of any printer in its range, specify the Dataproducts 2230.

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Every member of the 2200 family of Line Printers is interface compatible.

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SNA

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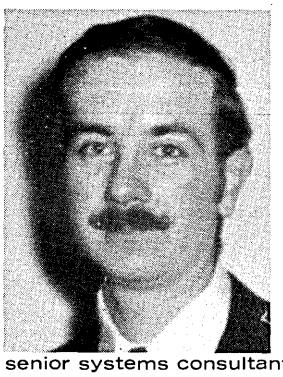

As a senior systems consultant for Rehab Group, Inc., in Arlington, Va., Mr. Moulton is presently responsible for a data communications network design study being performed for the Immigration and Naturalization Service. During the last five years he has designed and evaluated data communications systems and networks for several federal agencies including the Environmental Protection Agency, the Internal Revenue Service, the National Aeronautics and Space Administration, and the National Weather Service.

He had previous experience as a system engineer and project manager at Sanders Data Systems, Inc., where he worked on the development of intelligent terminal systems and front-end processors.

Mr. Sander has held senior technical positions in the data communications industry as a vendor, consultant, and user. He previously spent five years with Sanders Associates and its subsidiary Sanders Data Systems, Inc., dealing with large systems of programmable displays and communications processors. His other experience includes working on the design of large online systems as a senior technical staff member of Arinc Research Corp., and being responsible for technical specifications of networks while working for COMTEN, Inc., a manufacturer of communications processors.

Now employed at a federal organization that is a heavy user of IBM equipment, Mr. Sander is responsible for the design and operation of a network which has several hundred terminals and multiple large 370 data centers.

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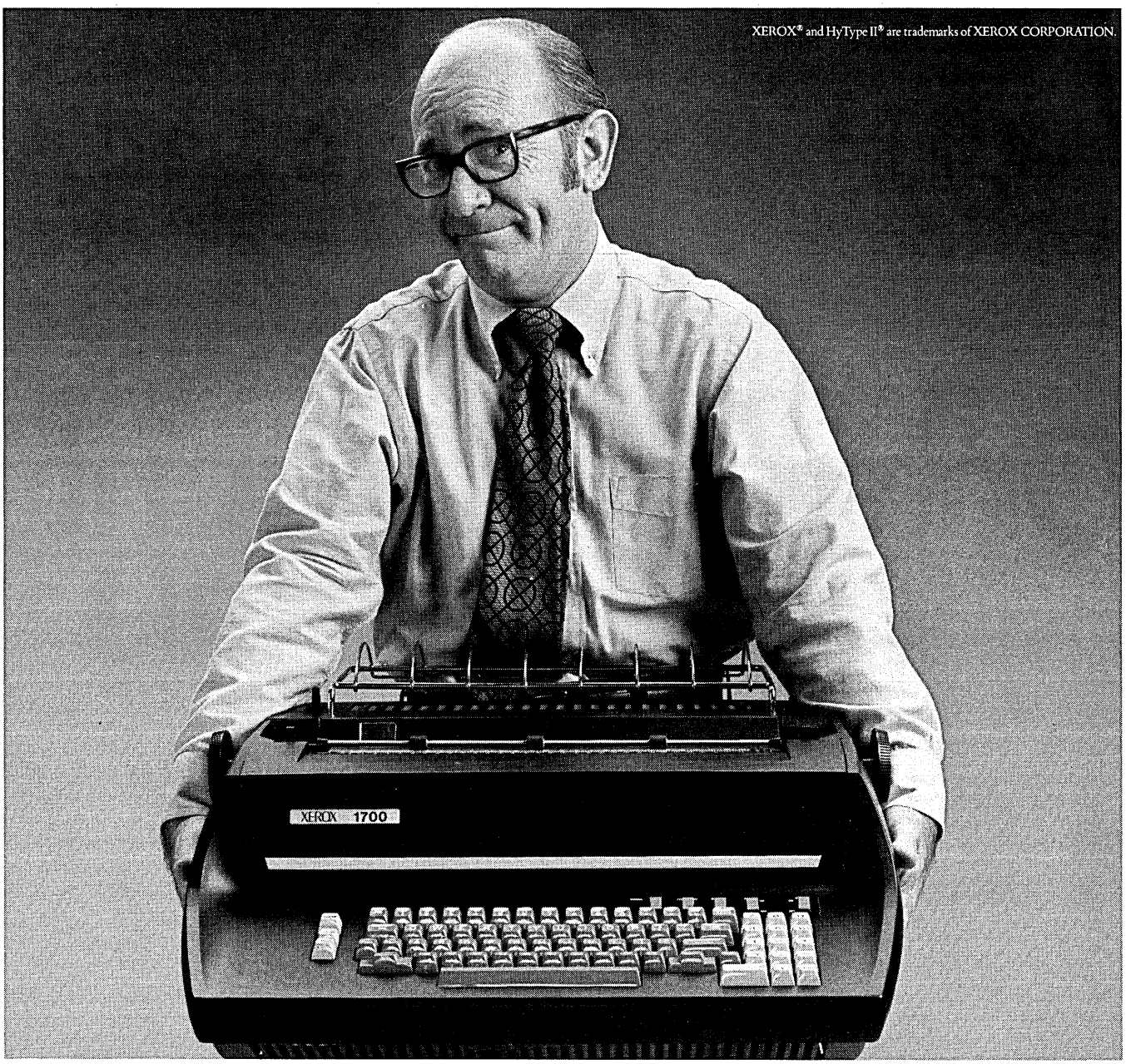

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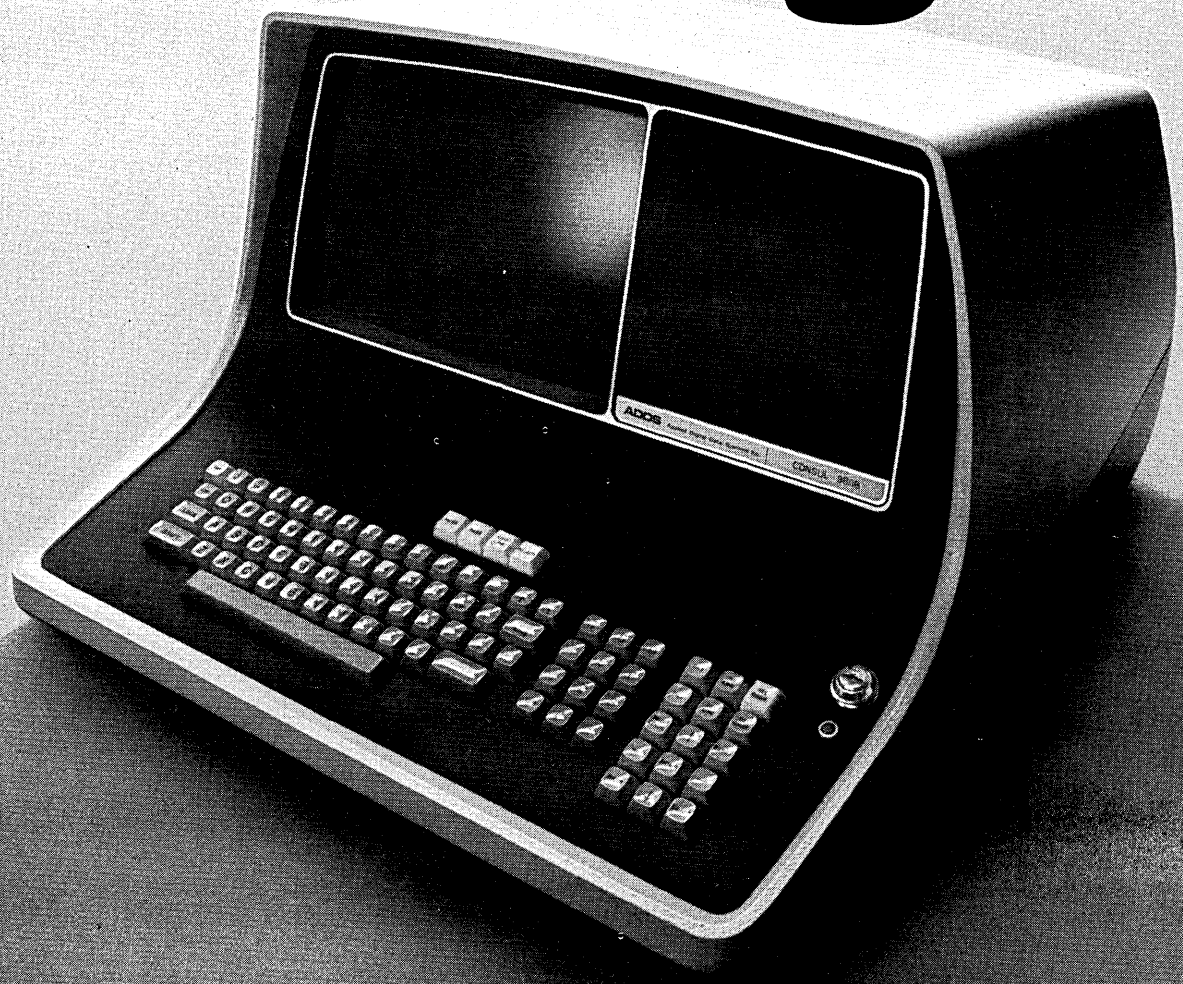
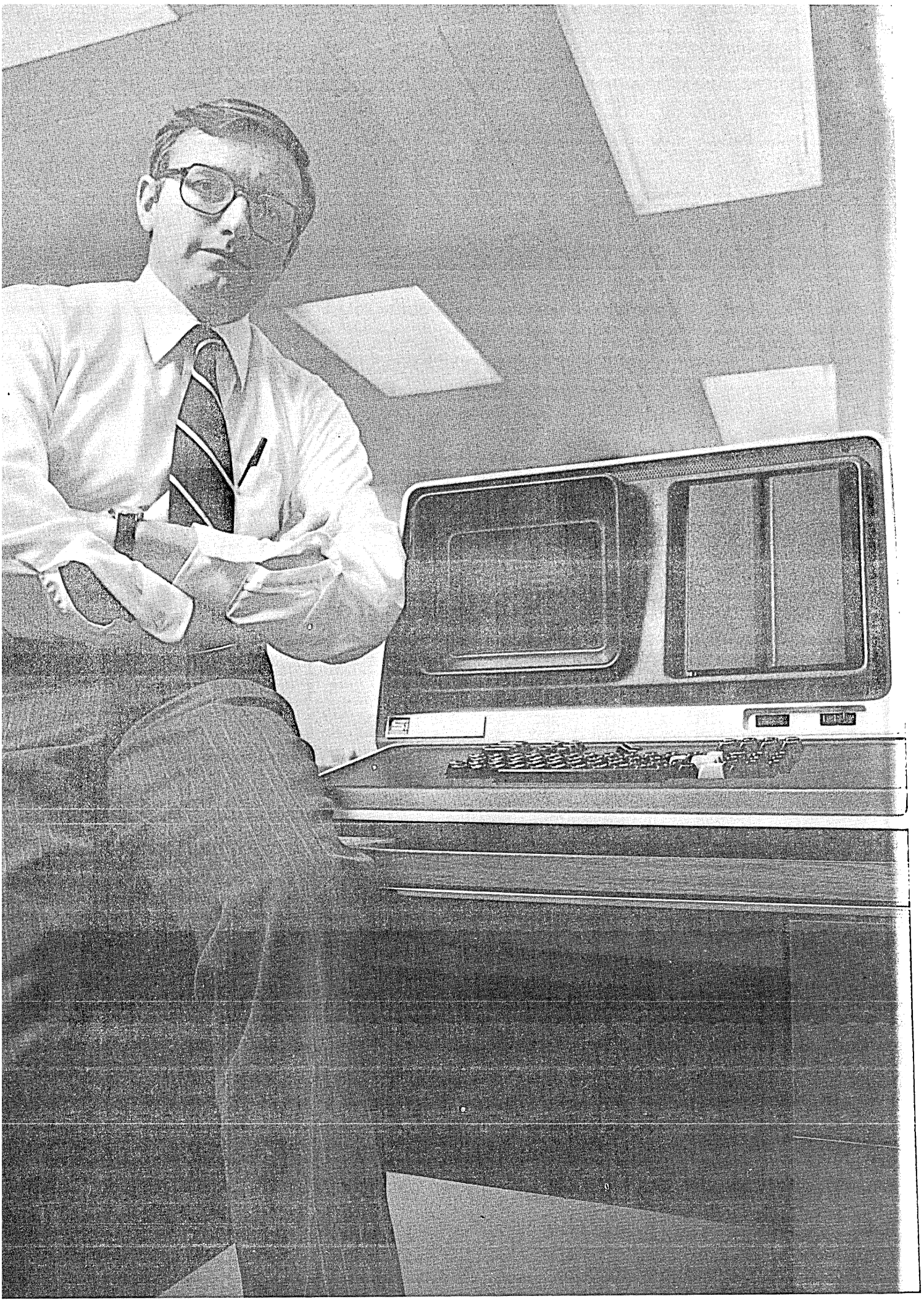


ADDS CONSUL 980B

CIRCLE 11 ON READER CARD



"Sycor 350 terminals perform the edits and checks we used to do on-line. At a fraction of the time and cost."

Jack Robinson, Asst. VP
State Street Bank of Boston

State Street Bank & Trust Company of Boston is one of the largest custodian banks in America with over 125 portfolios totaling some $20 billion in assets. This includes serving as custodian bank for mutual funds whose assets represent 30% of the entire domestic mutual funds industry, as well as variable annuities, pension funds, and college endowments.

Each day, the custodian service department must report the net asset value of the mutual funds to the National Association of Securities Dealers for publication by the daily news media.

Getting this information out on time—and getting it out accurately—is vital. To do it,the bank depends on Sycor 350 terminals for processing over 500 daily portfolio and general ledger transactions.

Sycor picked for speed and economy.

"Our growth was placing heavy demands on both our on-line terminal network and keypunch facilities," notes Jack Robinson, assistant vice president. "Typewriter terminals were simply not fast enough to get the job done, and making improvements in the on-line program would have required a massive overhaul.

"The replacement of on-line terminals with Sycor 350 terminals took care of both problems. It also eliminated the need for nighttime keypunching which helped us save even more on operating costs."

The dual-flexible-disk Model 350 is microprocessor-controlled and has 16k bytes of memory.

Sycor terminals keep working when the CPU goes down.

"Every Sycor terminal has an independent microprocessor, so we have as many back-up systems as we do terminals," Robinson says. "If the mainframe goes down, we can still continue entering data.

"We currently receive 12,000 transactions per month by TWX, phone and mail. We enter the data on Sycor terminals and, at scheduled intervals, transmit it to our CPU. This gives us an on-line batch system that gets the job done economically and gets it done right. It's the best of both worlds."

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The Tough Ones.

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2. System Down—Disc Failure.
3. System Down—Repairing Hardware.
4. System Down—Restoring Data Base.
5. System Down—Software Failure.
6. System Down—Changing to a Larger Processor.

Lots of things change when you go "on-line." Mostly for the better. That's why this is the most important trend in data processing today. But the one area which concerns management the most is "What happens when the computer goes down?" It's a good question, and until Tandem introduced "NonStop" processing last year the answers weren't pleasant. Service is interrupted; that's bad enough. But there is worse news still. At the instant of failure, a transaction in process could be lost (or duplicated), a record being updated could be destroyed, or a pointer changed incorrectly could cause the loss of untold records. In short, loss of service is the surface cost. Loss of data base integrity is an even greater problem. Tandem's NonStop System, hardware and software, is the first top-down, designed-in solution to both these problems. To make it even better, we've designed it so it's easy to program, easy to expand, and easily the most efficient transaction processing system around.

1. System Down—Processor Failure.
Every computer will fail sometime. The bigger they are, the more often they fail. Tandem has replaced bigness with a unique multiple processor architecture. Workloads are shared by the processors under control of Guardian, the only NonStop Multiple Processor Operating System available regardless of price class. When a component fails, Guardian automatically reassigns both processor and I/O resources to ensure that in-process tasks including file updates are completed correctly. You decide the priorities; Guardian does the work. And no interruption of your "on-line" workload occurs. Restart is virtually instantaneous.

2. System Down—Disc Failure.
When one of your disc storage devices fails in the middle of a file update, unknown damage to the record, to record pointers, or to indices can occur. Enscribe, Tandem's NonStop Data Base Record Manager, ensures that the damaged record is restored; and, with our optional Mirror Volume duplicate file technique, that operation is continued using the back-up file. The back-up files are created automatically and are used by Enscribe to improve system response time. When the down disc is repaired so are its files, automatically, by Enscribe. You decide which volumes to back up; Enscribe maintains them, and no interruption of service occurs.

3. System Down—Repairing Hardware.
With any system, a hardware failure must be repaired. But only with Tandem can the system keep operating, right through the failure and through the repair, too. Tandem's Customer Service Representative can remove and replace any failed module in your system without interrupting service. The operators at terminals and the programs in process are totally unaware of either the failure or the repair. And routine maintenance, too, is performed with the system fully operational. This is one more unusual feature of our system, but without it, no system can truly be called "NonStop."

4. System Down—Restoring Data Base.
When a hardware failure occurs during file update in any "on-line" system which is not NonStop, there is every reason to question the integrity of the data base. Integrity of the data base is crucial. For this reason, elaborate procedures to maintain restart points and backup files are required in almost all "on-line" systems. Not with Tandem. Using Guardian and Enscribe, the Tandem NonStop System ensures that all transactions are completed correctly even if a processor, I/O channel, disc controller or disc drive fails during that transaction. Equally important, the system downtime normally required for "restore" and "restart" operations is eliminated.

5. System Down—Software Failure.
System software crashes are an important source of downtime in ordinary on-line systems, but not in Tandem installations. Because all Tandem software is designed and tested to run in a multiple processor environment, it is also designed and tested for failure modes never considered in single processor systems software. Most important, the use of independent processors, each with its own memory, assures that a software failure in one processor cannot cause a failure in a second processor or contaminate the data or programs executing in that processor.

6. System Down—Changing to a Larger Processor.
On-line systems tend to grow, and as they grow they change. New applications, more stations, improved service; all of these result in a need for bigger, faster processors. With Tandem's NonStop System you can actually add processors, add memory, and add peripherals without any re-programming whatsoever. Using Guardian, Enscribe, and Envoy, Tandem's Data Communications method, all user programs and all files are geographically independent. They have to be for NonStop operation. You can also write your programs using a powerful high-level compiler for a multiple processor environment as easily as for a single processor.

7. System Up—Confidence Down.
When an "on-line" system is up, people come to rely on it. And because today's computers are reliable, people have come to rely on them quite heavily. Which makes it even worse when the system does go down, or the information it supplies is wrong. Confidence is severely damaged. And anyone who has tried manual back-up systems knows that they are not the answer. An automatic back-up, non-stop system is the answer. And Tandem has it.

Line" Data Base Systems System solves them.

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All transfers via DMA.

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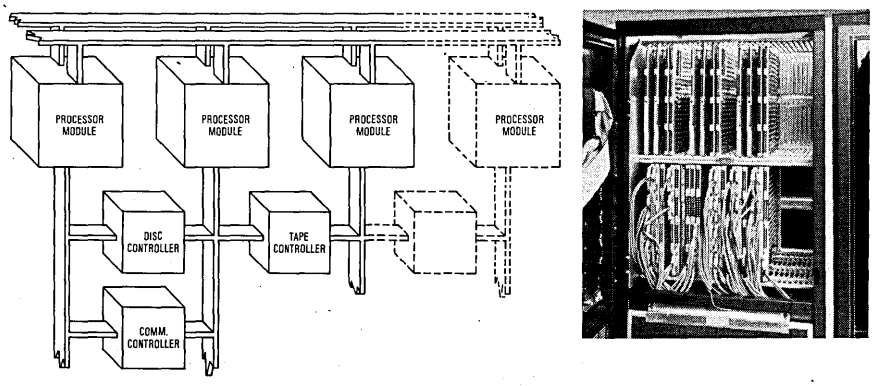
Photo and schematic show three processor modules with space for fourth module, interconnected to disc controllers, tape controllers and communications controllers.



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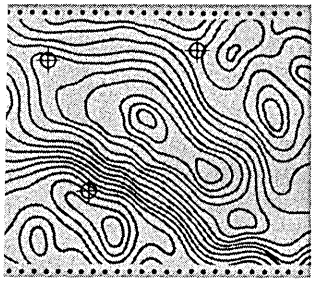

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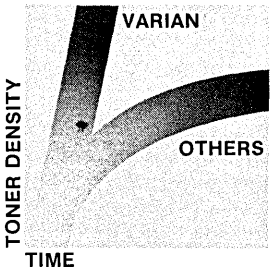
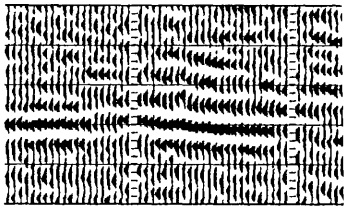


Next, the microprocessor: While serving many controlling and computing functions, this 2K X 8RAM* also serves as a buffering memory to counter the "asynchronous" actions of a CPU. This then benefits the user by further smoothing out the complete output-to-document cycle as well as dramatically reducing the "gray bars"*.



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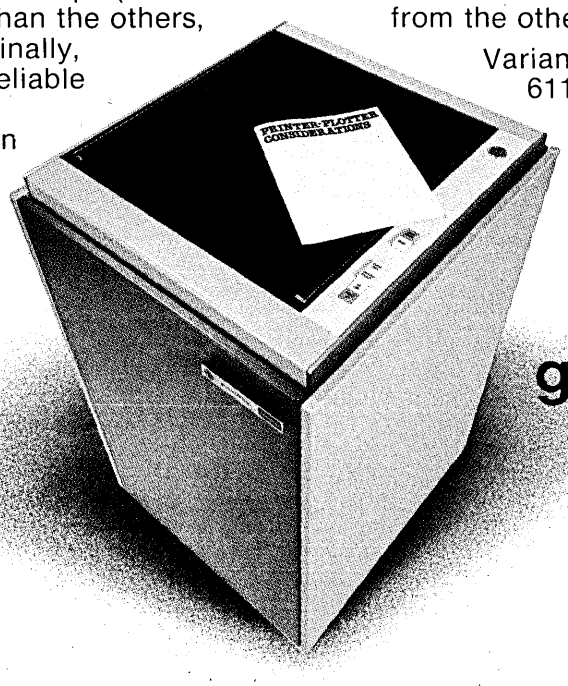

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Issues in Centralization

by Carl H. Reynolds

A look at the tangible and intangible factors. The question of economy of scale, as it relates to the computer equipment itself, has disappeared.

The question of centralization-decentralization of computing resources has been under intensive study for five or ten years. Three economic considerations must be evaluated:

1. Personnel required to operate the hardware
2. Data processing applications programming efforts
3. The computing hardware

With respect to operations personnel, there usually is an advantage in centralizing the work done in support of the machine. Staging jobs, handling tapes, processing output, are all tasks which have built-in overhead. For example, we have to have at least one person there for a whole shift, even if he is needed only sporadically. I contend, however, that this is more a function of the means of processing than an advantage of centralizing the facility. As on-line processing comes into greater use, the operator expense will be less and less a factor in the centralization-decentralization decision.

Another factor works against centralization. In the small installation, it is relatively easy to have individual persons perform multiple tasks. For example, the supervisor can run the tape library and, as needed, assist in mounting and de-mounting tapes and/or loading or unloading printers. In large shops, these activities become more and more specialized. Personnel become rigidly assigned to tasks. Work rules develop whether or not one is unionized, which prevent one class of worker from carrying out another class' tasks. Benefits from saving operations personnel do not seem to me to be a major issue in deciding the centralization issue.

When we centralized operations at Hughes Aircraft Co., we assumed there would be a major savings in applications programming. Hughes is comprised of a group of engineering and manufacturing elements, all of which have, theoretically, the same data processing problems to solve. Products must be designed, documentation must be released to the factory, materials and parts must be purchased, products must be fabricated and assembled, and the goods must be shipped. If one could have just one production control system, one purchasing system, and one order status system for all factories, the costs of development and maintenance could be cut two or three times. In fact, we estimated that the costs could be cut by a factor of two, and that more than $1.5 million per year would be saved by the development and installation of such "common" systems.

Not always feasible

This common system approach is reasonable for financial systems. The accounting department at Hughes, while reporting to individual line management, nevertheless has many common objectives and practices. They all use the same chart of accounts, for example. Accounting also is constrained by legal regulations, reviewed by outside auditors, and has a long, well documented tradition. This has led to most accounting operations using the same basic dp systems. Individual differences are accommodated by special data entry and output reporting programs. The dp requirements of engineering and manufacturing, however, are quite different. There are two reasons for this. In the first place, what is to be done by the computer, or even by the underlying production control or engineering support systems, is only beginning to be codified and taught.

Furthermore, production and engineering dp systems are part and parcel of the very fabric of everyday work. There is really no such thing as a weekly or monthly or overnight kind of cycle. All of those production and engineering people and all the systems that support them work in the here and now. In a very real sense, batch processing—historically developed in support of accounting—is totally inadequate to be a real help in manufacturing and engineering. It is in these very areas that time-sharing, hand calculators, and on-line systems have had the biggest impact.

The task of controlling a job shop that produces one or two items to individual order is a lot different from controlling a production line which produces thousands of a single item. Finally, a production control system is the embodiment of the management control system imposed by the factory manager. This product development and manufacturing system, which includes the discipline of engineering data control, varies with the managerial style, sophistication, experience, and desire of the management of the operation. Therefore, the data processing system will vary from factory to factory, and we have been unable to make any great progress in developing "common" systems in the manufacturing and engineering areas.

Do what they want

We've come to believe that it is more important to do the job the people want than to save the money that would accrue in programming only one system. Data processing is a small part of the cost of the information

system it supports.

The charge for keypunching the data, printing the checks, maintaining the employee records, and tax reporting is approximately 18 to 20 cents. If we add to that the cost of the department which administers the payroll system, the price goes up to something like 33 cents. And if we include in these costs the secretaries, timekeepers, and supervisors who keep track of things at the local level, I suspect we would have to add another 10 to 15 cents to each check. (This local work is required in part because the big, batch corporate system doesn't give back its answers for several days or even weeks after the data is sent in.)

Here are some examples.

In one instance data processing is only four or five percent of the total cost of purchase orders. In another, one of our material control operations purchases, stores, and disperses items necessary for engineers to do their development task. This involves building bread boards, prototypes, and the like. Of the $2.3 million spent each year, about $400,000 is spend on data processing.

The point is that we are not out to minimize data processing costs, or at least that it is not the most important thing to worry about. The most important thing is to work on 33 cents for payroll checks. I have found that it is indeed true that making systems fit the special requirements of the individual organization is considerably more cost effective than trying to change the organization to fit some data processing operation. This is true even in cases where programming itself is quite expensive.

In summary, applications programming is an issue in centralization only to the extent that the management of the supported organizations is really centralized. The rising cost of programmers and the growth of packaged programs is quite another issue, which cannot be addressed here.

Importance of hardware

Finally, and perhaps most importantly, is the nature of the hardware Raw computing and high speed on-line

A Machine Isn't Better Because It Costs A Million Dollars

From a perspective of 1969 or 1970, you could do yourself a big favor by getting a 370/165 if you had sufficient work for more than one 360/65. Fig. 1 is a picture of the performance per unit price as the function of absolute performance of the IBM 360, 370, and "375" lines.

Taking a 1969 perspective on this data, we can see that the 165 was better than twice the absolute performance of the 65 and twice as cost effective. The 155, while about 25% more cost effective than the 65, was about the same in absolute capacity. It is pretty clear then, that in 1969 or 1970, if you had sufficient work for more than one 65, you could do yourself a big favor by getting a 165.

Let's take a look at the present, however.

If again you needed to increase your capacity, it's apparent that the 168 is not a whole lot more powerful than the 165 and is no better at all in price performance. The chart information actually favors the large machine because the data is heavily dominated by cpu performance, not I/O performance. The larger the machine, the less effective or efficient becomes the I/O. This is especially true above the 145, since all of the I/O devices are the same.

It is interesting to note several things from the accompanying chart:

1. The IBM 165 is as good a price performer as IBM makes, with the exception of its 168 attached processor, a very large, specially priced machine.

2. Two different evaluations of the Amdahl are both considerably better than the 165. The higher Amdahl estimate (IV at the 90 performance level in Fig. 1) is ours, and the lower estimate (IV) is IBM's. Note that the performance/cost improvement of the Amdahl over the IBM 370/165 is less than the improvement of the 165 over the 360/65. It is concluded that no current technology can achieve a jump equivalent to that of the 370 over the 360 line.

Big vs. small

Table 1 is an indication of the role of performance of some of the different machines which we've looked at. The Whetstone is an instruction sequence that's derived from the analysis of some typical scientific programs. It is really a measure of cpu performance. The Data General C300, the IBM 155, and the DEC-10 are all the same power on this particular application. They range in price from $100,000 to $1,000,000. While one can't draw complete conclusions from this, it is clear that price and performance are no longer

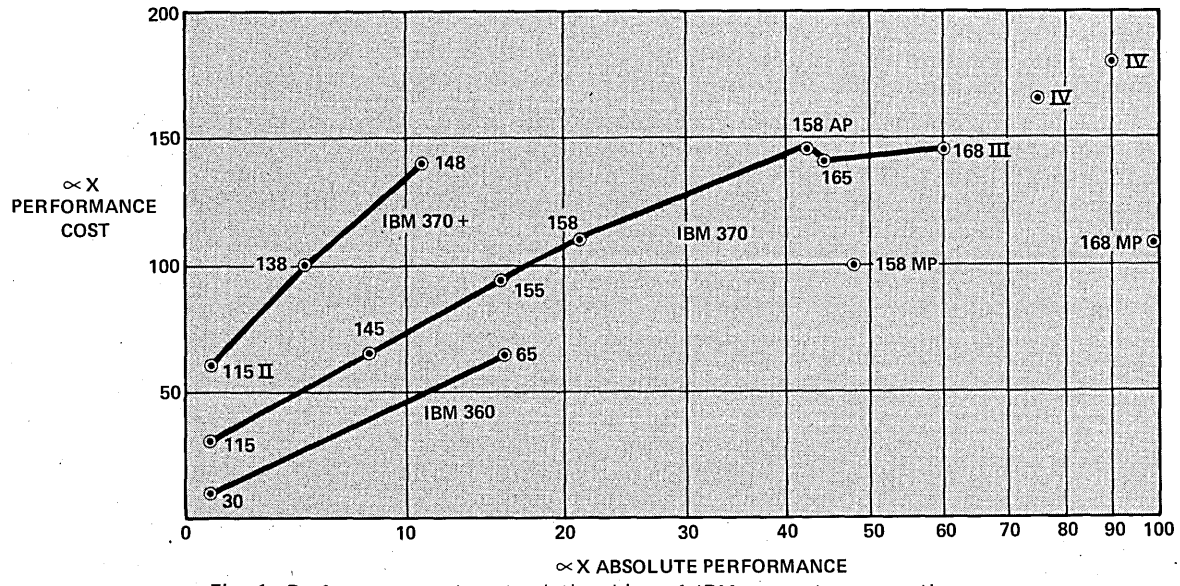

Fig. 1. Performance and cost relationships of IBM computer generations.

storage show, at present, no economy of scale. Off-line storage, disc, and probably tape still show better price performance in the large economy size. However, systems come in all sizes—$1,000 to $10 million at very nearly the same price performance. In the past two major factors influenced centralization of hardware and people in the computing business: the hardware which historically was cheaper the bigger it was; and hope that one set of programs could solve all requirements for particular functions. While the latter is still a hope, its validity is quite independent of whether or not the hardware and the personnel are centralized. That is, the package program approach is in fact growing and will continue to grow. It is just as applicable to decentralized hardware and operations as it is to centralized. Grosch's Law, however, no longer seems to hold. There is, today, no economic justification for lumping a lot of problems together to get a big machine. There is, rather, considerable evidence that if you misapply large machines, you're going to spend more money and do a poorer job than if you did them separately on small machines.

Complexity

The next major issue in centralization is the complexity of the large, modern data base/data communications system. With respect to complexity, there are really two forces at work. First is that in the IBM world, software has evolved over 10 or 15 years from original design premises, which are no longer valid. Too many new things were attempted prior to actual field experience, and too many people got committed to those early errors. A great many of today's complexities are due to the necessity of handling large volumes of batch work as it seemed to be back in 1960-1962. An indication of this complexity is shown (Table 3)—the allocation of memory to the various software functions. You can see that three million bytes out of six million are devoted to various kinds of operating and control programs. This is only resident space. Each of these areas has many times that much space reserved to it on disc or drum. The second element of complexity is the sheer size of the hardware and software. An idea of this is shown in Fig. 2, which does not include the teleprocessing network and equipment.

CORE MAP—DUAL IBM 165's		
COMPONENT/SYSTEM	S_1	S_2
OS	708	694
ASP	750	—
IMS CONTROL	530	—
ATS —	—	166
TCAM —	—	104
TSO CONTROL	—	128
USER	1084	1980
(TOTAL = 3064)		
TOTAL KILO BYTES	3072	3072

Table 3

Managing maintenance

Another major issue which must be addressed in large centralized installations is the management of maintenance. Size brings functional specialization. Size also means isolation and the inability to see the total situation from any one place. The result is that very specific management effort has to be directed to integrating these specialities to yield effective maintenance of the system. In our paper in DATAMATION (November 1975, p. 106), Jack van Kinsbergen and I discussed how we go about this. We have trouble logs; every failure is recorded; a group of two or three specialists spend full time tracking down the cause of each system failure. This is not to say that in the small shops one need not worry about such detailed tracking. It is to say that it is easier in a small shop to assess whether or not the level of reliability is adequate to the task. The man in charge of a small shop knows those things. Software and hardware is less extensive, so he spends less time chasing down the bugs. The impact, the remedy, and the effectiveness of operation are more easily visible in the small shop than a large one.

We have found in many cases that certain bugs are not completely defined for weeks after their occurrence. There are other bugs which occur once and never occur again. One cannot afford not to keep track of these in a large

SOME ROUGH COMPARISONS—BIG VS LITTLE			
MACHINE	APPROX WHETSTONES/SEC	APPROXIMATE CPU PRICE	APPROXIMATE PERF/ APPROXIMATE PRICE
IBM 165	1440	$1,800,000	0.8
IBM 155	400-500	$1,000,000	0.4-0.5
DATA GEN C-300	500	100,000	5.0
HP-3000 II	250	100,000	2.50
HP-2100	76	11,000	7.00
DEC-10	500	200,000	2.50

Table 1

directly connected in this business. It is erroneous to assume that the 155 is a better machine for all applications just because it costs a million dollars.

The figures for the HP 3000 are for the Model I. The Model II HP 3000 is two to four times the Model I, and thus in the same ballpark as the Eclipse (C300). The fact that you must be careful and thorough is shown by the HP 2100, which only costs $11,000 but performs at a performance divided by price of seven, the best on the page. There are a lot of other things to consider too, like elapsed time, and total I/O load.

Table 2 gives you some indication of the reasons for this equivalency of capability regardless of the size of the machine. The top part shows memory costs for a variety of equipment. Memory costs used to be around $1.55 per byte (1969-70), and they today range from 9 to 27 cents per byte. Today all these memories are made the same way, by use of semiconductors and large scale integration techniques. In fact, the memories seem to be the same in all machines whether large or small. It's just a matter of how many chips you put together.

There is one thing which does change with memory size, however, and that is disc storage. As we can see, in quantities of 100M bytes or less, the memory seems to cost $400 to $500 per million bytes. When one gets up to the several hundred million bytes, the price drops to around $100. Note, however, that this is just a factor of four at the very outside, not factors of 10 as we were looking at in the other chart for cpu's. It is interesting that the cost of a floppy for the minis—a mini floppy from Shugart Associates—is about $395 for approximately 100 kilobytes. In this case, the cost is $4,000 per megabyte or an order of magnitude more expensive than on the large machines. On the other hand, you're talking about absolute cost of only $400. ❋

COMPONENT COST		
MACHINE	DISC $'s/MB	MAIN MEMORY $'s/B
IBM 360 - 65	1081	1.55+
IBM 360 - 165	446 - 274	0.52
IBM 360 - 168	224 - 126	0.27
HP 3000	404	0.09
DG C300	242	0.12
MICRO'S	$4000	.05

Table 2

THE TRUE VALUE OF YOUR 360 CPU IS IN MEMORY!

For example . . . today's cost for an IBM 360 is about 25% of the current price for an add-on Memory. This does not mean that you should put your 360 out to pasture. Far from it. Your 360 is a very enhanceable CPU and Standard Memories has a better idea . . . SMART® Systems. The simple addition of the Standard SMART® compatible Core Memory can give your basic 360, regardless of Model, an entire new generation of life expectancy.

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MODEL SM 500
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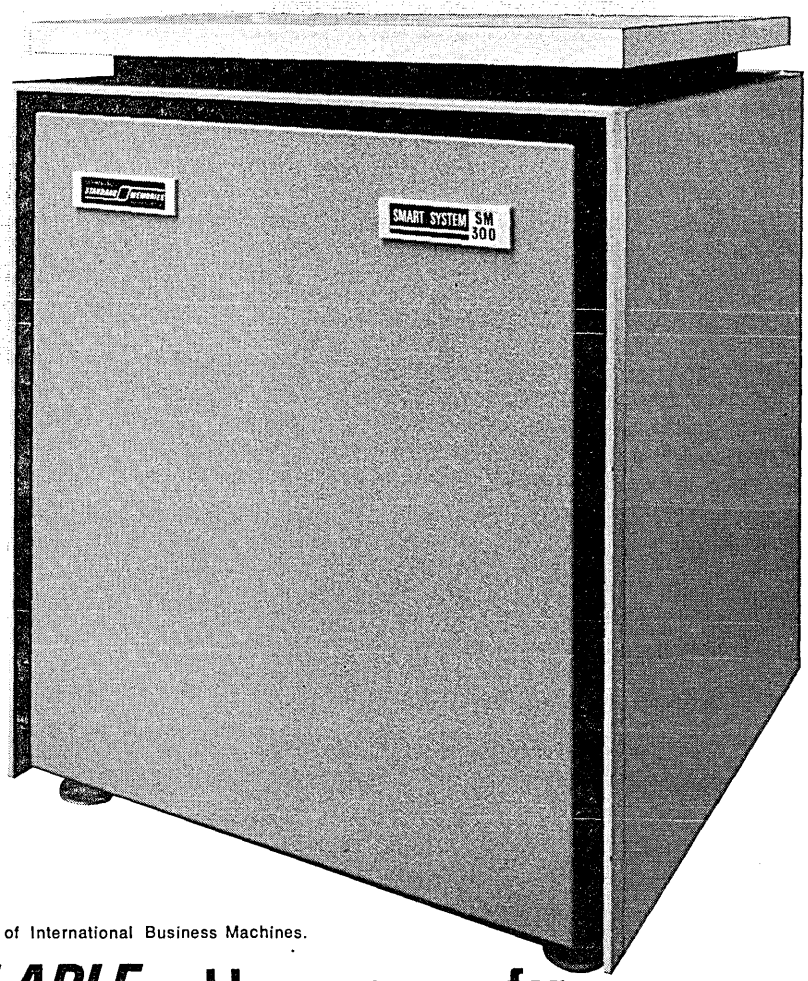

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Los Angeles Convention Center—April 5–7
Cleveland Convention Center—April 19–21
Minneapolis/St. Paul, St. Paul Civic Center —April 26–28
Chicago, McCormick Place—May 3–5
New York Coliseum—May 10–12
Philadelphia Convention Center—May 24–26
Washington, DC, Sheraton Park Hotel —May 31– June 2
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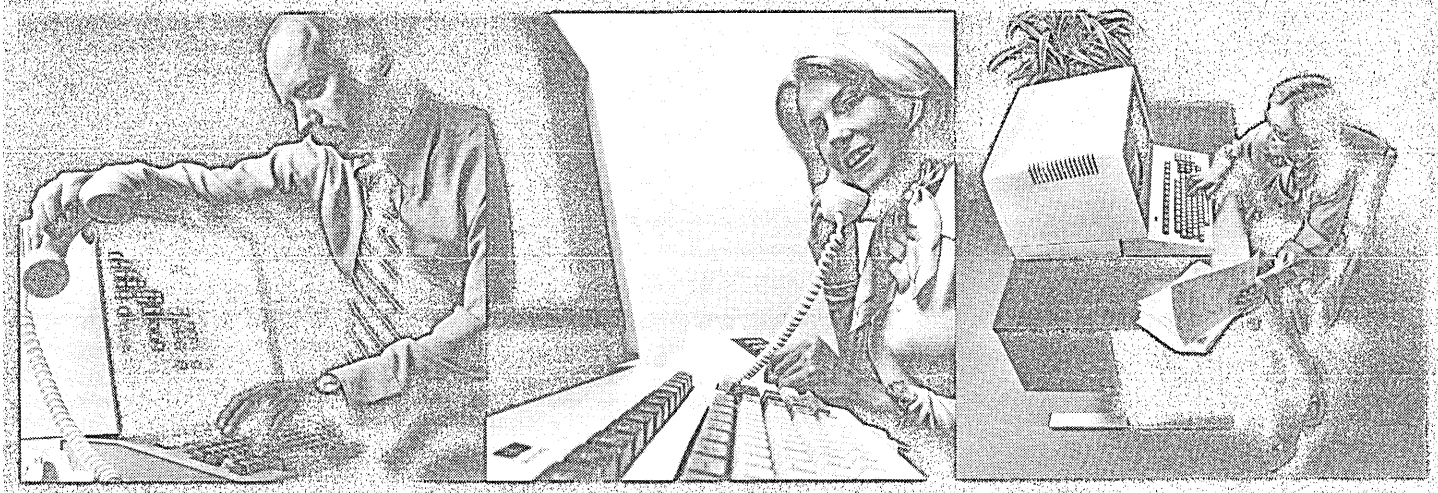
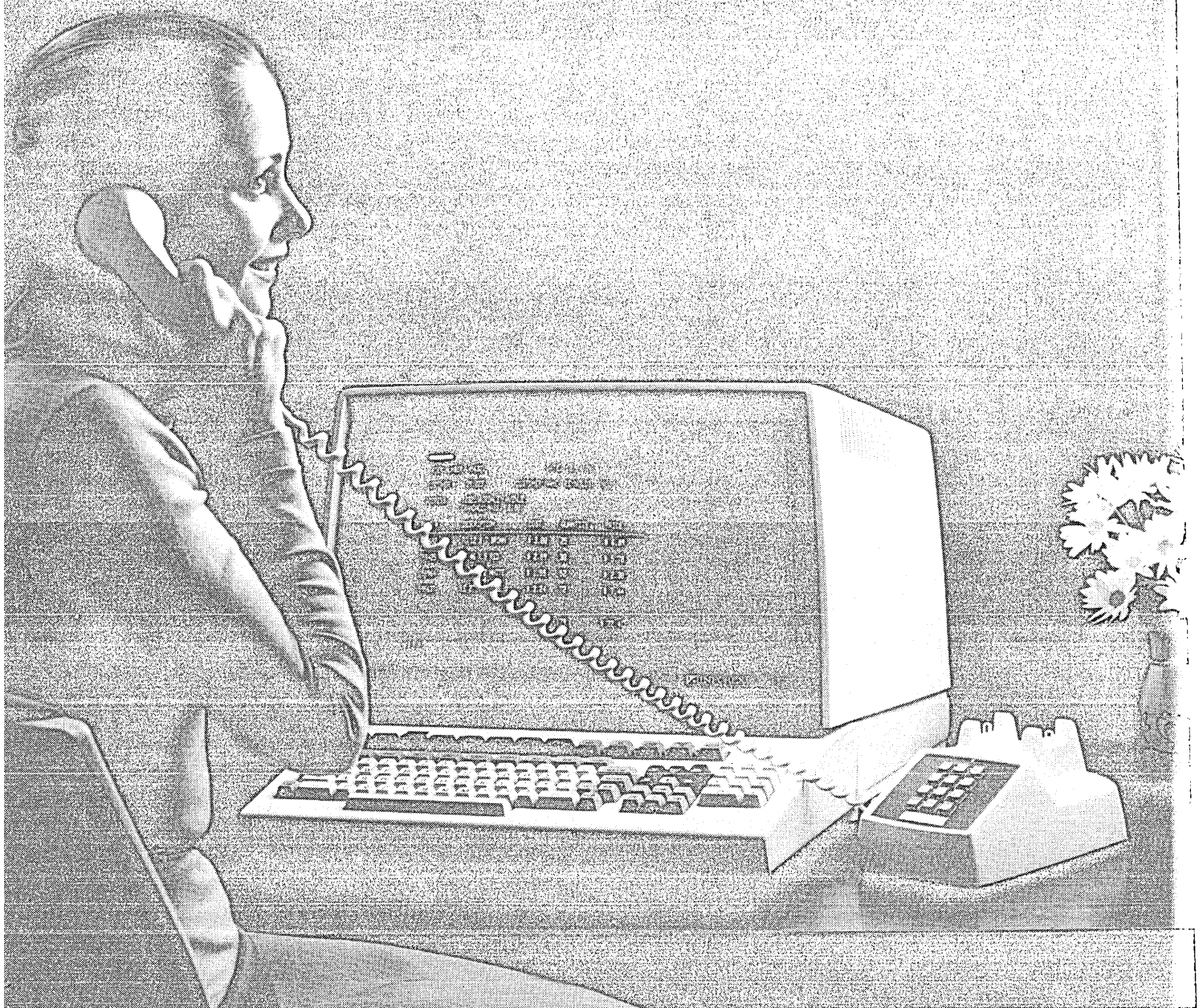




shop because of the large impact should the bug recur or turn out to be a permanent problem.

Impact of failure

The whole issue of overall effectiveness of the operation becomes clouded and complicated. A large, general purpose industrial installation serves a multitude of users with a wide variety of services requiring a whole set of disciplines. We have almost no personal, direct knowledge of what the users do with our services, or what the impact of partial and total failures of one or several of the services has on the company. As a result, we must have elaborate procedures for measuring performance. For example, we record the timeliness of every single report and group of reports out of our company. This is a good idea in any shop, but it takes on an added complexity in a place of our size. It even becomes difficult to know whether these facts are correct. Events occur on second shift in a variety of locations for a variety of users. Many hands are used to gather performance data. Therefore, we must check even the reliability of our performance recorders. In a smaller operation, dp is closely coupled to the needs of the group it serves, and the effectiveness of dp is much more easily judged.

Motivation

A major issue in centralization is motivation of the organization: the data processing people, the personnel using the data processing, the company management. In 1970, when Hughes decided to centralize, I discounted the warnings of several users that our dp organization would not be responsive to their needs. I had set up a pseudo-profit center. We would have to "market" our services to the users. If we did not satisfy their needs our organization would be eroded. Now, however, I recognize several flaws in my plan. First, the central dp organization is not really a profit center. Most of our business is captive; we know it and they know it. That knowledge lets us use daytime resources to return production systems that failed last night—even though that disturbs the open shop daytime users. Another example is that the production users are stuck with the costs of reruns. Thus we are not a separate business, and our people are motivated by things other than user happiness.

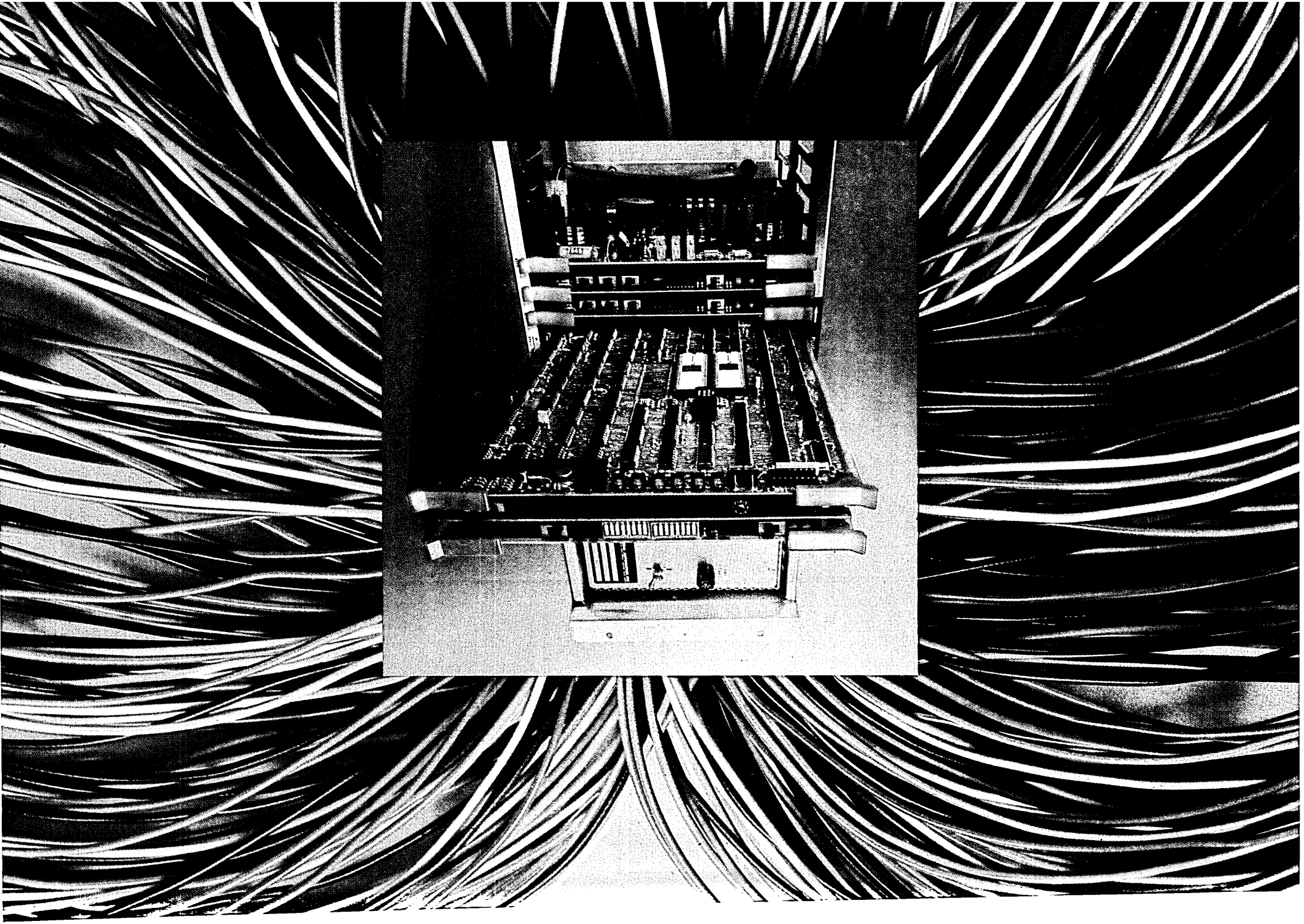
Some examples:

- Systems programmers rarely see a real user, and most never see the results of computing on a user organization. This isolation, plus the difficulty of their task, leads them to be motivated mostly to build their specialty. Vendors subtly encourage this. "Keep your resume updated by getting all the latest versions of the software," says the salesman, in effect. "I know it's not debugged, but think of the knowledge you'll gain debugging it for us. Your skills will be in even greater demand."
- All dp shops have procedures. All dp shops break the rules when the "situation warrants." We understand dp reasons for breaking procedure, but seldom are sympathetic to letting problems in other areas of the business influence our rules. "I cannot put that change in without a department manager's approval. It's not our fault he didn't do it yesterday before he got sick." You all know the problem.
- Priorities can be looked on as motivation dependent, too. Suppose you've had a serious overnight problem and the finance systems must be rerun to get the billing out. Suppose a series of open shop computer runs is needed to complete a proposal for a new contract? Which should get priority? Actually, only the general manager could make that decision.

An example of the problems with user motivation, or perhaps a parable, illustrates the impact that the inability to make choices has upon users. Some time ago, my wife had some difficulty with the phone company, and had been given the treatment that, "Well, that's the way it is because that's the way it is and we're not going to do anything differently." When I got home from work she was quite upset by this and carried on for 15 or so minutes blaming the telephone company and saying she'd do anything if she could just find a way to get along without using their blankety-blank services at all. I said, "Gee, you sound just like one of my users when the service goes sour."

As long as someone has no choice in the matter you can always expect that he will be dissatisfied with that service. If a user selects an alternate vendor, then he will tolerate a lot more failures on his part than if he is forced to pick the in-house supplier. It may be wrong, but, unfortunately, it's true. The more certain the user can be that the dp personnel are measured by the performance of his business unit, the more satisfied he will be with the level of service.

The interesting thing to watch, which is not often considered, is the line management of the user organizations. Management, in general, is not terribly enthusiastic and interested in data processing. They have many other interest-



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Competing against the world's best-known sources, General Automation was selected by these innovative corporations—*after* exhaustive analysis demonstrated GA's superiority in data communications technology.

There's not a minicomputer company today that can touch GA's capabilities: 3 protocol options including advanced SDLC. Full and half duplex, and simplex line operation modes. Line types: PSN, point to point, multiple drop. From 100 bits to 19 megabits.

Any volume, any speed, any type of line or protocol—count on GA to help carry your load. And you'll be in good company.

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For any type of operation, any volume, any speed—count on GA to help carry your load. And you'll be in good company.

☐ Please send information on GA's capability in distributive processing networks.

☐ Contact us for immediate consultation.
Tel: ( )_____ Ext_____

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Title_____

Clip coupon to business letterhead and return to General Automation, 1055 South East Street, Anaheim, CA 92803.

CIRCLE 62 ON READER CARD

CENTRALIZATION

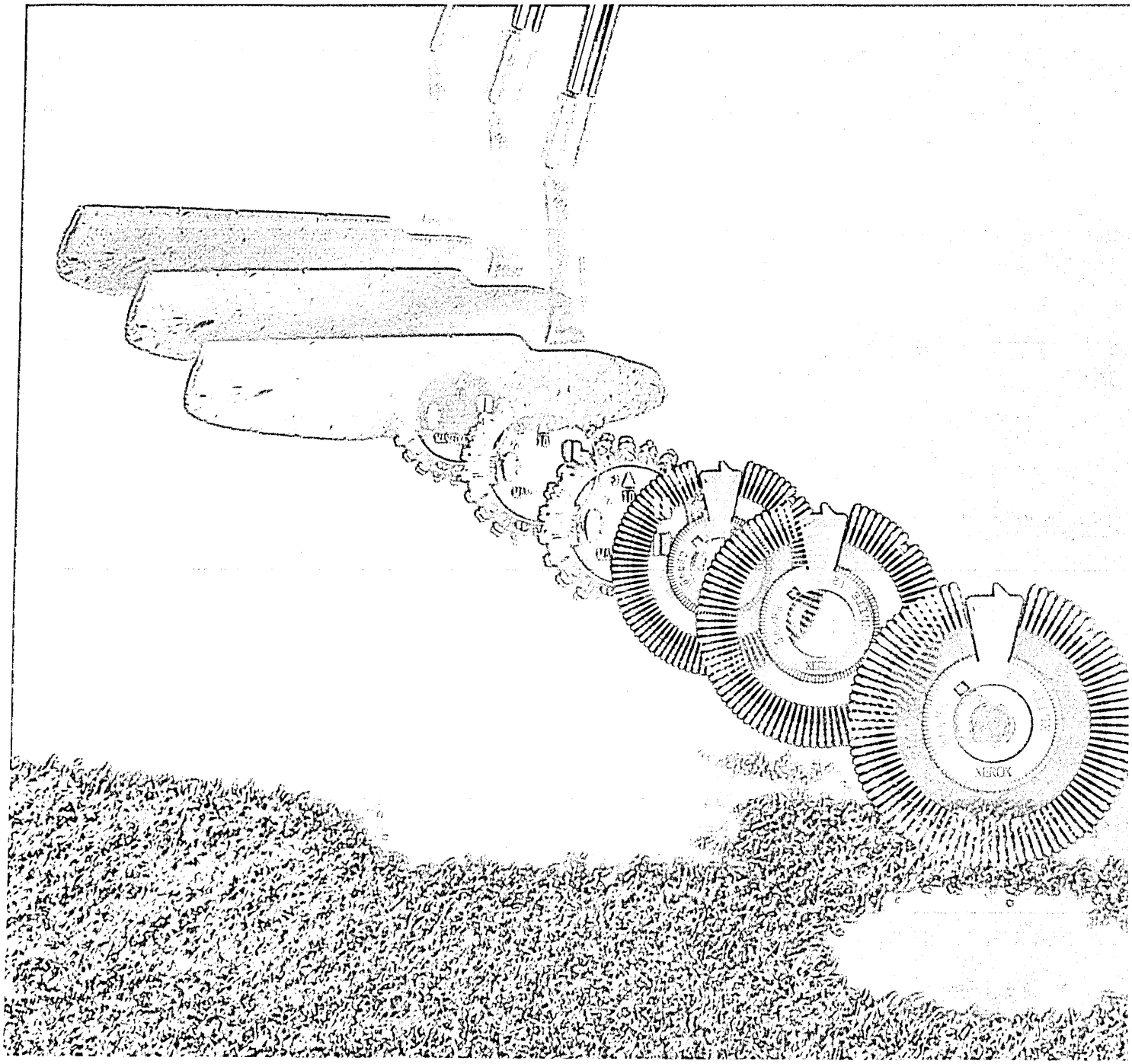
ing things to do—development, sales—anything but data processing. When the corporate management says the central data processing organization is "in charge of data processing," that is almost always interpreted by line management as "totally responsible." Nothing can go wrong with the information system—manual, automated, or even peripheral to the real system—that management doesn't look upon as a data processing problem. In fact, many system problems are outside of dp's control and even knowledge.

And there is the problem of resource allocation. Since none of the line management knows how much he's getting out of this corporate thing or how much he needs to do a good job, he is reluctant to spend resources on it. After all, corporate resources are limited. All line managers have more ways to spend money usefully than they have money to spend. All good managers believe they can spend dollars better than their peers. Thus the problem of resource allocation becomes one of "wait till disaster hits"—then reorganize dp.

Managing a big dp organization is a big task. It involves major resources, specialized skills, and management of complexity. The major motivation for taking on this task used to be computer economy of scale. That part of the scale economy which relates to the computer equipment itself has disappeared. Organizations will, therefore, be wise to reexamine their dp organizational direction in the light of current technical realities. ❋

From 1962 to 1966 Mr. Reynolds was manager of systems programming for the Systems Development Div. of IBM. His dp experience began at least as far back as 1952, when he was manager of the Analog Computer Laboratory at Goodyear Aircraft.

President of Computer Usage Development Corp. between 1966 and 1968, and of Kappa Systems from 1968 to 1970, he was appointed corporate staff director of computing and data processing for Hughes in 1971.



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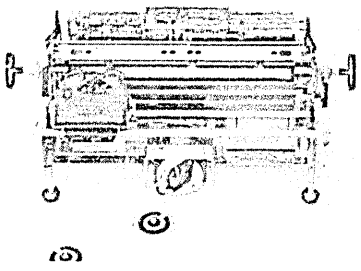

The Combined Resources Of Diablo And Xerox Replace The "Golf Ball"!

Diablo designed and delivered the first HyType daisywheel printers for Word Processing Systems. We have been better all around, ever since. Subsequently, our engineering, manufacturing and service facilities have expanded. We developed the daisywheel printer; we'll probably develop the next best printer! Until then, everything else is next best. We are the power behind power typing. You can rely on the combined Diablo and Xerox abilities to design, build and back high-speed high-reliability daisywheel print mechanisms. Call your local Diablo office or write Diablo Systems, Inc., 24500 Industrial Blvd., Hayward, California 94545 or Diablo Systems, S.A., Avenue de Fre 263, 1180 Brussels, Belgium.

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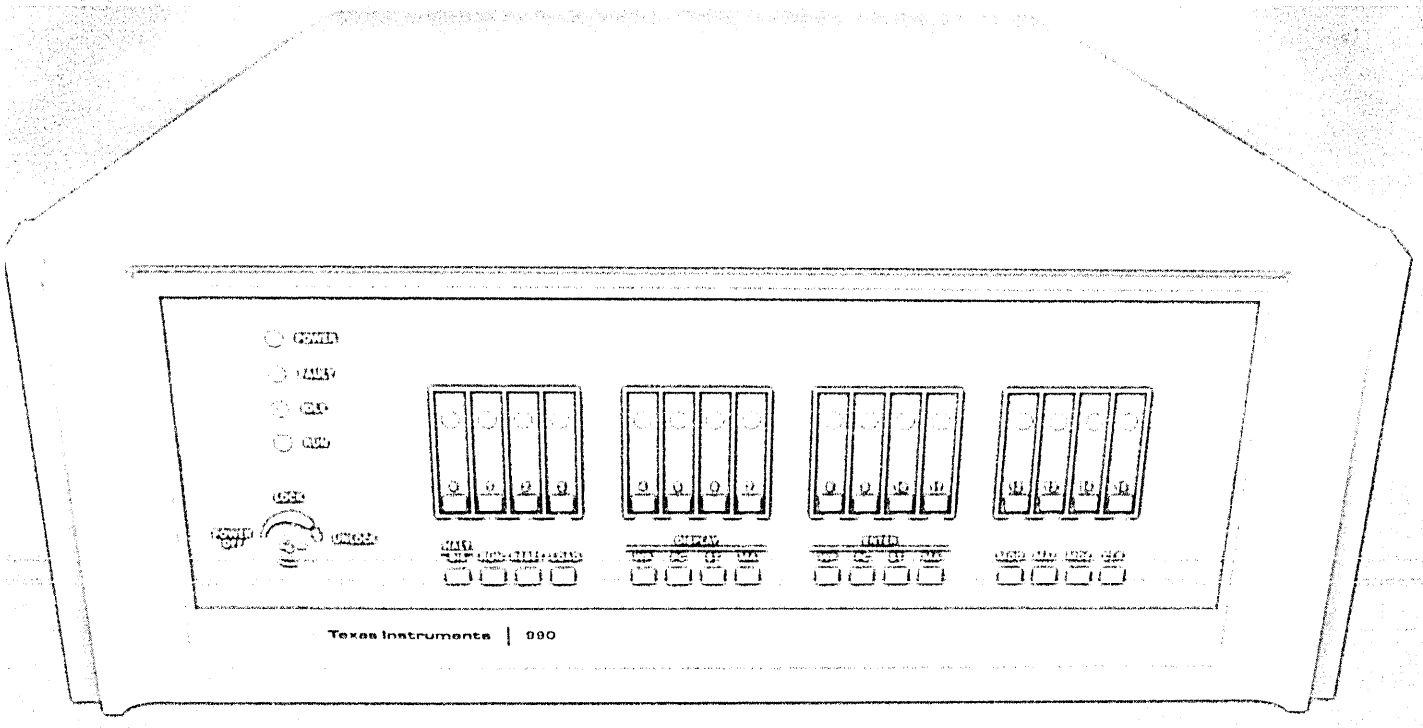
CIRCLE 25 ON READER CARD

990/10 OEM minicomputers.



Built, backed and priced to sharpen your competitive edge.

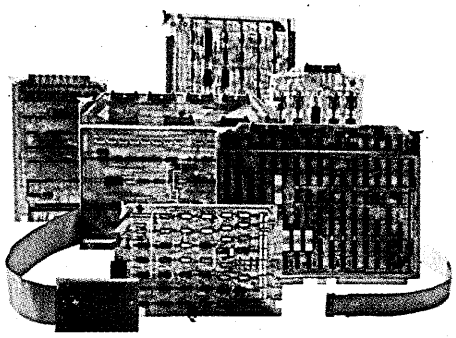
TEXAS INSTRUMENTS.

The 990/10 minicomputer from TI brings superior value to both you and your customers.

Starting with field-proven hardware, the 990/10 delivers the reliability you expect from TI. And all the off-the-shelf support you need for user applications. You get standard software languages, a broad choice of peripherals and nationwide service.

Built for more processing power.

The 990/10 is the most powerful member of the 990 computer family. Its architecture provides features that give you maximum processing power for your money. Like hardware multiply and divide. A 16-level hardware



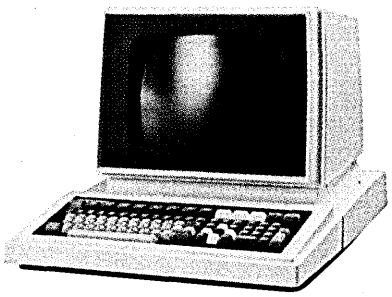
Peripheral Interface Modules

interrupt structure. 16 registers arranged in a workspace concept. I/O that's directly programmable through the Communications Register Unit (CRU) and autonomously through a high-speed data bus. And bit, byte and word addressing of memory.

Built for system flexibility.

In small or large configurations, the 990/10 design provides surprising flexibility for a small investment.

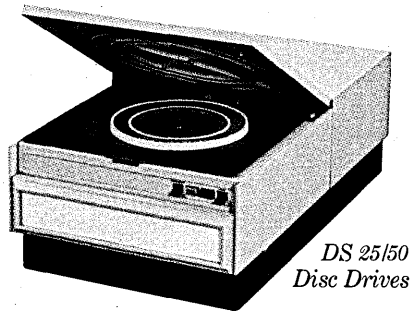
The CRU, with up to 4096 I/O lines, reduces interfacing costs by keeping controller complexity to a minimum. The TILINE* asynchronous high-



Model 913 Video Display Terminal

speed data bus can support both high- and low-speed devices and takes advantage of design simplicity for simultaneous data transfer between peripherals, the CPU and memory.

With the 990/10, you get a powerful instruction set with an extended operating feature that allows hardware to take over operations that software would normally execute. An optional mapping feature provides memory protection and memory expansion to 1 million words. And, optional error-correcting memory corrects single-bit errors for increased system reliability.



DS 25/50 Disc Drives

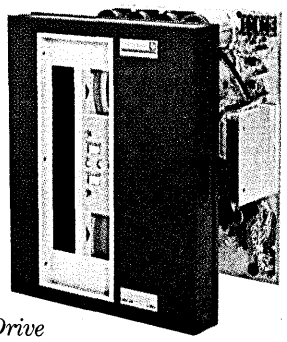
Full peripheral support.

As well as a range of standard peripherals, disc storage to 90 million 16-bit words and magnetic tape with 800 and 1600 bpi options are available for low-cost mass storage and back-up.

A choice of software.

With common higher level languages, FORTRAN IV, COBOL and Multiuser BASIC, plus the 990/10 assembly language, you have all the tools you need for an efficient application program.

Both the disc-based and memory resident operating systems give you modularity and flexibility for system generation to meet application de-



Model 979 Tape Drive

mands. We offer program development aids for creating and testing software, and communications software to support synchronous or asynchronous data transmission.

Backed with nationwide service.

Our responsibility to you doesn't end with the sale. We follow through with complete system training, plus a nationwide factory service network.

The TI 990/10 minicomputer. We build it, back it and price it the way you and your customers want it. You can start configuring a system now with our 990 Computer Systems Handbook on the upward-compatible family of the TMS 9900 microprocessor, 990/4 microcomputer and 990/10 minicomputer. For your free copy, send a letterhead request to Texas Instruments Incorporated, P.O. Box 1444, M/S 784, Houston, Texas 77001.

CIRCLE 39 ON READER

TEXAS INSTRUMENTS
INCORPORATED

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See Texas Instruments products at Interface '77 and Computer Caravan.

Hughes' low-cost C-9 display terminal makes a minicomputer work like a giant.

Here's an interactive graphic terminal that does with hardware what most terminals need software to do. It needs only a minicomputer or telecommunications coupler and a 110-volt outlet to give you a ready-to-work system. And it costs less than $10,000.

More for your money

The new C-9 terminal offers high resolution, selective erase, serial interface (standard), and several other features otherwise offered only by units costing almost twice as much—like 17-inch diagonal, 1029-line-scan, cathode-ray-tube video monitor with high light output screen for easy daylight viewing....computer independent zoom and pan....a joystick for graphics and alpha-numerics interaction....a hardware graphic processor for scaling and rotating graphics and alpha-numerics.

The architecture of the terminal embodies a micro-processor driven by micro-programs contained in read-only memories. A serial interface connecting the detached keyboard to the CRT display eliminates restrictions imposed by parallel interfaces used in other models.

Optional features

You can extend the C-9's capability even further with options like enhanced graphic hardware package with rotations, reflections, and line-texturing features or programmable gray levels for graphics (16 levels) and digital raster continuous tone images (256 levels). We also offer parallel interfaces for a variety of minicomputers and interfaces to popular digitizers for local data input and control of the interactive CRT cursor.

The new C-9 offers a continuous writing mode and a new capability which guarantees that writing occurs only during vertical retrace time.

Smoother curves and lower costs

The patented Conographic™ generator, using conic curves to plot curvilinear information, produces smoother curves from much less data, thus requiring less computer memory, simpler software, less computer or telecommunications time. Result: The lowest *total cost of ownership* of any graphic terminal available today.

Many FORTRAN IV software programs are available, including a new set of Tektronix-compatible subroutines. The basic software package, called CONO-PAC, is available at no extra cost.

To find out how your minicomputer can work like a giant for much less cost, contact your local representative, or Hughes Image and Display Products, 6155 El Camino Real, Carlsbad, California 92008. Or call (714) 438-9191.

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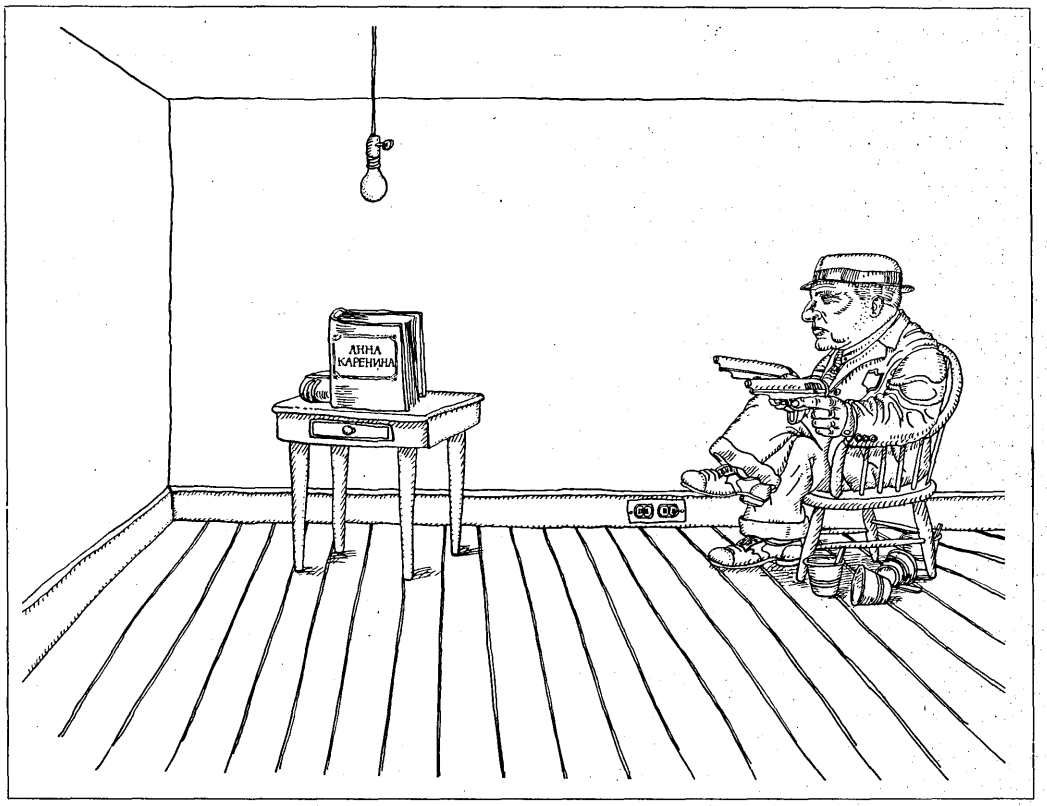
CIRCLE 72 ON READER CARD



Computer Capers

by James Gorman

Fantastic crimes from the FORTRAN file.

The computer is finally coming into its own. No longer is it the little-understood gadget of the scientist. Now it's the tool of the student, businessman—and thief. Yes, computers are now being used to steal. Enterprising and unscrupulous computer users are creating an electronic crime wave. Business and industry are up in arms. The government is holding hearings. Books are being written.

In fact, computer crime has progressed far enough that there are already former computer crooks going into the security business. But something is missing—imagination. To be sure, some of the crimes are unusual. One embezzler not only juggled his company's electronic books, he made a computer model of the firm's finances to see where the money he took would be missed the least. A Japanese kidnapper tried to channel the ransom he demanded through a bank's computer controlled automatic cash terminals. But by and large, just as the first television shows were vaudeville carryovers, most computer crimes are just new versions of old scams.

It's unfortunate. After all, stealing money with a computer is a bit like driving a Ferrari to work. It's enough to give technology a bad name. So, in the interest of innovation, in defense of technology, and in the spirit of whoever first realized that what the government calls "money" can be made in your basement, we have a few ideas. What if:

The Idiots

The Socialist Workers Party, long the victim of FBI burglaries, drops all legal action against the government. They disguise a party member who is a computer whiz as J. Edgar Hoover. The impostor walks into the FBI office on a Sunday morning. He announces that he has returned from the dead to add to the bureau's files the names of Communists he has discovered in the next world. The ecstatic agents take oaths of secrecy and show him to the computer.

Once in the computer room, he finds the bureau's most secret files and erases all the information on American citizens that the FBI has amassed over the years. In its place, he puts a massive list of characters from Russian novels, complete with genealogies.

Ten years later, a Congressional probe of intelligence activities uncovers a special FBI program that has cost the taxpayers millions. Scores of agents have spent years tracking down a conspiracy involving Raskolnikov, Anna Kare-

nina, and a cadre of anarchists known as the Karamazov four.

Subpoenaed records show several early morning burglaries of Brentano's. The Washington Post reports that FBI agents have completely missed the theme of guilt in Dostoyevsky's work. The Defense Department starts awarding grants in comparative literature.

The Best and the Brightest

A specialist in artificial intelligence is in residence at the Institute for Advanced Study. One night, he gives a lecture at nearby Princeton University. No one attends. He is outraged and begins to brood on the caliber of undergraduates and the inadequacy of admission procedures.

Spurred to action, he gets a job with the Educational Testing Service. Then, unbeknownst to his employer, he redesigns the computer program for scoring the College Board Examinations. Scores are awarded at random, but in the same proportion as in previous years.

The scores are mailed out. Thousands of senior class presidents abandon plans for college and start reading matchbook covers, looking for a career. Swarms of illiterates are forced into the Ivy League and fall victim to anomie. The *Times Sunday Magazine* runs an article on the changing atmosphere on college campuses.

Halfway through the academic year, after City College wins the Rose Bowl, a chimp from the Yerkes Primate Center with an 800 verbal SAT is elected president of Harvard's freshmen class. The American Association of University Professors discovers what has happened, decides nothing significant has changed, and votes to abandon the college boards. ETS folds. Every college in the country adopts open admissions. William Buckley disowns Yale.

Nielsen Schmielsen

Four graduate students in Far Eastern Studies at Columbia University celebrate the end of an academic year at a country music bar in midtown Manhattan. At the bar, they run into three IBM programmers. They discover that they all share a passionate hatred of popular television. That night, they hatch a plan to sabotage the Nielsen ratings.

As the first step in the conspiracy, two of the graduate students produce an introductory course in a 12th century Chinese dialect. They sell it to Public Television for Sunrise Semester. At the same time, the programmers obtain jobs with the Nielsen company. They juggle the ratings to show great interest in the Chinese course. At the end of the first season, the show outranks two news shows and the morning prayer. NBC picks it up and puts it on at 11:30 a.m., sandwiched between a game show and the noon news. The ratings soar.

Soon, the other two graduate students have jobs with ABC and CBS producing different courses in medieval Chinese. The Nielsen sample of television households is enlarged to investigate the new trend. Now firmly entrenched in the Nielsen computer hierarchy, the programmers are able to continue their subversion. The ratings continue to soar.

The shows are moved to prime time. The original course knocks out Kojak. Norman Lear produces a situation comedy set in 13th century Peking. "The Forbidden City" replaces "Medical Center."

Three years after the start of the hoax, the programmers return the Nielsen computer program to its original state. The conspirators prepare for the great revelation. But, every Nielsen household is, in fact, watching Chinese spinoffs day and night.

Stunned at first, the conspirators soon see the possibilities. Their next project is a course in organic chemistry disguised as a gourmet cooking show. They sell it to Public Television. ❋

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Data is a resource—a resource which can provide a wealth of information for management as well as technical personnel—a resource which can aid and increase productivity throughout a company. MRI Systems Corporation is in the business of providing tools for tapping this resource through the facilities of effective data base management.

Since 1969, MRI has continued to refine a system which satisfies user requirements, increases "resourcefulness" of data, and prevents user operating costs from rising.

The result of this refinement is SYSTEM 2000®, a generalized data base management system, a practical and proven capability used by hundreds of organizations which have recognized the need to get more out of their data.

MRI Systems Corporation has the specialists to help you bridge the gap from basic resources to highly refined management information. The technology is data base management and the company dedicated to serving your current and future DBMS needs is MRI. Together they make your data a more manageable and available resource.

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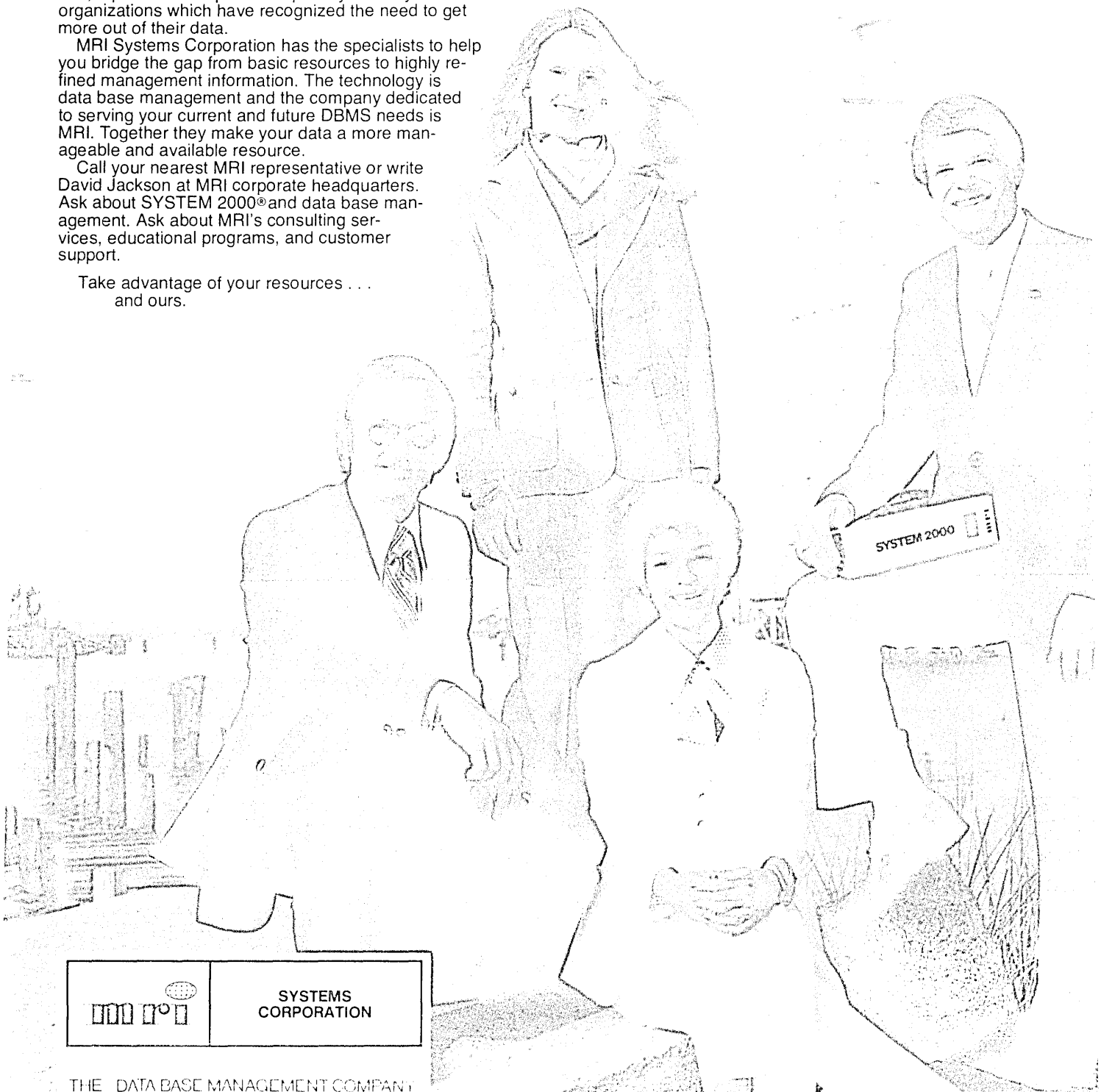

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By ENTREX...

Remote/Data Terminals

Stand-Alone Single Terminal Systems 600/20

Multi-Terminal Business Systems 600/30, 600/50

Entrex offers you an alternative to the rising costs and workloads experienced with today's centralized data processing facilities

The Alternative — The Entrex 600 Series. A compatible family of minicomputer-based systems designed to free centralized processing power, reduce communications costs, provide operational flexibility, and allow business to react to today's challenging opportunities. Each family member is a blend of power, state-of-the-art hardware, and field-proven software.

600 Series hardware is modular and upward expandable, allowing selection based on individual site performance requirements.

Our field-proven software provides for the traditional data processing requirements as well as a full range of communications emulators. A few of the features offered by each family member include: file inquiry, retrieval and update capabilities, terminal and system security, both batch and interactive communications, as well as Entrex's sophisticated data entry software.

Entrex is ready with a family of systems particularly suited to capturing and processing data at the source; a system alternative that can be implemented today, yet provides for tomorrow's growth; a system family that offers the network planner total flexibility in configuration planning.

Processing Systems

The Economic Alternative

PLANNED IMPLEMENTATION

The 600 Series can be implemented on an evolutionary and modular basis. Configurations range from 1) remote Data/Terminals connected via datacomm facilities, through 2) stand-alone single terminal systems, to 3) larger, multi-terminal, multi-tasking business systems. An extensive list of peripherals is also available to choose from.

And, since all family members use identical software, networks will be quickly and cost-effectively established.

COMMUNICATIONS FLEXIBILITY

In addition to our asynchronous remote terminal capability, the 600 Series provides two distinct communications facilities concurrent with multi-terminal operations:

Batch Oriented (2780, 3780 3741, etc.)

Entrex's Data/Comm package allows 600 Series processors to communicate with each other or with other mainframes.

Transaction Oriented

Each terminal, whether local or remote, can function as a plug-compatible IBM 3271/3277 combination, or as a stand-alone IBM 3275. This allows direct interaction with an IBM 370 or similar mainframe.

CENTRALIZED CONTROL

Centralized control is a critical element in network planning. The unique data management features offered by the 600 Series provide complete central control of all data processing operations, if required; local control if your company is totally decentralized; or the ability to establish controls based on key programs, files and data. Information security is achieved via a sophisticated security system which integrates password keys, hardware terminal addresses, and programmed access restrictions.

OPERATIONAL SIMPLICITY

With minimal training, non-technical personnel can implement data processing applications that guarantee virtually error-free input. Our Editor language, a straightforward COBOL-like language, dramatically reduces the lengthy process of report definition, design, programming and debugging. Additionally, the 600 Series provides a wide variety of flexible utility programs to further simplify the process of information utilization.

The powerful operating system fully manages all aspects of virtual memory allocation, application program relocatability and shareability, and simultaneous data base access. Application programmers are therefore free to concentrate on rapid implementation of the application at hand.

PLANNING FOR THE FUTURE

Whether you're replacing first generation remote job entry terminals or data entry devices, or designing a network of processors for the 1980's, Entrex has a system alternative with the price/performance characteristics you require. Let us demonstrate the Entrex approach to Source Data Processing.

Entrex's nationwide software, training, and maintenance support organizations are ready to serve. For complete details on the 600 Series and the address of your local Entrex representative, write today. Attn: Marketing Services, 168 Middlesex Turnpike, Burlington, MA 01803, 617/273-0480

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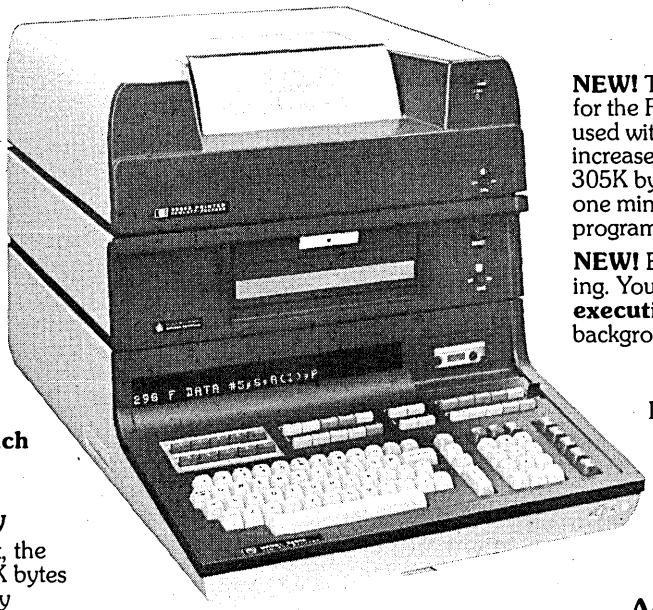

HP 9830A/B with the Infotek FD-30 Mass Memory

32,192-Byte Memory

Where more memory is important, the user area may be increased to 32K bytes with our EM-30... the first and only 16,096-word memory for the 9830A/B! Compared to newly introduced models equipped with commonly used ROM options, the 9830A/B with the EM-30 provides 8,192 bytes more user memory. A truly significant increase in capacity!

With the 9830A/B, the EM-30 provides 2,048 more bytes of memory, is priced right, and is fully warranted for a year.

FAST BASIC ROMS

Infotek's FAST BASIC ROMS add to the machine instruction set where HP left off. These ROMS provide spectacular increases in the work throughput of your 9830A/B. For example, you can process arrays at speeds of 40,000 words per second, attain an I/O capability of 10,000 bytes per second, greatly increase the power of a 9880A/B disk system, and print from a buffer while computing.

By providing 46 additional functions, statements, and commands, the FAST BASIC ROMS give your 9830A/B the most powerful BASIC language repertoir short of $200,000 systems.

If you need FAST BASIC but don't have enough unused ROM slots, don't give up! You can install our FAST BASIC ROMS without losing any present capability. **Contact us, we'll show you!**

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Floppy Disk Memory System

The FD-30A provides 305K bytes of on-line data that can be searched 50 times faster than your present cassette system. Data throughput is actually four times faster than the 9880A/B Mass Memory. Best of all, no software modifications are required since the FD-30A obeys all cassette syntax.

The FD-30A is the optimum magnetic memory for the 9830A/B. It has the right capacity, speed, and price.

Prices that you'll appreciate

EM-30 Memory, 16K Words $4,600	
Less trade-in of HP 8K Words 1,100	net $3,500
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FAST BASIC II ROM	525
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RS-30 High Speed RS232C Interface	750
RC-30 Real Time Clock	825
LP-30 Heavy Duty Line Printer	6,850
CP-30 Character Printer	3,400
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FI-30 10K Byte/Sec TTL I/O	395

All Prices Are U.S. Domestic

NEW! The FD-30S low cost Slave Drive for the FD-30A. Multiple slaves can be used with a single FD-30A so you can increase on-line capacity in blocks of 305K bytes. Also, the FD-30S provides one minute disk duplication under program control or stand-alone.

NEW! BP-30 automatic buffered printing. Your '30 will **continue program execution** while driving a printer as a background task under interrupt control.

Save $2,100

In our Word Processing Package you get the EM-30, FD-30A, FAST BASIC I and III ROMS, and the CP-30, including software, for a special package price of $10,850.

Other 9830A/B Accessory Equipment

RS-30 High Speed RS232C Interface. Provides seven crystal controlled Baud rates from 150 to 9600/sec.

TC-30 Real Time Clock. Provides time in 10-millisecond increments, is set or read via the OUTPUT and ENTER statements.

LP-30 Heavy Duty Line Printer. A 200 line-per-minute, 132-column printer (128 character set is standard). Comparable in every way to the 9881A, except the LP-30 is lower in price.

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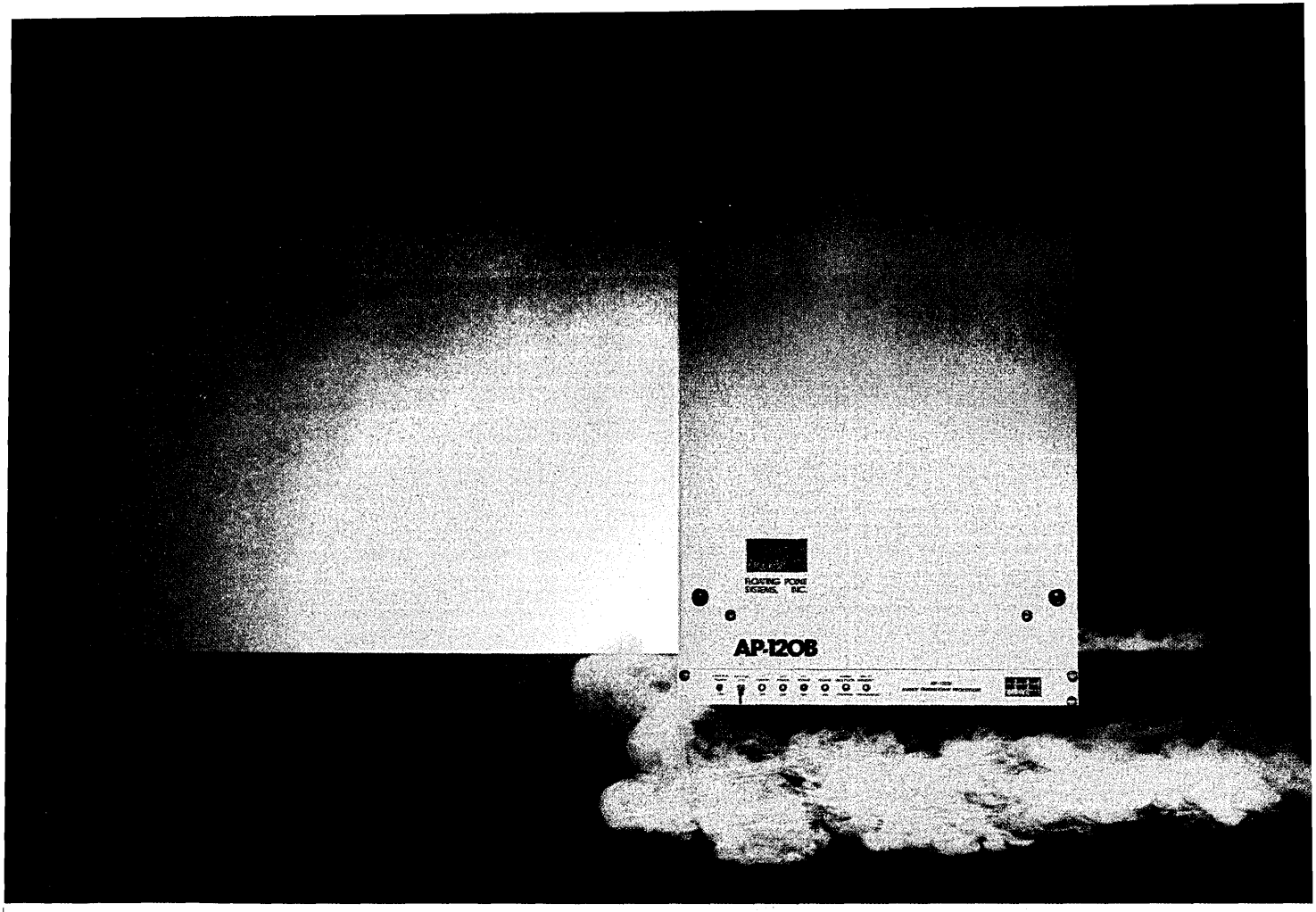

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FAST: 167 nanosecond multiply/add...2.7 millisecond 1024 FFT. Throughput 100 to 200 times greater than most computers.

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COMPATIBLE: Interfaced to all popular computers and their operating systems. A flexible format converter translates data to and from the host CPU. And a high speed DMA port is available to use with other peripherals.

CAPACITY: 167 or 333 nanosecond memories from 8K to 1 megaword.

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ECONOMY: Less than $40K delivers a complete system. That's a small fraction of what you must spend for comparable computing power.

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Job Simulation for Planning Purposes

by Irene E. Steele

With synthetic batch jobs, programs can be "tested" while still in the planning stage. The effect of switching to another mainframe can be "tried out." And benchmarks can be run without duplicating real files.

Occasionally a need arises for accurate estimates of the impact on computer operations of new or modified software systems. Operations managers must determine the feasibility of adding work to the operations schedule. Facilities managers must recognize the extra processing workload. Both categories of managers would benefit from a software package that demonstrates the resource requirements of systems undergoing growth or change, or yet to be installed.

A tool that enables the collection of preliminary data on how proposed software and/or hardware changes might affect overall installation performance can play a critical role in system optimization. It would be costly in time and expense, for example, to proceed with system redesign, or installation of a larger, faster cpu and/or more I/O channels, only to discover that the gains in throughput are minimal or insignificant. Job simulation can provide the needed predictive facility. If execution of the proposed new job(s) can be simulated on the intended hardware, performance can be measured by the usual methods at any given installation.

The old problem was I/O

Benchmarking has become one accepted method of job measurement. The approach is to run a real or semi-real job under controlled conditions, to observe its behavior. While a helpful tool, this approach suffers several disadvantages. Time-consuming modifications to the real job may be necessary. Also, many jobs are system dependent, and therefore not transportable. Often, data files are massive, making them cumbersome to move to another site for testing. Files must be backed up or copied prior to execution of the benchmark, to preserve data integrity.

Job simulation is a related technique for estimating how a job will function in a user-defined environment, one which attempts to avoid the problems associated with benchmarking of real jobs.

One type of simulation is the synthetic program. A synthetic program consists of code whose sole function is to duplicate a real job in terms of its computer resource utilization: main memory, I/O processing, and problem program cpu usage. This type of simulation allows for combining multiple synthetic programs into a representative job mix for multiprogramming, too.

Many versions of synthetic programs have been developed, but a basic problem has been their inability to simulate I/O handling. Rather than duplicate the number and block size (physical record length) of files used by a real job, some synthetic programs handle all I/O as one file of some optimum logical record length, alternating randomly between processing the same file for input and output, using QSAM if in an IBM environment. This attempt to make the synthetic program as general as possible eliminates the need for modifications for each distinct real job, which is certainly a desirable goal, but obviously this solution to I/O simulation introduces inaccuracies in the results.

At Coopers & Lybrand we have designed and implemented a synthetic program which tackles the problem of accurately duplicating I/O handling with excellent results. Under this program, the number and size of the real program files are duplicated without requiring any modifications to the synthetic program. Files are specified via Job Control Language (JCL) Data Definition (DD) statements, and from 0 to 255 files may be specified per job step (due to an IBM restriction) in any combination of input and output.

The C&L job simulation system is a software aid for measuring, evaluating, and predicting batch job performance on any IBM 360 or 370 computer system operating under OS and OS/VS. We think it is general purpose, simple in design, easy to use, and flexible. And we will show some examples which seem to bear us out.

The simulator uses a synthetic program, not a copy of the real program being modeled. This program consists of fixed code which opens, processes, and closes files, and exhausts a specified amount of problem program cpu time, all in accordance with information made available to it through the JCL used to execute it. The program does not have to be assembled and link-edited for each new real job or job mix

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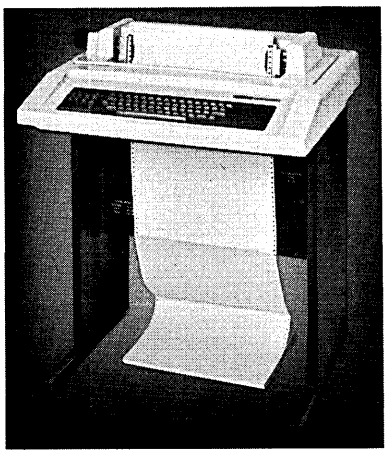

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under examination. It is stored and executed in one version only.

Start with SMF or estimates

The system was designed to model a real batch job from job accounting data captured by IBM's System Management Facilities (SMF) during execution of the real job. The SMF data contains information regarding job step termination, and output writer and data set activity, such as:

- number of card image records in DD DATA or DD * data sets
- step region/partition/private area size
- number of steps in job
- step cpu time
- on-line unit record devices (00C, 00D, 00E) used by the job step, and the number of I/O's (EXCP's) issued to each device
- number of records written by the output writer
- data files processed by the step (for each file: record format, block size, device class, unit type, ddname, number of EXCP's)

From this data the C&L system generates the JCL to execute the synthetic program. Information on files to be processed, cpu usage, and main memory size is contained in this generated JCL.

However, the JCL can be set up manually, without using SMF data. Most of the needed information is available from the computer listing generated by real job execution. (The number of records processed per file would have to be determined or estimated by the user.)

This ability to set up the JCL manually means that a synthesis of a job which is still in the *planning* stage can be built. Figures for number of records to be read and/or written, problem program cpu time to be consumed, and, optionally, main memory size must be estimated. By studying the execution of the synthetic job, feedback regarding design considerations and operational performance can be obtained before the new system is fully developed. If desired, the synthetic program can be run in a production environment. The impact upon production schedules can thus be observed.

If a real job is being simulated, the first objective is to model the real job in its natural environment as closely as possible, so that the results of the simulation can be checked for accuracy before any user modifications (software and/or hardware) are introduced. This helps insure that performance differences observed during execution under modified conditions will not be influenced by inaccuracies in the model.

A critical area is the total problem program cpu time consumed. SMF data recorded during execution of the synthetic job can be compared against SMF data collected previously during execution of the real job. If the results are not as accurate as desired, the synthetic program can be fine tuned to obtain more satisfactory results.

Tuning the job simulator program is easy because the program is designed to do no more than consume the same resources as the modeled program, and all of its inputs and outputs are supplied in straightforward fashion.

Once an accurate simulation has been achieved, modifications can be introduced into the execution of the synthetic program to measure the impact of changes such as blocking factor, different storage media, and increased transaction volume, etc. The synthetic program can also be run on another computer system, to study the affect of the proposed software and/or hardware changes.

The simulator processes I/O in a manner intended to duplicate the SMF data captured during execution of the real job. For SYSIN, SYSOUT, and on-line unit record files, SMF records the number of logical records read or written; therefore, the synthetic program accesses these files via QSAM.

For files stored on magnetic tape and direct access devices, SMF records the number of EXCP's issued for the file, which is equivalent to the number of physical records; therefore, the synthetic program accesses these files via BSAM.

All I/O is processed sequentially. Files may be of fixed, variable, or undefined length and are simulated exactly: e.g., if cards were read by the real job, cards are read by the synthetic program. This is all controllable through the JCL.

Protect the real files

Thus, real files need *not* be used; the system optionally builds pseudo files (containing garbage data) to be processed by the synthetic program. Real files do not have to be backed up. As an added convenience for when the synthetic program is run at another site, the input files can be built at that site, eliminating the need to transport them.

Similarly, the synthetic program generates garbage output for files assigned to magnetic tape and direct access devices. These files can be deleted at the end of the job to conserve storage space.

A file to be processed for both input and output is written to first. When the number of writes is exhausted, it is then closed, reopened, and read. This conserves storage space, in that the file need not be created and stored prior to execution of the model.

In contrast to its attempts at exactness in other aspects, the synthetic program tries to cut down on the waste of card and printer output during its execution. If card output is being simulated, blank cards are generated. For printed output, line spacing is suppressed to avoid wasting paper on meaningless output.

The design of the system allows the simulation of physical relationships between files, such as channel and unit separation or affinity. The appropriate JCL facilities are used in either the simulation step or pseudo-file generation job. Further, it is easy to alter the processing of a file regarding its block size, format, and the number of records to be read or written, simply by changing its associated JCL DD statement.

The execution JCL specifies the amount of problem program cpu time to be exhausted. At least part of this is used up processing I/O. Any remainder is consumed by executing a long instruction loop within the synthetic program. The cpu loops can be executed either concurrently with I/O processing, or after all I/O has been completed, as a user option.

The I/O loop and cpu loop consume different amounts of cpu time. Since these timings vary among computer models, they can be specified in the execution JCL. The timings are selected by the user from a table we make available, one which lists various 360 and 370 computer models. During the execution of each I/O and cpu loop, these values are subtracted dynamically from the total problem program cpu time remaining.

If the synthetic program is simulating a job which is still in the design stage, these I/O and cpu loop timings should correspond to the computer model on which the program is to be executed.

If the synthetic program is modeling a real program, these timings should correspond to the computer model on which the real program is normally run. If the synthetic program is later run on another computer model for speed comparisons, the timing figures to be used are those for the original computer. The effect is to have the synthetic program execute the same number of hardware instructions on every model.

(Suppose some program does no I/O. Suppose it runs on a computer model with a cpu instruction cycle of S seconds, in a total cpu time of T. The number of instructions (I) executed varies directly as the amount of time it runs ($I_\alpha T$, or $I = aT$) and inversely as

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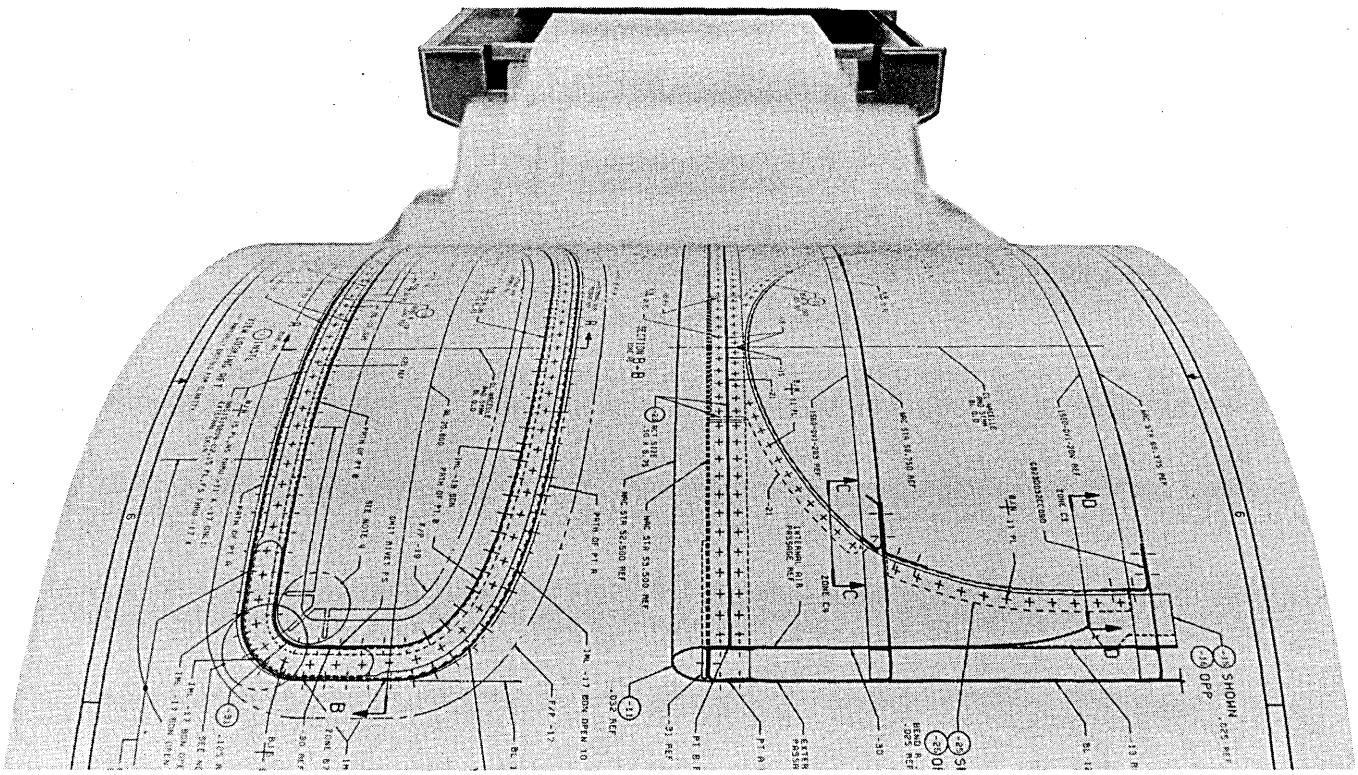

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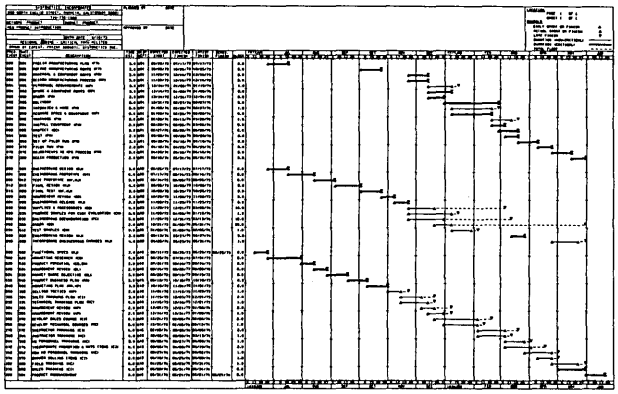
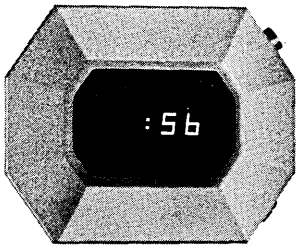
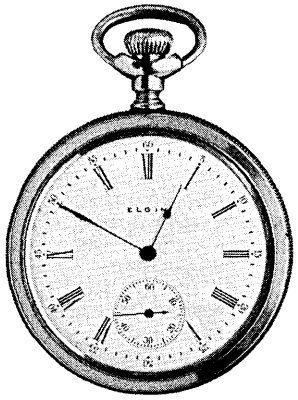
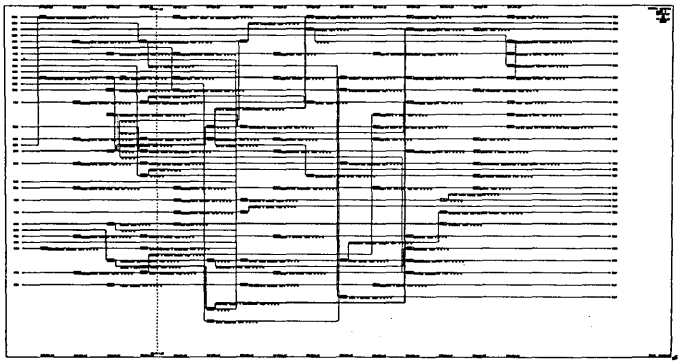
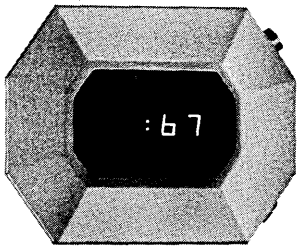
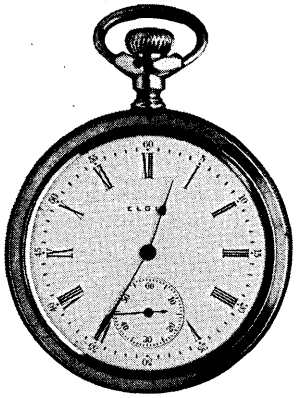
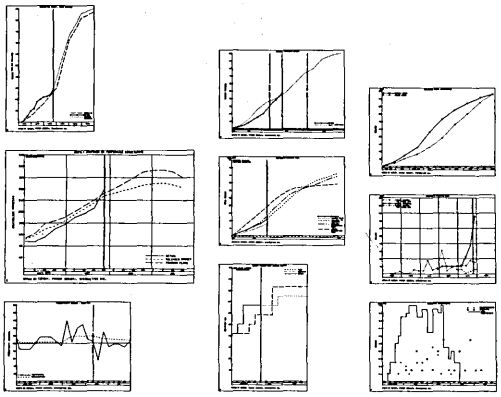
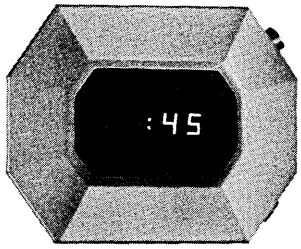
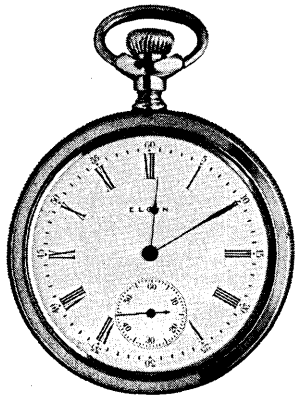
	Plotting time	
	Versatec Model 8136, operating off-line at half rated speed	**CalComp™** Model 1036
 Plot size: 56" x 36" 33,000 vectors CPU & I/O time for sort & rasterization: 9 seconds	 **56 seconds**	 **50 minutes**
 Plot size: 67" x 36" 16,000 vectors CPU & I/O time for sort & rasterization: 8 seconds	 **67 seconds**	 **35 minutes**
 Plot size: 45" x 36" 15,000 vectors CPU & I/O time for sort & rasterization: 6 seconds	 **45 seconds**	 **10 minutes**

Tests were performed with IBM 360/65 computer, OS/MVT operating system, EZPERT™ application software (Systonetics) and Versaplot™/Version 7 plotting software (Versatec). ™Trademarks: CalComp (California Computer Products), EZPERT (Systonetics), Versaplot (Versatec).

the cpu speed of the machine ($I_{\alpha}\frac{1}{S}$, or $I = \frac{b}{S}$). It is a fair assumption that on *all* 360 or 370 computer models the number of instructions it executes is $\frac{kT}{S}$, where k is a program constant equal to a times b.)

The execution JCL can optionally specify how much core is to be used by the synthetic program. The program will dynamically obtain this amount of core minus the amount needed for the program, tables, and control blocks. The program takes under 6K if only unit record and SYSIN files are used.

The simulation of large jobs can be scaled down by any user-specified value; this scaling is applied toward the number of I/O's (EXCP's) as well as the total program cpu usage. For example, the user might specify that the synthetic program use only one-eighth the program resources utilized by the real job being simulated.

Building a simulation

The C&L Job Simulation System consists of three Assembler language programs, one of which is a synthetic program. Execution of the remaining two is optional, depending on the facilities desired.

Fig. 1 shows the steps in building a simulation. First the real job is executed, processing real input and output files; raw SMF data is collected.

This raw SMF data becomes the input to the JCL Generator program, the first program in the system. Its execution is optional. Its purpose is to generate execution JCL for the synthetic (model) program and execution JCL for the File Generator program (which creates pseudo files input to the model).

When executing the JCL Generator program, the user identifies the job (or jobs, if more than one) to be simulated for which SMF data has been collected. As mentioned, the user may optionally specify a scaling factor to be applied to the number of I/O's and cpu time to be simulated.

The user also may optionally override the unit type recorded in the SMF input data for magnetic tape and direct access devices; that is, the user-specified value TAPE can replace Unit 3400 (recorded in the SMF data) in the generated JCL. This saves time in modifying the JCL manually when the model is to be executed at another site.

In addition, the user can specify a volume ID override for direct access devices; thus, files output by the model can be written to a work pack rather than to volumes used by the real job. Again, this saves time in modifying the JCL manually. In the generated JCL, certain DCB subparameters in the DD statement for each file are used to convey the EXCP count to the model; the model extracts the EXCP counts prior to opening each file and substitutes values valid for the subparameters.

The File Generator is the second program in the system. Its execution JCL is generated by the JCL Generator program. The File Generator need be executed only if the user desires creation of pseudo files to be processed as input by the model, either alone or in combination with real data files.

The third program in the system is

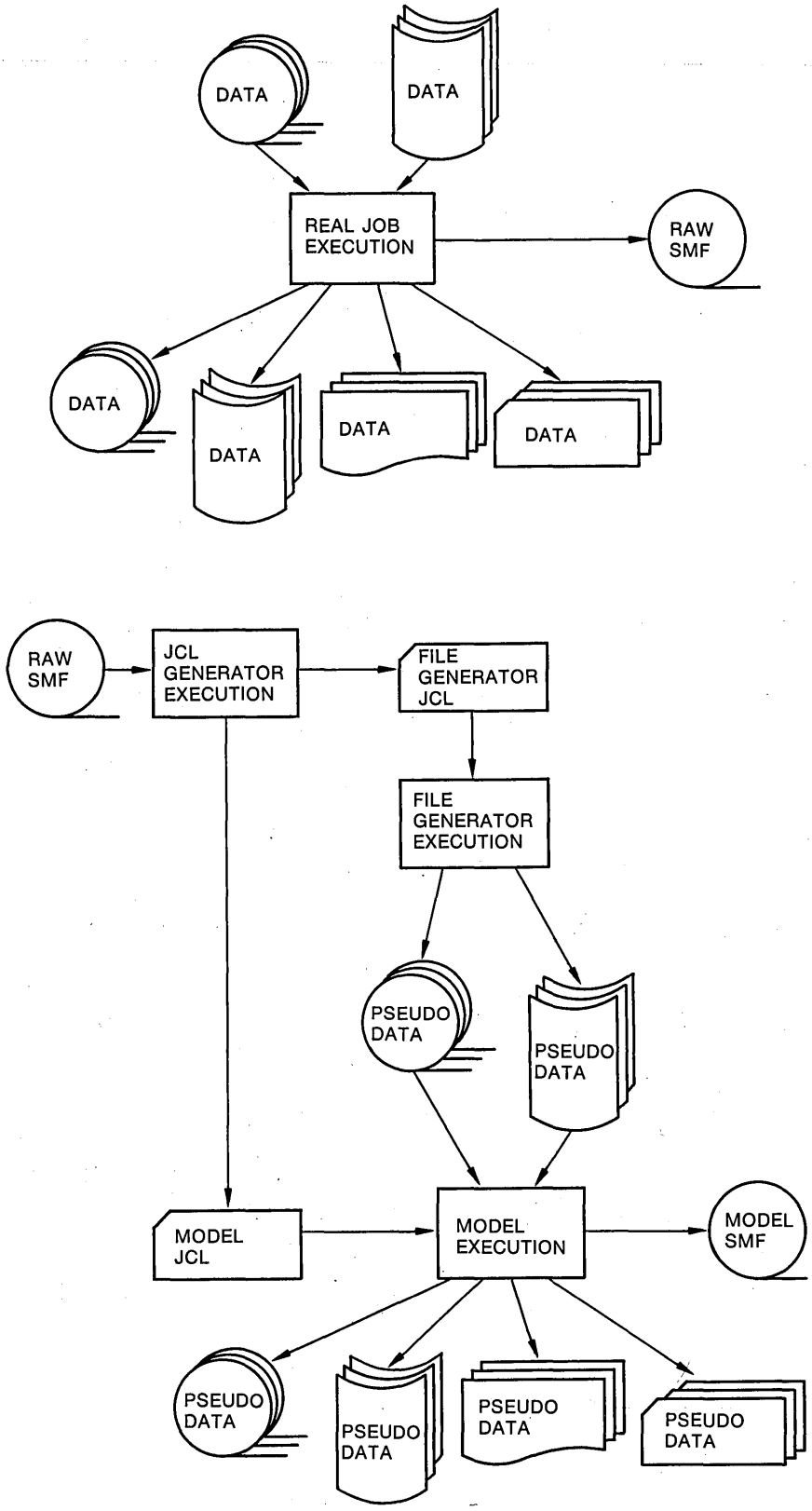


Fig. 1. The objective of the job simulation system used at Coopers & Lybrand is to produce a synthetic job which will accurately model a real one, to the extent of punching the same number of (blank) cards and printing the same number of (garbage) lines of output.

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the synthetic one, the Model. It may be executed with the JCL generated by the JCL Generator program, or with JCL set up manually by the user. Its input may be pseudo files created by the File Generator program, real data files, or a combination thereof. It outputs pseudo files, but an additional output is the SMF data collected (provided the SMF system option has been set On) during execution of the synthetic program; this SMF data may be compared manually against the raw SMF data collected during execution of the real job.

As can be seen in Fig. 1, the synthetic program is set up so that its input and output schema closely match that of the real job. In effect, the synthetic program is set up to look like the real job, as one might expect.

In one execution, the JCL Generator program can generate several sets of model JCL patterned on distinct real jobs. The different sets can be executed concurrently, or in any desired order, or mixed in with other real jobs, to simulate a batch of jobs.

In a comparison of the JCL for a real job against that for the model, some differences introduced both by the simulation system and by the user are:

- The synthetic program has a PARM field in its EXEC statements describing the job being simulated.
- In the synthetic job, data set names different from those accessed by the real job are specified in DD statements if pseudo input files are used, and for output files. Optionally, unit information for magnetic tape and direct access, plus volume ID's for direct access devices may differ. Certain DCB subparameters are modified to pass EXCP counts to the Model.
- The user may choose to modify direct access space assignments, channel and unit separation, unit affinity, EXCP counts, block sizes, etc.

Calibrating the model

In testing the simulation system, the objective was to simulate specified total amounts of problem program cpu time, during which a specified number of EXCP's were to be issued for various files. A "target" job was defined. The model simulated it, and SMF data was collected during synthetic program execution. The cpu time recorded in the data was then compared against the time value to be simulated. The figures in Tables 1a and 1b, (p. 124) resulted from a first-time run of the synthetic program in each case (no fine tuning was performed). The difference in cpu times illustrate the degree of accuracy of the simulation.

As a test case, we then selected a real job off some SMF data. The job consisted of one step and processed seven files with the characteristics listed in Table 2, (p. 124).

The original job consumed 13mins 7.31secs of cpu time on an IBM 360/40. The simulation was also run on a Model 40. It took the JCL Generator program 5 minutes elapsed time and

Target Program Resources to be Matched			Synthetic Program	Differences	
cpu time (sec/100)	EXCPs (number)	files (type)	cpu time (sec/100)	cpu time (sec/100)	fraction (%)
20,000	0	—	20,057	+ 57	+ 0.285%
80,000	20,000	A	80,023	+ 23	+ 0.029%
90,000	0	—	90,168	+ 168	+ 0.187%
180,000	87,102	B	178,808	− 1192	− 0.662%

Table 1a. Results of simulating target (non-real) program to calibrate the model.

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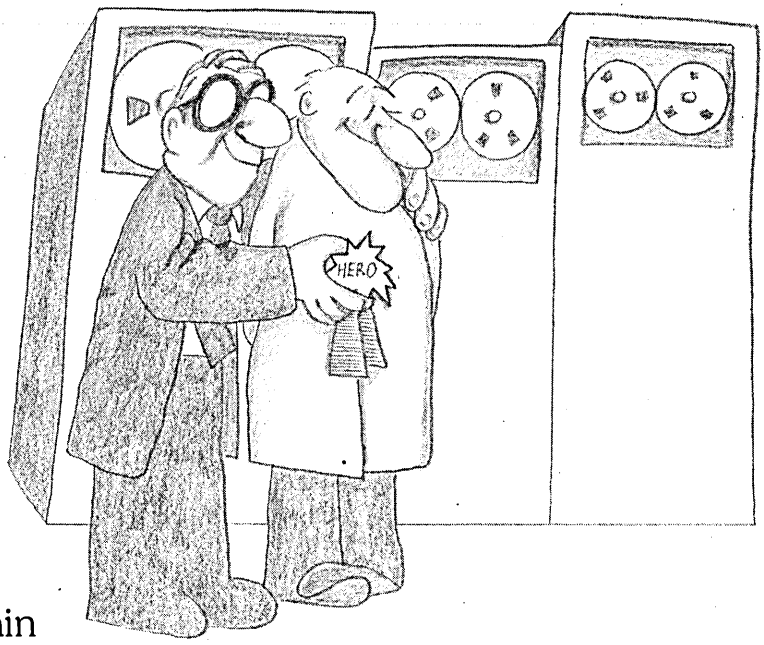

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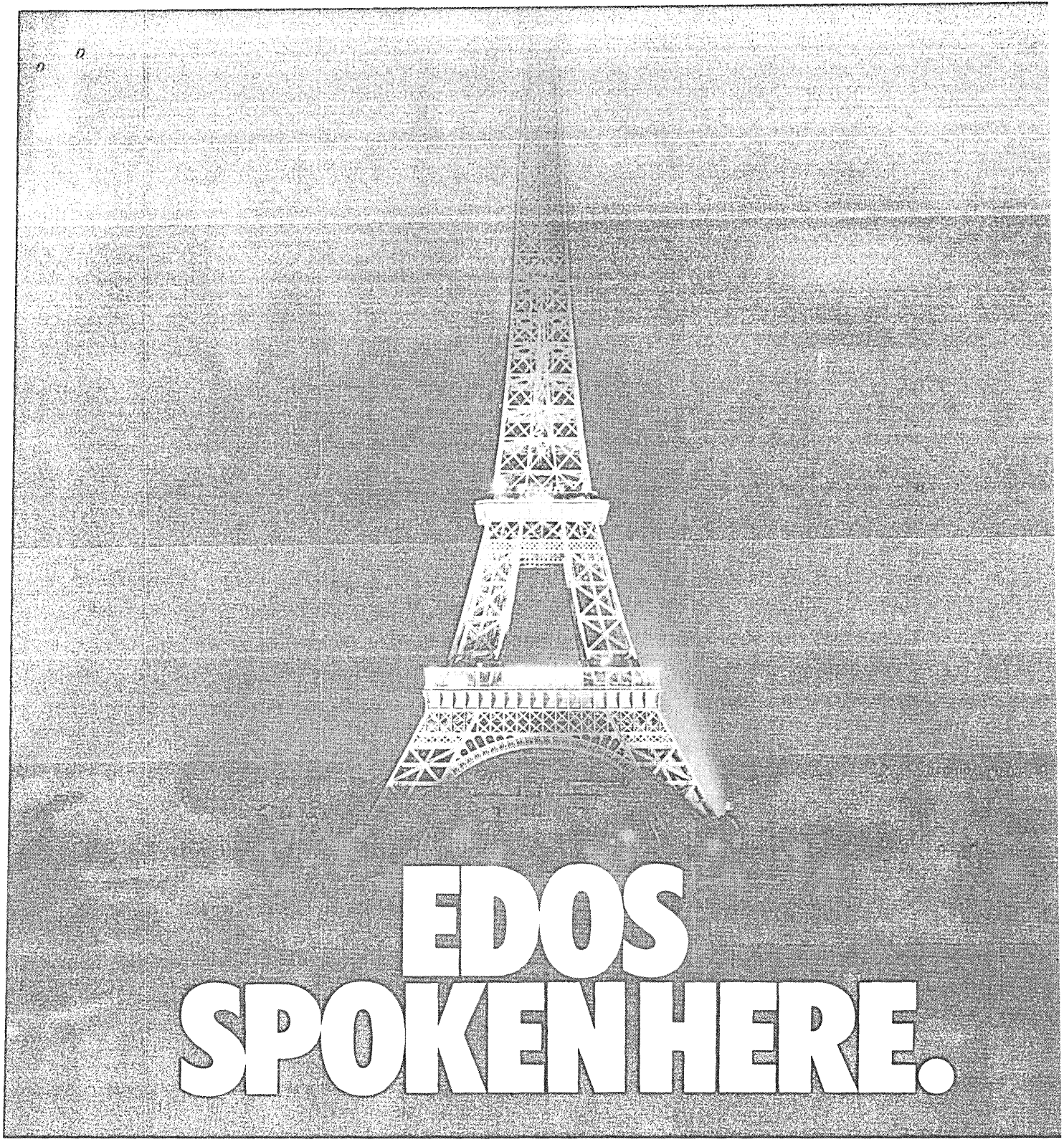

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CIRCLE 21 ON READER CARD

	EXCPs	Block Size	Record Format	Device Type
file type A:	16,000	800	V	2400 (tape)
	2,398	800	V	2400
	1,500	800	V	2400
	100	800	V	2314 (disc)
	2	800	V	2314
file type B:	500	80	F	SYSIN
	5,000	131	FA	SYSOUT
	20,000	800	V	2400
	20,000	300	U	2400
	40,000	40	FB	2400
	1,500	80	F	2314
	100	600	V	2314
	2	7200	U	2314

Table 1b. The file types used in the calibration run.

used 10K of memory to process the SMF data (over 1800 records) and generate the JCL for the File Generator and Model programs.

The File Generator ran another 8 minutes elapsed time and used 6K to create the three tape files to be processed as input by the model.

The Model was executed with the same file set up as the real job, with specifications to consume 13mins 7.31secs cpu time. The result was that it took 13mins 40.45secs—a 4.2% difference from the target cpu time—and executed 563,766 cpu loops. The job elapsed time was 23 minutes and memory usage was under 20K. We decided the 4.2% variation was not significant enough to attempt fine tuning the simulation.

Proving it works

We wanted to see an improvement in the job elapsed time by reblocking the tape files. The real job is a high execution priority one currently, because it is I/O bound. The block sizes of the five tape files were increased tenfold; the number of EXCP's for each file was reduced by 90% (the total number of logical records is therefore the same). The File Generator was executed to create the three tape input files with the new block sizes. (This required repunching three JCL cards.) The File Generator took 3 minutes elapsed time to create the new pseudo input files.

Five cards in the Model JCL were repunched to specify the new block sizes. In addition, the EXEC card was repunched to change the cpu time consumption requirement to a cpu loop reiteration count: the synthetic job was forced to execute the same number of cpu loops (563,766) as the previous execution of the model, thereby keeping the job processing time the same. Any resultant difference in elapsed time would be due to the change in file block sizes.

The second execution of the model took 12 minutes elapsed time, or 47.8% less than the previous synthetic job. It took 9mins 38.05secs cpu time, or 29.5% less than the previous synthetic job. The total number of EXCP's issued was 88.4% less than the previous synthetic job. It executed 563,766 cpu loops. Because of the larger buffer size requirement for the larger block sizes, the job required 5K more core.

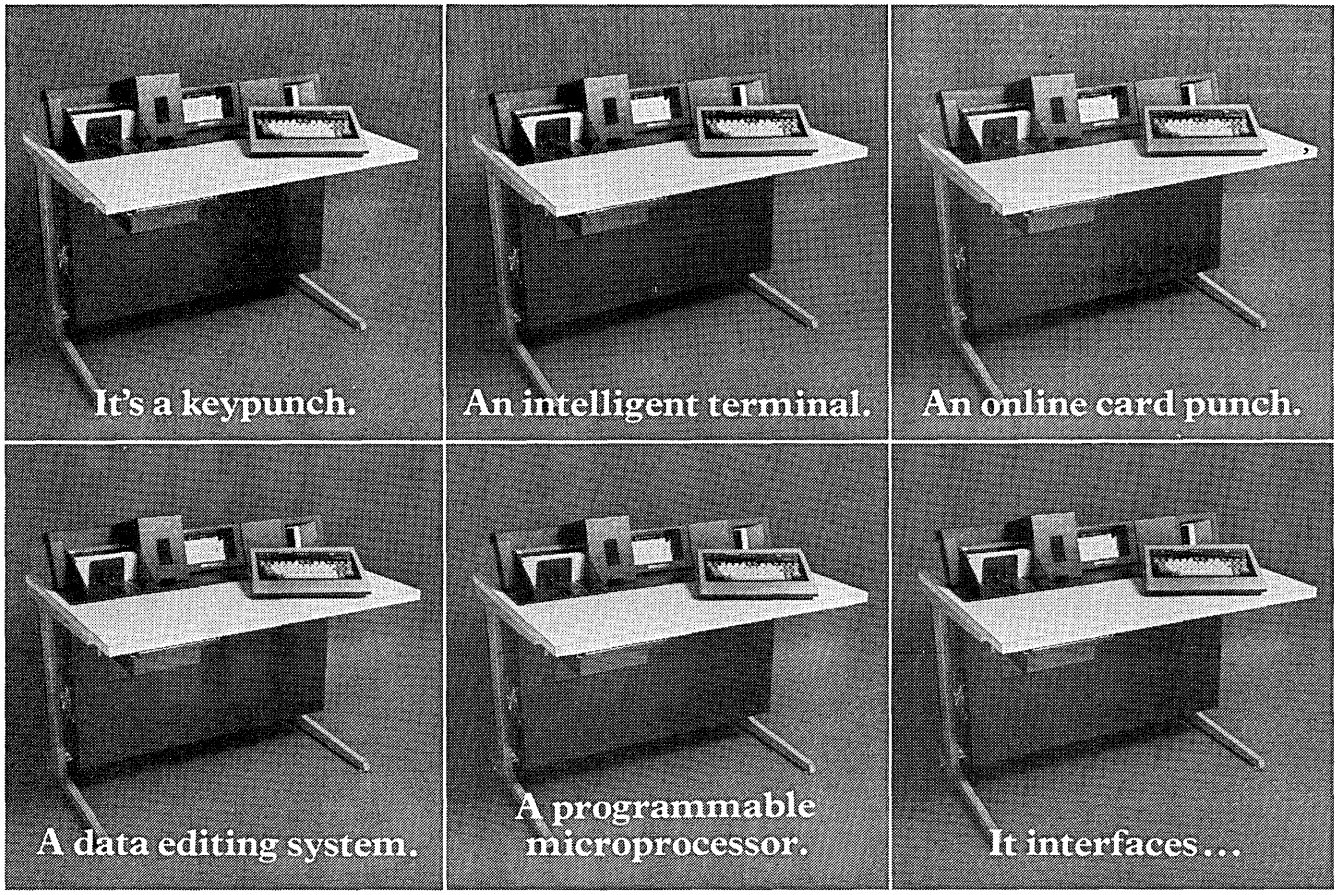
The real test of the model's predictive capability, of course, is if the real job performs as the model says it will after it has been altered. We therefore executed the real job again, with its files reblocked. It took 10mins 22.99secs of cpu time, an amount 7.2% greater than that predicted by the model. Since, as mentioned earlier, the simulator had taken 4.2% more cpu time than the original job had in dealing with unblocked files, the gross discrepancy between what the model said the job would take and the actual resources consumed was in the neighborhood of 11%.

Please understand that this run was only a calibration of the model. We wouldn't want to be chided for going to such lengths for as simple a task as reblocking files. The calibration run did indicate, however, how simply a simulation run can be altered, and it did give us some confidence in the model.

We then wondered what effect on job elapsed time doubling the number of tape file EXCP's of the original synthetic job would have. We considered a hypothetical situation wherein the installation analysts determined the processing time in the job could be optimized 50%; thus, the same processing time (herein represented by 563,766 cpu loops in the synthetic program) could handle double the volume

Unit	Record Type	Block Size	EXCP's	Data Flow
2400	FB	120	14974	in
2400	U	500	8306	in
2400	FB	48	3672	in
2400	V	300	622	out
2400	FB	108	12000	out
SYSOUT-A	FA	133	703	out
SYSIN DD *	F	80	3	in

Table 2.



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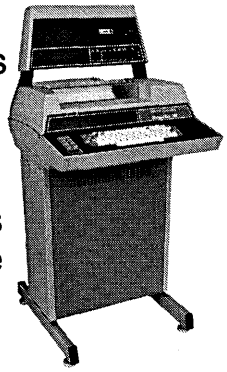

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currently on the tape files (that is, two tape subsystems might be merged). This meant a 98% increase in the number of EXCP's to be issued by the synthetic program.

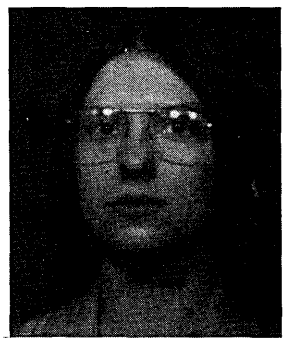
Five cards in the Model JCL were repunched due to the EXCP count changes. This third execution of the model took 37 minutes elapsed time, or 60.8% more than the first execution. It also took 18mins 32.00secs cpu time, or 35.5% more than the first execution.

The File Generator did not have to be executed prior to executing the third test of the Model. The model used the same files created for the first execution. Because the number of blocks to be read was twice the number existing on each tape file, the model simply read each tape file twice to satisfy the required EXCP count for each file.

The above two modifications to the synthetic program provided information to the installation analysts with minimal effort and no modifications to the real job.

Unfortunately, we do not really know how to optimize the real program to cut its processing time in half. Again, the run was performed only to demonstrate how easily such a test could be made.

The results demonstrated that the synthetic approach can be used to simulate real jobs with considerable accuracy, very often with much less preparation than required to use traditional benchmarking approaches. Our investment has been about three months of one person's time in coding and testing. We think it will repay us many times that amount, and that other installations ought to consider making the investment too. ❋



Ms. Steele is a consultant at Coopers & Lybrand, and the designer of the job simulation system she calls CALIPRE (C&L Imitative Program Resource Evaluator) which is described in this article. Prior to joining C&L, she gained experience working as a Systems Programmer in batch and time-sharing environments.

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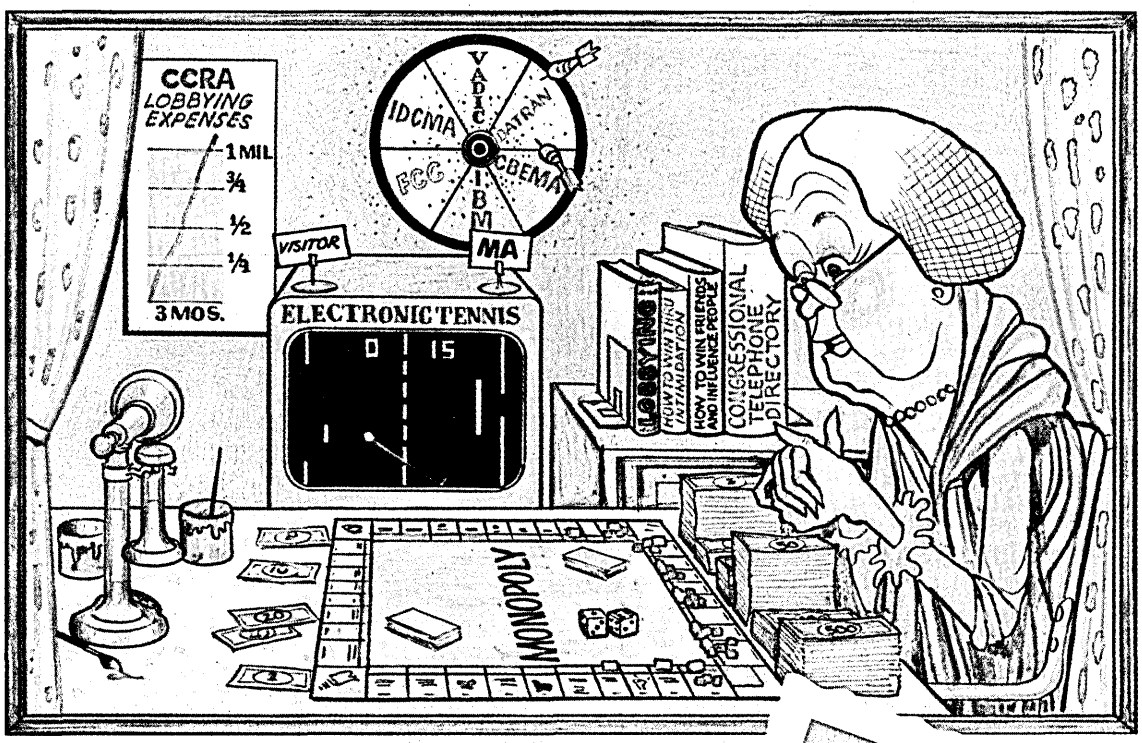

Dear Ma:

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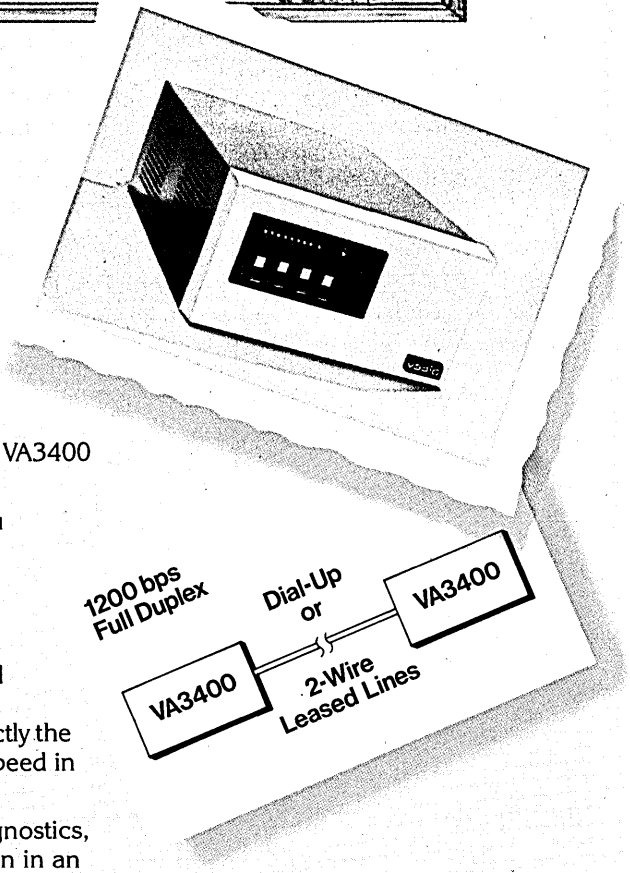

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CIRCLE 118 ON READER CARD

What Kind of Programmer Are You?

by Norman Grabowsky

This test may tell you more than you want to know about your programming.

Here is a quick test which will enable you to evaluate yourself as a computer programmer. A fixed-point full word variable called *I* always has a value of one or two. Provide code to change the value of the variable *I*. If *I* is found to contain a value of one, change it to two and vice versa.

Find your category by first comparing your solution to each of the 10 solutions supplied, selecting the one that most closely resembles your solution, and choosing the category with the same number as the solution selected.

You may code in any language and compare your method with those shown below, but PL/1 is the choice we've used.

Solutions:

(1)
```
IF I = '2' THEN I = 1;
ELSE I = 2;
```

(2)
```
IF I = 2 THEN I = 1;
IF I = 1 THEN I = 2;
```

(3)
```
IF I = 1 THEN GO TO SKIP;
I = 1;
GO TO DONE;
SKIP: I = 2;
DONE:
```

(4)
```
J = 2;
IF I = 2 THEN J = 1;
I = J;
```

(5)
```
DECLARE SWITCH LABEL;
        .
        .
        .
IF I = 1 THEN SWITCH = ONE;
IF I = 2 THEN SWITCH = TWO;
GO TO SWITCH;
ONE: I = 2;
GO TO DONE;
TWO: I = 1;
DONE:
```

(6)
```
DECLARE ONETWO(2) FIXED BIN(31)
    INITIAL(2,1);
        .
        .
        .
I = ONETWO(I);
```

(7)
```
I = 3 - I;
```

(8)
```
I = I - (I/2 * 2) + 1;
```

(9)
```
IF I = 2
    THEN DO;
            I = 1;
        END;
    ELSE DO;
            I = 2;
        END;
```

(10)
```
IF I = 1 THEN I = 2;
ELSE DO;
  IF 123 ¬= 2 THEN PUT LIST
    ('BAD I—WILL SET TO 1');
  I = 1;
  END;
```

Categories

(1) *Recent IBM School Graduate.* I estimate not more than one out of ten recent IBM school graduates knows the difference between 2 and '2.' It is a mystery to me how anyone can successfully program without understanding such a basic concept.

(2) *Programming Instructor.* Like the preceding solution, this one is also incorrect. I question how many persons teaching programming have ever actually designed, coded, and debugged a program of any consequence.

(3) *Old-Line FORTRAN Programmer Who Just Finished a PL/1 Course.* There is a lot of truth to the saying: "You can't teach an old dog new tricks." This solution gives the proper results, but that is about all you can say for it.

(4) *Assembly Language Programmer Who Took the Same Course.* Actually this solution is quite reasonable for readability, but is not too straightforward and efficient. This is probably a result of PL/1 training. This solution is surprising in that it did not contain any self-modifying code, but then again this is most likely a result of returning to earth by learning a high level language.

(5) *Systems Analyst.* This best illustrates the school of thought that feels the duty of a systems analyst is to poorly design a program to such an extent that even a good programmer appears to be incompetent.

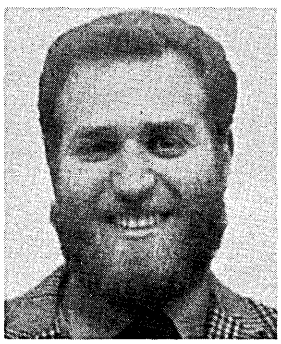
(6) *Computer Scientist.* This is probably the most clever of the solutions. However, it is not explained with a comment, and therefore mere mortals could have some problems comprehending it.

(7) *Mathematician.* This is very similar to the last solution in that it is also quite elegant but difficult to comprehend without further explanation.

(8) *Job Security-Minded Programmer.* This is quite a work of art and of course there are no comments. Would Macy's tell Gimbels? It actually works, but according to Lewis Carroll, "I could have thought of a much more complicated way of doing it said the red queen immensely proud."

(9) *Structured Programming Devotee.* One might say this is a cheap shot at structured programming. However, it seems to me that too many persons worry about trivialities as how many columns one should indent, rather than using the techniques as intended.

(10) *Good Programmer.* Notice that none of the other solutions checked *I* for out-of-range values. This is a very dangerous yet common practice. Unfortunately, all the structured programming, fancy algorithms, elegant solutions and efficient coding would not save you if for some reason *I* did not originally have a value of one or two. ❋



Mr. Grabowsky is a project manager with Xonics, Inc., in McLean, Virginia, and is experienced in the development of software for scientific, commercial and real-time applications.

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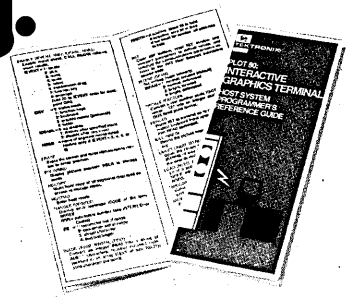

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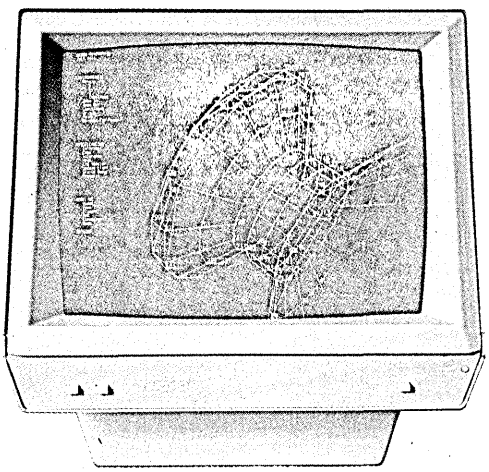

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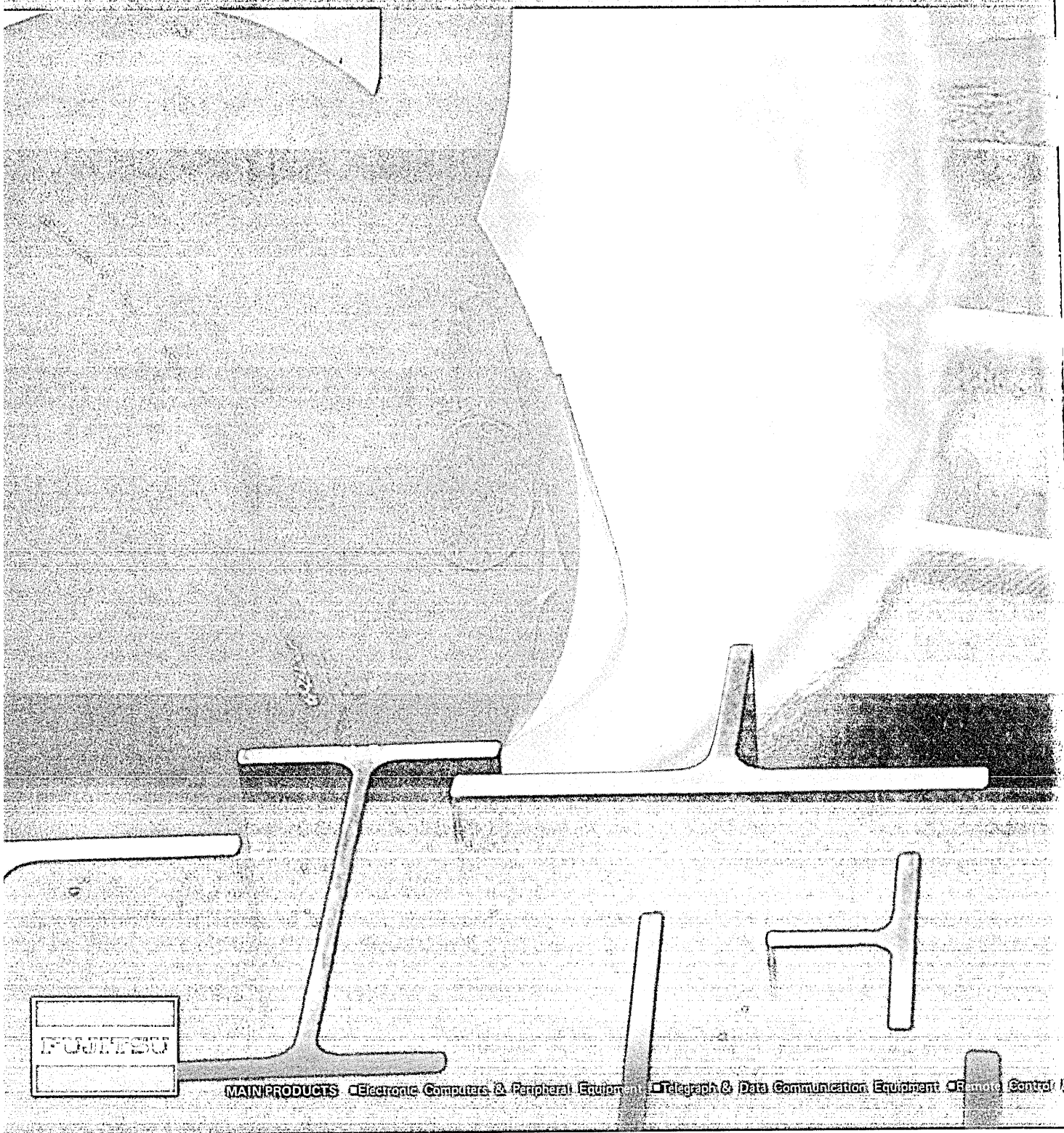

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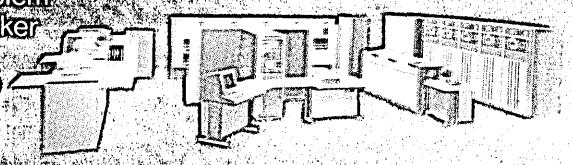

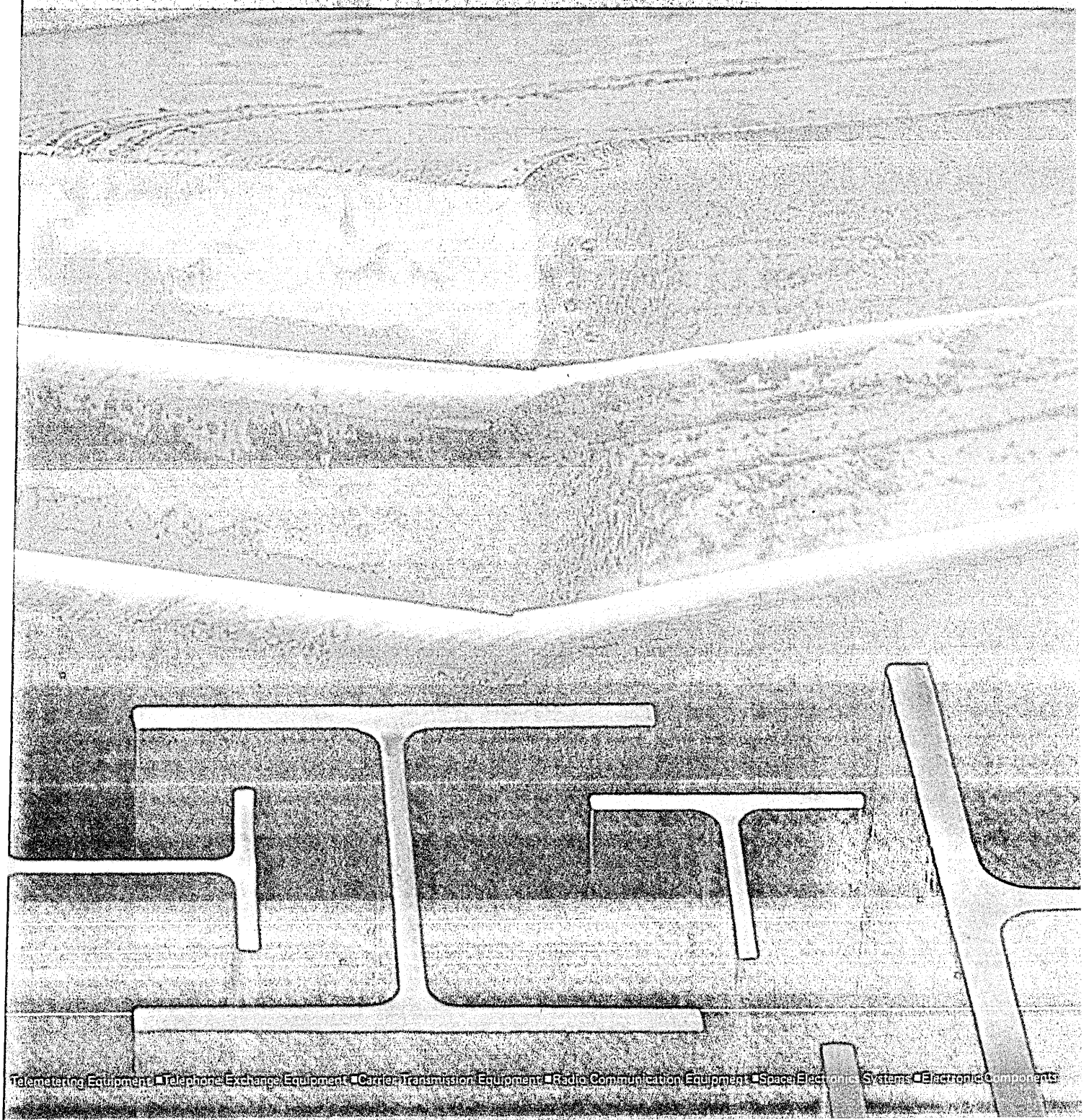

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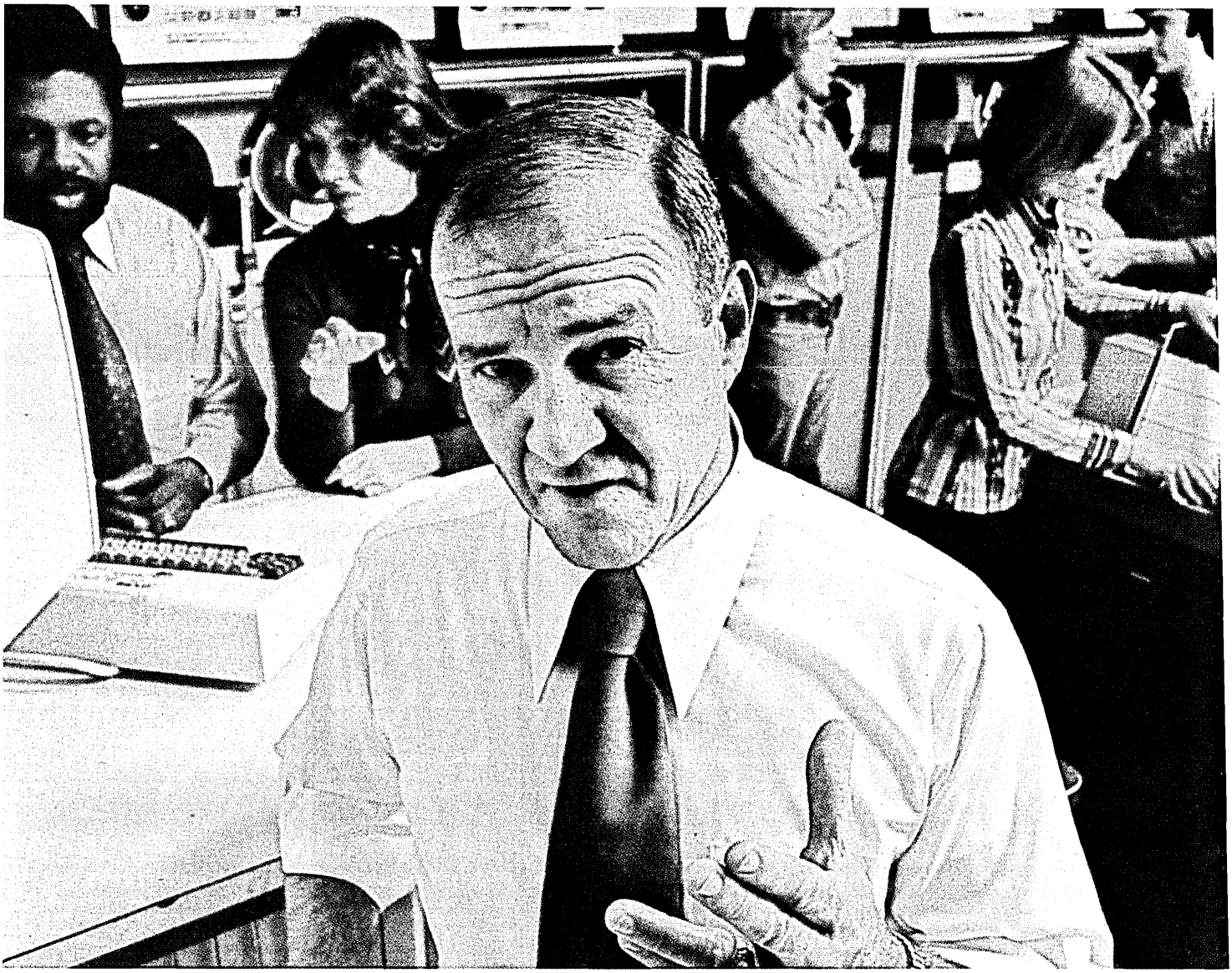

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The Concept of Throwaway Code

by Ephraim R. McLean

If the code is done right to begin with, it isn't that difficult to redo. The argument seems to work for APL anyway.

From its beginning, APL has been considered something of a "personal" programming language. Part of this may be attributable to the personality and outlook of Kenneth Iverson of IBM, APL's developer and continuing arbiter. Certainly we do not find the same association between Kemeny and Kurtz and their brainchild, BASIC.

This latter programming language was developed, with General Electric's extensive help and support, at Dartmouth College and then sent out into the world to make its own way. Since then, it has been used for a wide variety of applications; but primarily it has been associated with business and management. In some people's minds, it has even become the *de facto* standard for business time-sharing use.

In contrast to this, APL has spread quite independently of the efforts—or lack of efforts—on the part of IBM. Although its usage is still far less than that of BASIC, the range of applications is probably greater; and, more importantly, the enthusiasm of its users approaches that of religious fanatics. It is not uncommon to come away from an encounter with an active APL user with the feeling that you have been to a revival meeting and have been exposed to the "true faith."

This missionary fervor is somewhat of a double-edged sword, however. Certainly the use of APL would not have come this far without it. On the other hand, it makes some people who are considering its adoption vaguely uncomfortable. This is particularly true for managers who are responsible for developing commercial applications. They concede that APL is a valuable tool for individual or "amateur" programmers, but not for professional or production applications. (By "amateur" and "professional" I do not mean to indicate bad and good; instead, as Gerald Weinberg suggests, the "differences emanate from differences in the ultimate user of the program. Almost invariably, the sole intended user of an amateur's program is the amateur himself, whereas the professional is writing programs which other people will use." Gerald M. Weinberg, *The Psychology of Computer Programming,* Van Nostrand Reinhold Co., New York, 1971.)

There are many examples of the use of APL as a personal problem-solving tool. But what of its use in a "production" environment? Is APL equally well suited here? The number of reported instances of such use is presently fairly small, but it appears to be growing. DATAMATION's characterization of the 1975 APL conference in Pisa, Italy, was "APL goes commercial (Oct. 1975, p. 108)." The 1976 Conference in Ottawa placed a particular emphasis on commercial applications.

At Xerox, it has been reported privately that the internal use of APL, particularly for financial applications, runs into several $million annually. The president of IBM's Data Processing Division stated "we have gone from 4,000 to 16,000 APL users within IBM. And the balance has shifted from scientific to commercial users. Every IBM division relies on the language in some way." American Airlines, Massachusetts Mutual Life Insurance Co., and American Broadcasting Co. are three more examples which come to mind immediately.

But before continuing, it would be worthwhile for me to make some distinctions between the "commercial" and "production" uses of APL. It is easy to confuse these two terms and yet they are really quite different. "Commercial" refers to the area of application while "production" refers to the status of the program. When speaking of the commercial uses of APL, we are typically talking about business and financial applications, as opposed to engineering, medical, scientific, or other possible application areas. Production, on the other hand, like the earlier reference to professional programming, means programs that have completed their debugging and testing phases, and are *ready to be used by others*—be they doctors, engineers, or businessmen. Rather than being programs that are written by amateurs to solve individual problems, they are programs written by professionals to a class of problems. And because of this, the programming requirements are different.

When you write a program for yourself, the specifications can be fuzzy, the resultant code obscure, and the documentation nonexistent. And if there are bugs which your particular data never encounters, who cares?

In a production environment, however, any of these shortcomings can be potentially disastrous—as any dp manager can attest. And these same managers, while acknowledging the power of APL for individual problem-solving, argue that this same power—or conciseness, if you will—makes APL unsuitable for production use. In a number of instances, managers have said that they consider APL "unmaintainable" and "no one can read APL code—not even the person who wrote it!"

This second objection should perhaps be addressed first; for, since the development of COBOL, there has been a feeling that production programs should be "self-documenting" and that anyone, including dp managers, should be able to pick up a source code listing and be able to read and understand what is happening.

Although many may question whether COBOL or PL/1, FORTRAN, or any other general purpose language, for that matter—has achieved this aim, there are few who would maintain that APL is "easy to read." Indeed, it is its very elegance and power which tempts professional programmers to produce the arabesque one-liners that we have all encountered from time to time. This APL "pornography," as Philip Abrams of Scientific Time-Sharing Corp. calls it ("like a well-known American jurist, I cannot fully define pornography in APL, but I can recognize it when I see it!"), is therefore one of the main reasons that managers resist its use for production applications.

The second reason is closely linked to the first. Because APL is unreadable, it therefore follows that it must be unmaintainable. Maintenance, or the modification of existing program, is a fact of life for every computer installation.

Maintenance activity can occupy

anywhere from 20% to 80% or more of programmers' time, depending upon the number of programs in production and the rate of change in the organization. And yet, in spite of this huge manpower requirement, relatively little attention has been directed to it—except by managers, who must face it on a day-to-day basis. In this regard, many of them would echo Gerald Weinberg's question: "Why, we should ask, do programmers, who know full well that programs will inevitably be modified, write programs with no thought to such modifications? Why, indeed, do their programs sometimes look as if they had been devilishly contrived to resist modification—protected like the Pharoahs' tomb against all intruders?" In light of this, it is understandable why these managers resist the adoption of APL for production use.

What then, is the answer? Is there some way these objections can be overcome—or at least mollified? Basically, there are two approaches: modifications to the language itself and modifications to programming practice.

Change APL or change APL programmers

Since its introduction, a number of modifications, enhancements, and extensions to APL have been proposed and, in some instances, implemented. Some of these are designed to add to the general capability of the language (such as Scientific Time Sharing's formatting and file features), while others are aimed more directly at aiding the programming process itself. Xerox' APL, for instance, added the OBSERVE and CATCH commands. With these commands, a programmer was able to trace the functioning of APL expressions and the occurrence of named variables and, this way, make program modifications more easily. Another approach was the development of APLGOL, which included explicit statements to aid in top-down, structured programming.

Although efforts like these are commendable and point out areas where improvements to APL could profitably be made, they presently represent nonstandard versions of the language. And until some mechanism is devised to review and adopt such proposed changes (other than IBM functioning as the de facto standards committee), it is unlikely that managers of production systems will want to adopt such changes unilaterally.

An alternative to the preceding is to alter the manner in which APL code is written. It is my contention that the establishment of standards for programmers who are writing production APL programs would go a long way toward meeting the objections of managers who are concerned about its maintainability. By this, I do not mean just any set of standards; although it could well be argued that from a maintenance standpoint almost any mutually agreed upon way of writing code would be preferable to having each programmer write his program as the mood struck him. Specifically, I have in mind procedures for four particular aspects of program writing: size, structure, documentation, and replacement.

Size

A number of people have spoken of the value of modular programming—the breaking down of large programs into manageable modules. APL, with its user-defined functions, is ideally suited for this. Yet, in spite of its compactness, it is not uncommon to find defined APL functions that run to dozens and dozens of lines of code. Therefore, with the possible exception of functions whose sole purpose is dialogue or "conversation" (giving instructions to novice users of the program), I would suggest that no APL function should ever be longer than one page of printout or, in a crt environment, one dis-

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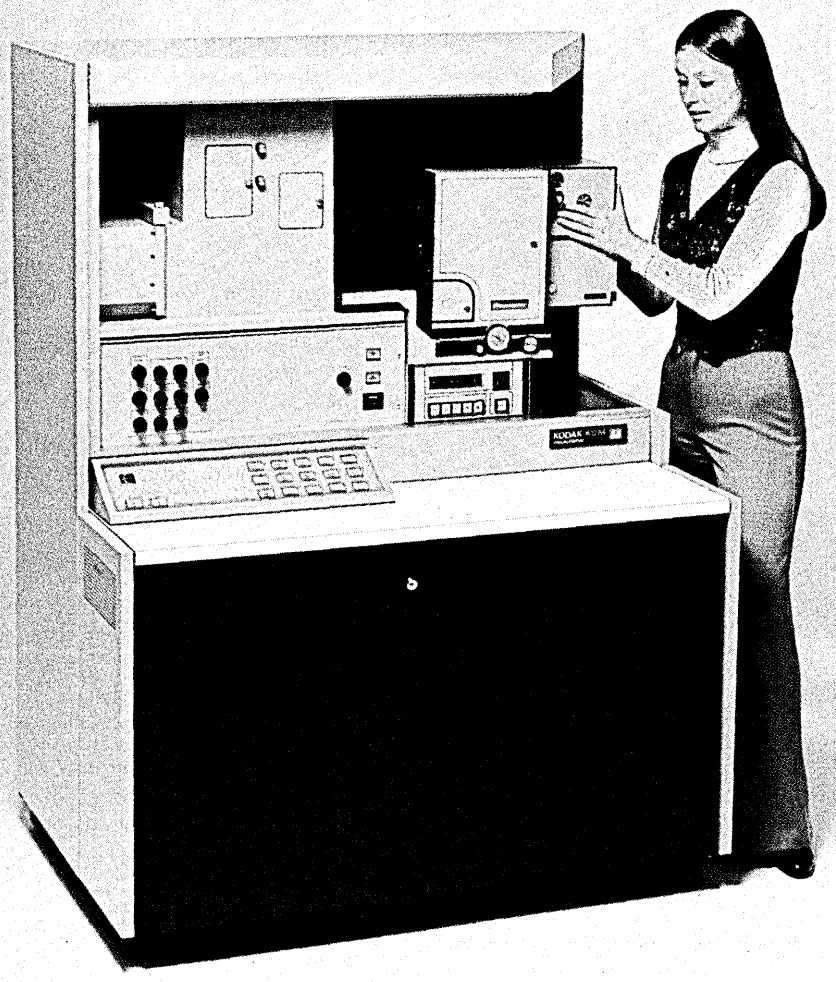

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play screen (usually either 24 or 30 lines). If the code cannot be fit onto one page, then rethink the logic and create two (or more) functions that can fit onto a page.

Perhaps it should be no longer than 12 lines of code! While very little can be accomplished with 12 lines of COBOL code, it is almost obscene (to continue with Abrams' APL pornography notion) what can be squeezed into a dozen lines of APL. Nevertheless,

Rule No. 1: *No* APL *function should ever be longer than one page.* This rule, like those others that are to follow, must naturally be applied with judgment; but if exceptions are requested, the burden of proof should fall upon the requester to justify the deviation.

Structure

From the preceding length limit, it would appear that I am encouraging the production of the very type of densely written code that I earlier decried as being unmaintainable. Actually, I am being a realist for two reasons. Frequently, compact code is more efficient to execute (although not always); and, in any event, programmers seem to prefer producing such tours de force. Therefore, a standard which recognizes this latter fact is more likely to be readily adopted than one that does not. Does this mean that, within a given function, anything goes? Clearly not; but the fewer rules there are, the better.

The first rule of structure has to do with entry to and exit from functions. I maintain that there should be but one entry and one exit point per function. The first half is easy, because merely by invoking a function, we automatically begin at the top. But there is a great tendency to have multiple termination points. Needless to say, this makes flow of control much more difficult to analyze.

The second rule concerns the passing of parameters to functions. Under no circumstance should any variable inside a function be assigned a value outside the function. In other words, all variables with a function should be declared as local variables and all passing of values should be done through the arguments in the header. Similarly, the result of the function should always be stored as an explicit result. In fact, it is good practice to make all functions have explicit results, because even when a programmer envisions his function as "standing alone," it is quite possible that someone else may subsequently wish to incorporate it into another program.

There are many other suggestions which could be made toward improving the structure of APL programs, but I am purposely trying to keep the rules as simple as possible. Thus I am proposing only the following three:

Rule No. 2: *All* APL *functions should have but one starting and one termination point.*

Rule No. 3: *All variables within an* APL *function should be defined as local variables.*

Rule No. 4: *All* APL *functions should be defined with explicit results.*

Documentation

There is little that I can add to what others have already said about the importance of good documentation. At the beginning of every APL function there should be a statement as to what the function does, what inputs are expected, and what outputs are produced. By this, I do *not* mean a detailed explanation of each line of code. I do mean, however, that there should be sufficient detail to allow another programmer to recreate the entire function—although not necessarily the same logic—with no more information available to him than that contained in the header comments. This last point is important; it lays the foundation for my last rule on program replacement.

Naturally, such documentation is felt to be the responsibility of the programmer. But, as Weinberg has ob-

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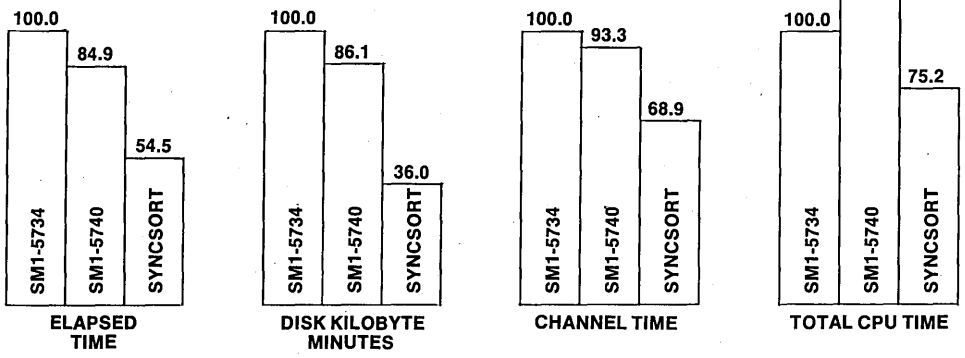

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Call in an Indian tribe to hold a snow dance.

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served: "Documentation is the castor oil of programming—managers think it is good for programmers, and programmers hate it! . . . However, considering the matter coolly, there is no reason to believe that a professional programmer will be qualified as a professional documenter." This suggests that perhaps the program documentation be prepared by someone other than the person writing the code.

In fact, I would argue that the documentation be prepared *before* the program is written. In this way, its completeness is tested at the outset; for if the development programmer is unable to complete the program with the available information, how can the maintenance programmer be expected to modify or rewrite it later?

Thus, Rule No. 5: *All* APL *functions should have sufficient documentation so that the entire function can be recreated without reference to the code itself.*

Replacement

We have now come to my main point. "How," the dp manager still asks, "do I maintain APL programs when they are so impossible to read?" By this he means, "How do I modify and revise APL programs for which the requirements have changed or the equipment on which they are being run is being replaced?" My response is: you don't; you throw the existing code away and rewrite from scratch. I call this concept "throwaway code."

Understandably, the initial reaction to this must be one of horror. But if the first five of my rules have been followed, "starting from scratch" is not as odious as it first may seem. Each function is relatively short (Rule 1). Each function has a straightforward entrance and exit point (Rule 2) and a clean method of passing parameters and results (Rules 3 and 4). Finally, and most importantly, the documentation was written with just this eventuality in mind (Rule 5).

In everything from automobiles to computers, the hand reworking of component parts has been discarded in favor of replaceable modules. Surely computer programs are amenable to similar approaches. APL is particularly suited to such a concept. Although it is hard to document, some programming managers have reported that using APL —rather than FORTRAN, COBOL, or PL/1—to write production packages has resulted in dramatic increases in productivity.

So if an APL programmer can do in a week or less what it may take a COBOL programmer a month to do, the penalties for rewriting, as opposed to attempting to rework, are not very heavy. In fact, I would argue that in most cases it will take *less* time to begin afresh than to attempt to decipher someone else's APL code.

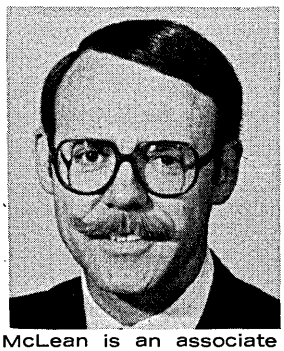
Also, without the "dead hand of the past" to control the recoding, all new enhancements to the language can be incorporated—something that rarely happens in a typical maintenance situation. Finally, the job of maintenance programmer, often considered as the backwash of programming activity, will be viewed much more positively, for now the work being performed will be every bit as creative as that of the programmer who wrote the code originally.

So finally,

Rule No. 6: *Do not attempt to rework* APL *functions; when the need arises for modifications, throw the old code away and rewrite from scratch.*

Conclusion

Anyone who ventures to supply a few simple rules as *the* answer to a complex problem can rightly be considered as either naïve, a fool, or both. Certainly, this is true of those who argue that the mere elimination of GOTO statements (as found in many programming languages) will automatically improve program structure. I hope I have not fallen into this trap with my proposed six rules for APL programming practice. As I pointed out earlier, they must be applied with discretion and judgment. And, with more experience, it is entirely possible that they may need to be modified, expanded, or—following Rule No. 6—thrown away and redone from scratch!



Dr. McLean is an associate professor of information systems at UCLA's graduate school of management. He has taught APL to first year MBA students since 1971, and in 1975 was given a grant from IBM to teach APL to other business school faculty members from around the country. His thoughts on throwaway code were first developed for a paper presented at APL 76, the International APL conference held in Ottawa, Canada, last September.

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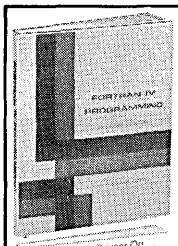

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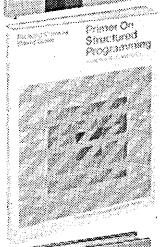

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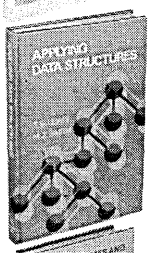

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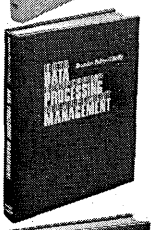

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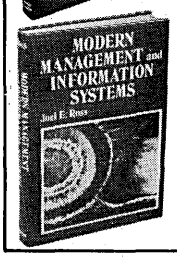

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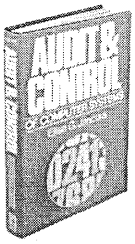

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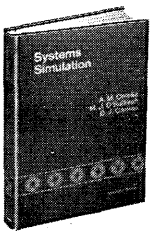

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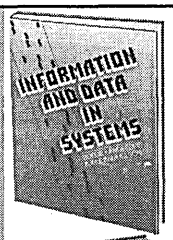

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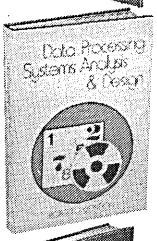

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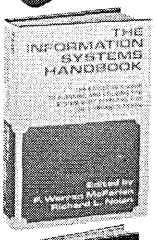

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P39194

White Collar Crime

Is Paper Products Case Tip of the Iceberg?

Indictment in Hartz Mountain case of illegal kickbacks may be first of a score of incidents involving dp people

Unlike the commuters milling about the platform on that mid-June day in 1974, Eugene Corey and George Barney hadn't come to the Scarsdale train station to catch the next local to New York.

The two men had chosen the anonymity of the station as a setting for the secret cash kickback Corey, v.p. of data processing for Hartz Mountain Corp., was to receive. Illegal payments like this made to Corey by firms supplying Hartz with computer paper, data processing forms, and other paper products would net him more than $60,000 and cost Hartz at least twice that amount, a recent seven count Grand Jury indictment against Corey and two co-defendents alleges.

If the Corey case were merely an isolated incident of executive culpability, it would probably merit nothing more than a few lines in the papers and be forgotten. But indications are it may be only the tip of the iceberg. The same white collar crime unit that nabbed Corey—a select group of FBI agents assigned to work exclusively with the U.S. Attorney's office in New York—currently is investigating similar alleged irregularities in the dp department of a major U.S. firm.

And a score, or more, dp managers and purchasing executives interviewed regarding this highly sensitive subject admit privately that opportunities for kickbacks on purchases of computer paper, forms, and tape have long been a fact of life in the industry, one that may well be costing dp users millions of dollars.

Who keeps track

The computer paper and tape business is particularly vulnerable to criminal exploitation because, as one dp manager puts it, "Paper is paper, and tape's tape. Who keeps track?"

"You have companies with big dp operations spending a half million or perhaps a million on forms alone each year," Frank M. Knox, a New York City based consultant in paperwork expense control, explains. "That's big money, and it's very loose. If a fellow's susceptible to any kind of illegal dealings with distributors, this is a bad place for him to be, at least from the company's standpoint."

Buying executive got a new Cadillac every year.

Corporations and other computer user organizations, including the government, that may keep close tabs on spending in other areas often overlook, or insufficiently monitor, form and tape expenditures, Knox and other authorities in the field maintain. Consequently, even blatant rake-offs often go undetected.

In a major St. Louis firm for which Knox did consulting work, for example, the illegal profits garnered from computer paper buying irregularities were so lucrative that the paper supplier had been, among other things, rewarding the company buying executive with a new Cadillac every year for years.

In a similar situation in San Diego, Knox recounts that the supplier and the dp buyer had gotten so bold, they were charging the buyer's company $112 per thousand computer forms, or ten times the going rate, and splitting the difference.

The Hartz case

Corey himself had managed to defraud Hartz, a major pet food manufacturer based in Harrison, N.J., for almost ten years before being apprehended, the Grand Jury indictment alleges. He purportedly began requesting kickbacks from George Barney, president of Tabulating Stock Forms, Inc. in New York City, as early as 1967 in exchange for granting Barney the Hartz business. Payments, the indictment asserts, were made in cash and transacted at secret meeting places such as the Scarsdale station.

While he continued to work with Barney, Corey allegedly put together a second ongoing kickback scheme with David H. Krasner, president of a New York paper supply outfit, Commercial Forms, Inc. Unlike Barney, Krasner allegedly made kickbacks by check made out to a dummy firm Corey had set up called, appropriately enough, Data Con Co.

The alleged kickbacks apparently enabled Corey to take early retirement from Hartz after 16 years with the company, and move to a townhouse in Lauderhill, Fla., where he reportedly continued to draw the balance of what was owed him by his partners. The final

check for $4,950 arrived from Tabulating on or about June 22, 1976, just seven months before Corey, 51, Barney, 49, and Krasner, 38, would be indicted for commercial bribery fraud.

Go through a distributor

The Corey case follows certain classic patterns, insiders familiar with the mechanics of computer room fraud maintain. "To work something like this you have to go through a paper or forms distributor the way this guy apparently did, rather than use one of the major suppliers like Moore (Moore Business Forms)," one source explains. "A big supplier generally gives you a list price and that's it—no shenanigans. But the distributor doesn't have a list price. He may buy his paper directly from the mill, use his own trucks for delivery, and be willing to finagle on price, or grease the buyer's palm if necessary. It's a real rat race."

Even buyers who initially have no intention of doing anything illegal can get sucked in by unscrupulous distributors. "Typically you have a dp manager who's probably got an engineering background and is a little naive about the world of purchasing," confides a Washington, D.C., systems executive. "He moves into a job where he's got buying authority and the distributors begin courting him. Maybe they start out by taking the guy to dinner or giving him a couple of tickets to a ball game. It's a gradual thing, but one day the distributor says, 'Look, what can I do to get this account?' "

They start with dinner . . . it's a gradual thing.

"You've got to be on your guard all the time," adds a purchasing manager from the West Coast. "A distributor can be setting you up and you may not even know it."

If the buyer and distributor come to an agreement, there are a variety of ways to ensure the distributor gets all the company business thrown his way. The Washington systems executive explains: "To cover himself with his superiors, the buyer lays down a regulation that every purchase over, for example, $1,000 has to be bidded on, but he can 'sole source' (buy exclusively from one vendor) anything less than that. From then on, he simply makes sure that all his orders run under $1000 so he can dole out the business to the distributor."

Or, if the purchase is open to bidding, the buyer tells the distributor what the low bid is, and the distributor comes in just below it, bidding last."

A number of schemes

Once the distributor has the account locked up, he and the dp manager can work a number of money making schemes. "Often, you'll find they're substituting an inferior grade of paper," one source explains. "It may look like IBM paper, feel like it, and even meet company standards. But the company's getting short-changed because it's not getting what it's being billed for."

A more blatant means of bilking the company was allegedly employed by Corey, who arranged to have Barney and Krasner deliberately "short ship" on Hartz orders so that in some instances Tabulating and Commercial Forms would only ship 50% of the quantity of commercial forms ordered and billed. The upshot was that Hartz paid for products it never received.

The dp head of a big association headquartered in Washington ran into a similar scheme when he took office a few years ago. "My predecessor had a deal with a distributor whereby with every 100 roles of tape he'd buy, he'd turn over 30 or maybe 40 to the association, then resell the balance through the same vendor," he explains. "The vendor wanted to continue the arrangement with me, and I told him to go to hell, though it certainly would have been an easy enough thing to get away with. Our board doesn't know the first thing about data processing costs."

Make it difficult

How does a company ensure it's not being swindled in its computer room? "If an individual really wants to cheat or steal, he'll probably try it no matter what controls and rules and regulations you use," says a dp executive who's a graduate of General Electric, a firm that's notorious for its stringent purchasing controls. "But you can make it much more difficult for him by centralizing all your purchasing activities in one area, opening all purchases to competitive bidding, and making sure every purchase can stand an audit."

The fact that these kinds of controls were not in effect at Hartz made it relatively easy for Corey to carry out his alleged scheme. Had he been a little more careful, and a little less greedy, Corey might well be basking scott free in the Florida sun today without a worry, one of his former colleagues maintains. Instead, he and the other defendents face a maximum five year jail term and a fine of $1,000 on counts of fraud, and Corey also faces an additional maximum five year jail term and a $10,000 fine on a conspiracy count.

Distributor is told what the low bid is and comes in below it.

—Laton McCartney

Super Computers

Super-Super Computer

Machine Dedicated to Wind Tunnel Tests At $30 Million Price

A supercomputer that's a hundred times faster than the Control Data 7600 is being sought by scientists at NASA's Ames Research Center in Northern California. A graph that plots past supercomputers according to their availability date and speed and then is carried into the future, shows that such a machine would not be available even by the year 2000. But these scientists want the machine to be built for their particular application and to be up and running in the early 1980s. It might cost up to $30 million.

"The question we're asking is, if we pushed the technology such that we ask someone to design a machine to suit our problems, can we force this speed up at a quicker rate? We think we can. We think we can drive the technology," says Victor L. Peterson, head of the thermo and gas dynamics division at Ames. He adds that the machine would not be a general purpose device, but would use off-the-shelf technology.

The specialized application, not totally dissimilar from weather studies, is the modeling of aircraft in a wind tunnel. Not with the intention of replacing wind tunnels, but rather to substitute for the early testing of a model in a tunnel. In those early stages, by trial and error, a model of an airfoil (a cross section of a wing) or an entire wing or fuselage is constructed (of metal, in the case of a high speed craft). Time in the tunnel is then reserved, a run is made, and the test results evaluated—before the model is modified and another test made. It might mean the shaving of some metal here, the addition of more elsewhere.

"What we're trying to do with our computational program is to do a lot of this cutting and filing, more or less, on the computer," Peterson explains.

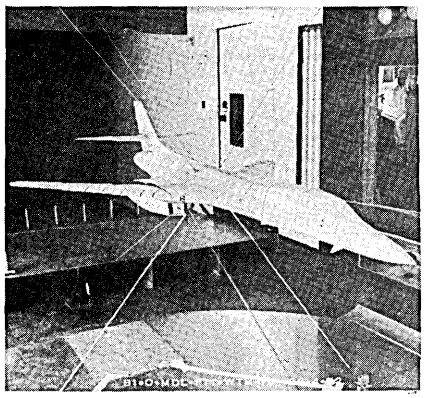
Complicated equations

"We know the equations that govern fluid flow," he says. "But these equations are so complicated that we don't have the means to solve them in their complete form, even with the largest computers, in a reasonable time, and including all the effects of turbulence. The real crucial issue is that near the surface of a wing or an airfoil you have turbulent flow. And the size of the turbulent eddies is so small, relative to the surface, that if you try to compute that—if you have a computational mesh and try to solve the equations at a number of points in the flow field—you must have so many points in the flow field to capture that small-scale turbulence that it's just out of the question. So what we have been doing over the years is solving various approximate forms of the equations."

The simplest thing is to throw out all the terms having to do with viscosity or turbulence. Then you omit all nonlinear terms. What you end up with are linear, inviscid equations—those not having to do with viscosity.

The use of only linear terms was prevalent until the late 1950s or early '60s, at which time computers became available to include nonlinear terms, although still omitting viscosity and turbulence. Computers of the class of the IBM 704 required a few hours to arrive at one solution, and it was considered reasonable. But that was only for airfoils—two dimensional forms—not for entire wings.

"Finally we're to the point now where computers like the CDC 7600 are powerful enough to solve the nonlinear inviscid equations for three dimensional shapes," Peterson adds. "In other words, we can do whole wings." From such computations, they are able to determine, for example, the pressure distribution over a wing, but still not including the effects of the boundary layer, the so-called viscous effects. Thus it does not compute the friction, which prevents them from determining the drag.

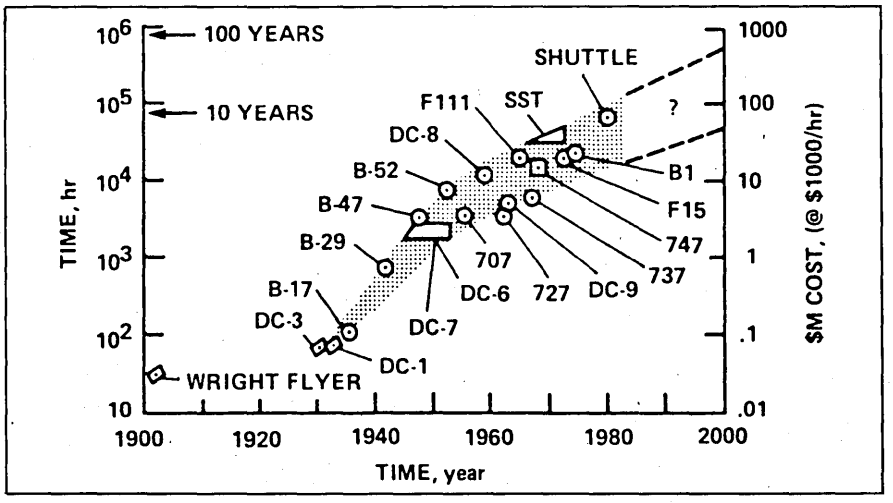


THE B-1: Model suspended to simulate free flight in a low speed tunnel and structured to evaluate the torsion and flexure of various model components.

Can't fly an airfoil

"The next level of approximations to the equations is to start to include the viscous effects." That adds more terms to the increasingly complicated equations. "And present day computers like the 7600 and even the Illiac IV are only two dimensions." There is apparently much that can be learned by studying two dimensional shapes, but as Peterson points out, one can't fly an airfoil. So the next step is to model an entire wing.

To do so, of course, requires that the computational mesh become a three dimensional grid. At each point in the grid is a set of variables representing physical conditions, such as temperature, velocity, and air pressure. An airplane or wing can then be pictured within this computational mesh. They use finite difference approximations to partial differential equations throughout the field, reducing the partial equations to a set of coupled nonlinear algebraic relations. The finer the grid, the more accurate is the approximation of the air-



Even the Wright Brothers used about 50 hours in wind tunnel tests of their Kittyhawk. Today, it's up to 45,000 hours for the space shuttle, as illustrated in this chart of wind-tunnel test house for development of various aircraft.

flow conditions. With the Illiac, a system of some 50,000 grid points can be handled, but to achieve an accurate, usable estimate of airflow is said to require from 500,000 to a million.

"We have made estimates that in order to compute these solutions in a reasonable length of time, we need a machine that's roughly a-hundred times more powerful or effective than a CDC 7600." He adds that it would be 40 times more powerful than the Illiac, a class that also includes the Cray 1, the CDC Star, and the Texas Instruments ASC computers.

Million operations a second

As a measure, they use the term mflops, or a million floating point operations per second. "We need an effective computing speed of a million mflops or a billion per second," Peterson says. They find that vendors' claims are more of an ideal speed, a theoretical upper limit as to how fast a machine will perform a floating point operation if you had a perfectly matched problem for it, and the effective speed is more like a third to a half that advertised claim.

By this measure, the Illiac class rates at 20 to 40 mflops, the CDC 7600 at 5 to 6 mflops, the IBM 7030 (the so-called Stretch) had about 0.3 mflops, and the IBM 704 about 0.03. The people at Ames need about 1,000. Unfortunately they do not see the next generation of supercomputers having the requisite speed.

"If we want that kind of capability, we first have to determine whether it is practical to get it if we tailor the architecture of that machine to our problem," says Peterson. And that's the purpose of two studies they've initiated, one given to Burroughs Corp. and one to Control Data Corp. Each has been asked to survey the outlook for general purpose computers coming down the pike and, given Ames' set of problems for solving aerodynamic flows, whether it is feasible to tailor the architecture of a machine for them. Along about September of this year, the two vendors are also expected to provide some concept definition of the architecture, as well as early cost estimates.

A $30 million price tag

"We feel we can justify the development of a machine like this on its aerodynamic application only," he says. They figure the price will be close to $30 million. "That sounds like a fair amount of money, but it turns out that the next generation of general purpose supercomputers is probably going to be in the $15 million range, so we're talking about a factor of two increase for a special purpose machine, but one that will have maybe 40 times the capability of supercomputers of today." He fails to point out that the Illiac IV cost about $35 million.

Peterson adds that the computer would have the capability to simulate the entire range of speeds, whereas no single wind tunnel can test the entire spectrum required. The space shuttle, for example, must fly at orbital speeds and at landing speeds, from Mach 0 to Mach 23 or 24, Mach being the speed of sound. So it must be tested in different wind tunnels, each with a specific range of aircraft speeds—for landing speeds, for transonic speeds (ranging from Mach 0.7 to about Mach 1.4), for supersonic and for hypersonic speeds.

Not so with the computer. "The equations that govern fluid flow are known over the whole flight spectrum," he says. "And it's the same set of equations, from Mach 0 to orbital speeds." Additionally, because the test cells are small, the tunnel's walls have an effect, as do the pylons that support the model.

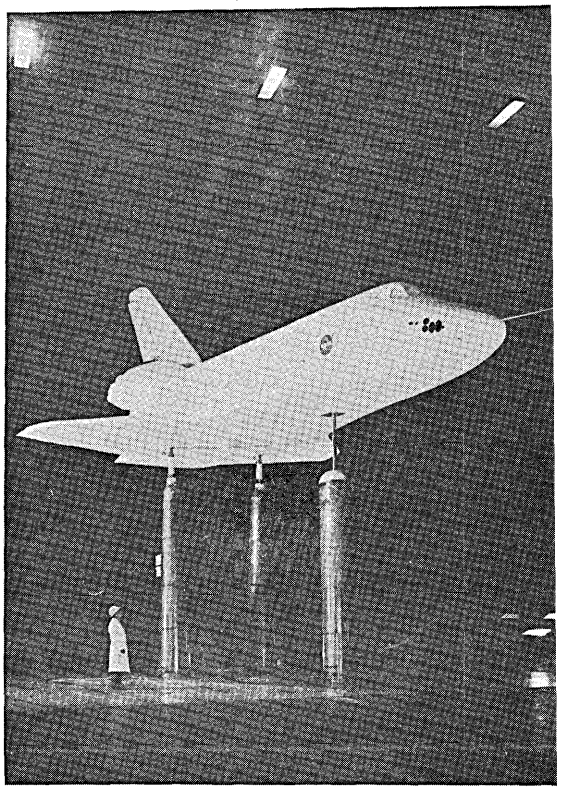
More wind tunnels

Still, construction of wind tunnels continues. The space agency recently received approval for a transonic tunnel to be built at NASA's Langley Research Center in Virginia. Price tag: about $70 million. And at Ames, in Moffett Field, Calif., where short take-off and landing (STOL) aircraft are being studied, an $83-million addition to an existing tunnel has been authorized.

Peterson declines to say how much they've saved in wind tunnel time with their modeling activities, but says the real effect on tunnel time and new aircraft development will come when they're able to do three dimensional simulations with viscosity.

He says they can solve these problems with viscosity on the Illiac for one flight condition, but it would take days. "The trouble is that if your solutions are going to take that long, it isn't practical as a design tool. It's only practical as a research tool." A vehicle flies through a spectrum of flight conditions—angle of attack, Mach numbers, etc. And if it takes a day to get one data point for one set of flight conditions, it's not practical as a design tool.

MORE THAN 100 major aircraft designs have been tested in the test section of this 40 x 80-foot wind tunnel, covering an area of more than two city blocks. It measures speeds from zero to 230 miles per hour. In it, this one-third scale model of the space shuttle orbiter undergoes wind tunnel testing to gather low speed flight data in support of approaching and landing tests. Another purpose is to calibrate the vehicle's air data probes. In photo at left, the Air Force's B-1 strategic bomber takes to the air in its maiden flight last April 1 in Palmdale, Calif. It has 25,000 hours of wind tunnel tests.



They want to do a three dimensional problem with viscosity in about 10 to 15 minutes per solution. It would enable them to sort through a number of designs in a reasonable time, even if it took a day or two of computing. That day or two might replace what requires six months in a wind tunnel.

Cutting six month chunks of wind tunnel time is not insignificant. The average cost of that time is about $1,000 per hour, not to mention the huge amounts of ever-precious energy consumed in the process. The Boeing 747 spent more than 10,000 hours in a tunnel at a cost of more than $10 million. The B1 bomber required on the order of 25,000 hours, and the space shuttle orbiter, by the time testing is complete, will require about 45,000 hours in a tunnel. That's the equivalent of about 10 years. Even the Wright brothers used about 50 hours of time in a wind tunnel that they built.

A plot of wind tunnel time used by various aircraft shows it's going up exponentially. "One of our goals is to be able to turn the tide on this increasing number of wind tunnel hours . . . Our hope is to be able to do more of the preliminary design of vehicles that fly through the atmosphere on a computer before we actually go into a wind tunnel. We'll use the wind tunnel to verify final designs and to get additional information that we still can't compute accurately."

At Ames they are using the CDC 7600 and the Illiac, usage of the latter increasing with familiarity. "We need to start getting our codes and our tools in order so that if we get our special purpose machine in the 1981 or '82 time period we'll have our codes all checked out and ready to go on this device," says Peterson. "So we're going to be using the Illiac very heavily, starting now to pioneer these three dimensional viscous flow codes."

—Edward K. Yasaki

Mainframers

A Very Busy Year

Product Announcement Includes Full Scale Marketing of Multics

Nineteen Seventy Six was a busy year for Honeywell Information Systems.

It was a profitable year, too, with sharply increased earnings and minicomputer revenues.

It was a year in which HIS prepared for what one spokesman called, "one of the most important announcements in Honeywell's history"—its Distributed Systems Environment.

Honeywell also used the year to ready a wide array of new products for the Xerox user base which it acquired a little more than a year ago (see p.155).

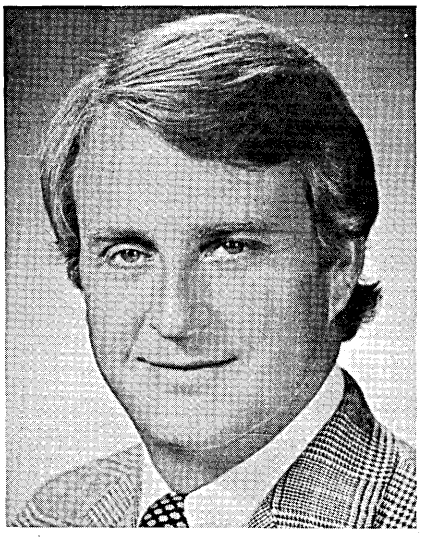
And it was a year in which Honeywell finally launched full scale marketing for something that has been around since 1965, and which has been exclusively a Honeywell product since 1973—Multics, its Multiplexed Information and Computing Service.

The DSE announcement was made with considerable fanfare. It came simultaneously in Phoenix, New York, London, and Milan, with a full complement of Honeywell top brass present at all locations.

Phase Two

In Phoenix, William Patton, Western District vice president called DSE Phase two of an evolution of technology and marketing begun with the company's announcement of Series 60 in April 1974. He said the significance of DSE is in flexibility and control. "A user is free to establish his own configuration. He's offered a cross compiler, common data structure, common protocols, local transmission capability . . . the broadest possible range of options."

In New York, Honeywell president Edson W. Spencer said the announcement represents "a midpoint between the introduction of our Series 60 systems and their implementation in the sophisticated distributed networks of the 1980s."



WILLIAM B. PATTON, JR.
DSE offers the user the broadest possible range of options

HIS president, C. W. Spangle, said that under Honeywell's concept of distributed systems, "processors—components that are capable of altering the content of data or managing files—and not simply transmission or communications devices, are placed more directly into the hands of end users."

Dick Meise, Large Systems marketing director, said in Phoenix that the primary marketing emphasis would be to existing customers with add-on systems second and replacement systems third.

Patton said he believes Honeywell will be successful in all three areas. He predicted the market for "this type of equipment will total $5 billion commencing into the '80s."

Four Processors

The products announced for DSE include four host processors: the large scale Model 66/85 and the medium-to-large scale Models 64/60, 64/50, and 64/30; the Datanet 6678 front end network processor; the DST 6/500 intelligent terminal; RBT 6/300 remote batch terminal systems; and a low cost display terminal, the VIP 7700R.

The 66/85 was described by Norm Feldman, vice president and general manager of the Large Information Systems Div. as "the most powerful computer Honeywell has ever built." He said it is 400% faster than the 66/80, current top of the Honeywell Line.

The 66/85 makes use of Common Mode Logic (CML), instead of the more common Transistor-Transistor Logic (TTL), and a new micropackaging technique (see p. 245). CML also is used by Burroughs, but the micropackaging technique is proprietary to Honeywell.

Feldman called CML and the micropackaging technique "the technologies of tomorrow." The British news magazine *New Scientist* calls CML tantamount "to a backward step to a type of logic evolved in the design of first generation computers." The magazine says when digital circuit designers "first evolved the emitter-coupled linear circuit as a digital switch for very fast computers, it was called current steering logic or current mode logic (CML). The publication does concede the micropackaging technique is new and that coupled with CML it means faster and smaller computers.

C. Walker Dix, chief engineer of Honeywell's Large Systems Div. said the company eventually intends to take the technology down the line. He also said he expects Honeywell to use the technology in computer memories (currently it is used only in logic circuitry), "but not in the near term. It depends

DISSPLA

USERS MEETING

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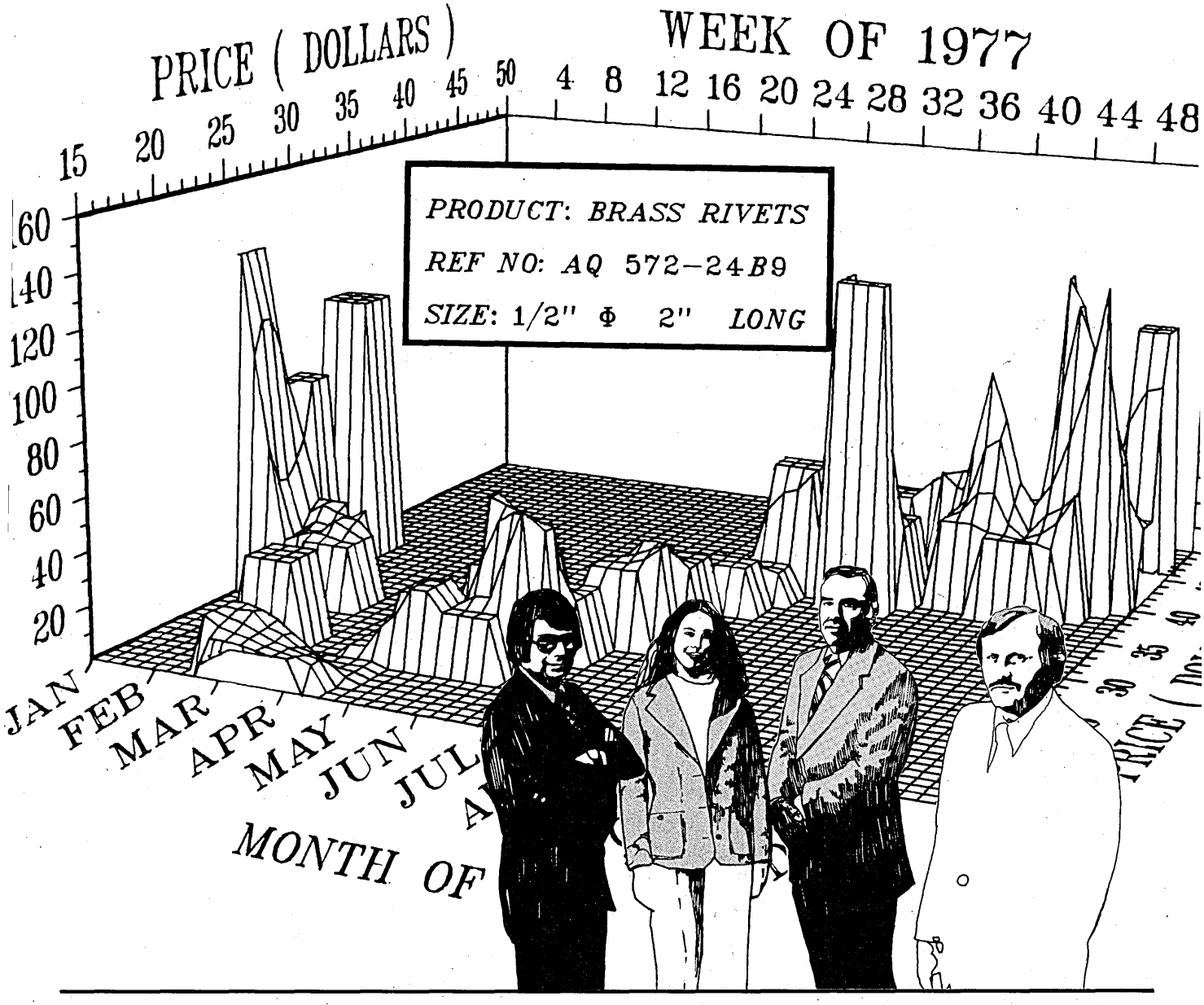

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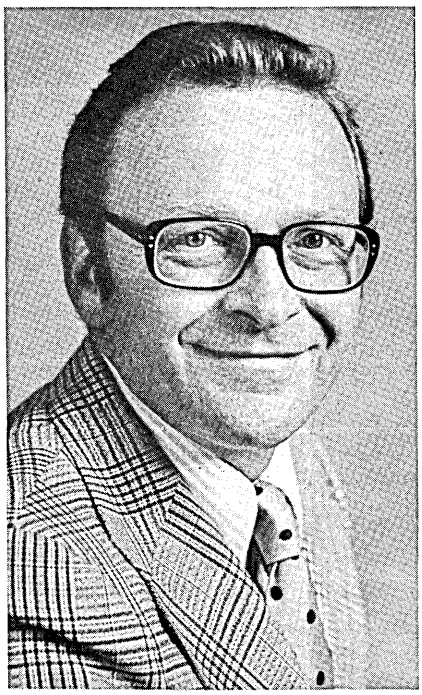
CIRCLE 88 ON READER CARD

on the timing of the price cross-over compared to MOS RAMS."

A Major Element

As a major element of DSE, Honeywell also announced support of a standard bit-oriented protocol, High Level Data Link Control (HDLC). The company described HDLC as offering significant advantages over earlier protocols, with code transparency and ability to accommodate two way simultaneous operation.



RICHARD G. MEISE
Primary marketing emphasis is to existing customers

NORMAN N. FELDMAN
CML and micropackaging are "the technologies of tomorrow"

And if Honeywell is announcing tomorrow with its DSE, it could be said to be catching up with yesterday in launching its full scale marketing efforts for Multics. Design activities for Multics began in 1965 as a joint activity of General Electric and the Massachusetts Institute of Technology. Honeywell got into the act when it purchased the GE computer operation in 1971. Multics became operational as an MIT campus computer business in 1969. In 1973 a selective sales campaign was attempted and MIT's interest was terminated. It became exclusively a Honeywell product.

"Its orientation was scientific timesharing," said Warren D. Martin, manager, Multics marketing. "Honeywell felt it had shortcomings for commercial use, such as lack of Cobol, and set out to conduct an aggressive research and development program. The last of the key software packages were delivered in 1975 and we got into full scale marketing last year."

Martin said Multics offers users four major benefits: productivity, management and control, expandability, and security. Both Martin and Ronald R. Riedesel, senior product manager, Multics marketing, deplore the fact that Multics is well known mainly for its security features, although they both believe "it is the most secure system today." They agree too that this will be a plus feature for Multics "when industry gets around to addressing privacy issues."

What they don't like is that people "think security is all Multics offers, and it offers so much more." They point to the fact that two of their big users, the U. S. Geological Survey and Industrial Nucleonics, whose system is used in process control for pulp and paper, have no particular security problems. Multics currently is installed at 10 sites.

No Dead Ends

Riedesel likes to stress the fact that Multics can provide a variety of services and operate in a variety of modes—batch, RJE, transaction processing, etc.—simultaneously and with no dead ends for the end user. He said there is no restriction on languages used to access data bases or files.

He said Multics has a totally on-line orientation, with an inverted operating system oriented toward service to a terminal user. A batch job, he explained, is treated as a terminal user who doesn't have a terminal.

There is no job control language (JCL) with Multics, Riedesel said. "It responds to specific commands. It features total sharing of languages, data bases, applications packages, user codes, and data but with the capability for privacy restrictions."

He called Multics the "most powerful software development system today," pointing out it can write programs, debug converted software, provide archiving, editing, and automatic structuring. "You can even open up the code and modify it."

Riedesel said Multics has had virtual memory longer than any other vendor—since 1969. And the "Multics Data Base manager gives the user a choice between the network and relational approach to data base management."

Word Processing

Word processing capability is a Multics feature highly touted by Martin and Riedesel. "We use it for all our documentation. We pull material off the system camera ready." The system also interfaces with a page printer. It has an on-line dictionary which goes through 50,000 correctly spelled words and can handle automatic hyphenation, automatic suffixing, document formatting, list processing, form letters, and electronic mail.

Its graphics systems, Riedesel said, can include nongraphic information and dynamic animation.

The system affords priority scheduling in that each user is guaranteed a certain percentage of the cpu. If response time becomes a problem, he said, a supervisor can change the allocation instantly from a remote location. "If throughput starts to degrade you can find out with metering, and tune it on the fly."

Riedesel said source code is always delivered with the operating system. "We never deliver a patch. If you find a bug we send the source code out."

Unattended operation is possible because of a protective feature which shuts the system down if there's trouble. "We run in Phoenix over the weekends with no operator present. The first time there's a problem the system goes down, tries to correct the problem, and comes back up again. If it happens again the system says 'Oh I must really be sick; I'd better go down and stay down.' "

Multics runs on Honeywell level 68 hardware but is compatible with level 66 GCOS (General Comprehensive Operating System) and can run in a GCOS environment.

All hardware is modular, and a 10 times growth factor is possible—up to a six processor system with 512 disc devices and a trillion bits of on-line storage, Riedesel said.

All this and security too.

—Edith Myers

Honeywell: "The Honorable Path"

"Honeywell is proceeding down the honorable path," Randy Best, chairman of Exchange, the Xerox users group, told the group at the conclusion of a three day meeting in Atlanta last month.

"A reasonable amount of new life has been breathed into the products," Best said. But he conceded, "that's my system, not everyone's system." Best is with Motorola Corp.'s data processing center in Phoenix. "We have to remain vocal," he told the user group meeting.

Many, particularly smaller users, were quite vocal during the meeting, citing problems with maintenance, particularly software support, and fears their equipment wouldn't be supported for as long as they wanted to keep it.

The meeting was attended by 242 users representing 116 companies. There were 109 representatives present from Honeywell, far more than generally attend other Honeywell user group meetings.

The first part of the conference was devoted to Honeywell's introduction of an impressive array of new products designed to provide a growth path for the Xerox equipment users.

A Smattering

At the conclusion of the Honeywell presentation, Best called it, "a reasonable commitment on the part of Honeywell." He asked the users, "Are things going well?" The applause could only be called a smattering.

Said one user: "The lack of applause can only mean that we don't really know what Honeywell's going to do about a lot of equipment we intend to keep through the '80s and maybe the '90s. Are they going to cut us off?"

Honeywell's response was that the company has maintained everything it has ever manufactured with one exception (not noted). "We don't have to defend that record."

Most attention was given during the Honeywell presentation to Control Program 6, successor to CP V, the Xerox operating system much beloved by its users. The message was: "CP 6 is on its way."

Henry Haugland, product marketing for Honeywell, said the design phase for CP 6 is nearly complete at Honeywell's Los Angeles Development Center. It is scheduled to be benchmarked during 1978 and to be available in the first quarter of 1979.

Haugland said CP 6 will support real time batch, remote batch, time-sharing, and transaction processing. He said an "extensive array" of conversion aids will be made available to CP V users.

Shel Klee, director of the L.A. center, described its activities. "There were 65 of us in the center in July 1976. A hardware contingent was transferred (from Xerox Data Systems) in October 1976. The original CP V developers have rejoined us. We now have 103 people and we're actively recruiting."

He said that CP 6 is built on CP V technology and Honeywell level 66 architecture, using Honeywell Level 6 minicomputers as front end components. He said of CP 6: "it has all the strengths of CP V and will address its perceived weaknesses." He said it will feature improvements in throughput and responsiveness. In CP 6, he noted, operators' console functions can be assigned to any terminal in the system, not possible with CP V.

RANDY BEST OF EXCHANGE
"Are things going well?"

One of the major strengths of CP 6, he said, is its common scheduler which allows, for all execution modes, the consistent control of such functions as: program dispatching, response and throughput optimization, swap memory management, multiprocessor management, pooled system resources, and multibatch job initiation.

Products introduced by Honeywell at the meeting included: an MOS memory subsystem for the Sigma 9; and extended memory subsystem for the Sigma 6 and 7; a dual processing option for the Sigma 6 and 7; a virtual memory subsystem for the Sigma 5; a removable disc storage subsystem for the Sigma and 500 series; and a magnetic tape subsystem for the Sigma and 500 series.

Retain a tape

With the tape subsystems for Sigmas it is necessary that a user retain one Sigma tape drive on site. This caused some unhappiness. "The new tape drives are good and we want one, but we're small. We can't afford maintenance on two tape drives," said one user.

Harvey Swett of Honeywell responded: "We felt it was important to get a tape offering into your hands as quickly as possible and as economically as possible, and the only way to do it was with the requirement of keeping one tape. Sorry about that. It was a question of getting it or not getting it."

Exchange's planning committee compiled a list of user needs which it sent to Honeywell last November. Honeywell had a written, point by point response which it distributed at the meeting.

"They met about 90% of our demands," said Best. He was particularly happy about the MOS memory subsystem for the Sigma 9 and was planning to order "a couple" as soon as possible. "I can double the memory on my Sigma 9 and not increase the cost, getting MOS to boot."

Free rent

Most of the Honeywell enhancements announced at the meeting were designed to provide Xerox users with migration paths to Honeywell Level 6, 62, or 66 equipment. Hoagland said any users who go to this equipment can retain Xerox equipment rent free for six months after the Honeywell equipment goes on rental. "They pay only the property tax."

Honeywell also announced a new Xerox contract extension program under which any combination of long and short term agreements can be included under one contract. These are device specific agreements, the firm explained, under which, in a mixed configuration, each unit has its own agreement.

The company also said it was reducing charges for extended period maintenance in systems using its new upgrades, most of which will be available in the fourth quarter of this year and the remainder in the first quarter of next. Where Xerox extended maintenance charges were 110%, Hoagland said, the new premium will be 25%.

Quality of maintenance was one of the things most challenged by unhappy users. There was talk of long down time and one user wondered why "it should take four weeks to get a disc drive fixed." There was also concern expressed about inventory and parts availability.

Honeywell feels it has these problems resolved. Although Xerox went out of the general purpose computer business in mid-1975, it continued to be responsible for logistics support, refurbishing, and spares and repair through 1976. Honeywell took this over on Feb. 1, 1977.

Transfer to Phoenix

More than 50 support field engineers have been transferred to Phoenix, Hoagland said, where Honeywell has acquired a 107,000 sq. ft. building for

The Missing Link

The HP 3000 Series II closes the gap between the small business system and the big central computer.

Until recently, that gap was a real problem. For small to medium-sized companies the cost of a big computer was prohibitive. But there was a growing need for extensive batch processing and real-time information management.

Today, the HP 3000 Series II fills that need. A fast, powerful general purpose system, it can handle a wide variety of computing modes concurrently. Yet system prices start as low as $110,000 (U.S. domestic price).

A versatile operating system is the key.

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Our system has virtual memory, giving you the flexibility to run large programs with a relatively small real memory. And with batch plus terminal capability, you can develop programs at a terminal using our interactive EDITOR—then run them unchanged in batch mode for production work.

The HP 3000 is fluent in COBOL, RPG, FORTRAN, BASIC, APL and SPL (our ALGOL-like Systems Programming Language). These are high-level languages, which the operating system treats alike. The same simple control language statements let you use any programming language.

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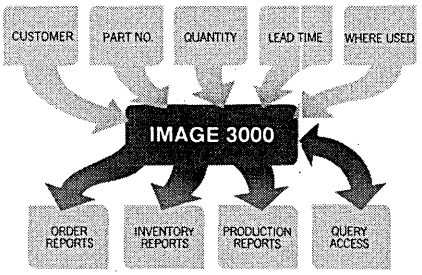

Turning raw numbers into usable information. *All the tools for data base management are provided by our IMAGE/3000 software package and English-like QUERY inquiry language.*

You can compile reports, make casual inquiries without writing programs and update data on-line. You can generate forms, titles, page and column headings, data sorted by categories, subtotals, totals and averages.

IMAGE has proved to be such a useful DBM capability that it was named to the 1976 Datapro Software Honor Roll. This places it among the 38 top software products, and one of only three DBM packages, among 1447 rated by computer system users throughout the country.

The software was judged in six categories: ease of installation, throughput efficiency, vendor support, ease of use, documentation and overall satisfaction.

We've made our data management capability even more useful with the addition of KSAM (Keyed Sequential Access Method), giving you fast access to indexed sequential files.

Hardware advances add speed and reliability.

HP's "fault control memory" keeps the CPU running at full speed, even when a memory circuit has failed. Five error-correcting bits in every 21-bit word determine where a fault has occurred and the system compensates for it. A RAM automatically stores the information about the faulty chips. When our Customer Engineer arrives for regular maintenance, he calls up a status report and replaces any faulty circuits—even though everything has been running fine as far as you're concerned.

Fast (350 ns access) semiconductor memory is used, making the CPU easy to expand. In fact, you can go from 128K bytes of main-

frame memory to 512K bytes, depending on the system you choose. And disc capacity ranges from 15 to 400 megabytes.

At the heart of the CPU is a 32-bit bipolar ROM-based microprocessor. It contains 209 firmware instructions that execute many system operations normally left to software. This microprogramming speeds up such recurring operations as moving character strings from one location to another, scanning strings for a particular character and environment switching. Processing interrupts and linked list searches are also implemented in microcode, relieving the operating software of considerable overhead burden.

With its power and versatility, the HP 3000 is a natural upgrade for companies outgrowing their small business computers. If you'd like to see it in action, call your nearest Hewlett-Packard office listed in the White Pages. Or write to Bill Krause, Hewlett-Packard, 11000 Wolfe Road, Cupertino CA 95014.

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With a throughput two to six times greater than the original HP 3000, the Series II is designed to handle batch operations and multi-terminal on-line computation simultaneously.

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The smallest system, the Model 5, has a 128K main memory (expandable to 256K), plus a 15 megabyte moving-head disc, a 1600-bpi magnetic tape unit, an HP 2640B CRT terminal and a 16-port asynchronous terminal controller.

The Model 7 takes you to 192K bytes of main memory (expandable to 256K), with two 47 megabyte discs, IMAGE data base management, COBOL and RPG. The Model 9 has 320K bytes of main memory (expandable to 512K). IMAGE and five programming languages are standard.

Any configuration can be enhanced with the addition of line printers, card readers and punches, terminals, discs, tapes and more main memory.

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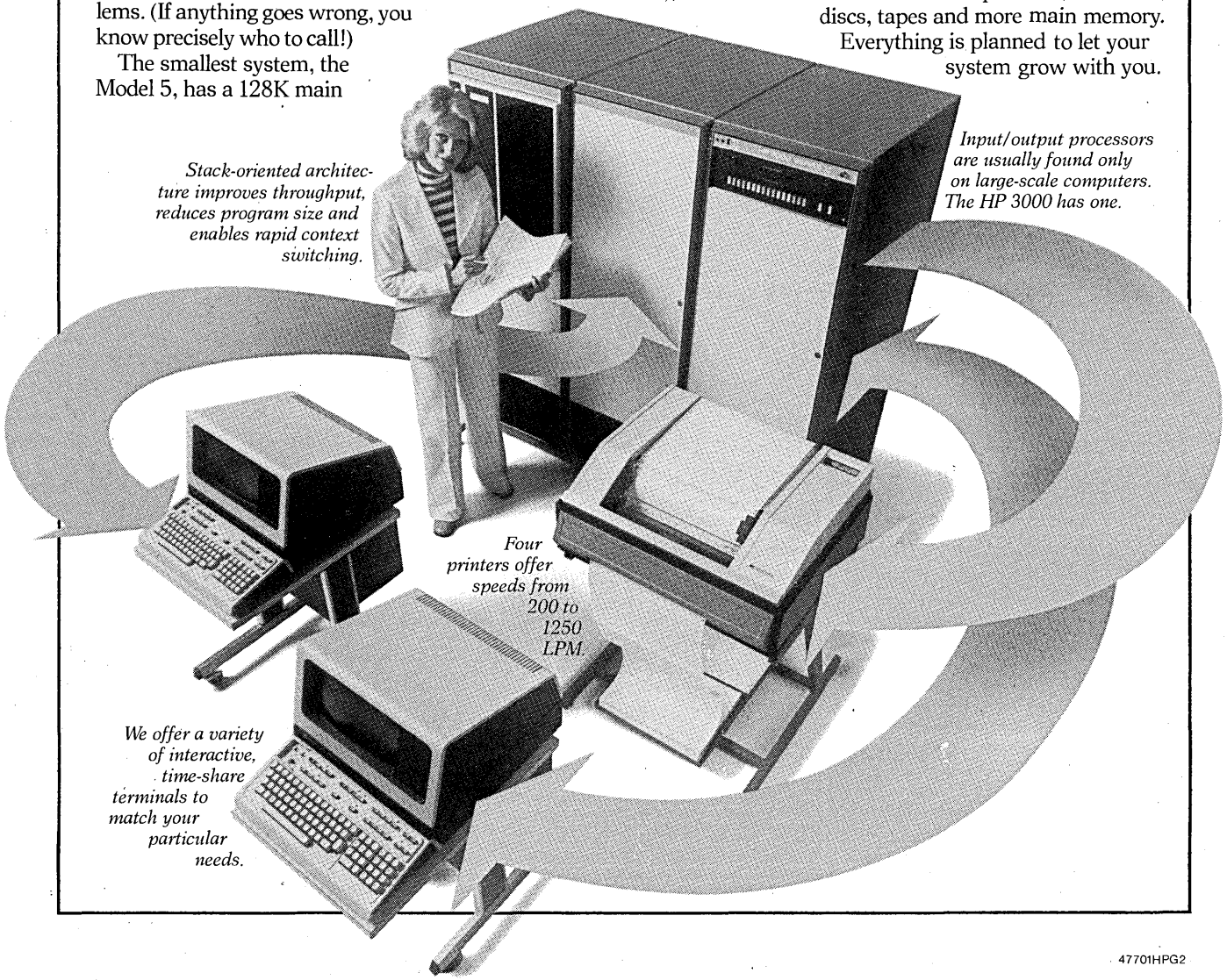

Stack-oriented architecture improves throughput, reduces program size and enables rapid context switching.

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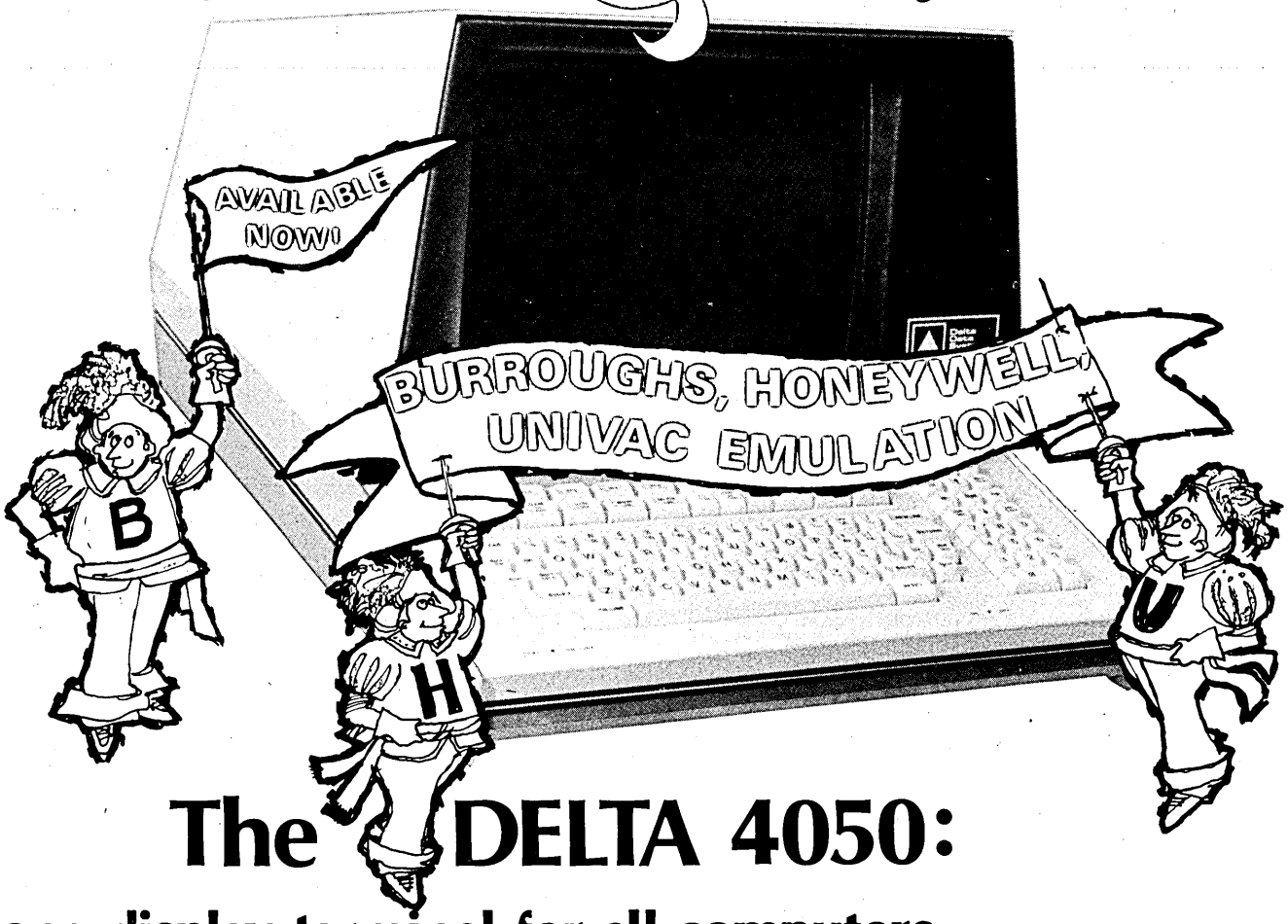

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all computers for one display terminal

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refurbishment, spares, and repair. The company also has put a field inventory control system on-line.

"We have more than 7,500 field engineers now," Hoagland said, "and the quality of service is up."

Leo Razatis, head of the field engineering office in the southeastern area noted, "in the past several months, our rehires have exceeded our attrition."

There were other concerns. One user who has a Sigma 7 and a Sigma 9 and is about to lease another Sigma 7, wondered about trade-ins and was assured, "we'll have a policy."

Another commented that the CP 6, level 66 configuration "discussed here seemed large. What about smaller systems? What kind of dollars does this mean?"

On beyond

Hoagland told him CP 6 will span the price/performance range of today's Xerox products and will go beyond it."

Best noted that a low level entry machine for CP is something users should continue to be vocal about.

But, he told them, "sometimes we forget where we were a year ago. This is not another RCA or GE situation. I think field engineering found out a lot of things here that they weren't aware of before."

Hoagland noted that the installed base of Xerox equipment "grew more than 10% last year." He made some final promises . . . a front end processer in late '77 . . . an interface to allow level 6 computers to talk to Sigmas . . . a variety of products for Sigma based on work at Honeywell's Process Control Div.

"There is no plan to discontinue support for any products," he said. "If Sigma computers are in the field in 1985 or even in 1990, you'll get software support until then." He characterized activities at Honeywell in 1976 like "putting socks on an octopus." Maybe when Exchange meets next on the West Coast all the socks will be in place.

—Edith Myers

Pricing

Honeywell Revises Second User Policy To Appease Users, But Some Aren't

What if IBM announced that users whc picked up a secondhand 1401 would have to pay a few thousand dollars for the 15 year old operating software? What if it said that OS 360 or VS 370 came with a price tag of tens of thousands—plus a monthly charge—for anyone who buys a used 360 or 370? And what if it said that Amdahl users had to shell out for the current operating system in the field? The industry would go berserk, and the Justice Department would swoop in.

Then what if its only reaction to the screams was lowering the price of that old 1401 software to $50, and it claimed, "The majority of the user complaints have been answered." Would that make all those 360 and 370 users happy?

Fortunately, IBM has not done any of this. Everything that it delivers as part of the system price is never charged for again—first user, second user, third user.

But Honeywell Information Systems doggedly has pursued such a second user policy since 1975. The crowd-appeasing modification came recently when it decided to release most of its early '60s software for a $50 license fee, plus $200 for each requested distribution of the tapes. It also has lowered the price 17% to 21% on slightly newer (pre-1970) operating systems. But it has retained the stiff fee and monthly charges on OS-2000 and all GCOS software. (See chart for details.)

Not all are appeased

This is the policy modification that it says resolves most of the major user complaints that wracked the Honeywell community in 1975 and 1976. The user groups themselves are not so sure, however. Jim Healy, head of the Honeywell User Group policy committee, said he feels Honeywell has many more answers to give on software policy, and that personal visits with Honeywell management are mandatory. The various Honeywell user groups for small and medium scale systems around the country are working toward a unification program that should strengthen their position in resolving problems and policy disagreements with the vendor.

The policy still leaves users who bought their equipment before that policy change—and those who intended to exercise their purchase option on extended leases—with a fundamental problem. The value of their systems has been downgraded not only by the Honeywell price for software, but also by the fact that the open market value has slipped dramatically because of the policy. What's more, Honeywell itself, as is true of many vendors, is a formidable competitor with its own inventory of aging systems and its ability to upgrade a user to newer models under attractive negotiated contracts.

If there are legal questions involved in these moves—such as the right to charge anything for old software that for years has been given away, or to charge for software under licenses that were not enforced for four years—it is doubtful that they will be resolved in the courts. (Honeywell put a no-fee license in its contracts in 1970.) Cases such as that brought by Integrated Computer Services of New York have been settled out of court. Many more legal arguments have been resolved before the case reached the filing stage. Three we know of have settled for undisclosed terms,

Locking in your Customers

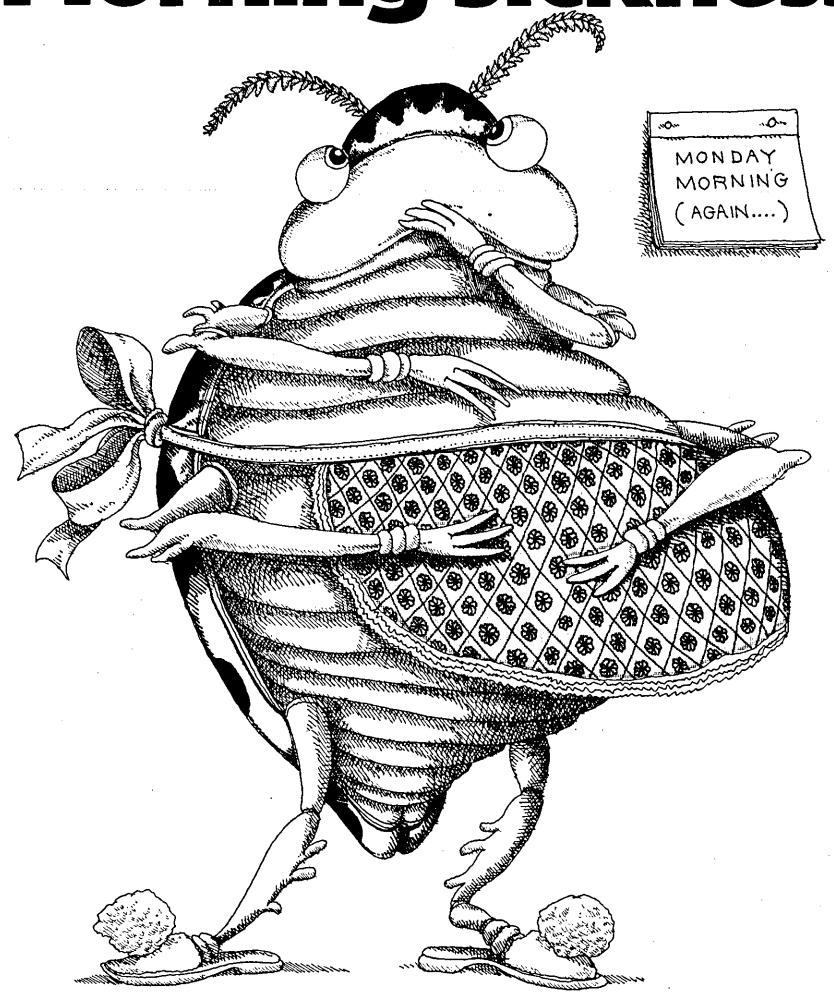
One aspect of the second user policy for Honeywell's Series 60 customers points out the current vendor trend toward locking the customer in to buying more and more equipment from one source. A Honeywell customer must buy a complete minimum system configuration in order to receive the operating software as part of the system. This means that a user could not buy a controller, disc, or other required unit for the minimum configuration from a third party without putting himself in jeopardy of becoming a second user and having to pay the license fee and monthly charge for the operating software. He definitely could not buy only a central processor from Honeywell. While these systems are fairly new, that is probably not a critical issue.

When more Series 60 equipment hits the used market, users will not be able to take full advantage of its lower cost unless they buy that minimum configuration from Honeywell, or are willing to pay the software levy.

One has already seen such tie-ins with IBM, for example, which chooses to accomplish it technologically. More memory, microcode, controller logic, etc. are being integrated into the cpu. Discs are being bolted into the drives, as in the 3350, making it tough on the independent media vendor.

Coupled with the increasing unbundling of software from the likes of Honeywell and IBM with their licensed program products, such moves are clearly channeling the user dollar and choice away from the independent supplier. ✲

The Morning Sickness Bug.



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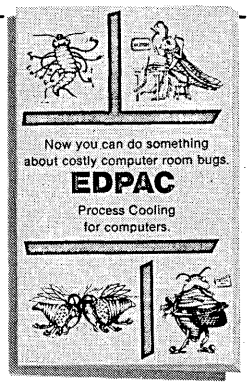

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WHAT BUYERS OF USED HONEYWELL SYSTEMS† MUST PAY FOR SOFTWARE
†(Hardware bought from third parties)

CLASS I OPERATING SYSTEMS*** (fully supported)	ONE-TIME CHARGE*		MONTHLY FEE**	
	1975 Policy	1977 Modification	1975 Policy	1977 Modification
OS/2000 & GCOS Level 64	$35K/ cpu	same	$350/ cpu	same
GCOS-6000, 600, level 66, 6023, & 6051	50K	same	500	same
CLASS 2 (enhancements, refinements, installation)				
MOD I-MSR, OS 200	9,500	7,500	not applicable	
MOD 4	15,000	12,500	not applicable	
CLASS 3				
MOD I-TR	3,000	50	not applicable	
G-400 DPS/MAPS	3,500	50	not applicable	
G-100/200	2,750	50	not applicable	
H-400/1400	1,000	50	not applicable	
H-800/1800	2,000	50	not applicable	
DAPS & TSPS	7,500	100	not applicable	

*Only for users obtaining software after 10/1/75
**Began Jan. 1, 1976
***Must have H15 hardware maintenance to get on-site software maintenance

but the users are reluctant to be identified.

One user who was trying to garner support for a class action suit fell silent after talks with Honeywell. A neighboring user, Jack Weiss of National Business Lists, Chicago, said his license document was removed by Honeywell salesmen without explanation. A Honeywell spokesman told us that Honeywell decided that while these users had bought some equipment elsewhere, they had purchased enough gear from Honeywell to warrant software as part of those purchases.

Two ways

Observers note that one can look upon such amicable solutions in two ways: Honeywell is quite willing to negotiate legal squabbles; and Honeywell wants to maintain the policy by never having its legality questioned and resolved in a precedent-setting action.

Whether one agrees legally or professionally with the Honeywell moves, it seems that they accomplished something. As Bill Grinker of American Used Computer noted, "If they were looking for a year or two in which to inhibit the transfer of used equipment, this has been a very successful implementation of that strategy." AUC, which used to deal in considerable Honeywell gear, has turned elsewhere, taking only an occasional deal. (For example, he recently delivered a 1250 with two disc drives, four high performance tapes, card reader, punch, and printer for $35,000. The user paid Honeywell for the software fee, $7,500 for Mod 1-MSR.) Grinker thinks that right now sales of Honeywell equipment between users and between users and dealers has dropped to about 25% of what it was two years ago, before the policy.

If the value of purchased Honeywell 200, 2000, and 6000 gear has dropped on the open market, it is also hard for anyone to compete with Honeywell discounts on that gear. One user with a 6000 found that he couldn't afford to sell his system without software for what Honeywell was offering with software. A midwestern company set out 2,500 targeted letters to sell its 2040 last year, and while the dp manager admits that the asking price was high, no one would make an offer. They'll sell it piecemeal. The dp manager, who is switching to IBM, said, "I have a long memory when I've been screwed."

A.P.

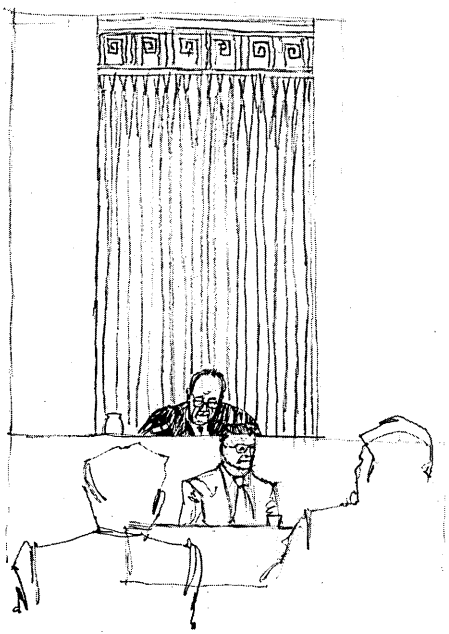
Antitrust

CalComp's Next Move: Appeal

It was a surprise to everyone, including IBM, when federal judge Ray McNichols directed a verdict for the computer colossus, ending trial of a $102 million antitrust suit brought by California Computer Products Corp.

"I was really shocked," said Omalee Coleman, one of the jurors on the case. The judge handed down his decision on IBM's motion for a directed verdict on Friday, Feb. 11. The *Los Angeles Times* carried a story on the decision the following day. "I don't usually buy a Saturday paper," said Mrs. Coleman, "but that day something told me to get one. It was a big disappointment."

Some jurors found out, like Mrs.Coleman, from the newspaper. One said she'd heard it on the radio. Some didn't find out until they showed up at the courthouse on Valentine's day, the day they were dismissed. "I showed up with my lunch," said Ernest Padilla. "Somebody asked me why I'd brought my lunch and I said, 'Why not?' then I found out. I was stunned."



JUDGE RAY MC NICHOLS
"reluctantly, but firmly"

Padilla had received a call from a member of the press the previous Saturday. He was asked his opinion of the case. "I was angry. I thought it was a ploy. I told her 'I can't talk to you' and hung up."

All of the jurors were disappointed. Most said they hadn't reached a definite opinion although Mrs. Coleman said.

she knew "all along that IBM was going to win."

Maxwell Blecher, CalComp's lead counsel, said one juror told him that a poll she had taken showed the jury favoring CalComp by ten to two. He also said that Judge McNichols had said in chambers that "the plaintiff has the jury in the bag."

Appeal filed

Blecher filed a notice of appeal of the case Feb. 16 with the Ninth Circuit Court of Appeals in San Francisco, the same court in which an appeal filed by Greyhound Corp., whose jury trial against IBM also ended with a directed verdict, has been languishing for five years.

Steve Diamond, an attorney on the Greyhound case said the Ninth Circuit court has "the longest mean time to decision of any Court of Appeals." Blecher agreed with his evaluation but feels the CalComp case will be expedited.

"The fact that those other cases are hanging will have an impact," said Blecher. He was referring to the rest of the so-called "West Coast cases" brought against IBM by Memorex Corp., Foro Precision, Inc., Transamerica Corp., Hudson General Corp., and DPF Inc.

Judge McNichols, who was to have heard all of the West Coast cases, has excused himself as trial judge in those remaining, although he continues as pre-trial judge. It's now up to Judge James Browning, chief judge of the Ninth Circuit Court, to name a new trial judge and all parties concede this could delay things some.

Will await outcome

One plaintiff, Hudson General, which, like CalComp is represented by Blecher, prefers to await a decision in the CalComp appeal. The others want to press on.

"We have evidence that CalComp didn't have," said Dick Lucas, an attorney on the Transamerica case. "We've laid great emphasis on the financial aspects, on IBM's pricing activities, on their profit margins before and after price changes, and on whether or not some of these changes were below cost. No other plaintiff has ever presented that evidence." Lucas hopes the Transamerica case will go to trial "sometime this fall." It, like CalComp's, will be a jury trial.

So will Memorex' which currently is scheduled for June. It is assumed that Memorex, like Transamerica, wants to press on, but Memorex attorney Robert Ericson was referring questions to the firm's public relations department.

Blecher feels the fact that the Ninth Circuit Court of Appeals has had the Greyhound case for so long also "will make it easier for us." Diamond, on the other hand, doesn't think CalComp's appeal will have any effect on the Greyhound case. "Each appeal is heard by a panel of three judges and the odds are very much against the same set getting CalComp's case as has Greyhound's."

Judge's decision

Judge McNichols directed the verdict in the CalComp case "reluctantly but firmly." The decision came after his reading of lengthy briefs and oral summaries by both sides which took the better part of the morning of the decision. David Boies, IBM's lead counsel, dwelt on IBM's share of market and monopoly situation arguing that CalComp had failed to prove either one. Jack Brown argued for IBM that CalComp had failed to prove damages.

Blecher, calling IBM's motion its "102-page diatribe" countered that the jury had heard enough evidence to make its own determination "as to what the general purpose computer market consists of and which of the quantification techniques it uses to apply to determine

the degree of IBM's monopoly power."

"It is my conviction," argued Blecher, "there is probably not a case under the Sherman Act under Section 2 in which the plaintiff has presented more cogent reliable and scientifically constructed evidence quantifying the share of the market by varying a series of techniques, both flow and stock, both inclusion and exclusion, of specific products so that the jury can make a fair and total evaluation of all the evidence. And no matter what they do, they are going to find monopoly power from that evidence."

But the jury didn't get that chance and they all would like to have had it. And they all enjoyed as much as they had of the case although some found it boring at times, particularly the lengthy reading of depositions. Live witnesses definitely were preferred.

"I was really dreading it at the beginning," said Stephani Tuttle, an Alhambra, Calif., housewife. "It was a surprise to me that I ended up enjoying it." Mrs. Tuttle said she was pulling for CalComp in the beginning "because I always like to root for the underdog and IBM is so big and powerful." But at the end she was leaning toward IBM. "A lot of things favorable to IBM were brought out in cross-examination. I would like to have heard Max Blecher cross-examining. There's always a chance I could have changed my mind. You never really lose until the end."

Another juror, Luther Staten, viewed the end of the trail with mixed feelings of relief and disappointment. He said he enjoyed hearing the case and would like to have heard the other side, but its length caused him to miss critical doctor's appointments and "its hard to go that long without talking to anybody."

Padilla felt the lack of being able to talk about the case a strain too. He said he felt "funny" after it was over. "I had an image of myself at the beginning of the case as a dynamite juror. It was going to be a piece of cake. Now I have my doubts. I took a lot of notes and when it was over I went back and read what I had written and I didn't understand most of it."

Neither Padilla nor Staten had formed an opinion for either side. Both said they respected the judge and his decision. "He's a learned man in the law and I'm not," said Padilla.

All of the jurors seemed to like Judge McNichols and he, them. In dismissing them, he wished them a happy Valentine's day and commended them for having served three months without ever having been late or missing. He thanked them for Christmas cards and Christmas cookies.

Cake for the judge

They, in turn, presented him with a heart shaped Valentine's cake. Then they went out to lunch with IBM. There were mixed reactions to that lunch. Padilla called it a "thorough" debriefing. Mrs. Coleman called it "a lovely experience meeting all those gentlemen. They're wonderful people."

Rosemary Simera, who made the cookies for the judge and brought him the Valentine's cake, said she'd looked forward to the luncheon in the Hyatt Regency. "The jury had gotten to know each other well; we were frustrated that we wouldn't see one another again and a luncheon seemed to be a great way to relax and say our good-byes.

"When I was leaving, Mr. Blecher said: 'Order the most expensive lunch and have three drinks.' " Instead it turned out to be a debriefing. The jurors lined up for what turned out to be a buffet lunch (and no drinks). "We were hustled out of line and made to sit at round tables with IBM people with only two or three jurors to a table. The rest were from IBM. I talked with a pleasant man, Dan Evangelista, a fellow Italian, and we discussed various Italian foods. Others, however, couldn't even swallow their luncheon as the IBM people began debriefing them."

Ms. Simera was disappointed with the directed verdict because she felt CalComp had a case and she wanted to see Blecher in action as a cross-examiner. "Towards the end of the CalComp presentation, I began to put the pieces of

the puzzle together. I began to see little companies come up against IBM and then disappear.

She said she felt that many companies could one day build a microcomputer for the home, "that would be as common as our stereo." But, she said, she felt there would be no companies around to do this if IBM continued to force them out of business.

"I could sense IBM's bigness at the luncheon," she said.

Ms. Simera, who traveled 108 miles a day to and from Fontana, learned of the directed verdict while working weekends "to help my employer" National Can Corp., where she operates accounting machines. During a break, she saw the headline in the newspaper, immediately turned the page because she had been told not to read anything about IBM. "But then I turned back to look for Judge McNichols' name. My first reaction was to say 'How could he do this to us?' "

Another juror, Joyce C. Hill, said it was like "being fired from a job."

Bill Chicoine, who traveled almost as far as Ms. Simera, some 80 miles round trip from Santa Ana, found it "depressing." Chicoine, like Ms. Simera, favored CalComp.

"No Case" for CalComp

Edna Kindall, who at 60 was the oldest member of the jury, said she "didn't see any real concrete case" for CalComp. "I speculated that after CalComp presented its case, IBM would offer them a long term contract as a subcontractor, or something, rather than continue their case for another three months."

"Insurance companies do that all the time," she said, adding that she suspected that IBM considered the CalComp case "a nuisance case."

Before reaching a decision, however, she said she would have questioned the judge about the 1956 consent decree to determine whether IBM's Fixed Term Plan (a leasing plan with discounts for IBM equipment) was illegal. "If it's illegal you take it to court; if it's immoral you take it to the priest."

Mrs. Kindall felt the presentations by both IBM and CalComp were done "quite well" although she felt at times that they were talking down to the jurors. She also said she felt the judge leaned towards CalComp. "I kept saying, why doesn't IBM object to this and that statement. When IBM would object, the judge often would overrule him."

Indeed Judge McNichols himself said in handing down his decision that he had bent over backwards to help CalComp. "A very considerable amount of testimony and documentary evidence has been admitted over strenuous objection," he said, "Certainly, the rules of admissibility of evidence have been as liberally construed in this case as any of which I am aware. Plaintiff was permitted, almost without restraint, to put into the evidentiary record every fact and instrument presented."

All of the jurors serve a six month stint on a panel available for trials. Mrs. Kindall has been empaneled since August, but was constantly rejected as a juror until the IBM case. In most cases, she said, it seemed she knew too much.

During a break she saw the headline but turned the page because she'd been told not to read anything about IBM.

"I read all the financial papers," she said, noting that her feeling that IBM would pay off CalComp with a long subcontract was based on her reading of the Sanders suit out-of-court settlement in January. Another reason: "My daughter is a police officer."

Padilla served on two other juries during his empanelment. Both were three day affairs, one an extortion/loan shark case and the other a narcotics case. He said in both of these cases some of the jurors did talk to each other about the cases even though they'd been admonished not to. "That didn't happen here (the IBM case)." Padilla was to report again for jury duty March 1. "If I don't get picked it won't break my heart," he said at the close of the IBM trial.

Mrs. Coleman feels differently. She enjoyed the IBM-CalComp case so much that when it was over she immediately volunteered for jury duty again. "But they haven't called me yet," she said in late February.

In one way, the IBM-CalComp case has had a lasting effect on Mrs. Coleman's life. "It thrills me now to read about computers and I know I'll continue to do so."

IBM was not the only group debriefing the jury when the trial ended. CalComp's lawyers met with the jurors for 15 minutes after court was recessed. And, Dr. Donald E. Vinson, associate professor of Business Administration at the Univ. of Southern California, had two hour interviews with many of them.

Dr. Vinson put together the so-called "shadow jury," a panel of six people who, for the better part of the trial, attended those parts heard by the jury, taking notes and forming opinions. Dr. Vinson was hired by Cravath, Swaine, and Moore, IBM's outside law firm. The shadow jurors didn't know they were working for IBM. Dr. Vinson would debrief them by phone each night.

Not all of the real jurors wanted to talk to Vinson, but those who did found it enjoyable. "He gave me a cassette tape of our conversation," said Padilla. "He was a really nice man."

However, the tape like Padilla's notes caused him to have second thoughts about himself as a juror. "I played it back and I just didn't sound right."

—Edith Myers

EFTS

Still a Small Market Until the Mid-'80s

A recently completed study on Electronic Transfer Systems conducted by Quantum Science Corp. has produced some surprising and perhaps even controversial projections.

Put together at a cost of approximately $350,000 for 31 major clients including computer service, equipment and communications suppliers, as well as the U.S. Postal Service and the White House Office of Telecommunications, the study asserts, among other things, that:

- The impact of Electronic Funds Transfer Systems (as opposed to the more broadly defined Electronic Funds Transaction Systems) will be relatively small at least until the mid-1980s_the earliest date by which a national EFTS switching network is likely to be operational.
- Growth of the Electronic Text and Graphics Transfer Systems—Electronic Mail market may accelerate faster than industry observers had previously anticipated. Already several major corporations are preparing to install extensive intracompany electronic mail systems, and with the addition of electronic mail terminals such as the newly announced IBM System 6 with inkjet printer, that market should approach the $4 billion level by 1985.
- Banking EFTS networks are proving uneconomical for retail applications; moreover, the big commercial banks will be unable to market proprietary networks to smaller banks.
- The United States Postal Service will lose a significant share of its first class revenues to electronic mail systems, but will remain the nation's primary physical delivery system with first class postage rates increasing to 39¢ by 1985.

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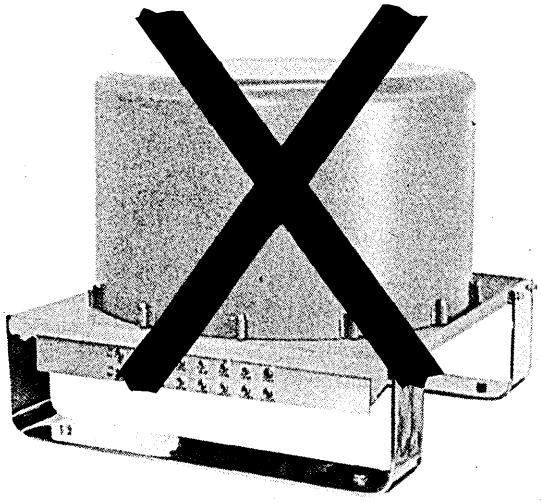

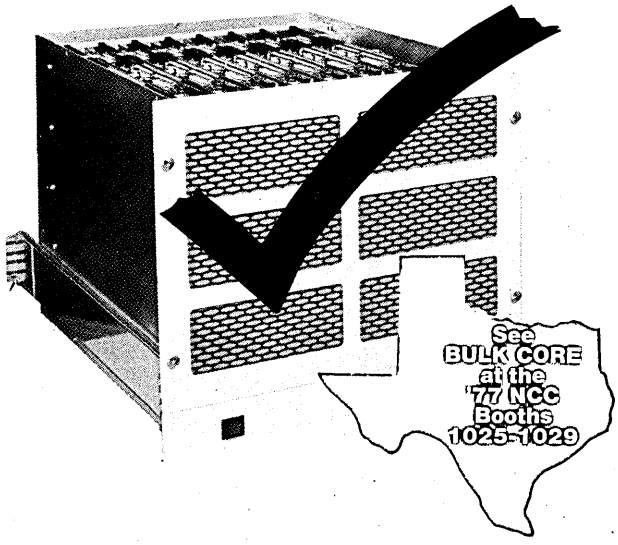

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news in perspective

$22 billion market

The total market for all electronic transfer systems and services will reach almost $22 billion by 1985, the study maintains. Currently the market is under $5 billion.

Hardware growth will be paced by point-of-sale and automated teller machine terminals. "The ATM market, however, may be fully saturated within four or five years while the POS market will continue to grow by about 15% annually," notes Quantum director D. P. Lavery.

Quantum sees competition in the electronic transaction business being broken up into three categories with IBM, NCR, Burroughs, TRW, and Bunker Ramo as chief competitors among the equipment firms. Control Data, SDC, TRW, and several bank consortiums, as well as the government will dominate the service area, while communications competitors will include AT&T, Western Union, ITT, GTE, and SBS (Satellite Business Systems).

Competition in the electronic text and graphic transfer system market will break out somewhat differently with IBM, 3M, Xerox, Burroughs, Pitney Bowes, and Texas Instruments prime contenders among the equipment companies. USPS, Computer Sciences, GE, Control Data, and, surprisingly, Bowne Tymshare are listed as the major firms in the service area. Chief among the communications companies will be the same group in the electronic transfer area plus Telenet, Quantum believes.

Electronic mail terminals

The study pinpointed major ET/GTS market opportunities as being in electronic mail terminals. These, Quantum says, will be natural extensions of current communications text editing terminals, PABX, facsimile, and copier products. Annual shipments for electronic mail terminals should reach $3.5 billion by 1985.

Other opportunities include value added services for text processing and distribution of electronic mail. These services will be coupled with text/graphics, store and forward, and network compatibility services.

Network design and management opportunities in electronic mail will parallel the remote computing market of the late 1960s, the study asserts. And combined data/text/graphic terminals will open up the smaller office market for electronic mail equipment.

In another area the study sees the EFTS share of non-cash banking transactions jumping from its present level of $1.4 billion, or about 4% of the total $35 billion in transactions, to $5.7 billion, or 12% of a total $46 billion in transactions by 1981. The study points out that thrift institutions are making strong inroads in the EFTS market, and while commercial banks are beginning to react to this, they are checked by stringent regulations. In addition, Quantum believes credit unions represent "long term sleepers" in banking competition, while consortiums enable smaller banks to participate in EFTS networks.

Despite rapid growth in local and regional credit information networks such as AT&T's transaction network service, the study asserts that a national EFTS switching network is far off, and that cash, checks, and credit cards will continue as the prime modes of funds transfer. ❋

Companies

Memorex: On The Move Again

Memorex Corp., whose antitrust suit against IBM is scheduled to come to trial in June, has reported record net income during 1976 of $25 million. At year-end it had cash and temporary investments on hand of $43.8 million. The company, which almost went under in the early 1970s, had total debt of about $300 million and a negative net worth of almost $87 million in 1973, and barely enough cash to continue operating. Indebtedness by the end of 1976 had been reduced to $158 million.

Under chairman and president Robert C. Wilson, who took over in 1974, the Santa Clara, Calif., supplier of peripherals and storage media that earlier had been looking for a buyer has, itself, begun to look for acquisitions. In January it agreed to acquire Lencor International, a computer media manufacturer, and also Business Systems Technology, a small business systems house, both located in Southern California.

During the past year, Memorex revenues were almost $345 million, a 31% increase over the previous year, and its net income of $25 million contrasts with $8.2 million in 1975.

It was a year when the firm shipped its first IBM 3340-compatible disc drives, which are made by Nippon Peripherals Ltd., and also announced a 3350-equivalent drive of its own manufacture. In both instances, the data modules are made by Memorex. It also shipped its 15,000th model 651 floppy disc drive, which was introduced in 1972. The company ended its manufacturing of COM processors, although it continues to provide supplies to those users. ❋

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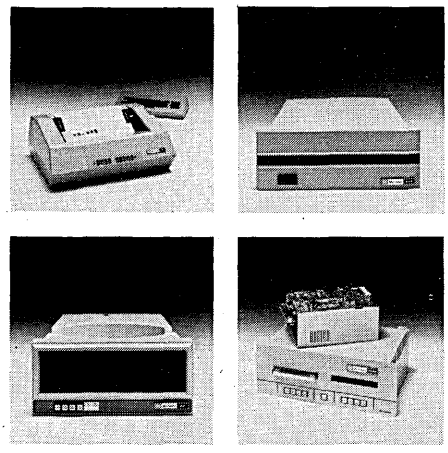

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news in perspective

Technology

He's Making Caruso Sound Like Caruso

Very few people remember the true tonal quality of the incomparable voice of Enrico Caruso. Although the great tenor died in 1921, most of his records have remained constantly in production. But since they all originated during the "acoustic" or mechanical era of recording between 1890 and 1925, only those who heard a live Caruso concert can claim with any credibility that they remember exactly how the legendary performer sounded.

Now, however, a Univ. of Utah computer scientist has changed all that by developing a sort of "time machine" that makes possible a musical trip back more than 50 years to enjoy the power, opulence, and expression of the Caruso voice—very nearly as it must have sounded during a live performance at the Metropolitan Opera House shortly after the turn of the century.

Using a minicomputer with specially designed hardware and software systems, Dr. Thomas G. Stockham, Jr., and his staff have developed a "deconvolution" process that removes many of the technical defects of early acoustic recordings, while recapturing much of the pleasing quality of the original performance.

Formed soundstream

The success that Stockham achieved in enhancing Caruso discs, as well as other early 20th century classics, led him to take a leave of absence from his university professorship two years ago to establish his own organization—Soundstream, Inc., in Salt Lake City. The company since has become the country's leading producer of deconvoluted recordings as well as a pioneer in the field of digital audio recording.

Last August, RCA released the first Soundstream long playing record of Caruso singing 16 famous operatic selections, all of which were recorded originally between 1906 and 1920. In the last two months of 1976 *Billboard* listed "Caruso, a Legendary Performer" as the number one best-selling classical record in America, and at this writ-

DR. THOMAS G. STOCKHAM, Jr., president of Soundstream (seated) with Richard B. Warnock (left), chief engineer, and Robert B. Ingebretson, director of computer services. In photo at right, Dr. Stockham listens to an improved Caruso record, restored by his company's deconvoluted process.

ing the record still is among the top 10 on the classical charts.

Several kinds of defects

There are several different kinds of defects in records made prior to 1926, the year that Bell Laboratories introduced electronic recording. Says Stockham: "All of the pre-1926 records were produced by a method invented in the 19th century by Emile Berliner. These records were made by a purely mechanical recording process wherein sound waves were gathered through a megaphone, amplified through a simple resonant cavity, and passed directly to the recording stylus.

"In addition to high surface noise," Stockham continued, "acoustically produced records had very pronounced resonance and reverberation problems. Unusually loud passages would cause the stylus to vibrate too violently, resulting in 'blasting.' Even further distortion was induced when the record was played back on an acoustical machine.

"In Caruso's day," he continued, "the instrumental accompaniment also contributed to the unnatural, 'rinky-tink' sound of the old recordings. Violins, for example, had to be fitted with resonators to achieve needed volume, and instead of a string bass, a tuba was used to obtain better low tones because it was more easily recorded."

Problems for Caruso

Serious limitations were placed on the artist during that period, Stockham pointed out. "For example, Caruso could not use the full dynamic range of his extraordinary voice. He had to avoid singing too loudly to avoid blasting, and if he sang too softly the sound would be obscured by surface noise.

"Another problem was that the artist could not always retain his normal tempo because the maximum recording time of early 78 rpm discs was four and one-half minutes," he said. "Caruso often had to sing much faster than he would in a live performance. This invariably resulted in recordings not fully representative of his superior voice."

Stockham's deconvolution process doesn't attempt to bring discs made 60 or 70 years ago by the acoustical method up to the same quality of today's electronically produced records. "What our digital process does is strip away a 'curtain' of sorts, which had hidden the historical and musical value of old records," he explained. "It is not intended as a step toward high fidelity in the sense of modern electronics, but was designed to achieve an accurate insight into musical history."

Basically, deconvolution attacks the problem of tonal imbalance in an acoustically produced record. The computer program designed by Stockham and his associates determines the location and magnitude on the record of tonal abnormalities after converting the original analog signals to digital forms. The program then corrects the imbalances through a resonance inversion procedure.

A PDP-11/45

Head of Soundstream's computer configuration is a Digital Equipment Corp. PDP-11/45 with 64K 16-bit words

of main memory. Peripherals include two small and one larger capacity disc drive. A DECwriter II serves as the console terminal. The system also includes a Tektronix crt and a DEC high-resolution storage tube display. The PDP-11/45 runs under Digital's RSX-11M operating system. Although the original application programming was in FORTRAN, Soundstream converted most programs to machine language for maximum efficiency.

A precision audio conversion system designed and built by Soundstream is connected to the computer. The unit combines computer interface modules, analog-to-digital and digital-to-analog converters, waveform conditioning circuits, a timing mechanism, filters, amplifiers, and other components into an integrated hardware package essential to computer interfacing of high-quality audio signals. Soundstream's audio conversion system also is used in a variety of other forms of digital signal processing besides record restoration, including seismographic and speech recognition research and development applications.

There were two considerations involved in selecting the PDP-11/45 as the company's central computer, Stockham says. "First, the machine has the right cost/performance combination for our particular position and goal," he said. "An equally important factor is the computer's basic architecture, which permits easy interface with our analog devices."

Each record received for restoration must be treated as an individual and unique "mystery," due to the variety of techniques used by different recording engineers during the acoustical period, Stockham explained.

"In addition to deliberate modification of instruments from one recording to another, engineers were constantly cleaning and tuning the sound box on the recorder in an attempt to maintain peak quality," he said. "This frequently resulted in shifting resonances from one recording to another to the extent that information for restoring one record could well result in degradation of another."

Converting sound waves

The deconvolution process begins with conversion of the analog sound waves to a numerical format with values ranging above and below the line of zero, or silence. Numerical data is stored on the larger disc, which will hold nearly 800 million bits of data representing about one hour of music.

For processing, a three to four and one-half minute production is chopped up into one-half second lengths. Each of the resulting 300 to 400 sections is treated to precise analysis, involving an examination of more than 1,000 frequency components.

Frequency imbalances detected by the program are then reversed by the computer. If a particular range of frequencies is determined to be too loud, the reversal process will cause the frequencies to become softer. In the same manner, a range of frequencies that is too soft is reversed to become louder. Frequencies that fall within a range where noise dominates are discarded by the reversal process.

"The basis of the program is a digital Fourier analysis that is performed on each half-second segment, followed by an averaging for the entire performance," Stockham disclosed. "There are two basic factors involved in the analysis. The first is the average tonal balance one would expect for a performance of its kind if recorded by modern electronic methods. The second is the false tonal balance of the acoustic mechanism."

As a guide, Stockham's group uses recordings of modern day singers and music. Tonal balance of the modern recording is used to isolate imbalance in the original performance. The inverted

imbalance is then used by the computer to generate a linear digital filter that amplifies the voice or instrument where it is attempted, and vice-versa.

Now a standard

Stockham first discovered an effective method for linear digital filtering in 1965 during his research at MIT. The process, known as high-speed convolution, has become standard for all digital signal processing work.

"Without the capability for linear digital filtering, our record restoration project would be impractical," Stockham says. "The huge amount of computing time involved would amount to 80 to 100 times more computing capacity than we now use," he said.

In the Soundstream procedure, a four and one-half minute recording requires only about two and one-half hours for conversion, analysis, deconvolution, and reconversion to the final analog recording.

Soundstream's long-range goal is to expand the use of digital recording methods as opposed to traditional analog methods. In support of this objective, Richard B. Warnock of Soundstream has designed and built a sophisticated prototype audio/digital tape recorder which will record up to eight ultra-high quality audio signals on a one inch tape.

"By recording digitally, using numerical data instead of sound waves, we are able to eliminate many problems inherent in analog recording, such as distortion, background noise, time-based error (flutter), and print-through (echo)," he explained. "The quality of the sound is significantly better, and copies can be made digitally with no generation loss whatsoever."

Small and square

The Soundstream president predicts that most records eventually will be small and square, perhaps no larger than a few square inches. Sounds will be represented by microscopic arrays of magnetically recorded numerics that can be scanned by a digital playback device.

Meanwhile, the company is continuing restoration of old records by deconvolution. It has produced a restored version of "Rhapsody in Blue" as part of a recently released RCA album, "Gershwin Plays Gershwin." "The inventory of vault records that can be restored by our process numbers in the thousands," Stockham said. "These include over 200 acceptable Caruso records, as well as many classics by such great artists as John McCormick, Rosa Ponselle, and Geraldine Farrar.

"From the viewpoint of recording companies, deconvolution provides an opportunity to build a new inventory of records that otherwise could not be sold because of their poor quality." ✻

Communications

Research Tool for Bell Bill Debates

Senator Edward M. Kennedy likes to play his political cards close to his chest. While carefully maintaining neutrality on the communications issues now brewing in the Congressional caldron, the 45 year old Massachusetts pol has been quietly brainstorming plans to put together a far-reaching and influential probe into the impact of telecommunications technologies.

As early as last August, Kennedy aides began "exploratory work" on the hotly debated telecommunications front. Spurred by the controversy stirred up by AT&T's Consumer Communications Reform Act, Kennedy staffers started digging into the issues, targeting the bulk of the work for the Office of Technology Assessment.

Set up three years ago, the office, an advisory arm of Congress, was the brainchild of Sen. Kennedy, who currently heads up the Technology Assessment Board. Up until recently, the office has been cooling its heels, concentrating mainly on materials and energy studies. Now after "wandering around looking for direction," notes one Capitol Hill

The '77 National Computer Conference: a unique learning experience

For the individual with a need to know, the 1977 National Computer Conference, June 13-16 in Dallas, offers a wealth of information on computer technology and data processing applications. It's all available at one time, in one place — a record-breaking exhibit of more than 1,100 booths; an extensive conference program covering the latest in technology, cost-effective computer usage, management concerns, and public policy issues.

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At the '77 NCC exhibits, you'll obtain firsthand information on the latest hardware, software, systems, and services offered by more than 250 organizations, with industry representatives and technical experts on hand to assist you in meeting your data processing needs.

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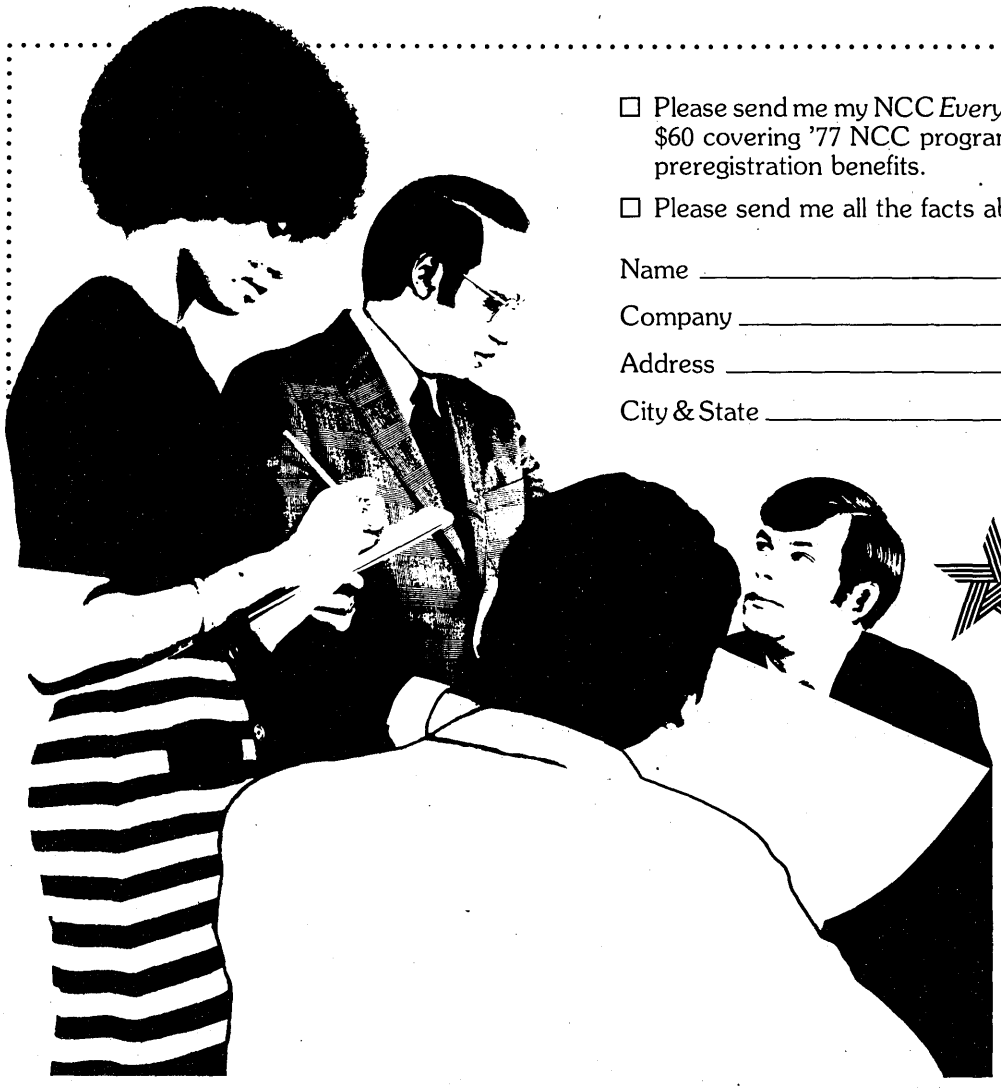

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observer, "it finally has something to sink its teeth into."

What OTA will be sinking its teeth into is a mammoth undertaking. "In terms of staff, dollars, and social impact, this telecommunications study," claims one Kennedy aide, "could turn out to be the biggest project we've ever done." Basically, the OTA study team will be tackling the whole range of complicated policy questions raised by the Bell bill. Working closely with the Senate Communications Subcommittee staff, the study group will serve as a research tool to both the Senate and House in their upcoming debates over revamping the outdated Communications Act of 1934.

SEN. EDWARD M. KENNEDY
OTA also would cover related issues as privacy, computer crime, and EFT

While Kennedy has pinpointed this as OTA's main mission, he also wants to expand the overview to cover the related issues of privacy, computer crime, electronic funds transfer, and electronic mail. A Kennedy spokesman explains this broader approach: "There are many things happening in the computer and communications technologies. Kennedy's interest is in trying to take a very serious look at the social and political implications of these issues—the direction we're going in, the benefits and costs, and the government's role."

But before this myriad of information technology problems can be sorted out, OTA has got some important administrative chores to do. First, the office has to put together a staff to do a preliminary assessment, which is expected to take two to three months. Working with an initial paltry budget of $75,000, OTA plans to bring on board a skeletal staff of two to three professionals, possibly supplemented by a few outside consultants. Kennedy's special OTA assistant, Ben Massell, has already started headhunting and is particularly concerned about recruiting a good leader, "someone with no ax to grind," he quips.

"We don't want someone who's going to come in and say 'I want to screw AT&T,' or someone who says 'AT&T has all the answers,' " he points out. "Clearly the person has to be objective and has to be prepared to listen to both sides."

Advisory panel

Once the study team gets rolling, then an advisory panel will be set up to make sure both sides get a chance to voice their views. Made up of roughly a dozen members, this ad hoc group would be drawn from a cross-section of the major special interest groups such as IBM, AT&T, the specialized common carriers, as well as neutral experts in the computer/communications field. The study team itself will also be boosted, winding up by the next fiscal year with 12 or more full time staffers.

Sen. Ernest F. Hollings, the soon-to-be chairman of the Communications Subcommittee, has also been staffing up in preparation for the upcoming Bell battle in the Senate. Hollings' troops

were all set to launch their own telecommunications study when they caught wind of Kennedy's OTA proposal. Kennedy aide Massell admits there was some confusion over exactly who was going to do what.

"It set us back a little bit in our planning," he concedes, "since we had been working for some time on a study in the (telecommunications) area." To resolve this minor impasse, the two Democrats met early last month and agreed on a "combined study."

Kennedy has also indicated an interest in holding OTA board hearings sometime this year on certain aspects of the study, but right now those plans are up in the air. And the only thing certain now is that once it's wrapped up, the study should carry a lot of weight with the leaders of both communications subcommittees. OTAers know this all too well; as Massell points out, the project "is being taken very seriously here (at OTA)."

"We feel under pressure," he acknowledges, "to get moving but on the other hand we want to have good people. That's the major constraint. If we had people in-house who could do the job, we'd be doing it right now."

—L.F.

History

The Early Days of Computing

Dedication ceremonies for IBM's selective sequence electronic calculator (SSEC) had been scheduled. The machine, built in Endicott, N.Y., on orders from Thomas J. Watson Sr. after the publicity earlier accorded the ENIAC, had been installed at the corner of 57th Street and Madison Ave. in New York City. It was shortly after the end of World War II, and everything was in short supply. And yet there stood the machine, impressively paneled in stainless steel and plate glass.

"Mr. Watson was asked to make the tour a day or two before the dedication ceremonies," recalls Dr. Herb Grosch, a former IBM scientist who now is president of the Assn. for Computing Machinery. The occasion was to be marked by the presence of the captains of American industry, by military brass, and a few scientists. "I remember Courant was there," Grosch continues, "and von Neumann, of course." And a beautiful brochure with a photograph of the new machine had been printed.

But on his tour Watson noticed that huge pillars rose from the floor to spoil the effect of the machine. He ordered they be removed. Unfortunately, those columns helped support the ceiling above, very much an integral part of the building, and there were but two days remaining before the ceremonies. In that short period, it was decided, the columns could not be cut away. So they collected all the brochures, which had a foldout picture bound in the center, and they reprinted the photograph with the pillars retouched out of the picture.

"I still have copies of that brochure,"

DR. H. R. J. GROSCH
". . . Courant was there, and von Neumann of course."

Grosch says. "It's much handsomer without the pillars." But when Watson again made the tour, on dedication day, he never mentioned to anyone that the pillars were still there—"fortunately for those who had been ordered to remove them."

Grosch was one of four speakers who reminisced of the early days of computing, mostly centered around IBM, in a panel session organized last month by the San Francisco area chapters of the Assn. for Computing Machinery (ACM). The panel, chaired by Prof. Henry Tropp of California's Humbolt State College, consisted also of Paul Armer, a former AFIPS president now with On-Line Business Systems, Cuthbert Hurd, IBM's first director of applied research and a subsequent founder of Computer Usage Corp., and Rex Rice of Fairchild Camera.

Tropp, who is the Alex Haley of the electronic computer, was the principal investigator for the computer history project sponsored jointly by the Smithsonian Institution and AFIPS, the American Federation of Information Processing Societies. He was credited by panelist Hurd with having "put professionalism into the history of computing." Hurd said Tropp spent two years taking oral histories from pioneers in the field and convincing them to put their important documents at the disposal of AFIPS and the Smithsonian.

Said Hurd: "I think everyone at AFIPS is delighted by the fact that now there are a number of leading universities around the world who are following that work, and who regard the depository at the Smithsonian as extremely important in . . . further research . . ."

Hurd spoke of gatherings of eminent scientists he assembled at Endicott to talk about the things they could do if they had the advanced calculators, or computers, that they figured IBM could produce. He said he got members of IBM management to listen in on these discussions—which they did from the hallway, since they were overwhelmed by the caliber of scientists inside. Those discussions, in 1949, he said, convinced management to get into computers.

$10 per instruction

Armer spoke of the IBM card programmed calculator (CPC), and the 701 that followed, and of the concern over the high cost of programming—plus the problem of software incompatibility even among 701 users in the aerospace industry. He said the consensus was that it was costing about $10 per instruction, "and an instruction in those days did less than it does today." This led to the formation of a Project for the Advancement of Coding Techniques, the objective being to make programming more efficient. It eventually produced a compiler for the 701 called PACT. It was followed by PACT 1A for the 704, both to be overtaken by FORTRAN.

Rex Rice, who had joined Northrop in 1946, was one of those instrumental in getting IBM to produce such an advanced, for that time, machine as the 701. He mentioned a course he took at MIT to become acquainted with the Whirlwind, and there was to learn about stored programming. He told of being able to walk through the commodious mainframe, and of writing a program to solve the bouncing ball problem through the solution of partial differential equations. He pointed to the similarity of this with today's electronic video game, Pong, a result of the microelectronic technology. Referring to today's microprocessor, he said, "You can hardly see the thing through a microscope, let alone walk through it."

Rice also reminisced of early discussions in Los Angeles about the center of gravity of computing in the world. They thought it centered at about the IBM office in Santa Monica, taking into consideration a computer installation in San Diego, at Boeing in Seattle, and the machines at aerospace firms in L.A. Balanced against that was the ENIAC and Whirlwind back east. "We finally admitted, on the West Coast, that including all the computers on the East Coast, the center of gravity had moved as far east as Bullock's Wilshire."

—E.K.Y.

News in Perspective
BENCHMARKS . . .

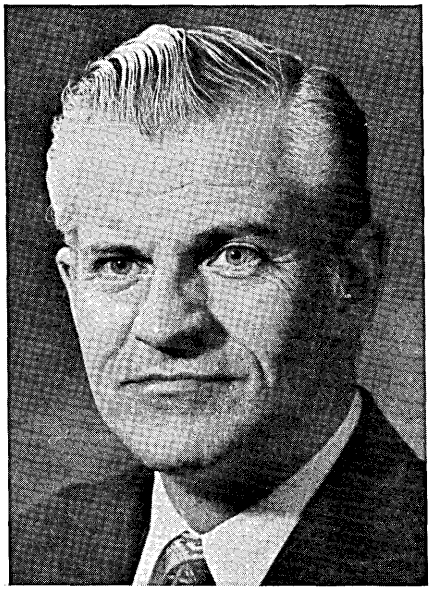
New Deal Overseas: Sycor Corp. early last year introduced its 400 series of distributed data entry and processing systems, but found that its traditional overseas distributor did not want to sell it. Olivetti & Co., distributor of Sycor's earlier products, the models 340 and 250, has with the Japanese distributor, Matsui, accounted for nearly half of the Ann Arbor, Mich., firm's 1976 revenues of $67 million. When Olivetti ran into trouble in the South American market late last year, Sycor's stock dropped from $30 to around $9. It was selling

SAM IRWIN
Olivetti deal will be renewed

for about $13 in late February. Sycor now has made a deal with a privately owned European group, Computer Machinery Co., Ltd.; CMC France, S.A.; and Computer Machinery Deutschland GmbH to distribute the 400 line—but Sycor also must buy a majority interest in the French and German companies and a minority interest in the English company, CMC, Ltd. President Sam Irwin of Sycor said his three-year renewable contract with Olivetti for the 340 and 250, expiring at the end of 1977, will be renewed. He said some 500 models of the 400 line have been made, but declined to say how many had been installed "for competitive reasons." Sycor products are sold in 34 countries, he said, and the arrangement with CMC will add 40 offices. Although revenues have been growing at an anticipated rate of 20 a year, Irwin declined to predict a similar performance in 1977 "until the CMC negotiations are completed." The company didn't put a purchase figure on the CMC deal.

The Last of Amcat?: Addressograph Multigraph has put its Amcat credit authorization terminal line up for sale and, at this writing, there were no known bidders. A-M's new chairman Roy L. Ash, who has been trimming the company since he took over last fall, said the line has been unprofitable. The sale, if and when it happens, does not take A-M out of the funds transfer field as it retains its Documenter point-of-sale for restaurants and fast food chains line acquired in mid-1972. This line, said a spokesman for the firm, is profitable. A former A-M employee said the end of the line for Amcat really came two years ago when "the Arabs stopped shipping fuel to the United States and Proxmire (Senator William) was talking up moratorium on EFT (electronic funds transfer) experiments." He said these events led to cancelation of a big order for Amcat terminals by National Data Corp. which was handling credit authorization for major gasoline companies. He also said any company buying the Amcat line "would have to be major company like TRW. If the line is just phased out it'll be putting the transaction business in IBM's back pocket."

A Loss for Honeywell: Lee E. Sheehan, vice president and general manger of the U. S. Information Systems Group of Honeywell's worldwide computer business, died suddenly last month at his home in Wellesley, Mass., of an apparent heart attack. He was 49 years old. His job has been assumed by Stephen G. Jerritts, a veteran of 28 years in the computer industry. Jerritts, 51, was managing director of Honeywell Information Systems Ltd., the company's United Kingdom computer affiliate, from early 1974 until Dec. 15, 1976, when he was named vice president, Product Management Operation, Honeywell Information Systems, Minneapolis. Sheehan, a native of Sioux Falls, S.D., joined Honeywell in 1949. He most recently was responsible for the firm's computer marketing, planning, design, engineering, manufacturing, and field engineering activities in the U.S.



LEE E. SHEEHAN

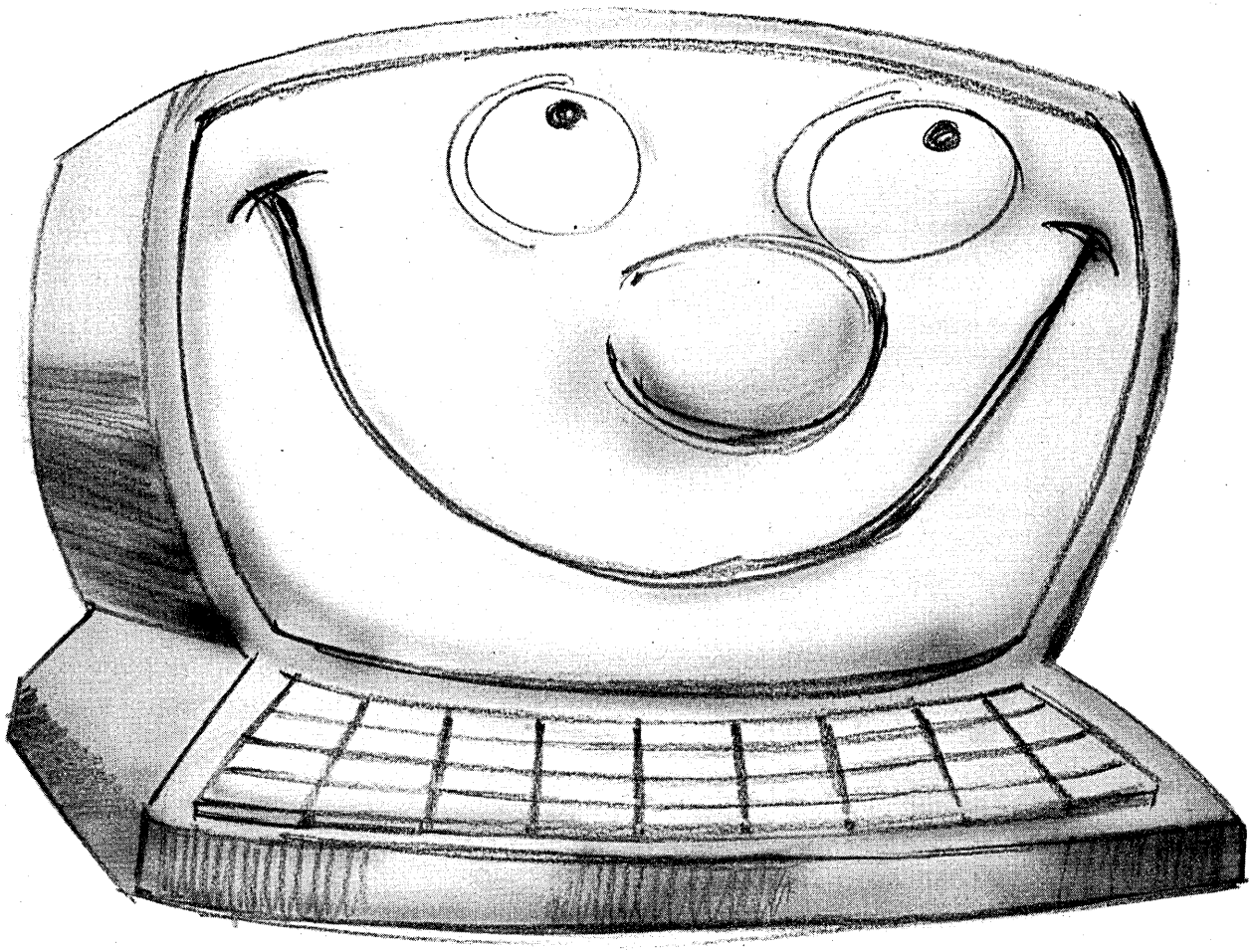
He joined Honeywell's North American Operations in 1970 as vice president of the Computer Systems Div. In 1974 he became vice president of the North American Systems Operation with re-

STEPHEN G. JERRITTS

sponsibility for all computer systems engineering and manufacturing. He became vice president and general manager of the company's North American Operations in 1975, and was appointed to his latest position in December 1976.

A Scenario for Europe: A new 385-page research report by market research specialists Frost & Sullivan, Inc., New York City, forecasts that the European market for word processing equipment, at $94 million in 1975, will climb to $200 million by 1980 and to $568 million by 1985, though shipments last year only increased slightly. Over the ten year period, the study shows, the market will cumulatively total $2.7 billion with revenues on software and services adding 10% to the cumulative value. By country, F & S says, Germany looms as the dominant market, followed by France and Britain which will be about equal in size.

Word Processing Abroad: TRW Datacom International is now international distributor for Lexitron Corp.'s word processing products, providing sales and service of the products abroad through its world wide distribution network which will include existing Lexitron distributors. TRW Datacom currently has 30 distributors in 50 countries with an annualized end user sales rate exceeding $80 million. The agreement with Lexitron markes the TRW Inc. subsidiary's first entry into the office equipment market. The agreement "in principle" with Lexitron calls for TRW Datacom's purchase of Lexitron equipment over a 10 month period. ❋



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Our software "talks" daily to thousands of smiling terminals. Know what makes them happy? When they're *communicating perfectly* with their 360 or 370 *—fast, dependable response.*

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It's No Wonder!

You can never outgrow DATACOM/DC. Performance in proportion to your size. We've had smiles on just 2 terminals and great big grins on 1500 terminals. We've never reached the limit of our TP potential. An added bonus: DATACOM/DC *helps you avoid CPU upgrades.*

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Unequaled support. DP Professionals across the country whose TP networks use DATACOM are highly enthusiastic about our service, training and dedication to their needs.

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Firm _____ Phone _____
Address _____
City _____ State _____ Zip _____

LOOK AHEAD

(Continued from page 16)
It's known as "deep pocket" strategy and AT&T, according to legal observers, is using it to the hilt to make the MCI antitrust suit as long and drawn out, and as expensive, as possible for the specialized common carrier.

To complicate discovery in the three year old case and make it tougher for MCI, AT&T cleverly had a gag order imposed, requiring that all discovery depositions and other documents be made to the court on a confidential basis. MCI, which originally agreed to the gag request to save time, is now complaining that the order is totally unnecessary. They also charge that AT&T has been dragging its feet and has abused the discovery process. Anxious to bring its suit to trial, the company hopes to wrap up its discovery effort by June 30 to be ready to go to trial by October. But AT&T has a different timetable in mind. Trying to stall for more time, mighty Ma Bell claims it needs three to five more years of discovery. Meanwhile, the final word on all this has to come from the Illinois District Court Judge, who was expected to rule shortly on a trial date and a cutoff date for discovery.

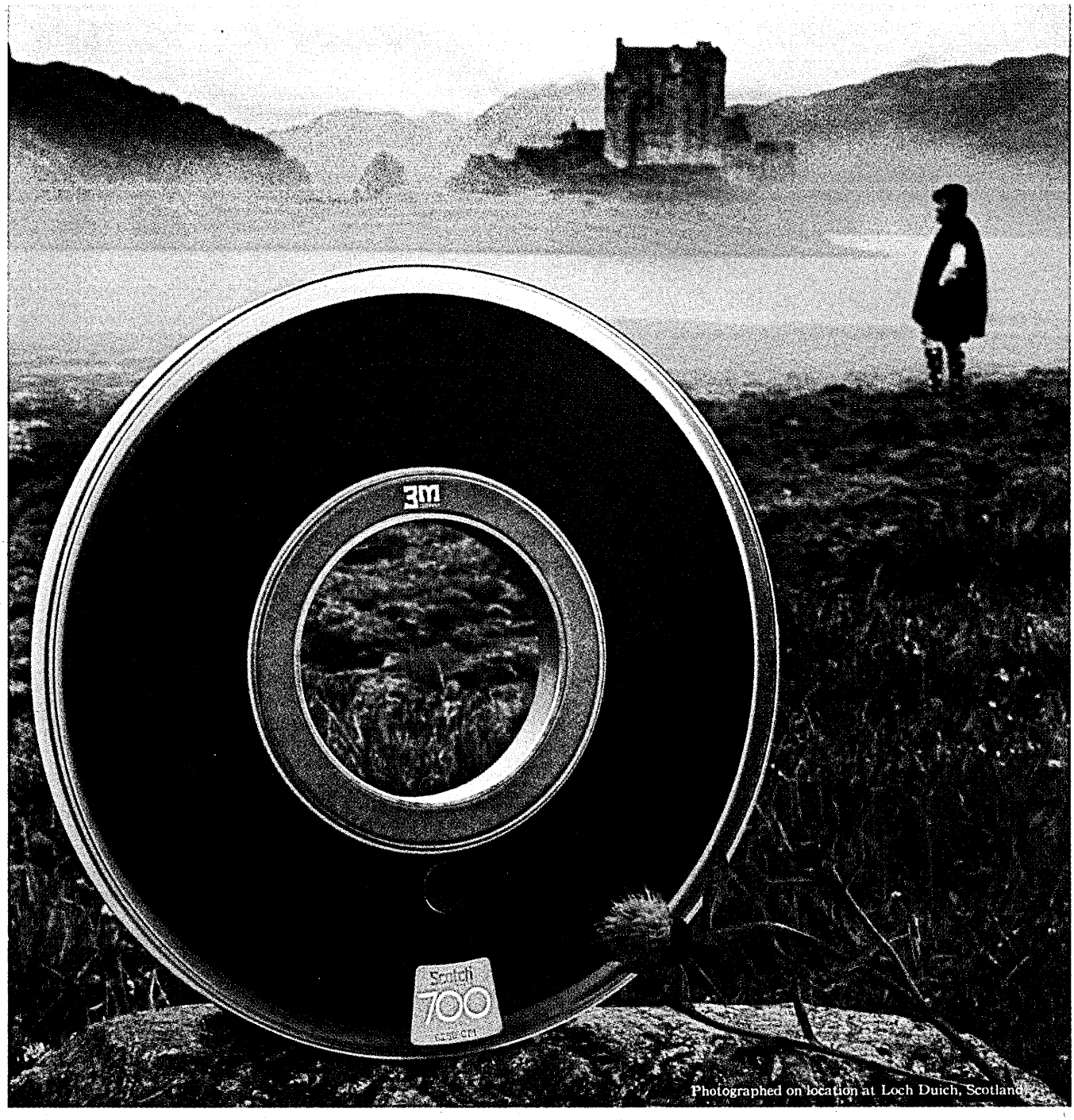
AT&T MAY OFFER PACKET SWITCHING NEXT YEAR

After years of thumbing its nose at packet switching, AT&T may be about to do a short turnaround. According to communications industry sources, the company is planning to unveil its own packet switched service this year for operation some time in 1978. Sources speculate that the new service will be tailored to several different industry markets and probably will be linked with Bell's Dataphone Digital Service (DDS).

Bell Labs, which for years had shunned research work in packet switching technology, has recently beefed up its efforts in this area. This plunge into packet came on the heels of a market feasibility study conducted a year and a half ago. While concentrating most of its packet switching activity within its new Transaction Network Service (TNS), the company also has a packet switching setup which has been operating for about six months at Pacific Telephone Co. for the State of California. But AT&T's real packet plunge, expected within the next six months, is aimed directly at its heavy duty data communications competitors--Satellite Business Systems and ITT. Finally, the company has realized it can no longer pass up packet. "The technology," says one industry expert, "is so attractive that Bell cannot afford not to be on that boat."

RUMORS AND RAW RANDOM DATA

Another footnote on Citibank's Series/1 purchase: IBM's General Systems Div. is providing operating system development aids to Citibank who's building a commercial system out of it. Says the bank's Jon Gould: "They're doing some of the work along with our people...helping us use what they have and modify what they have." GSD hastily declared the project was not pursuant to any IBM-Citibank sales agreement. Gould doesn't know if it's unique: "It might be unique in that we probably worked it out with them first". . . "Be Heard on The Bell Bill" says a red, white, and blue bumper sticker offered by Lively Communications, Cambridge, Mass., to promote study of the Consumer Communications Reform Act and communication of positions on the act to representatives in Congress and the Senate. The stickers sell from 50 cents apiece to 25 cents in quantities of a thousand.



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Now, Black Watch and all Scotch computer tapes are more widely available to you than ever before. From leading data products suppliers who have joined our clan. 3M Data Recording Products Division.

Count on the clan.

3M COMPANY

Modem Survey

by Fonnie H. Reagan

Thanks partly to the FCC's pro-competition stance, there are more than 300 commercial products to choose from.

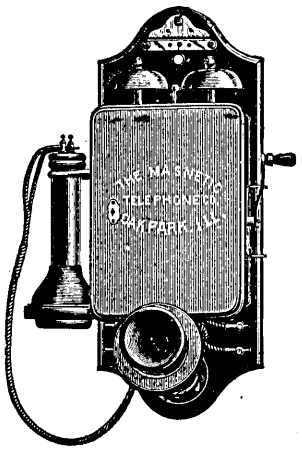
Though most computer users are becoming increasingly familiar with data communications, including such "everyday" items as modems, the current array of modem models available can be bewildering. This survey is intended to make understanding the choices easier, cutting down on that bewilderment.

Choosing a modem wasn't always this difficult. During the infancy of computer-oriented communications, the only modems commercially available, for all practical purposes, were those supplied by the common carriers as extra cost options. The modem concept, however, was not a new one; suppliers of military communications equipment and telephone equipment had been incorporating them into systems for years before they became available as separate items.

With emphasis on terminals as a powerful extension of the computer and with the increasing use of terminals such as the IBM 1050 system (circa 1963), the modem market opened up. Beginning with just a handful of suppliers and a limited number of modem models, the industry expanded rapidly to where there are over 40 well known suppliers offering more than 300 models of commercial modems. And projections for the number of units to be installed predict as much as a five-fold growth from the end of 1975 to 1980 (from 1 million units to 5 million).

The impetus for such rapid growth can be accredited to the growth of time-sharing, the proliferation of computer communications installations, and to the slowness with which AT&T responded to the users' needs.

The independent market has changed very little during the past year



in respect to the number of vendors. To the amazement of those who continue to predict a large dropout as a result of stiff competition among the independents and of increased pressure from AT&T, 1976, like 1975, saw the demise of only a few vendors.

Each year also sees Bell competing more vigorously—either through product announcements, before the FCC, or in the courts. The high speed modem business, for example, was once the private domain of a handful of independents who are credited with having established the market as early as 1969. That market was invaded by Ma Bell, who in 1972 announced her entry with the 4800bps System 208A, in a move allegedly aimed at regaining some of the ground she had lost to independents. Designed for private line use, the 208A was priced at a low $125/month; it jolted the industry and focused the spotlight on 4800bps as a Bell-approved transmission speed.

Then Bell rapidly moved up to 9600bps in 1974 with the 209A.

Bell's newest units, on the other hand, address the low speed end of the market, the end where most of the action takes place. (A large percentage of all modems installed operate at or below 600bps.) To Bell's credit, the new products—Dataphone 300 (Model 103J) and 300/1200 (Model 212A)—bringing the benefits of LSI construction to Bell customers operating at 1200bps and below—the 208 and 209 had done that for high speed users.

Thus the Old Lady is attempting to catch up across the whole modem

This article and the accompanying product listings are condensed from material published in *Datapro 70*, a looseleaf information service which includes reports on dp products and services. "All About Modems," the 48-page section on which the article is based, is available separately for $12 from Datapro Research Corp., 1805 Underwood Blvd., Delran, NJ 08075.

range. But the independents still have some innovations left, including recently announced abilities to build microprocessors into their units.

Units built around microprocessors offer distinct advantages over others, including improved equalization capability, increased reliability, and added flexibility. Equalization is improved through more sophisticated algorithms which allow for reacting automatically to changing line conditions. This minimizes errors due to line distortions.

Reliability is improved through the elimination of circuitry.

Then, since microprocessor based modems can be reconfigured to handle changing operating requirements, flexibility is improved. (And this flexibility is an advantage to the vendors, too, who can use it for extending product lifetime.)

Microprocessors may be viewed as a "plus" when a user chooses a modem. Another recent development is more difficult to assess; that is the matter of certification. One of Ma Bell's ploys in fighting off the advances of independents was the now-infamous Data Access Arrangement, a line protection device which Bell forced competitors to use. After many skirmishes, a 1975 FCC decision stated that independent modems should be allowed to connect to the telephone line if those modems are certified by the FCC.

After certification, users will be allowed to connect certain FCC-approved devices, including modems, directly to the telephone network without any kind of intervening protection module like the DAA.

The program is to become effective as of June 1, but strong repercussions are still expected from Bell. Currently there are some 120,000 DAA's in use. At unit costs of from $2 up to $8.20/month, this represents only a small revenue for Bell, but more significantly, competitive advantage for its own modems.

What are some of the implications of a non-DAA environment? Vendors will tend to charge more for modems which incorporate the protection circuitry—probably about $50 more for manual DAA equivalency and $150 more for automatic DAA equivalency. For their part, vendors will spend about $2,000 to $5,000 more per device type for certification. The net result, fortunately, will be a substantial savings for the user of low speed dial-up lines.

None of this helps in choosing from today's modems, however. The problem is that although the certification idea seems simple enough, no one yet knows how to go about it. An overwhelming majority of the modem manufacturers contacted on the question of certification either declined to comment or indicated that they had not yet applied for approval. The consensus was that the issue is highly confusing, and users should not consider it as a buying criterion until the waters clear a little.

There are still many criteria on which to judge these devices, and many of the parameters for that judging are included in the product descriptions in these pages. A few of those parameters require a word of explanation. First, many of the features listed may be optional; the descriptions listed are intended to show a range of capabilities.

Second, sometimes each and every speed level at which the modems operate has not been given. Asynchronous devices should be able to work at any bps rate up to their maximum; but synchronous devices, which by definition work at fixed rates, may work at many discrete levels below their maximum. For clarification or elaboration of such data, please contact the vendors directly, either by using the address and phone listed in the vendor index, or by circling the appropriate number on the reader service card bound into this issue.

Finally, two terms require minor explaining. "Multiplexing," as used in the text, is intended to mean multiplexing of data streams going to the modem from terminals or other local equipment—not the use of two phone lines to send from the modem. "Short haul," in referring to a modem, usually means the device operates at distances of about three to five miles. Again, the vendor should be contacted for full details about limitations.

A Word About The Listings

The modem data which follows was supplied by the manufacturers, and this leads to a minor problem in looking for a model of a certain speed. Some vendors like to be represented with many listings for products which differ only in minor details. Other vendors list the specifications for a series of devices as a single entry. We think the latter choice is more helpful to the potential customer. (In fact, we made the choice for a few vendors.)

Please remember that the number of entries for a given vendor often is more related to how he fills out a questionnaire than to how broad his product line is. And also be careful to *look into the higher speed categories* when searching for a device of any given speed. For example, many of the modems listed in the mid-range category can also handle the slower speeds.

The categories used are as follows:

Telephone Couplers
Low Speed Modems (to 600bps)
Medium Speed Modems (to 2400bps)
High Speed Modems (to 9600bps)
Wideband Modems
Short-Haul (Limited Distance) Modems
Parallel Interface Modems

Note too that there will be some duplication between the first two categories since some devices may connect to the phone line through coupling or wiring as the user chooses.

Telephone Couplers

ACRODYNE **VTC-1**
Bell 103A-compatible originate-only type
1,500 VTC series sold
Runs up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses acoustic coupling or 2-wire line
RS232B/C or contact interface
$325 ($7.50/mo) plus $20 installation

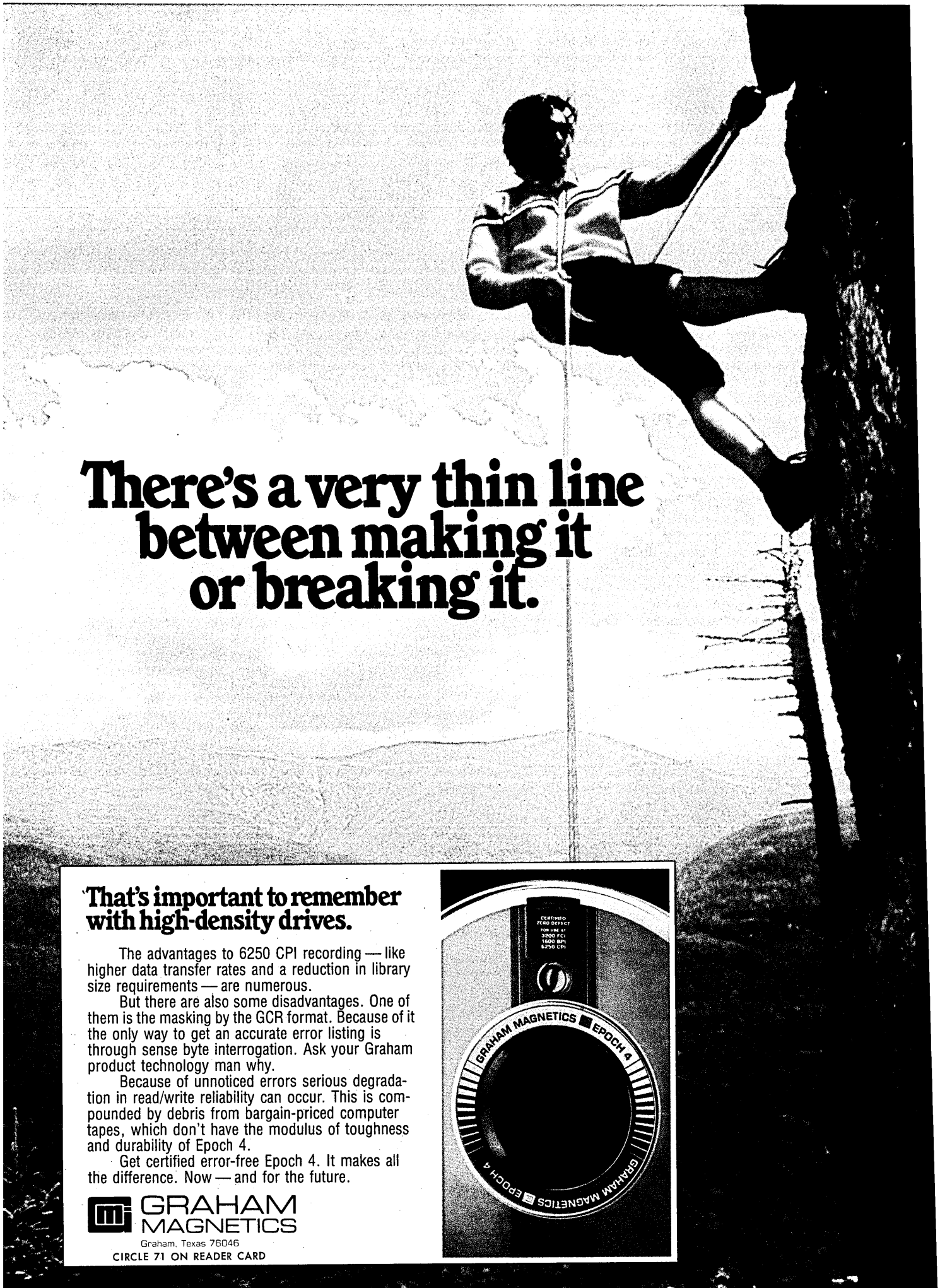
ACRODYNE **VTC-2**
Bell 103A-compatible orig/answer type
1,500 VTC series sold
Runs up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses acoustic coupling or 2-wire line
RS232B/C or contact interface
Features: auto answer
$625 ($15/mo) plus $20 installation

ANDERSON JACOBSON **A 242**
Bell 103A-compatible originate-only type
Over 20,000 sold since 1970
Runs up to 450bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses acoustic coupling
RS232B or Teletype interface
$365 ($21/month)

ANDERSON JACOBSON **A 246**
Bell 103A-compatible originate-only type
Sold since 1974
Runs up to 450bps using FSK modulation
Asynchronous, full-duplex operation
Uses acoustic coupling
RS232C, DTL or TTL interfaces
$210 (oem only)

ANDERSON JACOBSON **AD 342**
Bell 103A-compatible originate/answer
Over 1,000 sold since 1968
Runs up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses acoustic coupling or 2-wire line
RS232B or Teletype interface
$435 ($24/month)

ANDERSON JACOBSON **ADAC 1200**
Bell 202C-compatible type
Sold since 1969
Runs up to 1200 bps using FSK mod.



There's a very thin line between making it or breaking it.

That's important to remember with high-density drives.

The advantages to 6250 CPI recording — like higher data transfer rates and a reduction in library size requirements — are numerous.

But there are also some disadvantages. One of them is the masking by the GCR format. Because of it the only way to get an accurate error listing is through sense byte interrogation. Ask your Graham product technology man why.

Because of unnoticed errors serious degradation in read/write reliability can occur. This is compounded by debris from bargain-priced computer tapes, which don't have the modulus of toughness and durability of Epoch 4.

Get certified error-free Epoch 4. It makes all the difference. Now — and for the future.

GRAHAM MAGNETICS

Graham, Texas 76046

CIRCLE 71 ON READER CARD

Asynchronous, simplex/half-duplex
Uses acoustic coupling or 2-wire line
RS232B interface
$985

ANDERSON JACOBSON AM 211 (FRENCH S63 OR ERICSSON HANDSET VERSION)
Originate-only type
Sold since 1975
Runs up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses acoustic coupling or 2-wire line
CCITT interface
$495

ANDERSON JACOBSON ADC 212 (U.K. VERSION)
Originate-only type
Sold since 1971
Runs up to 300bps using FSK modulation
Uses acoustic coupling
Asynchronous, full-duplex operation
CCITT interface
$495

ASTROCOM 110
Bell 103/113-compatible orig-only type
700 sold since 06/72
Runs up to 300bps using FSK modulation
Asynchronous, simplex/half/full-duplex
Uses acoustic coupling or 2-wire line
RS232B/C or Teletype interface
$295 ($18/month)

ASTROCOM 110A
Bell 103/113-compatible orig/answer type
Runs up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses acoustic coupling or 2-wire line
RS232C or Teletype interface
Features: local loopback
$345 ($25/month)

COMDATA 150 SERIES
Sold since 1972
Runs up to 300bps using FSK modulation
Asynchronous, full-duplex operation
Uses acoustic coupling or 2/4-wire line
RS232C or CCITT interface
Features: carrier indicator
$147 to $175

COMDATA 302 SERIES
Bell 103/113-compatible orig/answer type
Sold since 11/68
Runs up to 300bps using FSK modulation
Asynchronous, full-duplex operation
Uses acoustic coupling or 2/4-wire line
RS232C, CCITT, MIL188B, contact
Features: auto answer, local loopback
$245 to $325

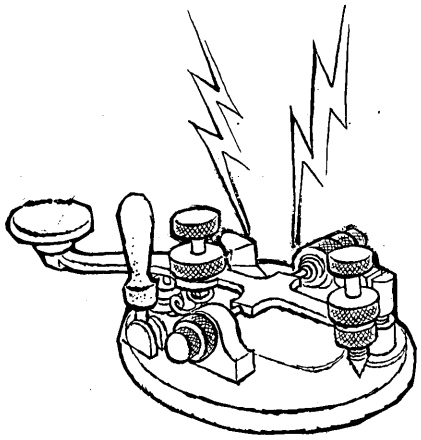
DATAPOINT 3400
Bell 103-compatible originate-only type
Over 2,000 sold since 1969
Runs up to 300bps using FSK modulation
Asynchronous, full-duplex operation
Uses acoustic coupling
RS232C interface
Features: local loopback
$350 ($24/mo) plus $20 installation

LIVERMORE DATA SYSTEMS CLASSIC SERIES
Bell 103A2-compatible orig/answer type
Runs up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses acoustic coupling
RS232B/C or Teletype interface
$325 ($33/month)

LIVERMORE DATA SYSTEMS 76 SERIES
Bell 103/113A-compat. orig-only type
Over 4,000 sold since 1975
Runs up to 600bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses acoustic coupling or 2/4-wire line
RS232B/C or Teletype interface
$300 to $325 ($30-2 years)

MI² CORP. 76/100/101/103/113
Bell 101/103A/113A orig and/or ans-only
Sold since 1970
Runs up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
Acoustic, inductive, or 2-wire line
RS232C or Teletype interface
Features: alternate voice/data, integral handset, auto answer, remote loopback on 101 and 103
$200 to $600

MULTI-TECH FM 30 SERIES
Bell 103/113A-compat. orig-only type
300 sold since 1976
Runs up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses acoustic coupling
RS232B/C, Teletype or TTL interfaces
$190 to $270 ($20/mo), installation NC



MULTI-TECH FM 300/310
Bell 103/113A-compat. orig-only (300), originate/answer (310)
Over 3,500 sold since 1971
Runs up to 450bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses acoustic coupling or 2-wire line
RS232B/C or Teletype interface
Features: auto answer & local loop (310)
$210-$390 ($22/mo), installation NC

NOVATION 36
Bell 103-compatible originate-only type
3,000 sold since 08/75
Runs up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses acoustic coupling
RS232C, Teletype or DAA interfaces
Designed for DECwriter II (LA-36)
Features: remote and local loopback
$235

NOVATION DC 3100 SERIES
Bell 103-compatible originate/answer type
15,000 sold since 08/74
Runs up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses acoustic coupling or 2-wire line
RS232C, Teletype or DAA interfaces
Features: remote and local loopback
$295-$410 ($25-$30/mo) plus $35 instal.

OMNITEC 103/202
Bell 103/202-compatible orig-only type
129 sold since 1976
Runs up to 450/1200bps using FSK mod.
Asynchronous, half/full-duplex operation
Uses acoustic coupling
RS232 interface
Features: reverse channel
$1,698, installation NC

OMNITEC 401A/B/C
Bell 103-compatible originate-only type
2,000 sold since 1974
Runs up to 450/600bps using FSK mod.
Asynchronous, half/full-duplex operation
Uses acoustic coupling or 2-wire line
RS232B interface
Features: remote and local loopback
$300, installation NC

OMNITEC 501A
Bell 103-compatible originate-only type
1,500 sold since 1974
Runs up to 110bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses acoustic coupling
Teletype interface
Features: remote and local loopback
$164, installation NC

OMNITEC SERIES 700
Bell 103-compat orig and/or answer type
Over 30,000 sold since 1963
Runs up to 300/450/600bps using FSK mod.
Asynchronous, simplex/half/full-duplex
Uses acoustic coupling or 2-wire line
RS232B or Teletype interface
Features: auto answer, remote/local loop
$341 to $690, installation NC

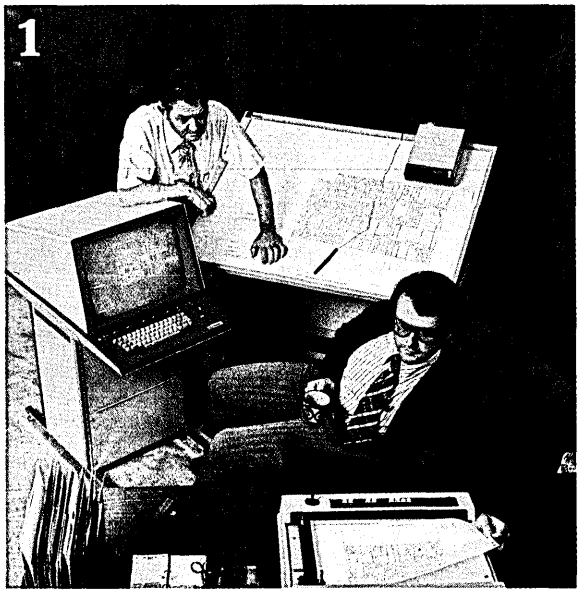
OMNITEC 1200A
Bell 202C-compatible orig/answer type
Sold since 1974
Runs at 1200bps using FSK modulation
Asynchronous, half/duplex operation
Uses acoustic coupling or 2-wire line
RS232C interface
Features: reverse channel, remote and local loopback
$975, installation NC

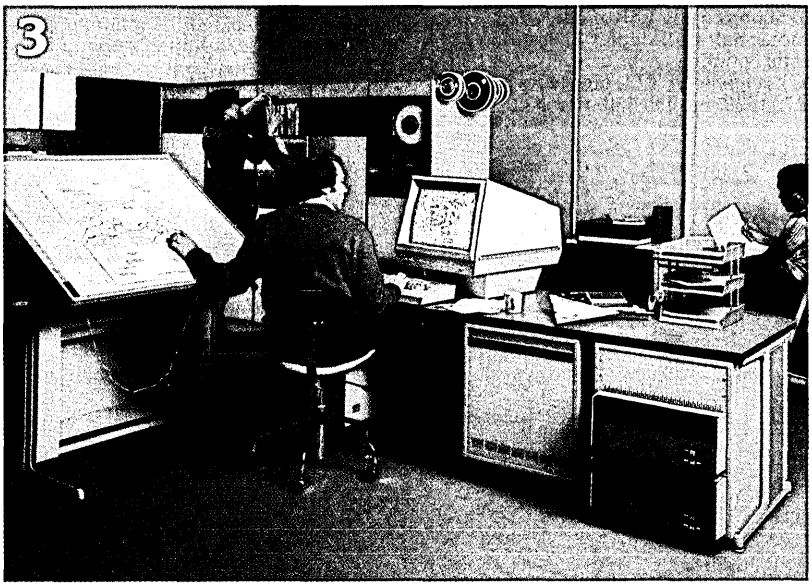
RFL 5105/5220
Bell 101/103/113-compat. orig/ans only
Runs up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses acoustic coupling or 2/4-wire line
RS232C or Teletype interface
Features: auto answer, remote/local loop
$130 (5105), $275 (5220)

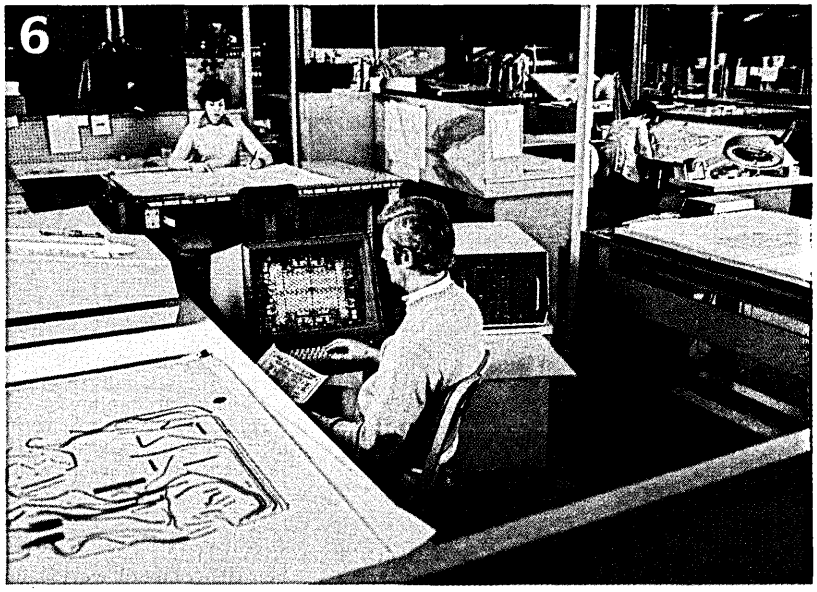
STELMA 703AC
Bell 103A-compatible orig/answer type
Over 200 sold since 01/70
Runs up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses acoustic coupling
RS232C interface
$380

TELE-DYNAMICS 7102A/D
Bell 103/113-compatible orig/answer type
400 sold since 02/74

IMPROVING COMPUTER OUTPUT







If you're not using Graphics you should see who is.

1 Civil engineers are taking the tedium and expense out of mapping by digitizing plots on the 4954 Graphic Tablet and manipulating real time details on the big-screen 4014-1 terminal.

2 High-resolution results from analytical instrumentation tests, as displayed on the 4012 Graphic Display Terminal, reduce research costs and eliminate the inaccuracy of manual analysis. The 4662 Interactive Digital Plotter produces camera-ready copies.

3 Combined storage and refresh graphics capabilities of the 4081 Interactive Graphics Terminal are saving aeronautics and aerospace engineers hundreds of manhours in relating the dynamics of flight to design methods and materials.

4 The personal, desktop computing power of the 4051 Graphic System frees marketing, finance and administration departments from dependency on the mainframe while it graphically facilitates decision-making.

5 Education discovered the 4006-1, Tektronix' lowest-cost Graphics terminal, as a dynamic means of demonstrating complex theories and concepts while involving and intriguing students of all levels.

6 IC modeling takes on a new dimension via the 4014-1. Interactive manipulation, debugging and critical adjustments are made quickly and accurately.

Today, hundreds of companies rely on Graphics to find oil, fight disease, forecast budgets, stimulate education, plan cities, design circuits, unsnarl traffic–to instantly interpret complex ideas. Everything expressed in Graphics is better understood, more effectively communicated... by you, or by your competition.

As the world's Graphics leader, Tektronix can give your communications a dimension you've been missing. With high-resolution graphics terminals. Desktop computing calculators. And complete graphic systems. All supported by peripheral devices, proven software, wide-ranging sales and service–and a worldwide reputation for quality and dependability.

Back when Graphics was a $100,000 novelty, you could afford to ignore it. You can't afford to ignore it now.

Today, Tektronix provides Graphics from under $3000. Graphics that's reliable, versatile, easy to use. A technology that's essential to modern day efficiency of man and computer. Write us, or call your local Tektronix Sales Engineer and find where our products fit your picture.

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Information Display Group
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Get the picture. Get results.

FOR FURTHER INFORMATION, CIRCLE 57 ON READER CARD; FOR OEM INFORMATION, CIRCLE 58 ON READER CARD.

Runs up to 300bps using FSK modulation
Asynchronous, full-duplex operation
Uses acoustic coupling or 2-wire line
RS232C, CCITT, Teletype or TTL interfaces
Features: remote and local loopback
$292 ($12/month), installation NC

TUCK 1500 SERIES
Bell 103/113-compat. orig and/or ans only
Runs up to 300bps using FSK modulation
Asynchronous, simplex/half/full-duplex
Uses acoustic coupling or 2/4-wire line
RS232C or Teletype interface
Features: auto answer, remote loopback
$122 to $395

VEN-TEL AC103
Bell 103/113-compatible orig/answer type
6,000 sold since 06/75
Runs up to 300bps using FSK modulation
Asynchronous, full-duplex operation
Uses acoustic coupling or 2-wire line
EIA, CCITT or current loop interfaces
$265

VEN-TEL AC1212
Originate/answer type
300 sold since 09/76
Runs up to 1200bps using FSK modulation
Asynchronous, full-duplex operation
Uses acoustic coupling
EIA, current loop or CCITT interfaces
Features: remote loopback and indicators
$530

VEN-TEL DCI-120
Bell 103/113-compatible orig/answer type
2,000 sold since 1976
Runs up to 300bps using FSK modulation
Asynchronous, full-duplex operation
Uses acoustic coupling or 2-wire line
TTL, EIA, or CCITT interfaces
Designed for DECwriter LA36 terminal
$325

Low Speed Modems (to 600bps)

ANDERSON JACOBSON AD 342
Bell 103A-compatible orig/answer type
Over 1,000 sold since 1968
Runs up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses acoustic or DAA connector
RS232B or Teletype interface
$435 ($24/month)

ANDERSON JACOBSON L142 & L145
Bell 103F-compat. orig and/or answer
Sold since 1970
Runs up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses 2- or 4-wire line
Features: L145 has auto answer
$240

ANDERSON JACOBSON L150/12 SERIES
Originate/answer type
Sold since 1972
Runs up to 150 or 600 bps using FSK mod.
Asynchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232C interface
Features: remote and local loopback
$155-$200 ($8/mo.) plus $25 installation

ANDERSON JACOBSON L184/12
Bell 103F-compatible answer-only type
Sold since 1973
Runs up to 450bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses 2-wire line
RS232C interface
Features: remote and local loopback
$180 ($9/month) plus $30 installation

ANDERSON JACOBSON MU 290/12 SERIES
Bell 103A/E-compatible orig/answer type
Sold since 1970
Runs up to 450bps using FSK modulation
Asynchronous, full-duplex operation
DAA line connection
RS232C interface
Features: auto answer, remote/local loop
$200-210 ($9-12/mo.) plus $20-30 inst'l.

ANDERSON JACOBSON TMU 330K
Bell 103A-compatible orig/answer type
Sold since 1971
Runs up to 150bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses 2- or 4-wire line
Teletype interface
Features: mounted in teleprinter
$320

ASTROCOM SERIES 130
Bell 103-compat. orig and/or answer
2,000 sold since 02/70
Runs up to 300bps using FSK modulation
Asynchronous, full-duplex operation
Uses 2-wire line
RS232B/C interface
Features: auto answer, indicator lamps
$145 to $415 ($12.50-$18.50/month)

BELL SYSTEM DATA SET 103A
Bell 101/103/113-compatible orig/answer
Runs up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses 2-wire line
RS232C interface
Features: alternate voice/data and integral handset with 804B, auto answer, fixed equalization
Vendor will not release pricing.

BELL SYSTEM DATA SET 103J
Bell 101/103/113-compat. orig/answer
Runs up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses 2-wire line
RS232C interface
Features: alternate voice/data, auto answer, fixed equalization, remote and local loopback
Vendor will not release pricing.

BELL SYSTEM DATA SET 113A
101/103/113B-compatible orig-only type
Runs up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses 2-wire line
RS232C interface
Features: alternate voice/data, integral handset, fixed equalization
$12/month

BELL SYSTEM DATA SET 113B
101/103/113A-compat. answer-only type
Runs up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses 2-wire line
RS232C interface
Features: alternate voice/data, integral handset, auto answer, fixed equalization
$10.50/month

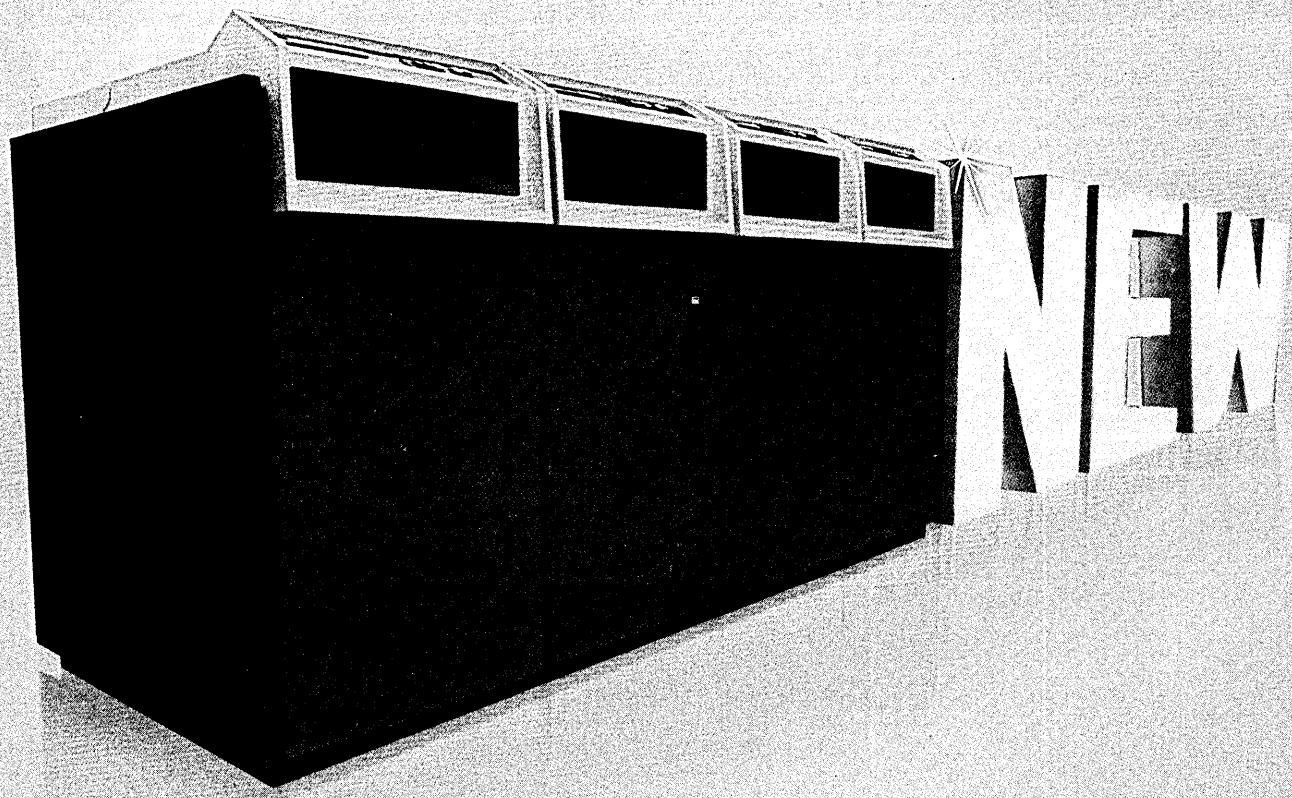
BELL SYSTEM DATA SET 113D
Bell 101/103/107-compat. ans-only type
Runs up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses 2-wire line
RS232C interface
Features: alternate voice/data, auto answer, fixed equalization, remote digital loopback
Vendor will not release pricing.

BELL SYSTEM DATAPHONE 300/1200 DATA SET 212A
Bell 101/103/113-compat. orig/answer
Runs up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses 2-wire line
RS232C interface
Features: alternate voice/data, auto answer, fixed equalization, remote and local loopback
Vendor will not release pricing.

CARTERFONE DS 103A
Bell 103A/C-compatible orig/answer type
2,000 sold since 04/71
Runs up to 440bps using FSK modulation
Asynchronous, full-duplex operation
Uses 2- or 4-wire line
RS232B/C or Teletype interface
Features: reverse channel, alternate voice/data, integral handset, auto answer, remote loopback
$425 ($26/mo.) plus $35 installation

CARTERFONE TELEX MODEL
Originate/answer type
2,000 sold since 05/74
Runs up to 75bps using Std. Telex. mod.
Asynchronous, half-duplex operation
Uses Standard Telex line
Standard Telex interface
Features: local loopback
$330 ($65/month) plus $35 installation

CONTROL DATA ANNOUNCES the Disk Drive that surpasses the 3350; and needs no 3330-11 software conversion!



We have it.

Our new CDC 33801 — the newest member of our family of Sealed Module "Winchester"-Technology Drives.

Why install a 3350 and spend money reblocking and retuning your software—when CDC can offer you 25% greater capacity (400 MBytes) with no software conversion cost.

The CDC 33801 operates under OS and DOS systems as well as VS systems. You protect your software investment—and get better cost-per-byte—all at the same time!

What's more, CDC's new 33801 Data Module Drive provides 100% greater capacity than the 3350 when used in the 3330-11 mode. The CDC Sealed Module incorporates a fixed head (zero seek time) option. And, Control Data's optional 1.24-million-byte fixed head capacity gives you 100,000 bytes more than the equivalent 3350 option.

Before you decide on a 3350, find out about the 33801. Compare. Discover the less costly, more flexible growth path of this expandable 33801 system. See how it enhances both 3330 and 3350 storage and can serve as a staging device for the CDC 38500 Mass Storage System.

Check out the CDC 33801, and you'll know it makes a better business decision.

For the price-per-byte and performance you need today plus a more logical growth path for 3330 users call (612) 553-4158 or mail the coupon to: Ronald L. Kamps, Sales Manager, Peripheral Product Sales, Control Data Corporation, Box 1980, Twin Cities Airport, St. Paul, MN 55111. Dept. D37

Ask the CDC Peripherals People

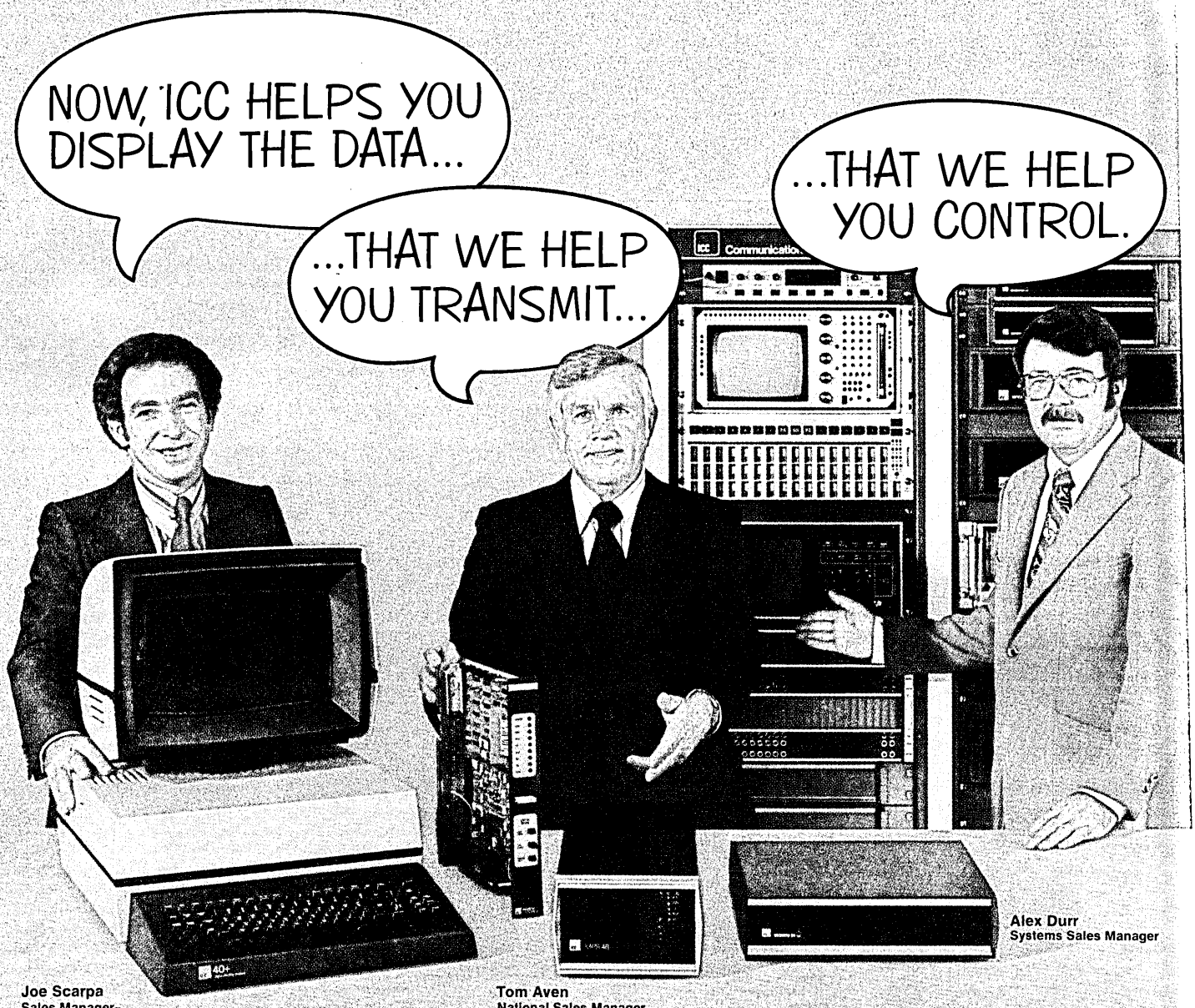
Name_____ Title_____

Company_____ Address_____

City_____ State_____ Zip_____

Area Code_____ Phone_____

CONTROL DATA CORPORATION



Your data—where you want it, when you want it, in the form you want it. Now you can get it all from ICC. Dependable ICC data display terminals give you superior visual displays with optional hard copy printouts. Our full line of modems transmits your data at speeds up to 9600 bps. And ICC system monitoring and controls can improve the efficiency of your entire data network.

More than just products, ICC provides unsurpassed customer support . . . highly qualified specialists to keep your data communication system up and running.

For information on our new expanded product line and support policy, contact your ICC Communications Consultant.

SEE US AT INTERFACE '77

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8600 N.W. 41st Street, Miami, Florida 33166 Telephone (305) 592-7654
In Europe: RACAL-MILGO LIMITED Reading, Berks, England

a milgo company member of IDCMA

CIRCLE 107 ON READER CARD

SURVEY

CARTERFONE TWX/DDD MODEL
Bell 101C-compatible orig/answer type
2,500 sold since 12/73
Runs up to 440bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses 2- or 4-wire line or DAA
RS232C or Teletype interface
Features: alternate voice/data, auto answer, remote loopback
$425-$650 ($31/mo) plus $35 installation

COHERENT DAM-1 & TYM-1
Originate/answer type
1,000 sold since 09/70
To 600bps (DAM-1)/150bps (TYM-1), FSK
Asynchronous, simplex/half/full-duplex
Uses 2- or 4-wire line
RS232C, CCITT, MIL188B, contact closure
Features: reverse channel, alternate voice/data, multiplexing
$525 to $600

COLLINS FDM
750 sold since 05/73
75/100/150/300/600bps using FSK mod.
Asynchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232C interface
$600 to $750

COLLINS TE-110
Originate/answer type
450 sold since 1974
Runs up to 110bps using FSK modulation
Asynchronous, full-duplex operation
Uses 4-wire line
RS232C interface
$600 to $750

COLLINS TE-150
Originate/answer type
750 sold since 1974
Runs up to 150bps using FSK modulation
Asynchronous, full-duplex operation
Uses 4-wire line
RS232C interface
Features: local loopback, integral test, multiplexing
$600 to $750

COLLINS TE-300
Originate/answer type
400 sold since 1974
Runs up to 300bps using FSK modulation
Asynchronous, full-duplex operation
Uses 4-wire line
RS232C interface
Features: local loop, integral test, multiplexing
$600 to $750

COMDATA 330 SERIES
Bell 103/113 compatible orig/answer type
Sold since 11/71
Runs up to 300bps using FSK modulation
Asynchronous, full-duplex operation
Uses 2-wire line or DAA
RS232C, CCITT, Teletype, MIL188B
Features: auto answer, local loop
$150 to $170 ($5-$5.50/mo.)

DATAPOINT 9401
Bell 103-compatible originate/answer type
Over 3,000 sold since 1970
300-440bps using FSK modulation
Asynchronous, full-duplex operation
Uses 2-wire line or CBT DAA
RS232C interface
Features: auto answer, manual equalization, local loopback
$1,500 ($74/mo.) plus $15 installation

GENERAL DATACOMM 100 SERIES
Bell 103/113-compat. orig and/or answer
Sold since 1970
Runs up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232C, Teletype, or logic level
Features: auto answer on some models, remote loopback
$215 to $440 ($11 to $24/month)

GTE LENKURT 25C
Originate/answer type
Sold since 1971
Runs up to 600bps using FSK modulation
Asynchronous, simplex/half/full-duplex
Uses 2- or 4-wire line
RS232C interface
Features: VF and digital loopback, multiplexing
$450/channel

GTE LENKURT 25D
Originate/answer type
Sold since 1971
Runs up to 200bps using FSK modulation
Asynchronous, simplex/half/full-duplex
Uses 2- or 4-wire line
Teletype interface
Features: VF loopback, multiplexing
$550/channel

LIVERMORE DATA SYSTEMS 76 SERIES
Bell 103/113A-compatible orig-only type
Over 4,000 sold since 1975
Runs up to 450bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses acoustic and/or 2- or 4-wire line
RS232B/C or Teletype interface
$300-$325 ($30/mo-2 yr.) install. NC

MI² CORPORATION RCU-1
Originate/answer type
Sold since 1974
Runs up to 50bps using FSK modulation
Asynchronous, half/duplex operation
Uses 2-wire line
Teletype interface
Features: auto answer
$350

MULTI TECH 300 & 310
Bell 103/113A-compatible type
Over 3,500 sold since 1971
Runs up to 450bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses acoustic coupler or 2-wire line
RS232B/C or Teletype interface
Features: auto answer, 310 has local loopback
$210 to $390 ($22/mo.), installation NC

MULTI TECH 320
Bell 103/113B-compatible type
Sold since 1971
Runs up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses 2-wire line
RS232B/C interface
Features: auto answer, remote loopback
$230 to $325 ($22/month)

NOVATION ATM 103D
Bell 101C-compatible type
Sold since 01/72
Runs up to 300bps using FSK modulation

A lot of computers offer multi-level batch processing, or RJE, or realtime, or interactive timesharing.

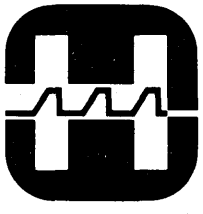
But only Harris offers all of it, concurrently.

Only Harris delivers multi-use concurrency. Our high performance S100 and S200 packaged systems, combined with our responsive VULCAN operating system delivers simultaneous compute services to each user. As well as simultaneous individual user access to the system.

The S220, shown here, is packaged around the most powerful CPU in the industry. Dozens of benchmarks, including Whetstone, prove the S100/S200 series superior performance. The S220 is one of 6 packaged systems available today, starting at $85,000. All operate with COBOL, FORTRAN, BASIC, RPG II, FORGO, SNOBOL, and extended BASIC. And all 6 in the series deliver multiple RJE, multi-level batch processing, multiple interactive timesharing, and real-time processing...all at the same time. If your need is distributed processing, time-sharing, data base management, or any kind of multi-use concurrency, benchmark the S100/S200 packaged systems.

Only Harris gives it all to you, concurrently. Write Harris Computer Systems, 1200 Gateway Drive, Fort Lauderdale, Florida 33309. Europe: Techmation N.V., Gebouw 105/106 Schiphol-Oost, Netherlands.

HARRIS



COMMUNICATIONS AND INFORMATION HANDLING

SURVEY

Asynchronous, half/full-duplex operation
Uses 2-wire line
RS232B or Teletype interface
Features: alternate voice/data, integral handset, auto answer, remote and local loopback
$350 to $520

NOVATION — DC 3100 SERIES
Bell 103-compatible originate/answer type
20,000 sold since 08/74
Runs up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses acoustic coupler or 2-wire line
RS232C, Teletype or DAA interfaces
Features: remote and local loopback
$295 to $330 ($25-$30/mo) plus $35 inst.

NOVATION — EC 100 SERIES
Bell 103-compat. orig and/or answer
Sold since 07/71
Runs up to 440bps using FSK modulation
Asynchronous, full-duplex operation
Uses 2-wire line or acoustic coupler
Logic level interface
Features: self-test
$100

OMNITEC — 401A/B/C
Bell 103-compatible originate-only type
2,000 sold since 1974
Runs up to 450 or 600bps using FSK mod.
Asynchronous, half/full-duplex operation
Uses 2-wire line or acoustic coupler
RS232B interface
Features: remote and local loopback
$300, installation NC

OMNITEC — 503A
Bell 103-compatible originate-only type
1,000 sold since 1976
Runs up to 450bps using FSK modulation
Asynchronous, half/full-duplex operation
Designed for DECwriter LA36 terminal.
Features: remote or local loopback
Vendor will not release pricing.

OMNITEC — SERIES 700
Bell 103-compat. orig and/or answer type
Over 30,000 sold since 1963
Runs up to 300, 450 or 600bps using FSK
Asynchronous, simplex/half/full-duplex
Uses acoustic coupler or 2-wire line
RS232B or Teletype interface
Features: auto answer, remote/local loop
$341 to $690, installation NC

OMNITEC — 4500/4700/4900
Bell 101C-compatible orig/answer type
675 sold since 1974
To 110bps (4500)/300bps (4700/4900), FSK
Asynchronous, half-duplex operation
Uses 2-wire line
Teletype or RS232 interface
Features: auto answer, remote/local loop
$560 to $760, installation NC

OMNITEC — 1108
Bell 108-compatible originate/answer type
Sold since 1975
Runs up to 300bps using FSK modulation
Asynchronous, half-duplex operation
Uses private line
RS232 interface
Features: simultaneous voice/data, integral handset, fixed equalization, meters for diagnostics
$844 plus $45 installation

OMNITEC — 9113B
Bell 103-compatible originate/answer type
100 sold since 1976
Runs up to 450bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses 2-wire line
RS232 or current loop interface
Features: remote and LED diagnostics
$342, installation NC

PENRIL — 300 SERIES
Bell 103/113-compatible orig/answer type
5,000 sold since 01/70
Runs up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses 2-wire line
RS232B/C or current switching interface
Features: reverse channel, alternate voice/data, integral handset, auto answer, fixed equalization, remote and local loop
$200 to $250 ($10-$25/mo) plus $50 inst.

PRENTICE — LINE ADAPTERS
Originate/answer type
1,500 sold since 12/70
Runs up to 600bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232C or Teletype interface
Features: remote and local loopback
$135 to $200 ($9-$15/mo), install. NC

PRENTICE — P-103/P-113
Bell 103/113-compat. orig and/or answer
15,000 sold since 09/70
Runs up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses 2-wire line
RS232C or Teletype interface
Features: remote and local loopback
$135 to $195 ($8-$11/mo), install. NC

PULSECOM — 4080 SERIES
Bell 108-compatible originate/answer type
1,500 sold since 01/71
Runs up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses 2-wire line
RS232B/C or Teletype interface
Features: alternate voice/data (4086), auto answer, fixed equalization, remote and local loopback
$225 to $300

PULSECOM — 4321
Bell 43A/B-compatible orig/answer type
Sold since 1972
Runs up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232C or Teletype interface
Features: local loopback
Vendor will not release pricing

RFL — 5105/5220
Bell 101/103/113 orig or answer-only type
Runs up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses 2- or 4-wire or acoustic line
RS232C or Teletype interface
Features: auto answer, remote/local loop
$130 (5105), $275 (5220)

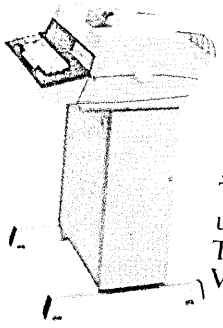
RIXON — DS-300
Bell 103A/E/113-compat. orig/ans. type
Runs up to 300bps using FSK modulation
Asynchronous, full-duplex operation
Uses 2-wire line
RS232C or MIL188B interface
Features: alternate voice/data, auto answer, remote loopback
$345 ($23/month)

If the last copy of your forms isn't as legible as this, your printer should be the TermiNet® 30

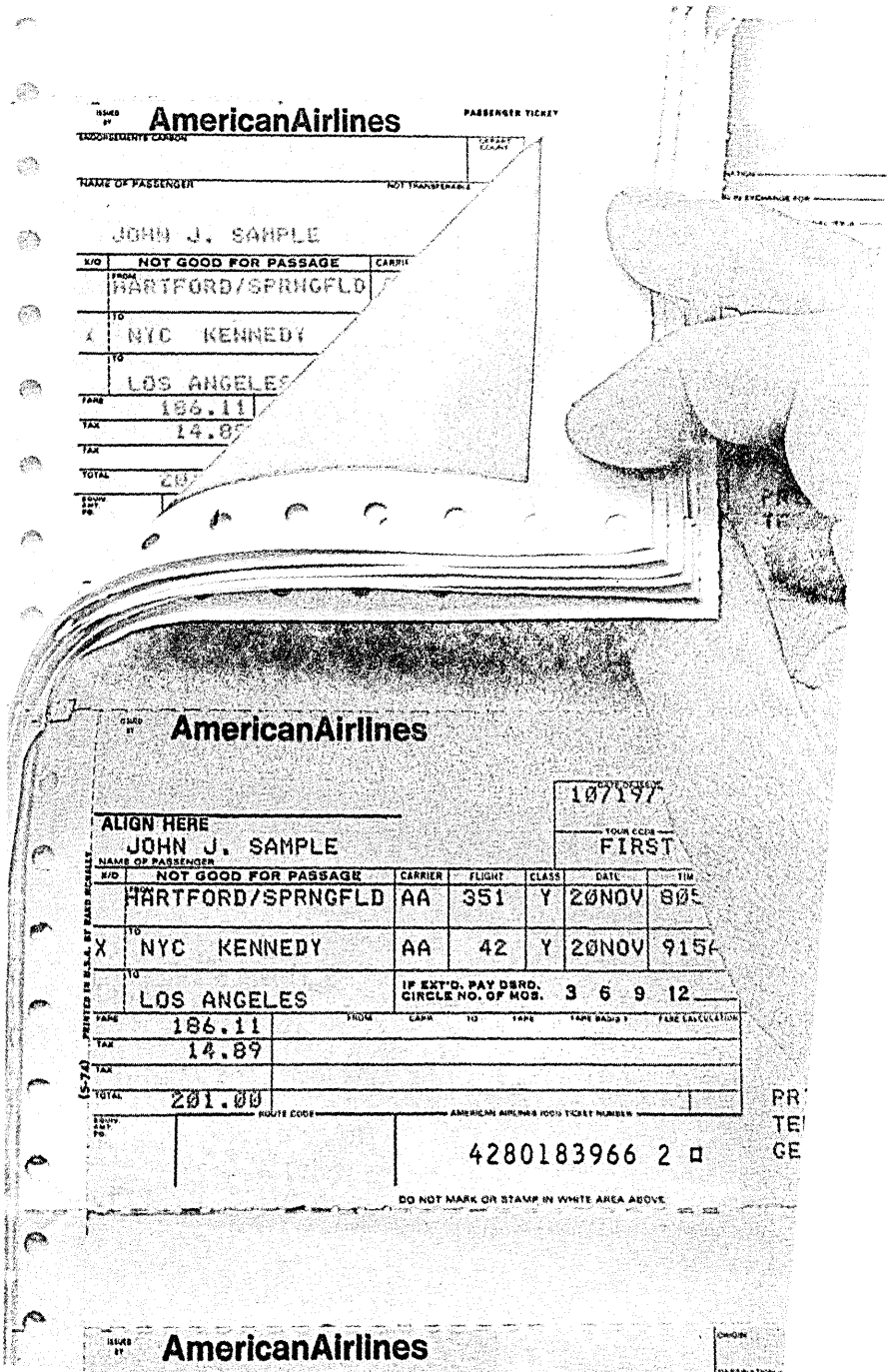
Finally, somebody has come up with a way to produce multi-part forms that you, your customer and everybody in between can actually read.

The answer is General Electric's new multi-form selector. It's available now as an option on GE's TermiNet 30 matrix printer. Add this new feature to the convenience of a snap-in ribbon cartridge, nationwide service in over 90 locations and proven reliability and you can see why the TermiNet 30 should be your next printer.

Performance? Even ten-part forms (up to .7110 mil.) are no problem for this remarkable printer. Every form—from first to last—will be crisp, clean and readable. Operators will also appreciate the new tear bar design, which makes tearing these thick forms easier.



Major airlines and travel agents around the country are already using these printers to produce clear, legible, high-quality multi-part tickets. So if your business routinely produces multi-part forms day after day, your printer should be the TermiNet 30. Find out why. Write us at General Electric Company, TermiNet 794-21, Waynesboro, VA 22980.



For your special kind of needs-
a special kind of printer

GENERAL ELECTRIC

CIRCLE 20 ON READER CARD

All the punch of ASR without all the paper.

DECwriter II announces ASR capability.

Before now, to get all the plusses of an ASR, you had to accept all the minuses of punched paper tape. The difficulty in editing. The awkwardness of handling. The complexity of operation.

All that is in the past.

DECwriter's new ASR capability is completely solid-state. And it can store from 4K to 16K of data—the equivalent of 30 to 120 feet of punched paper tape.

With it, you can prepare, edit, update and store data off-line for batch transmission up to 300 baud. This store and forward capacity saves you communications charges and, in DP applications, computer time. In fact, our new ASR capability will pay for itself in line fees in about 4 months of average use.

Besides being more reliable, faster and more economical than paper tape, it's also much easier to operate. Instructions are self-cueing and, in simple English, so most people can use it without much training time.

There's more. Because it's small, our new ASR capability inserts easily into the base of all existing DECwriter IIs. It has its own power supply, EIA port and is compatible with modem and x-on/x-off protocol.

The DECwriter II with our new ASR capability.

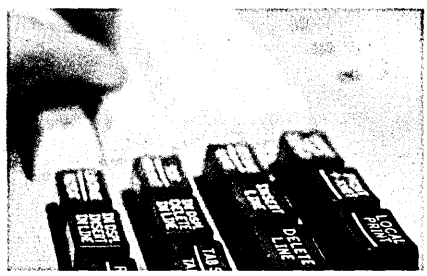
It's the end of a lot of your paperwork.

For more details, write Components Group, Digital Equipment Corporation, One Iron Way, Marlborough, Mass. 01752. Or dial 800-225-9480 toll free (617-481-7400 ext. 6082). Canada: Digital Equipment of Canada, Ltd. Europe: 81 Route de l'Aire, 1211 Geneva 26, Tel. 42 79 50.

digital
COMPONENTS
GROUP

CIRCLE 37 ON READER CARD

How Blyth Eastman Dillon moves millions of dollars an hour:



INCOTERM®.

Blyth Eastman Dillon and Co., Inc., processes several million transactions a year: in stock brokerage; investment counseling; municipal and corporate investment banking; syndicate underwriting and real estate. It adds up to billions of dollars a year — several millions of dollars every working hour.

BEDCO required a fast and reliable system to handle all that information. Traditional methods would generate millions of pieces of paper. Response time would be measured in hours and days instead of seconds. Many facts would become obsolete before they became available.

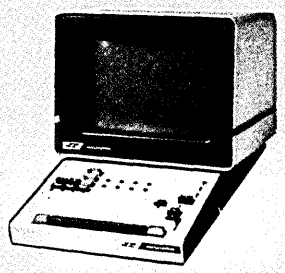
BEDCO chose INCOTERM for terminal support: in the branches and in the home office where timely information guides major investment decisions . . . with full control, on line and in real time.

INCOTERM helps speed administrative traffic, process orders, generate billing, retrieve money line data, transmit capital market data, produce quotations from an in-house quotation system, and control the distribution of underwriting information.

INCOTERM Intelligent Terminals provide the power and flexibility to give each branch in the BEDCO system an important competitive edge . . . in efficiency, in customer service, in speed and in cost per transaction.

INCOTERM can do the same things for you. Why not write or call for details.

More power to your terminal.



INCOTERM® CORPORATION

65 Walnut Street, Wellesley Hills, Massachusetts 02181 Telephone (617) 237-2100.
Sales and customer service offices in major cities throughout the United States and abroad.

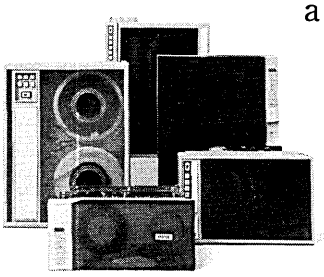
GET YOUR ACT TOGETHER:

It takes a lot of drive to make ends meet today.

We hate to see OEM frustration—the kind caused when you can't close the gap between advancing computer technology, and your peripherals' ability to fit in with your plans. Just coming "sort of close" won't do anymore.

Getting things together is a specialty at Pertec. We're industry-watchers, as well as seasoned participants—trust us to pinpoint exactly what you're going to need...often even before you do. To help you realize the full potential of state-of-art CPUs. With much greater cost-effectiveness.

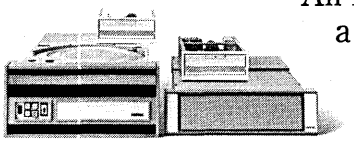
Take our tape drives. (Please.) Already available in more than 400 line-variations—but we didn't stop there. Not Pertec. We anticipated your need for a super-fast, sophisticated tape transport, to handle high volume dp throughput.



The result: our new T1000 family, a *new-generation* in vacuum column drives. 75 to 125 ips; dual density for now, but designed to handle GCR high density recording.

We're devoted to your disk demands too. Rigid or flexible. Both fixed-and-removable. From 0.25 mB to 50 mB.

And we didn't give you 50 megabytes by forcing a switch in technology. We simply *expanded* our D3000 Series to include 25-50 mB units. As extensions to an *existing* line. With technology and parts commonality you're already used to. 50 mB, without major logistic support changes...without special pre-recorded media.



All Pertec drives are built to *stay* together too. Reliability's a big number with us. Like testing at every manufacturing stage, with 40-hour burn-ins. Like setting up the biggest direct sales and service organization of any independent peripherals manufacturer. Like our toll-free 800 line, for 24-hour, 7-day emergency assistance from strategically located parts-and-repair depots around the world.

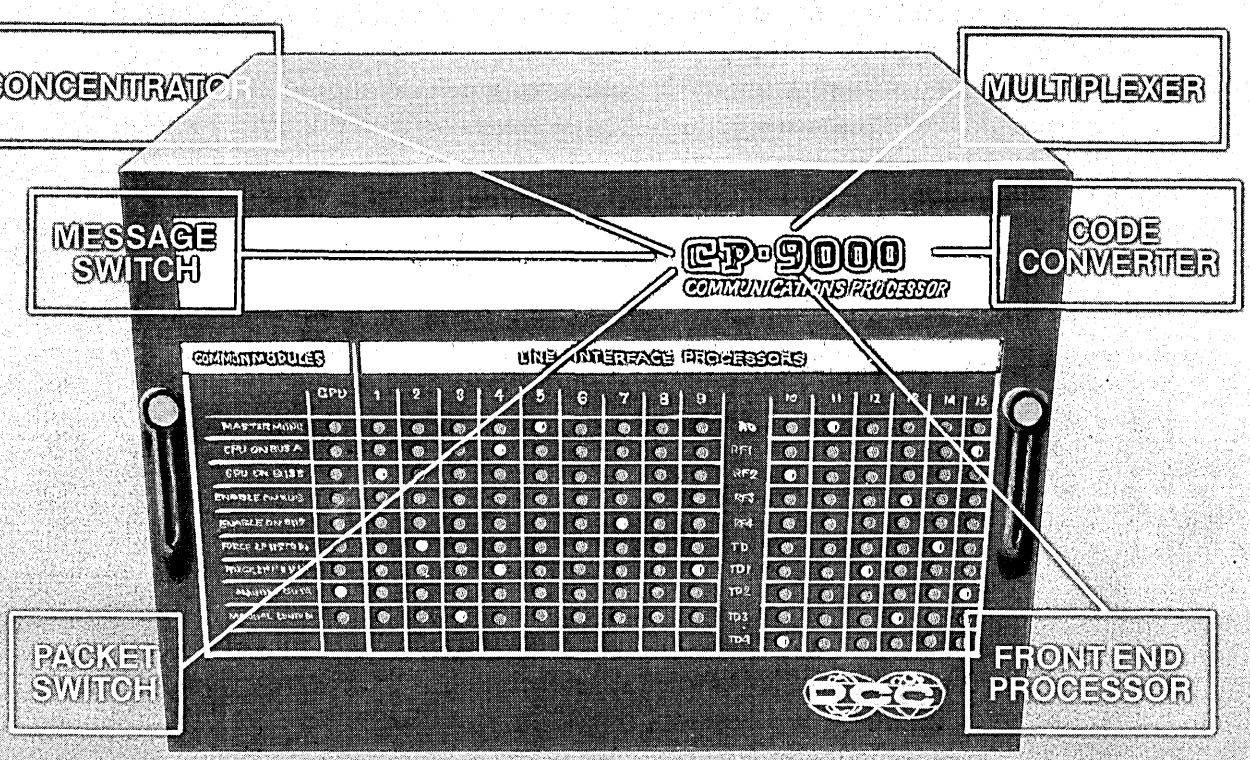
Pertec's product families are ready when you are. With on-target solutions—regardless of capacity, speed and performance specs...it's a snap with Pertec.

Get together with Pertec peripherals: write Pertec, 9600 Irondale Avenue, Chatsworth, California 91311. Or call the Pertec regional sales office nearest you: Los Angeles (213) 996-1333. Chicago (312) 696-2460. Hudson, New Hampshire (603) 883-2100. London (Reading) 582-115.

PCC PERTEC

a division of Pertec Computer Corporation

Introducing the CP-9000



A new dimension in Communications Processors.

DCC, long recognized for excellence in the design and manufacture of advanced digital telecommunications equipment, proudly introduces the CP-9000. The CP-9000 can be programmed to perform any or all of the illustrated functions.

It can be configured to support from 4 to 248 ports using modular line cards, each with its own microprocessor and up to 8 K bytes of memory. Network support functions are accomplished with two microprocessors and two memory banks, each with up to 262 K bytes of memory.

The CP-9000's features include: ☐ Up to 64 multiple microprocessors ☐ Asynchronous/synchronous interface ☐ X-25 protocol ☐ 50-64,000 baud data rates ☐ Up to 248 lines, modular ☐ Fully redundant ☐ Parity protected memory ☐ Parity protected busses ☐ Internal/external loopbacks ☐ Automatic memory tester ☐ Hardware failure traps ☐ Automatic speed detection.

If you require a communications processor with flexibility and modular growth capability, contact us for further details and applications.

See us at INTERFACE '77!

Excellence in Telecommunications Engineering

Digital Communications Corporation

19 Firstfield Road • Gaithersburg, Maryland 20760 • (301) 948-0850

RIXON **T103A2/3/F**
Bell 103/113-compatible orig/answer type
Runs up to 300bps using FSK modulation
Asynchronous, full-duplex operation
Uses 2-wire line
RS232B/C interface
Features: alternate voice/data, auto answer, local loopback and remote test
$435 to $480 ($23/month): T103F

RIXON **T103GSB**
Bell 103/113-compatible orig/answer type
Runs up to 300bps using FSK modulation
Asynchronous, full duplex operation
Uses 2-wire line (via DAA)
RS232C or Teletype interface
Features: alternate voice/data, auto answer, remote test
$500 ($23/month)

RIXON **T113 SERIES**
Bell 103A2/E/113B orig/ans-only type
Runs up to 300bps using FSK modulation
Asynchronous, full-duplex operation
Uses 2-wire line
RS232B or Teletype interface
Features: alternate voice/data, auto answer (T113 BDS only), remote test
$195 ($10/month)

SONEX **2103**
Bell 103-compatible originate/answer type
2,500 sold since 1970
Runs up to 300 or 600bps using FSK mod.
Asynchronous, full-duplex operation
Uses 2- or 4-wire line
RS232C, Teletype, or logic interfaces
Features: auto answer, auto equalization, remote and local loopback
$185

SONEX **2113 AUTOSET**
Bell 113-compatible originate/answer type
2000 sold since 1970
Runs up to 300 or 600bps using FSK mod.
Asynchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232C, Teletype, or logic interfaces
Features: automatic equalization, multiplexing
$115

STELMA **DATAPAK 103 & 113B**
Bell 103F, 103E/113B-compat. ans-only
Runs up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232C interface
Features: remote and local loopback
$272 to $550

SYNTECH **TT-103**
Bell 102/113-compatible orig/answer type
Over 1,000 sold since 1969
Runs up to 300bps using FSK modulation
Asynchronous, full-duplex operation
Uses 2-wire line
RS232C or TTL interface
Features: alternate voice/data, auto answer, remote loopback
$375 ($19—2 yr) installation NC

TEKTRONIX **4931**
Bell 100-compatible originate type
Introduced in 1977
Runs up to 300bps using FSK modulation
Asynchronous, full-duplex operation
Uses 2-wire line
RS232C interface
Features: reverse channel, automatic equalization, remote/local loop
$400 ($20/month)

TELE-DYNAMICS **7102A/D**
Bell 103/113-compat. orig/answer type
400 sold since 02/74
Runs up to 300bps using FSK modulation
Asynchronous, full-duplex operation
Uses 2-wire line or acoustic coupler
RS232C, CCITT, Teletype or TTL interfaces
Features: Remote and local loopback
$292 ($12/month), installation NC

TELE-DYNAMICS **7103-LC**
Bell 103/113-compat. orig/answer type
450 sold since 1975
Runs up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses 2-wire line
RS232C, MIL188B, or CCITT interfaces
Features: alternate voice/data via Bell 804A, integral handset on 804A, auto answer, remote and local loopback
$292, installation NC

TELE-DYNAMICS **7113-LC-4**
Bell 113A/B-compat. orig or answer-only
250 sold since 1975
Runs up to 300bps using FSK modulation
Asynchronous, full-duplex operation
Uses 2-wire line
RS232C, CCITT, Teletype or logic
Features: auto answer
$207, installation NC

TIMEPLEX **103**
Bell 103-compatible originate/answer type
Sold since 1973
Runs up to 300bps using FSK modulation
Asynchronous, full-duplex operation
Uses 2- or 4-wire line
RS232C, CCITT, or contact closure
Features: alternate voice/data, auto answer, remote and local loopback
$185 to $325

TUCK **1500 SERIES**
Bell 103/113 compat. orig and/or answer
Runs up to 300 bps using FSK modulation
Asynchronous, simplex/half/full-duplex
Uses 2- or 4-wire line or acoustic cplr
RS232C, M188C or Teletype interfaces
Features: auto answer, remote loopback
$199 to $349

UNIVERSAL **103/113**
Bell 103/113-compatible
Runs up to 300bps using FSK modulation
Asynchronous, full-duplex operation
Uses 2-wire line
RS232C or CCITT interface
Features: auto answer (via CBS DAA)
Vendor will not release pricing.

VADIC **VA 21**
IBM-compatible originate/answer type
2,000 sold since 1971
Runs up to 300bps using FSK modulation
Uses 2-wire line
CCITT V.24 or V.28 interface
Features: auto answer, remote/local loop
$600

VADIC **VA 300 SERIES**
Bell 103/113-compatible orig/answer type
55,000 sold since 08/69
Runs up to 300bps using FSK modulation
Asynchronous, full-duplex operation
Uses 2-wire line
RS232C interface
Features: auto answer, remote/local loop
$215

VEN-TEL **AC103**
Bell 103/113-compatible orig/answer type
6,000 sold since 06/75
Runs up to 300bps using FSK modulation
Synchronous, full-duplex operation
Uses 2-wire line or acoustic coupler
EIA, CCITT or current loop interfaces
$265

VEN-TEL **DCI-120**
Bell 103/113-compatible orig/answer type
2,000 sold since 1976
Runs up to 300bps using FSK modulation
Asynchronous, full-duplex operation
Uses 2-wire line or acoustic coupler
EIA, CCITT or Teletype interfaces
Designed for DECwriter LA36 terminal
$325

VEN-TEL **MD 103/113**
Bell 103/113-compatible orig/answer type
1,900 and 2,500 sold since 06/75
Runs up to 300bps using FSK modulation
Asynchronous, full-duplex operation
Uses 2-wire line
EIA or CCITT interface
Features: auto answer (MD113), remote and local loopback
$220 (103), $200 (113)

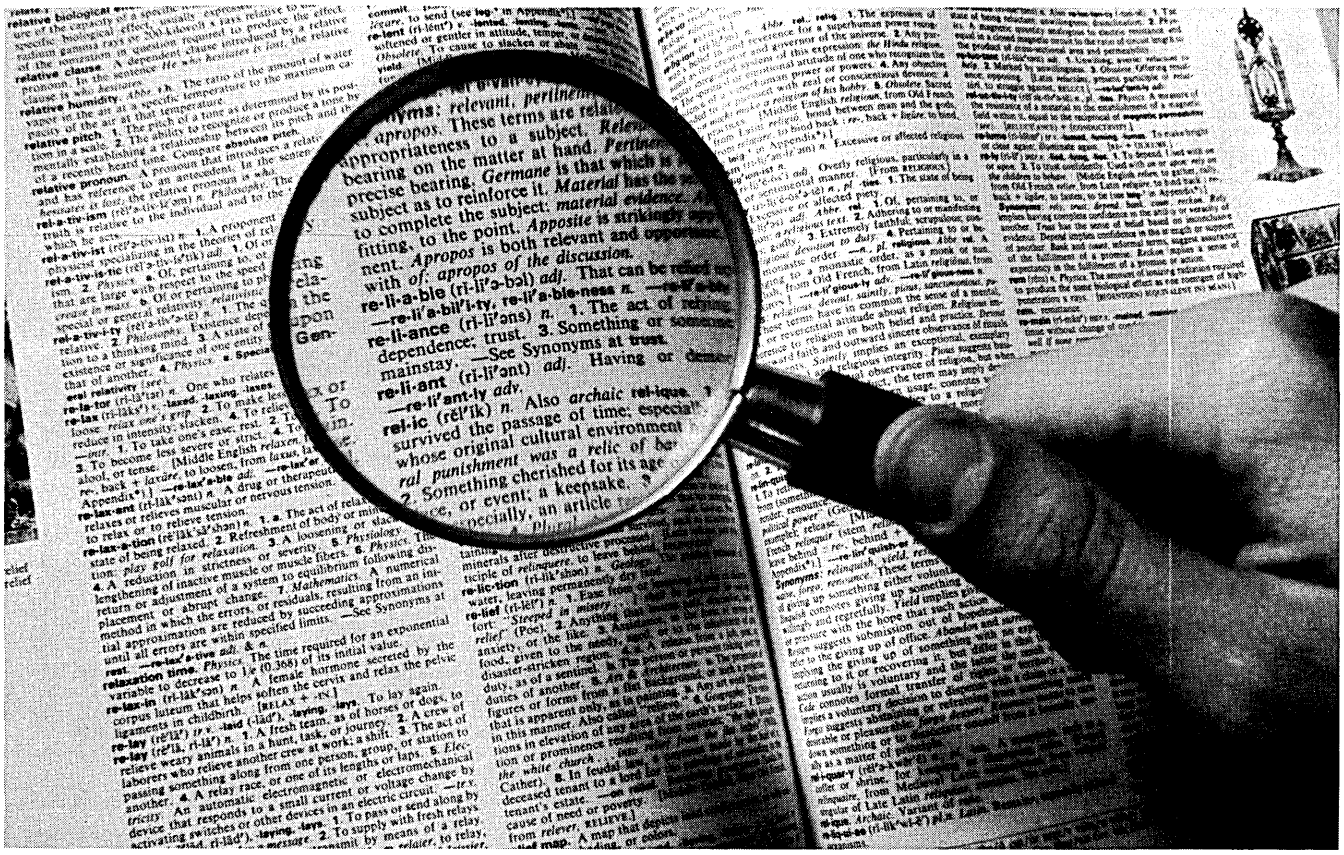
Medium Speed Modems (to 2400bps)

ANDERSON JACOBSON **MU 1291/12**
Bell 202C/D-compatible orig/answer type
Sold since 1974
Runs up to 1200bps using FSK modulation
Asynchronous, simplex/half-duplex
Uses DAA or 2- or 4-wire line
RS232C interface
Features: reverse channel, auto answer, manual equalization, remote/local loop
$350 ($18.50/month)

ASTROCOM **SERIES 120**
Bell 202-compatible originate/answer type
1,000 sold since 07/70
To 1200bps (dial-up)/1800 (leased), FSK
Asynchronous, simplex/half-duplex
Uses 2- or 4-wire line (C2 for 1800bps)
RS232B/C interface
Features: reverse channel, auto answer, fixed equalization, indicator lamps
$245 to $500 ($12.50 to $22/month)

ASTROCOM **140**
Originate/answer type
Sold since 05/75
Runs up to 1200bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses 2-wire line
RS232B/C interface
Features: reverse channel, auto answer, signal status indicator
$430 ($25 to $50/month)

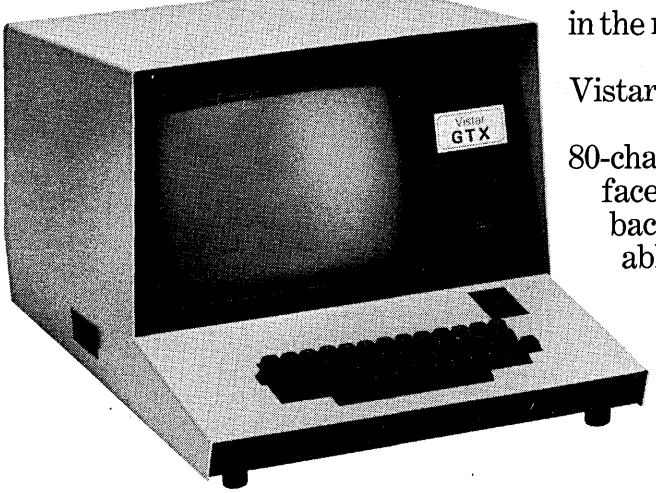
ASTROCOM **320/324**
Bell 201A/B/C-compat. orig/answer type
300 sold since 10/71
To 300bps (320)/2400bps (324) using PM
Synchronous, simplex/half/full-duplex
Uses 2- or 4-wire line
RS232B/C interface
Features: equalization, local loopback and self-test
$1,200 $50/month)



re·li·a·ble (rĭ-lī́ə-bəl)

Definition 1: that can be relied on; dependable, trustworthy.

Definition 2: Vistar/GTX



It's one thing to have a display terminal that is recognized throughout the industry for its performance and reliability.

It's another to have it at one of the lowest prices in the marketplace.

Yet that's exactly what the new Infoton Vistar/GTX has to offer.

GTX is a Teletype® replacement with an 80-character line and 24 lines of information. Its interfaces, both EIA and current loop, are standard with backspacing and non-destructive spacing available at no extra cost. Delivery is now! (30 days ARO).

There's only one more thing you should know: the price. Only $990 in quantities of 25.

Infoton

Second Avenue, Burlington, MA 01803 (617) 272-6660

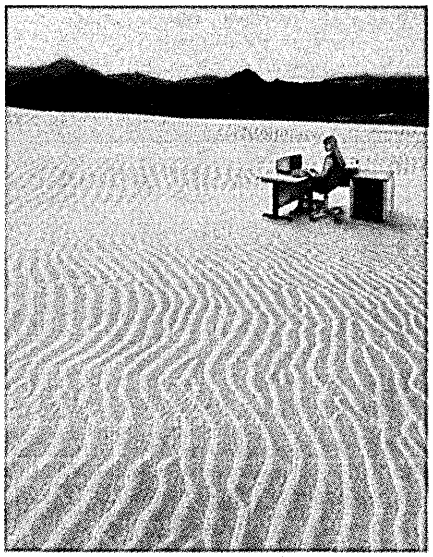
For full facts, just contact any of the Infoton offices below:
Bound Brook, NJ (201) 469-8188 • Gaithersburg, MD (301) 840-9270 • Compton, CA (213) 537-6767 • La Grange, IL (312) 352-8686 • Atlanta, GA (404) 455-0060 • Scottsdale, AZ (602) 994-5400 • Bellevue, WA (206) 454-9332

The loneliness of the long-distance computer.

From a distributed processing site, the staff and support of your headquarters data center seem a long way off. Successful operations therefore require that every remote site be supported by fast, effective field engineering.

Since 1970, Four-Phase Systems has been building a field engineering organization specifically designed to support distributed processing networks. Today, a staff of more than 350 Four-Phase field engineers provides round-the-clock service from over 70 offices nationwide. And each office is staffed by technical professionals with an average of seven years of data equipment service experience and six months full-time classroom training at our corporate education center.

These skilled, experienced technicians are supported by such advanced maintenance tools as remote diagnostics,



a national alert center, computer-managed spare parts inventories at over 200 sites, and a critical spares program that can deliver needed components almost anywhere in an average of six hours.

But quick, effective maintenance is only part of the Four-Phase field engineering concept.

Our rigorously-administered preventive maintenance program helps insure maximum system availability. And each service incident is carefully analyzed by our headquarters field support group to guide Four-Phase product engineering toward even higher equipment reliability.

By building a field engineering force specializing in network support, and by continuously refining equipment designs to enhance reliability, Four-Phase achieved a nationwide multi-shift uptime record of better than 99% in 1976. And when a service incident did occur, the mean-time-to-repair was less than three hours including dispatch and travel time... nationwide, 24-hours-a-day.

For further information, contact
Four-Phase Systems
19333 Vallco Parkway
Cupertino, California 95014
408-255-0900.

Four-Phase Systems®

BELL SYSTEM DATA SET 201A
Bell 201A-compatible orig/answer type
Runs up to 2000bps using 4-phase, PM mod.
Synchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232C or contact closure interface
Features: alternate voice/data and integral handset (with 804), auto answer, fixed equalization
$55 to $70/month

BELL SYSTEM DATA SET 201B
Bell 201B/C-compatible orig/answer type
Runs up to 2400bps using 4-phase, PM mod.
Synchronous, half/full-duplex operation
Uses 2- or 4-wire C2 conditioned line
RS232C or contact closure interface
Features: alternate voice/data and integral handset (with 804), auto answer, fixed equalization
$55/month

BELL SYSTEM DATA SET 202C
Bell 202A/D/E/R/S-compat. orig/answer
To 1200bps (dial-up)/1800 (leased), FSK
Asynchronous, half/full-duplex operation
2- or 4-wire (C1 at 1400/C2, 1800) line
RS232C interface
Features: reverse channel, alternate voice/data, integral handset, auto answer, fixed equalization
$30 to $35/month

BELL SYSTEM DATA SET 202D
Bell 202A/C/E/T-compat. orig/answer
Runs up to 1800bps using FSK modulation
Asynchronous, half/full-duplex operation
2- or 4-wire (C1 at 1400/C2, 1800) line
RS232C or contact closure interface
Features: reverse channel, alternate voice/data and integral handset (with 804A), auto answer, fixed equaliz.
$30 to $40/month

BELL SYSTEM DATA SET 202E
Bell 202A/C/D/S-compat. orig/answer
Runs up to 1800bps using FSK modulation
Asynchronous, half-duplex operation
2- or 4-wire (C1 at 1400/C2, 1800) line
RS232C interface
Features: reverse channel, alternate voice/data, integral handset, auto answer, fixed equalization
$14/month

BELL SYSTEM DATA SET 202R
Bell 202A/C/D/E-compat. orig/answer
Runs up to 1800bps using FSK modulation
Asynchronous, half/full-duplex operation
2- or 4-wire line (C1 at 1400/C2 at 1800)
RS232C interface
Features: alternate voice/data, fixed equalization
$18 to $20/month

BELL SYSTEM DATAPHONE 300/1200 DATA SET 212A
Bell 212A-compatible orig/answer type
Runs up to 1200bps using FSK modulation
Synchronous, full-duplex operation
Uses 2-wire line
RS232C interface
Features: alternate voice/data, auto answer, fixed equalization, remote and local loopback
Vendor will not release pricing.

BELL SYSTEM DATAPHONE 1200 DATA SET 202S
Bell 202C-compatible orig/answer type
Runs up to 1200bps using FSK modulation
Asynchronous, half-duplex operation
Uses 2-wire line
RS232C interface
Features: reverse channel, alternate voice/data, auto answer, fixed equalization, remote/local loop, self-test
$32.50/month plus $54.15 installation

BELL SYSTEM DATAPHONE 1800 DATA SET 202T
Bell 202D/R-compatible orig/answer type
Runs up to 1800bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses 2- or 4-wire (C2 at 1800bps) line
RS232C interface
Features: reverse channel, alternate voice/data, fixed equalization, remote/local loopback, self-test
$24.85/month plus $54.15 installation

BELL SYSTEM DATAPHONE 2400 DATA SET 201C
Bell 201B/C-compatible originate/answer
Runs up to 2400bps using 4-phase, PM mod.
Synchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232C interface
Features: auto answer, fixed equalization, remote/local loop, self-test
$59.55/month plus $81.20 installation

BURROUGHS TA 713
Bell 202D-compatible orig/answer type
Runs up to 1200bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses 4-wire line
RS232C interface
Features: remote and local loopback
$790 ($22/month) plus $40 installation

BURROUGHS TA 714
Bell 202C-compatible orig/answer type
Sold since 1971
To 1200bps (dial-up)/1800 (leased), FSK
Asynchronous, half/full-duplex operation
Uses 2- or 4-wire line (C2 at 1200bps)
RS232C interface
Features: auto answer, fixed equalization, auto call, remote/local loop
$1,090 ($31/month) plus $40 installation

BURROUGHS TA 783
Bell 202D-compatible orig/answer type
Runs up to 1800bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses 4-wire line
RS232C interface
Features: remote and local loopback
$950 ($25/month) plus $40 installation

BURROUGHS TA 2400 SERIES
Bell 201B-compatible orig/answer type
Sold since 1976
Runs up to 2400bps using PSK modulation
Synchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232C interface
Features: auto answer (2403), fixed equalization, remote/local loop
$1,600 ($55/month)

COHERENT DAM-4
Originate/answer type
1,200 sold since 08/71
To 600 or 1200bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses 2- or 4-wire line
CCITT interface
Features: reverse channel up to 75bps, alternate voice/data, local and remote loopback
$500

COHERENT DAM-50
Bell 202C-compatible orig/answer type
600 sold since 06/71
Runs up to 1800bps using FSK modulation
Asynchronous, simplex/half/full-duplex
Uses 2- or 4-wire line
RS232C, CCITT, MIL188B interfaces
Features: reverse channel, alternate voice/data, local loopback
$325 to $375

COLLINS TE-1200
Bell 202D-compatible orig/answer type
1,000 sold since 03/73
Runs up to 1800bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232C interface
Features: reverse channel, auto answer, local loopback, integral test
$475

COLLINS TE-2400
Bell 201B-compatible orig/answer type
1,800 sold since 1975
To 1200 or 2400bps using 4-phase PM mod.
Synchronous, simplex/half/full-duplex
Uses 2- or 4-wire line
RS232C or CCITT interface
Features: alternate voice/data, auto answer, compromise equalization, local and remote loop, integral test
$900 to $1,800

COMDATA 201
Bell 201-compatible originate/answer type
Sold since 06/69
To 2000 or 2400bps using PM modulation
Synchronous, half/full-duplex operation
Uses 2- or 4-wire line (C2 at 2400bps)
RS232C interface
Features: alternate voice/data, auto answer, manual equalization, local loopback
$895

COMDATA 202
Bell 202-compatible originate/answer type
Sold since 06/69
Runs up to 1800bps using FSK modulation
Asynchronous, full-duplex operation
Uses 2- or 4-wire line
RS232C interface
Features: reverse channel, alternate voice/data, auto answer, manual equalization, local loopback
$425

Solve tape operations bottlenecks!

The efficiency of Tape Operations depends on how rapidly the required volumes are mounted. Funneling of operator instructions through a CRT or hard copy device results in a bottleneck.

The **TASK COMMUNICATOR**, a second generation tape display system, sends mount messages to individual displays positioned at each tape drive. With this type of OS-to-Operator communication, the device requiring attention can be immediately identified.

The **TASK COMMUNICATOR** with big, bright 1¾" high characters and a wide viewing angle, allows the operators to easily read messages from almost anywhere in the operating area. Display housings can be adjusted vertically and horizontally to accommodate your equipment layout and produce a most astounding improvement in tape operations efficiency.

Seeing is believing! To see a live demonstration of the **TASK COMMUNICATOR** call or write:
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Logic Electric

Our bright idea.

More computer power for your dollar.

The SEL 32 family of high performance 32-bit computing systems offers a balance between big computer performance and minicomputer prices. Microprogrammable input/output processors, compatible central processing units, high-speed memory systems, and efficient data processing peripherals make up the hardware elements. On the software side, operating systems, language processors, libraries, application packages, and interactive terminal support balance the scales. Together, SEL 32 hardware and software provide a cost-effective solution to your current requirements, with expansion capability to meet your growth needs.

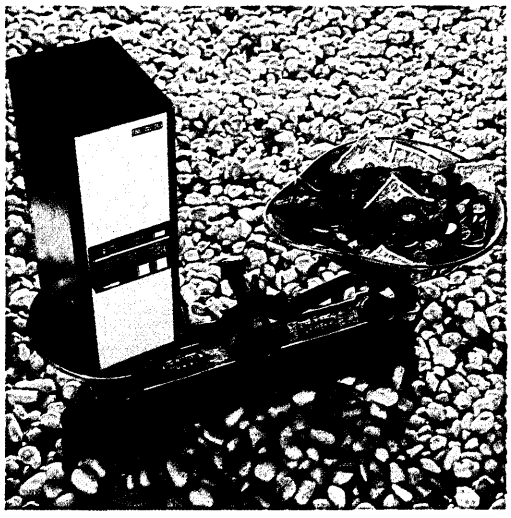
The SEL 32/35 is the strongest price-performer of any 32-bit single or multiple-CPU system available today. These computers can be configured from 64K bytes to 512K bytes of 900 nsec memory. Resembling its more powerful brothers, the SEL 32/35 is a complete package, including central processor with floating-point arithmetic, memory, chassis, power supplies, and cabinet.

The SEL 32/55, offered in a variety of both single and multiple CPU configurations, can be configured from 32K bytes to 1 million bytes of 600 nsec memory.

The SEL 32/50 is a single chassis computer providing the same CPU, I/O, and memory capability as the 32/55, but for dedicated applications.

Just circle our number on the Reader Service Card, or call us today. We'll send you the powerful story of the SEL 32 family.

SYSTEMS
ENGINEERING LABORATORIES



6901 West Sunrise Boulevard
Fort Lauderdale, Florida 33313
(305) 587-2900

European Inquiries: 85 bis Avenue Albert 1er 92500 Rueil, France. Tel: 967-8314

COMDATA **302**
Bell 202-compatible originate/answer type
New product
Runs up to 1800bps using FSK modulation
Asynchronous, full-duplex operation
Uses 2- or 4-wire line
RS232C interface
Features: reverse channel, alternate voice/data, auto answer, manual equalization, local loopback
$205 to $225

DATAPOINT **9402**
Bell 202-compatible originate/answer type
Over 2,000 sold since 1970
To 1200bps (dial-up)/1800 (leased), FSK
Asynchronous, half/full-duplex
Uses 2-or 4-wire line (C2 at 1800bps)
Datapoint I/O interface
Features: reverse channel, auto answer, manual equalization, local loopback
$1,500 ($74/month) plus $15 installation

GENERAL DATACOMM 201 SERIES
Bell 201A/B/C-compatible type
Sold since 1973
To 2000bps (dial-up)/2400 (leased), PM
Synchronous, half/full-duplex operation
Uses 2- or 4-wire C2 conditioned line
RS232C interface
Features: auto answer, remote/local loop
$700 to $1100 ($35 to $55/month)

GENERAL DATACOMM 202 SERIES
Bell 202C/D/E-comp. orig and/or ans-only
Sold since 1972
Runs up to 1200/1800bps using FSK mod.
Asychronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232C interface
Features: reverse channel, remote loopback
$365 to $420 ($18 to $21/month)

GTE LENKURT **26C**
Originate/answer type
Sold since 1965
To 1800bps (asynch), 150/300/600/1200/2400bps (synch), Duobinary FM mod.
Asynch/synch, simplex/half/full-duplex
2- or 4-wire line (none, C1, or C2)
RS232B or MIL188B interface
Features: reverse channel, alternate voice/data, manual equalization, remote and local loopback
$1,700 to $2,200

GTE LENKURT **261A**
Originate/answer type
Sold since 1974
Runs up to 2400bps using Duobinary FM
Synchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232C or RS334 interface
Features: reverse channel, alternate voice/data, manual equalization, back-to-back and loopback
$825

IBM **3872**
Originate/answer type
Sold since 1972
Runs up to 1200/2400bps using DPSK mod.
Synchronous, half/full-duplex operation
Uses 2- or 4-wire C1 conditioned line
RS232C interface
Features: alternate voice/data, auto answer, manual or auto equalization, line and self-test
$2,575 ($94/month)

ICC **20 LSI/24 LSI**
Bell 201A/B/C-compat. orig/answer type
Sold since 1972
To 2000 or 2400bps using 4-phase PM mod.
Synchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232C, CCITT or MIL188B interfaces
Features: reverse channel, alternate voice/data, auto answer, fixed equal. local and remote loopback, self-test
$1,585 ($48/mo—30 mos)

INTERTEL **MCS 1200**
Bell 202C/D-compatible orig/answer type
Sold since 04/73
Runs up to 1800bps using FSK mod.
Synch/asynch, half/full-duplex operation
Uses 2- to 4-wire line
RS232B/C or CCITT interface
Features: reverse channel, alternate voice/data, auto answer, statistical equalization, remote/local loopback
$960 ($30/mo.) plus $60 installation

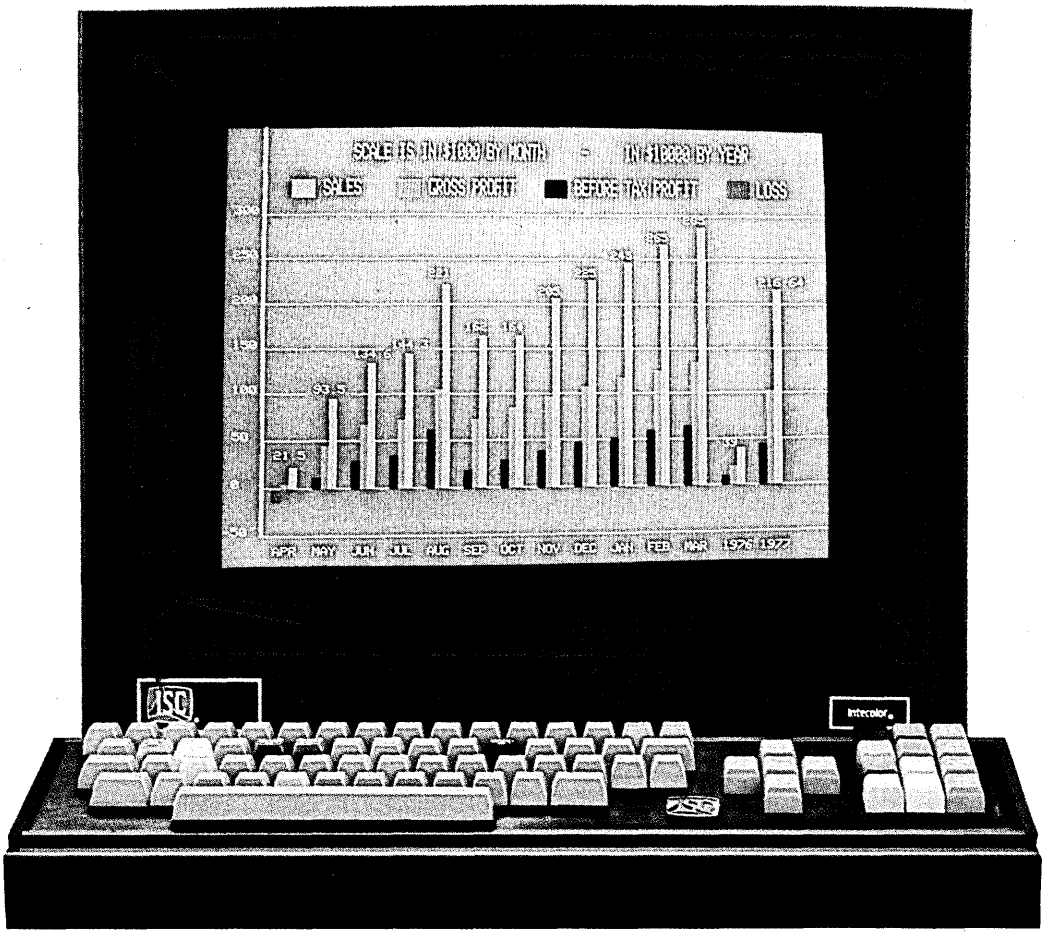
INTERTEL **MCS 2400**
Bell 201B-compatible orig/answer type
Sold since 05/73
Runs up to 2400bps using 4-phase, PM mod
Synchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232B/C or CCITT interface
Features: reverse channel, alternate voice/data, auto answer, statistical equalization, remote/local loopback
$1,750 ($48/mo.) plus $110 installation

LIVERMORE DATA SYSTEMS **412**
Bell 202S/1-compatible orig/answer type
Sold since 10/71
Runs up to 1200bps using FSK mod.
Asynchronous, simplex/half/full-duplex
Uses 2- or 4-wire line
RS232C, CCITT or MIL188B interfaces
Features: reverse channel, auto answer, remote loopback
$725 ($36—2 years)

LIVERMORE DATA SYSTEMS **424**
Bell 201B/C-compatible orig/answer type
Sold since 10/71
Runs up to 2400bps using 4-phase, PM mod
Synchronus, simplex/half/full-duplex
Uses 2- or 4-wire line
RS232C, CCITT, or MIL188B interfaces
Features: reverse channel, auto answer, automatic equalization, remote loop
$875 ($44—2 years)

MULTI-TECH **FM 1200**
Bell 202-compatible originate/answer type
Sold since 1974
Runs up to 1200bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232B/C interface
Features: auto answer, manual equalization, remote and local loopback
$225 to $460

NOVATION **202**
Bell 202C/D/E-compat. orig/answer type
8,000 sold since 03/71
Runs up to 1200 or 1800bps using FSK mod



Unretouched photograph of screen.

The Intecolor 8001 CRT. Buy One or Buy One Hundred. Just $1495.*

That's the price tag we'll put on the Intecolor 8001 if you place your order right now for 100 or more units. $1495. That's also the price we'll give you on a one-shot cash basis on an Intecolor 8001 CRT evaluation unit. Now, we'll never get rich with a price structure like that, but we look at it this way. That price is an investment in your future. We know that once you get your hands on the Intecolor 8001, once you see what it can do, you'll be back for more.

And it's because you'll be getting an Intelligent, 8-Color CRT that'll outperform any CRT on the market on a dollar for dollar and character for character basis. And it's complete. You won't have to lay out more cash for a keyboard, or 8080 CPU, or any of the standard features you'd expect to find on a good color CRT. It'll be ready to go. You can put it to work as a stand-alone CRT, incorporate it into your present system, or use it to upgrade the CRT's in the systems you're currently marketing. Whatever your application, it'll work for you.

But if your needs call for a more sophisticated CRT, a CRT that'll give you higher-level functions—no problem. We'll be glad to work with you to help you come up with an options package to fit your requirements. Like additional RAM to 32K, Roll, Background Color, Light pens, Graphics, 48 Line X 80 Characters/Line and up to 64 Special Graphics Characters. You define your needs, and we'll give you the capabilities to get the job done. It's that simple.

But if you'd like to see for yourself, look over our rep list on the adjacent page and ask the rep in your area for a demonstration. Whatever your application, he can show you the right Intecolor 8001 CRT at just the right price.

ISC

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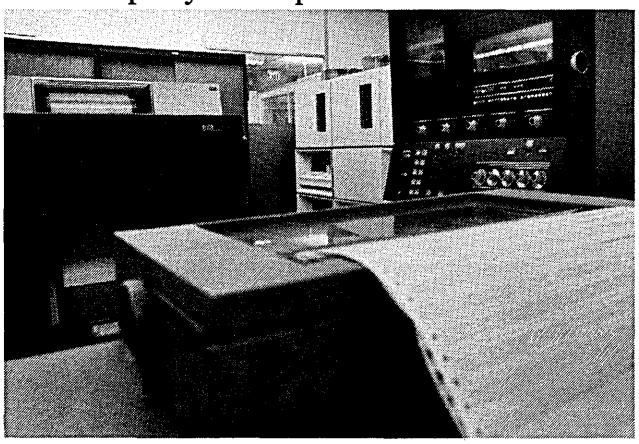
Norcross, Georgia 30071
(404) 449-5961

CIRCLE 91 ON READER CARD

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.

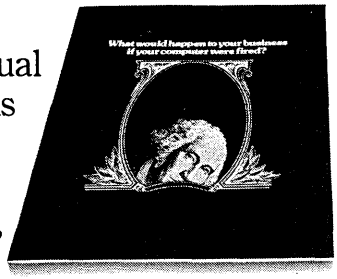
Even though the fire was inside the consoles, at the farthest point from the Fenwal discharge nozzles, the flames were snuffed out *dry* and major damage or personnel injury was completely averted.

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."

FENWAL®

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

Graphic hardcopy output from IBM systems: the Plotmaster® makes it a reality, not a dream.

If you have an IBM System 360/370 computer operating under DOS, OS or VS, you know what a nightmare it is to get graphic hardcopy output.

That's why the Gould Plotmaster Systems are like a dream come true. They deliver crisp, high quality graphics output from the computer, with no intermediate processing steps. They also work at incomparably fast speeds, without demanding additional system resources. No hours or days of waiting as when you use a slow pen plotter attached to the computer. No waiting for post-processing film development and blow-up as when you use graphic microfilm units.

Plus, Plotmaster Systems are economical as well as efficient. Initial and recurring costs are surprisingly low. And fast turn-around and high capacity adds up to additional savings.

Plotmaster Systems have three major components. Efficient and flexible graphics software. A Gould electrostatic printer/plotter that you can tailor to your exact application. And hardware to link the two—an on-line controller, or a tape drive for off-line operation.

In addition to this basic package, specialized software is available for business, scientific and engineering applications. Full printing capability is optional.

Let us tell you more about the fast, powerful, versatile Plotmaster Systems. They can be purchased or leased and are supported by Gould's specially trained service force.

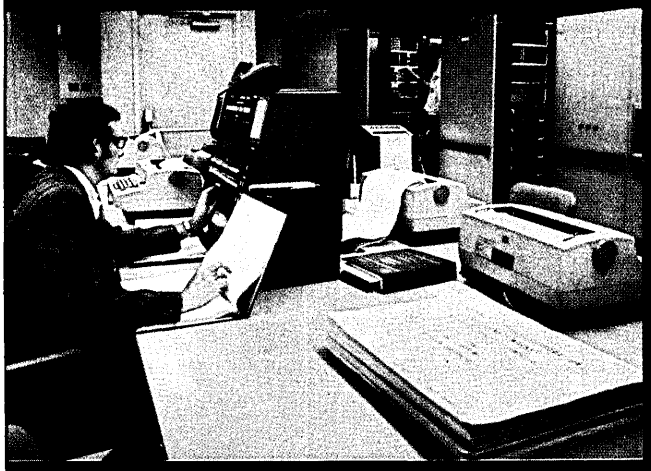
For a free brochure, write Gould Inc., Instrument Systems Division, 3631 Perkins Ave., Cleveland, Ohio 44114. Or Gould Advance Ltd., Raynham Road, Bishop Stortford, Herts, United Kingdom. Or call Gould toll-free at (800) 325-6400, Ext. 77. In Missouri: (800) 342-6600.

GOULD

The product development company

i&se*

maintains more computers now than when GE made computers.



The reason: I&SE now services computers of other makes. Moreover, I&SE is offering its worldwide computer service network to OEM's and computer manufacturers who need a ready-made service organization.

The advantage: I&SE experience. I&SE computer service engineers are systems oriented. They're experts at making your entire system work, including the computer.

For full information, phone I&SE's Manager-Computer Service, (602) 264-1751, or write General Electric Co., Section 950-17, Schenectady, New York 12345.

Who's maintaining your computer system?

*INSTALLATION AND SERVICE ENGINEERING DIVISION

GENERAL ELECTRIC

Asynchronous, half/full-duplex operation
Uses 2- or 4-wire line (C2 at 1800bps)
RS232B/C or TTL interface
Features: reverse channel, alternate voice/data, auto answer, fixed equalization, remote loopback
$366 ($35/month) plus $35 installation

OMNITEC 1200A
Bell 202C-compatible orig/answer type
Sold since 1974
Runs up to 1200bps using FSK modulation
Asynchronous, half-duplex operation
Uses 2-wire line or acoustic coupler
RS232 interface
Features: reverse channel
$975, installation NC

OMNITEC 1202
Bell 202C-compatible orig/answer type
Sold since 1974
Runs up to 1200bps using FSK modulation
Asynchronous, half-duplex operation
Uses DAA or 4-wire line
RS232 interface
Features: reverse channel, auto answer, remote and local loopback
$825, installation NC

PENRIL 1200/5 & 1200/150
Bell 202C/D-compatible orig/answer type
1,000 sold since 11/70
Runs up to 1200bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses 2-wire line
RS232B/C or CCITT interface
Features: reverse channel, alternate voice/data, auto answer, fixed equalization, remote/local loopback, integral handset
$300 to $400 ($15-$20/mo) plus $50 inst.

PENRIL 1800
Bell 202D-compatible orig/answer type
4,000 sold since 07/70
Runs up to 1800bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses 2- or 4-wire line (C2 at 1800bps)
RS232B/C or CCITT interface
Features: auto answer, fixed equalization, remote and local loopback
$320 ($12/month) plus $50 installation

PENRIL 2400/300
Originate/answer type
100 sold since 01/73
Runs up to 1200/2400bps using 4-phase PM
Synchronous, simplex/half/full duplex
Uses 2- or 4-wire line
RS232C or MIL188B interface
Features: reverse channel (75-300bps), auto answer, fixed equalization, remote and local loopback
$1,920 ($85/month) plus $100 instal.

PENRIL 2400B1 SERIES
Bell 201B/C-compatible orig/answer type
Over 4,000 sold since 1970
Runs up to 1200/2400bps using 4-phase PM
Synchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232B/C or CCITT interface
Features: alternate voice/data (B1), auto answer, selectable equalization, remote/local loopback, self-test, integral handset
$1,375 ($66/month) plus $50 installation

PRENTICE P-201B/C
Bell 201B/C-compatible orig/answer type
1,500 sold since 06/72
Runs up to 2400bps using PM modulation
Synchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232C interface
Features: automatic equalization, remote and local loopback
$865 ($55/month), installation NC

PRENTICE P-202
Bell 202C/D/R/T-compat. orig/ans. type
7,000 sold since 01/72
Runs up to 1200bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232C or Teletype interface
Features: reverse channel, auto answer, remote and local loopback
$300 to $350 ($15-$20/mo), install. NC

PRENTICE P-1200 SERIES
ARPA-compatible originate/answer type
Sold since 06/73
Runs up to 1200bps using FSK modulation
Asynchronous, full-duplex operation
Uses 2-wire line
RS232C or Teletype interface
Features: reverse channel (150bps), auto answer, auto equalization, remote and local loopback
$400 ($22-$25/mo.), installation NC

QEI QDM & Q70
Originate/answer type
4,000 sold since 07/72
Runs up to 1200bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232B/C or CCITT interface
Features: reverse channel, alternate voice/data, local loopback, auto answer (QDM-113)
$1,000

QEI Q700
Originate/answer type
12,000 sold since 10/71
Runs up to 1200bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232B/C or CCITT interface
Features: reverse channel, alternate voice/data, local loopback
$515

RFL 32DT/32DR
Originate/answer type
Runs up to 1200bps using FSK modulation
Asynchronous, full-duplex operation
Uses 2-wire C1 conditioned line
RS232C interface
Features: reverse channel, auto answer, compromise equalization, remote loop
$940 to $1,160 ($60 to $70/month)

RFL 6385
Bell 202C-compatible originate-only type
Runs up to 1800bps using FSK mod.
Asynchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232C interface
$235

RIXON DS-1800
Bell 202-compatible originate/answer type
Runs up to 1800bps using FSK mod.
Asynchronous, half/full-duplex operation
2- or 4-wire line (C1 at 1400, C2 at 1800)
RS232B/C interface
Features: reverse channel, alternate voice/data, auto answer, fixed equalization, remote and local loopback
$500 ($23/month)

RIXON DS-2401
Bell 201B/C-compatible orig/answer type
Runs up to 1200/2400bps using 4-phase PM
Synchronous, simplex/half/full-duplex
Uses 2- or 4-wire line
RS232B or TTL interface
Features: alternate voice/data, auto answer, manual equalization, remote and local loopback
$795 ($36/month)

RIXON TA201A/B
Bell 201A-compatible type
Runs up to 2000bps or 2400bps using PM modulation
Synchronous, half/full-duplex operation
Uses 2- or 4- wire line
RS232B or contact closure interface
Features: alternate voice/data (via 804A), auto answer, fixed equalization, remote test
$1,075 to $1,390

RIXON T202E
Bell 202E-compatible
Runs up to 1200bps using FSK mod.
Asynchronous, transmit-only operation
Uses 2-wire line
RS232B interface
Features: reverse channel, alternate voice/data, auto answer, remote test
$475 to $570

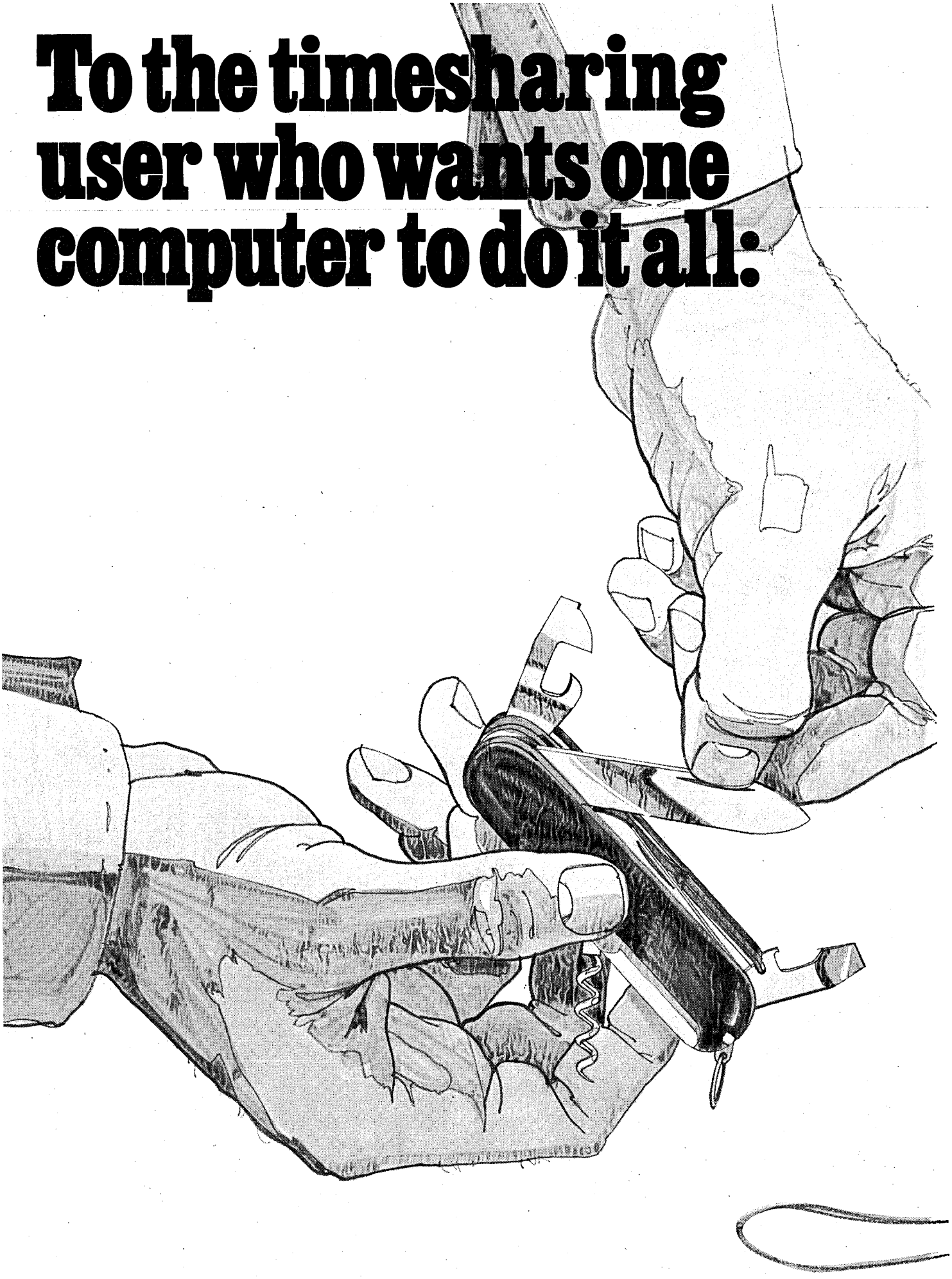
RIXON T202S/T
Bell 202S-compatible orig/answer type
Runs up to 1200bps or 1800bps using FSK mod.
Asynchronous, half/full-duplex operation
Uses 2- or 4-wire line (C2 at 1800bps)
RS232C interface
Features: reverse channel, alternate voice/data, auto answer, fixed equalization, remote and local loopback
Vendor will not release pricing.

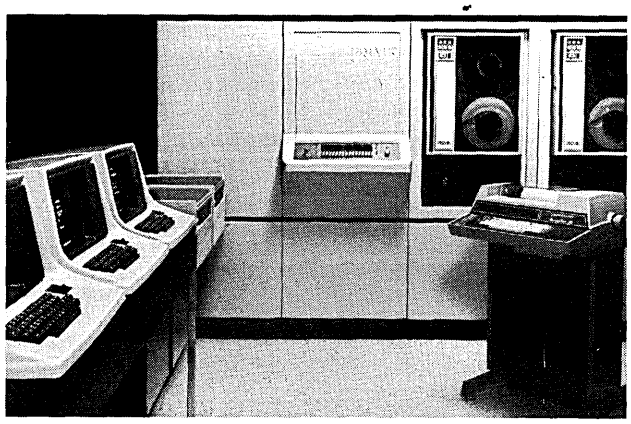
SONEX 2202 AUTOSET
Bell 202C/D/E-compat. orig/answer type
75 sold since 1972
Runs up to 1800bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses 2- or 4- wire line (C2 at 1800bps)
RS232C interface
Features: reverse channel, auto answer, automatic equalization, remote/local loopback, multiplexing
$325

STELMA DATAPAK
Originate/answer type
Over 2,000 sold since 08/70
To 75/150/300/600/1200/1800bps, FSK mod.
Asynch/Synch, simplex/half/full-duplex
Uses 2- or 4-wire line
RS232C, CCITT, MIL188B, Teletype
Features: multiplexing
$350/channel end

STELMA DATAPAK 202 PLUS
Runs up to 1800bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232C interface
Features: one 1800bps channel plus two 150bps channels, remote/local loop
$1,266 to $1,450

To the timesharing user who wants one computer to do it all:





Prime timesharing systems, like Swiss Army knives, are multifunctional, compact and easy-to-use. Both provide a collection of tools, each fitting a different need, all fitting together in one very reasonably priced, elegantly-engineered package. But a Prime computer, unlike the army knife, lets many people use all the tools all at once.

One Prime computer system has the right mix of tools. A family of program-compatible central processors, a broad range of input/output subsystems and a sophisticated interactive multi-user operating system are the starting points for selecting a system tailored to your exact applications mix.

One Prime computer system plays many roles. By providing virtual address spaces of up to 512 million bytes for each of up to 63 simultaneous users, up to eight million bytes of main memory and 2.4 billion bytes of disk storage, one system can be used for both interactive software development and computational processing.

One Prime computer offers many problem-solving alternatives. Any user can program in any mix of languages, including FORTRAN IV, ANSI '74 COBOL, BASIC, Macro Assembler and RPG II.

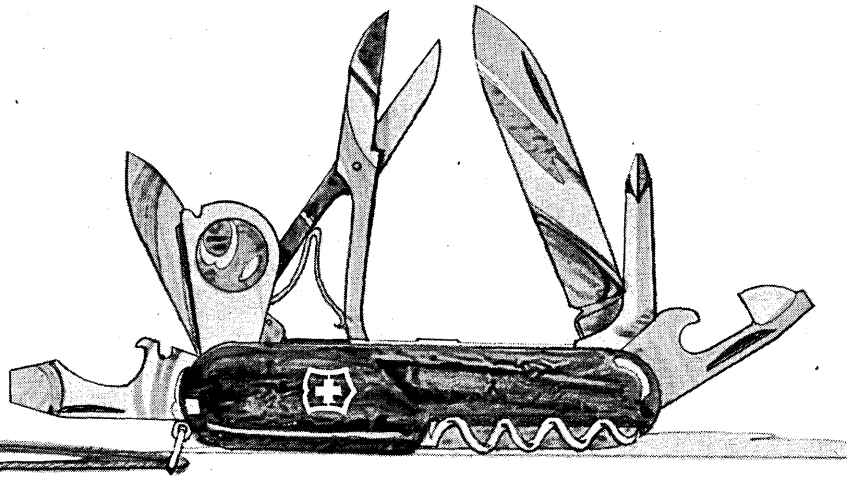
One file structure is used by all Prime system software. Thus, all Prime data management resources are totally compatible. User files managed by MIDAS, Prime's Multiple Index Data Access System, are interchangeable with common data bases managed by DBMS, Prime's CODASYL-compliant database management system.

One Prime computer can do it all: complex simulations in FORTRAN, straightforward calculation in BASIC, text editing, transaction processing, massive number crunching and more.

Typical systems for computational timesharing applications range from $41,000 to $300,000, or about $1,300 to $9,800 per month if leased from and maintained by Prime.

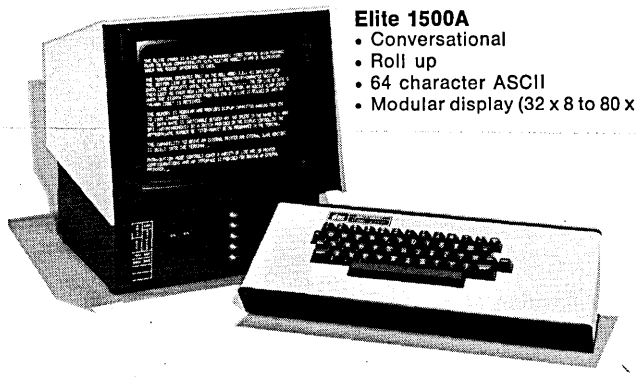
To find out how one Prime computer can do it all for you, contact David R. Johnson, Business Manager, Prime Computer, Inc., 145 Pennsylvania Avenue, Framingham, MA 01701, (617) 879-2960.

PRIME



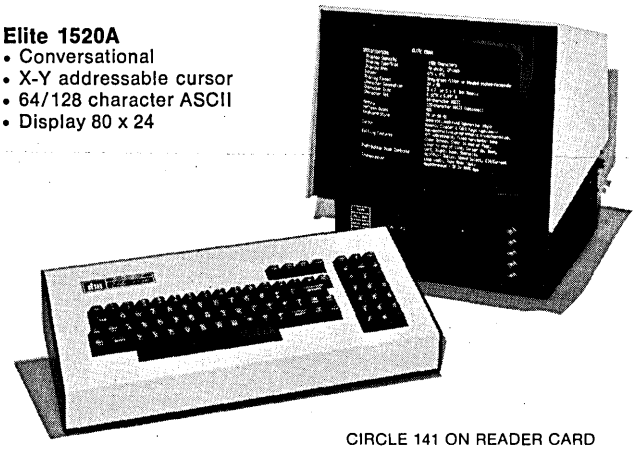
Prime can help

See things your way



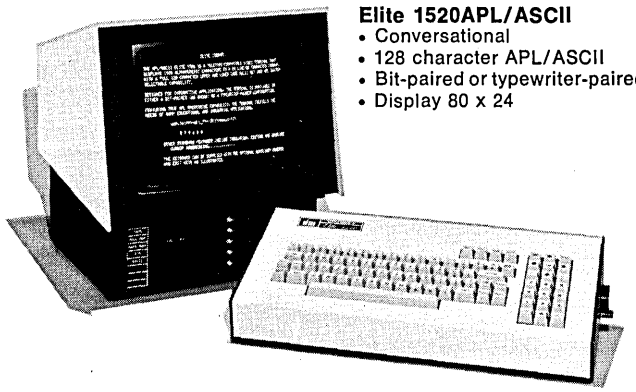
Elite 1500A
- Conversational
- Roll up
- 64 character ASCII
- Modular display (32 x 8 to 80 x 24)

CIRCLE 140 ON READER CARD



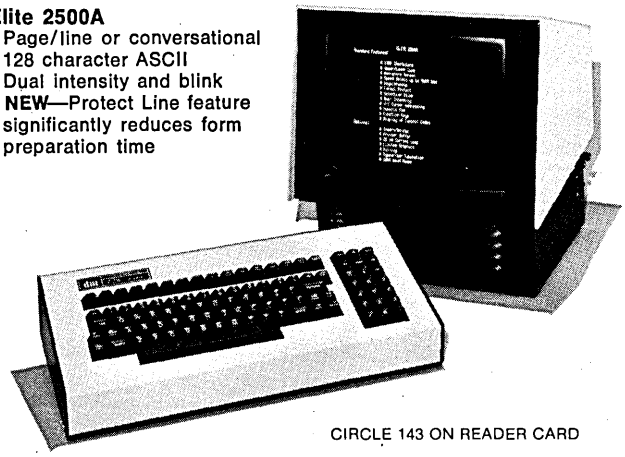
Elite 1520A
- Conversational
- X-Y addressable cursor
- 64/128 character ASCII
- Display 80 x 24

CIRCLE 141 ON READER CARD



Elite 1520APL/ASCII
- Conversational
- 128 character APL/ASCII
- Bit-paired or typewriter-paired
- Display 80 x 24

CIRCLE 142 ON READER CARD



Elite 2500A
- Page/line or conversational
- 128 character ASCII
- Dual intensity and blink
- **NEW**—Protect Line feature significantly reduces form preparation time

CIRCLE 143 ON READER CARD

with Datamedia Elite Video Terminals

A family of video terminals that offers a wide range of features to perform an even wider range of data entry and display tasks.

If you're with an OEM firm or a system house, and look at peripherals with one eye on cost and the other on performance, you'll want to take a long look at these proven products from Datamedia.

Their modular design makes troubleshooting a breeze, and facilitates conformance to your system needs, and their quality workmanship assures that those needs will be met longer than you thought possible.

And if you believe in service after the sale the way Datamedia does, you'll appreciate the new dimension we've given to the word "responsive."

Datamedia. We've been seeing things the right way for users in industry, business services, government, education, medicine and research around the world.

Why don't you see what we can do for you.

CIRCLE 144 ON READER CARD

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5456 McConnell Avenue • Suite 180 • Los Angeles, CA 90066 • 213-397-3556

Canada: Datamex, Ltd., Ontario/Quebec • **Belgium:** Inex, (02) 512 4037 • **Finland:** Suma, (90) 440391 • **Italy:** Eltron s.r.l., (030) 55-26-41554 • **Sweden:** Teleinstruments ab, 08-38 03 70 • **Switzerland:** Teledynamics, 01-56 3300 • **United Kingdom:** Mellor Data, 020629-8181 • **West Germany:** Video Data Systems GmbH, (0 61 81) 7 39 51 • **Australia:** Intelec Data Systems, (03) 232-3118 • **Japan:** Protech, Inc., (03) 384-0225.

STELMA DATAPAK 202R/SYNC/600
Bell 202R-compatible type
Runs up to 1200 or 1800bps using FSK
Asynch/Synch, half/full-duplex operation
Uses 2- or 4-wire line
RS232C interface
Features: remote and local loopback
$422 to $710

SYNTECH ESP-201
Bell 201A/B/C-compat. orig/answer type
Sold since 1975
Runs up to 2000/2400bps using 4-phase PM
Synchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232C interface
Feature: alternate voice/data, auto answer, fixed equalization, remote/ and local loopback, self-test
$1,350, installation NC

SYNTECH TT-201
Bell 201A/B/C-compat. orig/answer type
Over 5,000 sold since 1970
Runs up to 2000/2400bps using 4-phase PM
Synchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232C or TTL interface
Features: alternate voice/data, auto answer, fixed equalization, remote and local loopback
$1,095 ($55—2 years), installation NC

SYNTECH TT-202
Bell 202-compatible orig/answer type
Over 1,000 sold since 1969
Runs up to 1800 using FSK modulation
Asynch/synch, half/full-duplex operation
Uses 2- or 4-wire line
RS232C or TTL interface
Features: reverse channel, alternate voice/data, auto answer, fixed equalization, remote and local loopback
$450 ($25—2 yrs.), installation NC

TEKTRONIX 4931
Bell 202C/S-compat. originate-only type
Sold since 01/77
Runs up to 1200bps using FSK modulation
Asynchronous, half-duplex operation
Uses 2-wire line
RS232A/C interface
Features: reverse channel (5bps), automatic equalization, remote and local loopback
$750 to $850 ($38 to $43/month)

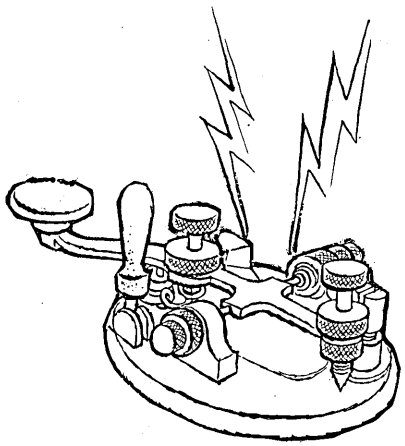
TELE-DYNAMICS 7201A/B
Bell 201A/B-compatible orig/answer type
3,000 sold since 08/72
Runs up to 2000/2400bps using 4-phase PM
Synchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232C or CCITT interface
Features: auto answer (NC option), fixed equalization, remote/local loop
$895 ($40/month) plus $50 installation

TELE-DYNAMICS 7202D/E
Bell 202D/E-compatible orig/answer type
900 sold since 02/72
Runs up to 1800bps using FSK mod.
Asynchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232C or CCITT interface
Features: reverse channel, auto answer, fixed equalization, remote/local loop
$440 ($21/month) plus $50 installation

TIMEPLEX 202
Bell 202-compatible orig/answer type
Sold since 1973
Runs up to 2000bps using FSK mod.
Asynch/synch, simplex/half/full-duplex
Uses 2- or 4-wire line (C2 at 2000bps)
RS232C, CCITT or MIL188C interfaces
Features: reverse channel, alternate voice/data, auto answer, statistical equalization, remote/local loopback
$285 to $425

TUCK 1600 SERIES
Bell 202-compatible orig/answer type
Runs up to 1200bps using FSK mod.
Asynchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232C or TTL logic interface
Features: reverse channel (5bps), alternate voice/data, auto answer, fixed equalization, remote loopback
$122 to $375

UNIVERSAL 12-12
Runs up to 1200bps using PSK mod.
Synch/asynch, full-duplex operation
Uses 2-wire line
RS232C or CCITT interface
Features: local and remote loopback
Vendor will not release pricing.



UNIVERSAL 201A/B/C
Bell 201A/B/C-compatible type
Runs up to 2400bps using PSK mod.
Synchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232C or CCITT interface
Features: auto answer (except B), five LED diagnostic indicators
Vendor will not release pricing.

UNIVERSAL 202C/D
Bell 202-compatible originate/answer type
Sold since 1972
Runs up to 1200 or 1800bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232B/C interface
Features: reverse channel (5 or 150bps) and auto answer on 202D, remote/local loop
$445-$495

UNIVERSAL 202M[5]
Originate/answer type
Sold since 1972
Runs up to 1800bps using FSK mod.
Asynchronous, half/full-duplex operation
Uses 2- or 4-wire line (C2 at 1800bps)
RS232C interface
Features: remote and local loopback
$675

UNIVERSAL 202SS
Originate/answer type
Sold since 1972
Runs up to 1200bps using FSK mod.
Synchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232C interface
Features: remote and local loopback
$560

UNIVERSAL RM-16
Bell 103/113/201/202-compat. orig/ans.
Sold since 1972
Runs up to 2400bps using FSK & PSK mod.
Asynch/synch, half/full-duplex operation
Uses 2- or 4-wire line
RS232C interface
Features: reverse channel, auto answer, remote and local loopback
Vendor will not release pricing

VEN-TEL MD1212
Originate/answer type
600 sold since 09/76
Runs up to 1200bps using FSK mod.
Asynchronous, full-duplex operation
Uses 2-wire line
EIA, current logic or CCITT interfaces
Features: auto answer, remote loopback and indicators
$450

VADIC LDA/LLA/SLA/
IBM-compatible originate/answer type
9,000 sold since 1970
Runs up to 134.5 or 600bps, (SLA & LDA), 600 to 1200bps (LLA) using FSK mod.
Asynchronous, half-duplex operation
Uses 2- or 4-wire line
RS232C interface
Features: remote and local loopback
$200

VADIC VA 23
Originate/answer type
4,500 sold since 1971
Runs up to 1200bps using FSK mod.
Asynch/synch, half/full-duplex operation
Uses 2- or 4-wire line
CCITT V.24 or V.28 interface
Features: reverse channel, alternate voice/data, auto answer, compromise equalization, remote/local loopback, integral handset
$600

VADIC VA 1200
Bell 202-compatible originate/answer type
45,000 sold since 1969
Runs up to 1800bps using FSK mod.
Asynchronous, half-duplex operation
Uses 2- or 4-wire line (C2 at 1800bps)
RS232B/C interface
Features: reverse channel, auto answer, remote and local loopback
$285

VADIC VA 2405
Bell 201B/C-compatible orig/answer type
3,000 sold since 1974
Runs up to 2400bps using DPSK mod.
Synchronous, half-duplex operation
Uses 2- or 4-wire line
RS232C interface
Features: auto answer, compromise equalization, remote/local loop
$600

VADIC VA 3400 SERIES
Originate/answer type
Sold since 04/73
Runs up to 1200bps

Asynchronous, full-duplex operation
Uses 2-wire line
RS232B/C interface
Features: auto answer, compromise equalization, remote/local loop
$715 plus $45 installation

High Speed Modems (to 9600bps)

BELL SYSTEM — DATAPHONE 4800 DATA SET 208A
Originate/answer type
Runs up to 4800bps using 8-phase PM mod.
Synchronous, half/full-duplex operation
Uses 4-wire private line
RS232C interface
Features: alternate voice/data, automatic equalization, remote and local loopback, self-test
$135/month plus $163 installation

BELL SYSTEM — DATAPHONE 4800 DATA SET 208B
Originate/answer type
Runs up to 4800 bps using 8-phase PM mod.
Synchronous, half-duplex operation
Uses 2-wire line
RS232C interface
Features: alternate voice/data, auto answer, automatic equalization, remote and local loopback, self-test
$135/month plus $163 installation

BELL SYSTEM — DATAPHONE 9600 DATA SET 209A
Originate/answer type
Runs up to 9600bps using QAM mod.
Synchronous, half/full-duplex operation
Uses 4-wire D1 conditioned line
RS232C interface
Features: alternate voice/data, automatic equalization, multiplexing, remote and local loopback, self-test
$249/month plus $216 installation

BURROUGHS — TA 733-48
Originate/answer type
Sold since 04/72
Runs up to 4800bps using 8-phase PSK mod.
Synchronous, half/full-duplex operation
Uses 4-wire C1 conditioned line
RS232C or CCITT interface
Features: remote and local loopback
$5,000 ($142/mo.) plus $42 installation

CODEX — 4800 C
Originate/answer type
Over 4,000 sold since 01/71
Runs up to 3200/4800 bps using QAM mod.
Synchronous, simplex/half/full-duplex
Uses 4-wire line
RS232C, CCITT or MIL188C interfaces
Features: reverse channel (to 150bps), alternate voice/data, automatic equalization, local/remote loopback, multiplexing
$4,500 ($95-2 yr) plus $125 instal.

CODEX — 4800 I
Originate/answer type
Over 1,000 sold since 12/73
Runs up to 4800bps using 8-phase PSK mod
Synchronous, half/full-duplex operation
Uses 4-wire M 102 conditioned line
CCITT interface
Features: reverse channel, alternate voice/data, automatic equalization, remote/local loopback, multiplexing
$4,500 ($95-2 yr) plus $125 instal.

CODEX — 7200 C
Originate/answer type
Over 1,000 sold since 04/71
Runs up to 4800/7200bps using QAM mod.
Synchronous, half/full-duplex operation
Uses 4-wire C2 conditioned line
RS232C, CCITT or MIL188C interfaces
Features: alternate voice/data, automatic equalization, local and remote loopback, multiplexing
$6,850 ($150-2 yr) plus $125 instal.

CODEX — 9600 C
Originate/answer type
Over 5,000 sold since 10/71
Runs up to 4800/7200/9600bps using QAM mod.
Synchronous, half/full-duplex operation
Uses 4-wire C2 conditioned line
RS232C, CCITT or MIL188C interfaces
Features: alternate voice/data, automatic equalization, local and remote loopback, multiplexing
$8,900 ($185-2 yr) plus $125 instal.

CODEX — 4800 DIAL
Originate/answer type
Over 100 sold since 11/72
Runs up to 4800bps using QAM mod.
Synchronous, half-duplex operation
Uses 2- or 4-wire line
RS232C or CCITT interface
Features: reverse channel, alternate voice/data, auto answer, automatic equalization, local/remote loopback
$5,575 ($105/mo) plus $125 installation

CODEX — LSI 48FP
Originate/answer type
Sold since 04/76
Runs up to 2400/4800bps using QAM mod.
Synchronous, half/full-duplex operation
Uses 4-wire C1 conditioned line
RS232C, CCITT or MIL188C interfaces
Features: reverse channel (150bps), alternate voice/data, auto equalization, local and remote loopback
$4,500 ($105-2 yr) plus $125 instal.

CODEX — LSI 72FP
Originate/answer type
Sold since 04/76
Runs up to 4800/7200bps using QAM mod.
Synchronous, half/full-duplex operation
Uses 4-wire C2 conditioned line
RS232C, CCITT or MIL188C interfaces
Features: alternate voice/data, automatic equalization, local/remote loop
$6,725 ($160-2 yr) plus $125 instal.

CODEX — LSI 96FP
Originate/answer type
Sold since 04/76
Runs up to 4800/7200/9600bps using QAM
Synchronous, half/full-duplex operation
Uses 4-wire C2 conditioned line
RS232C, CCITT or MIL188C interfaces
Features: alternate voice/data, automatic equalization, local/remote loop
$8,750 ($200-2 yr) plus $125 instal.

CODEX — LSI 96/V29
Originate/answer type
Sold since 11/76
Runs up to 9600bps using QAM mod.
Synchronous, half/full-duplex operation
Uses 4-wire M102 conditioned line
RS232C or CCITT interface
Features: reverse channel, alternate voice/data, standard equalization, local/remote loopback, multiplexing
$9,350 ($205/mo.) plus $125 installation

CODEX — LSI 481
Originate/answer type
Sold since 02/76
Runs to 2400/4800bps using 8-phase DPSK
Synchronous, half/full-duplex operation
Uses 4-wire M102 conditioned line
RS232C or CCITT interface
Features: reverse channel (150bps), alternate voice/data, auto equalization, local/remote loop, multiplexing
$4,325 ($95-2 yr) plus $125 instal.

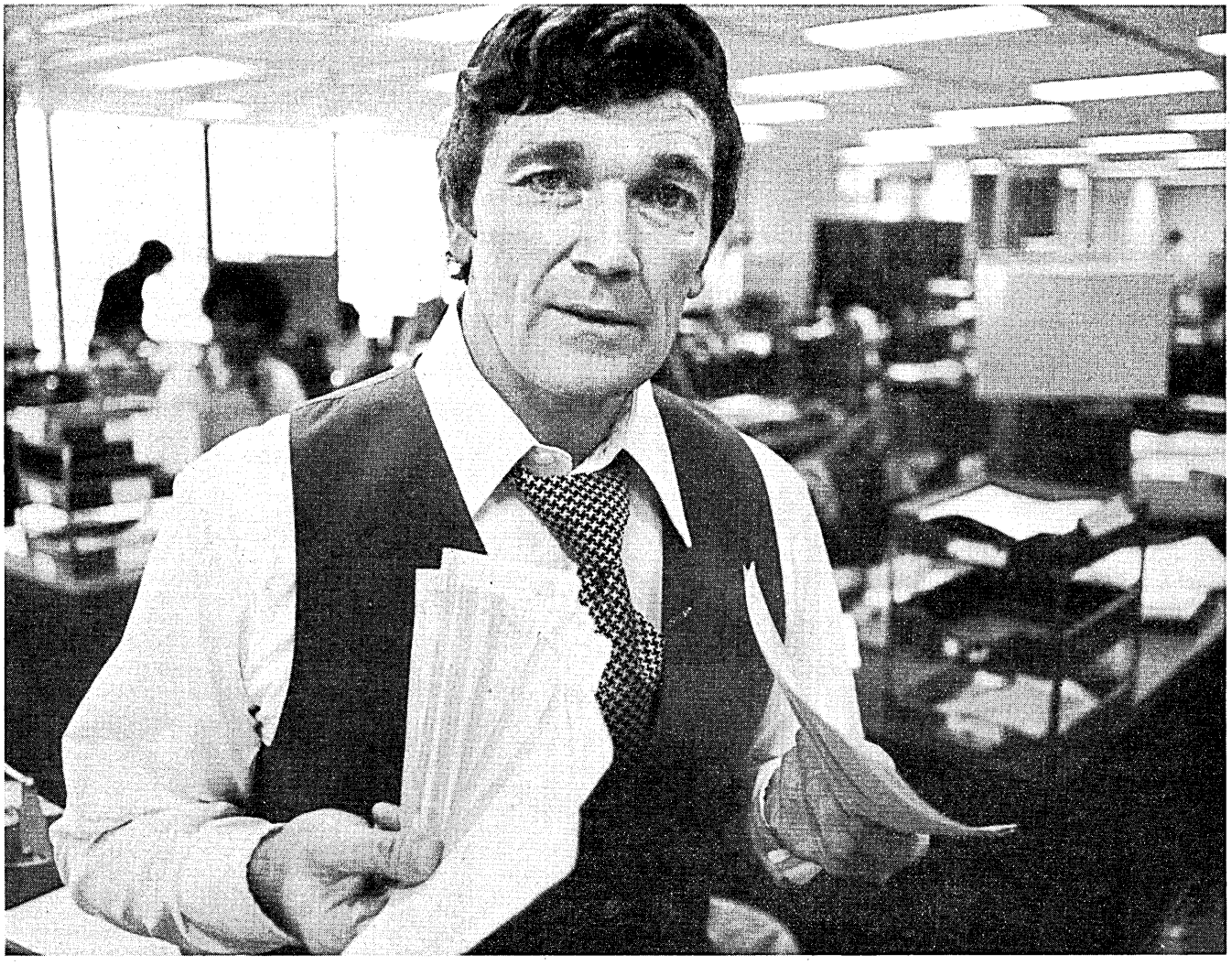
CODEX — LSI 4800
Originate/answer type
Sold since 02/76
Runs up to 2400/4800bps using QAM mod.
Synchronous, half/full-duplex operation
Uses 4-wire line
RS232C, CCITT or MIL188C interfaces
Features: reverse channel (150bps), alternate voice/data, auto equalization, local/remote loop, multiplexing
$4,325 ($95-2 yr) plus $125 instal.

CODEX — LSI 7200
Originate/answer type
Sold since 02/76
Runs up to 4800/7200bps using QAM mod.
Synchronous, half/full-duplex operation
Uses 4-wire C2 conditioned line
RS232C, CCITT or MIL188C interfaces
Features: alternate voice/data, auto equalization, local/remote loopback, multiplexing
$6,500 ($150-2 yr) plus $125 instal.

CODEX — LSI 9600
Originate/answer type
Sold since 02/76
Runs up to 4800/7200/9600bps using QAM
Synchronous, half/full-duplex operation
Uses 4-wire C2 conditioned line
RS232C, CCITT or MIL188C interfaces
Features: alternate voice/data, auto equalization, local and remote loopback, multiplexing
$8,500 ($185-2 yr) plus $125 instal.

CODEX — 4800 MP (MULTI-POINT)
Originate/answer type
Over 1,000 sold since 04/72
Runs up to 4800bps using 8-phase PSK mod
Synchronous, full-duplex operation
Uses 4-wire C1 conditioned line
RS232C or CCITT interface
Features: reverse channel, alternate voice/data, automatic equalization, local and remote loopback
$4,500 ($95-2 yr) plus $125 instal.

GENERAL DATACOMM — 208 SERIES
Bell 208A-compatible orig/answer type
Sold since 1975
Runs up to 4800bps using FSK modulation
Synchronous, half/full-duplex operation



Our Long Distance Phone Costs are Soaring. How Do I Control Them?

INFOSWITCH™, Datapoint's new computer-based long distance telephone management system, is the answer. INFOSWITCH provides the kind of cost control and efficiency that communications and financial executives have long been seeking.

With INFOSWITCH, companies spending as little as $5,000 or as much as $150,000 per month on long distance service can save up to half that amount while enjoying faster, more convenient service.

INFOSWITCH automatically controls and accounts for long distance telephone facility usage by quickly selecting the least-cost route for a long distance call and achieving optimum usage of all facilities, while recording information on each call for use in budget allocation. INFOSWITCH also provides additional convenience features, such as speed number dialing, call holding, individualized calling priorities and many others. The system supplements a company's existing Centrex or PBX telephone system.

INFOSWITCH is offered on a 1, 2, or 3 year lease and 5 year third party finance lease or may be purchased to meet the financial requirements of your company. And, pricewise, it can't be touched, with rates of 1/3 to 1/2 the prices of many competitive systems previously available. A typical 13-trunk INFOSWITCH system leases for less than a Band 5 WATS line.

There's much more to tell about INFOSWITCH and what it can do to keep your long distance telephone costs from soaring. For more information, call the INFOSWITCH group at (512) 690-7494 or use the coupon below.

DATAPOINT CORPORATION

The leader in dispersed data processing™

Yes, I'd like to learn more about how INFOSWITCH can save up to 50% of my company's present long distance telephone bill. infoswitch

NAME _____ TITLE _____

COMPANY _____ PHONE _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

Mail To: Datapoint Corporation
Attn: INFOSWITCH, 9725 Datapoint Dr., San Antonio, Tx. 78284

You shouldn't have to buy 25 terminals just to get a good price on one.

If you're confused about "smart" terminal prices, you're not alone.

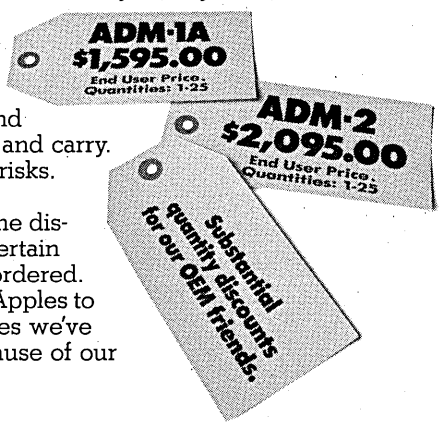
The way some terminal builders play with their prices—and misquote ours—it's hard to tell exactly what you're getting. Or when.

To help, we offer the adjacent prices. Prices that reflect what the Lear Siegler ADM-1A and ADM-2 are *really* selling for. To end users. In quantities of one. Cash and carry.

The point is there are no asterisks. No fine print. No games.

And no phony quantity volume discount prices that also assume a certain number of special options were ordered.

Just prices you can compare. Apples to apples. Oranges to oranges. Prices we've recently been able to lower because of our own successes.



Hurry up and wait?

In truth, a good terminal buy means much more than just an attractive purchase price.

Delivery can be just as important. Because waiting 60, 90, even 180 days for someone else's "bargain beauties" to arrive can cost you a small fortune. Not to mention the wasted time.

It's nice to know that ADM-1A's and ADM-2's are now available for immediate delivery. Ready to go to work.

And it's also reassuring to know that both the ADM-1 and ADM-2 have more than 2 years of field-proven performance behind them. In almost every conceivable application.

In place of the just-past-prototype risks you get with recent terminal arrivals, the ADM-1A and ADM-2 deliver field-proven quality and reliability.

Two things an attractive purchase price, alone, can never guarantee.

The lowdown on our highbrow. Our ADM·2.

New price aside, our ADM-2 is probably all the "smarts" you'll ever need.

Offering full editing facilities. Sixteen function keys for up to 32 discrete messages. Eight screen status indicators. A special numeric keypad. Eight selectable baud rates from 110 to 9600. Protected fields. A dual intensity, 12" diagonal screen. Even a keyboard that's detachable, as well as lockable.

All standard.

Or, have it your way. With our ADM·1A.

We call the ADM-1A our "with or without" model.

Because it lets you select the exact combination of options that are just right for your application.

Starting with some pretty smart standard features, like a 12" diagonal screen. New integral numeric keypad. Protected fields. Internal repeat. Block send capabilities. And building up from there.

You add just the "bells and whistles" you need.

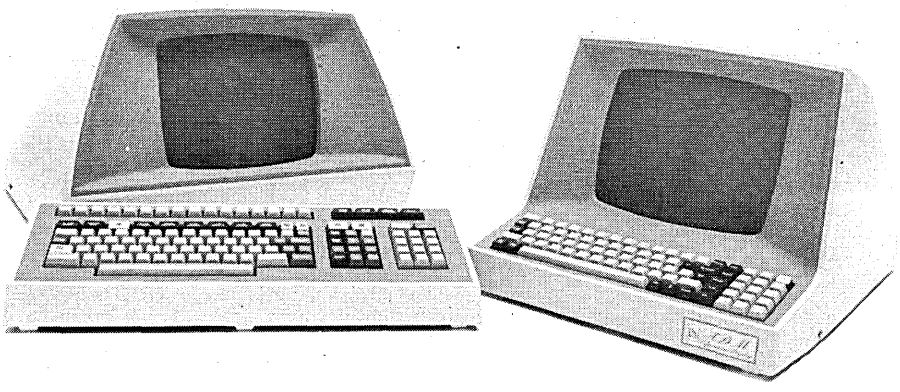
Instead of getting stuck with expensive engineering overkill you'll never use.

But then, that's always been our goal at Lear Siegler. Right from the start. To build terminals truly dedicated to the systems they serve. In terms of intelligence, function, and price.

LSi®

For more product/pricing information you can bank on, please contact: Lear Siegler, Inc./ Electronic Instrumentation Division, Data Products, 714 N. Brookhurst St., Anaheim, Calif. 92803; Tel. (714) 774-1010.

Smarter Terminals.
Smarter Buys.



Uses 4-wire line
RS232C interface
Features: alternate voice/data, auto answer, automatic equalization, remote and local loopback
$3,200 to $3,600 ($85/month)

GENERAL DATACOMM 9601
Originate/answer type
Sold since 1976
Runs to 4800/7200/9600bps using AM/VSB
Synchronous, full/duplex operation
Uses D1 conditioned line
RS232C interface
Features: alternate voice/data, automatic equalization, local/remote loop
$6,500

GTE LENKURT 262A
Bell 208A-compatible orig/answer type
Sold since 1974
Runs up to 4800bps using 8-phase DPS mod
Synchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232C or CCITT interface
Features: reverse channel, alternate voice/data, automatic equalization, back-to-back and loopback
$3,500

GTE LENKURT 262B
Bell 208B-compatible orig/answer type
Sold since 1975
Runs up to 4800bps using 8-phase PM mod.
Synchronous, half-duplex operation
Uses 2-wire line
RS232C interface
Features: auto answer, automatic equalization, remote and local loopback
Vendor will not release pricing.

IBM 3874
Originate/answer type
Sold since 01/75
Runs up to 2400/4800bps using CPSK mod.
Synchronous, half/full-duplex operation
Uses 2- or 4-wire C1 conditioned line
RS232C interface
Features: alternate voice/data, auto answer, automatic equalization, line- and self-test
$3,570 ($170/month)

IBM 3875
Originate/answer type
Sold since 09/72
Runs to 3600/7200bps, combined PM/AM
Synchronous, half/full-duplex operation
Uses 4-wire C2 conditioned line
RS232C interface
Features: alternate voice/data, auto answer, manual equalization, line- and self-test
$7,275 ($269/month)

ICC MODEM 96 MULTIMODE
Sold since 1974
Runs up to 9600bps
Synchronous, full-duplex operation
Uses 4-wire C2 or D1 conditioned line
RS232C, CCITT or MIL188C interfaces
Features: alternate voice/data, automatic equalization, remote and local loopback, multiplexing
$8,750 ($195-30 months)

ICC MPS 48
Originate/answer type
Sold since 1976
Runs up to 4800bps using 8-phase mod.
Synchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232C, CCITT or MIL188B interfaces
Features: reverse channel, alternate voice/data, auto answer, automatic equalization, local/remote loopback
$4,475 ($105-30 months)

ICC 4500/48
Originate/answer type
Sold since 1970
Runs up to 4800bps using AM, VSB mod.
Synchronous, full-duplex operation
Uses 4-wire line
RS232B/C, CCITT or MIL188B interfaces
Features: alternate voice/data, automatic equalization, self-test, multiplexing
$4,980 ($100-30 months)

ICC 4800/72
Originate/answer type
Sold since 1972
Runs up to 4800/7200bps using AM, VSB
Synchronous, full-duplex operation
Uses 4-wire C1 or D1 conditioned line
RS232B/C, CCITT or MIL188B interfaces
Features: alternate voice/data, automatic equalization, self-test, multiplexing
$6,900 ($165-30 months)

ICC 5500/96
Originate/answer type
Sold since 1970
Runs up to 9600bps using AM, VSB mod.
Synchronous, full-duplex operation
Uses 4-wire C2 or D1 conditioned line
RS232B/C, CCITT or MIL188B interfaces
Features: alternate voice/data, automatic equalization, self-test, multiplexing
$7,990 ($185-30 months)

INTERTEL MCS 4800
Originate/answer type
Sold since 09/74
Runs up to 4800bps using QAM mod.
Synchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232C or CCITT interface
Features: reverse channel, alternate voice/data, auto answer, automatic equalization, remote/local loopback
$4,400 ($105-2 yr) plus $135 instal.

INTERTEL MCS 9600
Originate/answer type
Sold since 1974
Runs up to 4800/7200/9600bps using QAM
Synchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232C or CCITT interface
Features: reverse channel, alternate voice/data, auto answer, automatic equalization, remote/local loopback, multiplexing
$8,700 ($195-2 yr) plus $200 instal.

LIVERMORE DATA SYSTEMS 440/48
Originate/answer type
Sold since 1974
Runs up to 2400/4800bps using DC AM mod.
Synchronous, full-duplex operation
Uses 4-wire line
RS232C or CCITT interface
Features: automatic equalization, remote and local loopback
$1,995 ($100-2 years)

LIVERMORE DATA SYSTEMS ADS 448
Originate/answer type
600 sold since 1968
1200/2400/3600/4800bps combined AM/PM
Asynch/synch, simplex/half/full-duplex
Uses 2- or 4-wire (C2, 2400/C4, 4800)
RS232C, MIL188BCCITT or contact
Features: reverse channel, alternate voice/data, integral handset, auto answer
$1,495 ($75-2 years)

PARADYNE BISYNC-48
IBM BSC-compat. originate/answer type
1,000 sold since 01/71
Runs up to 4800bps using 4-level PAM, VSB
Synchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232C or MIL188C interface
Features: alternate voice/data, auto answer, automatic equalization, remote and local loopback
$4,600 ($120-2 yr) plus $100 instal.

PARADYNE LSI-48
Originate/answer type
Sold since 1975
Runs up to 4800bps using 2-level PAM, VSB
Synchronous, full-duplex operation
Uses 4-wire line
RS232C or MIL188C interface
Features: alternate voice/data, auto answer, automatic equalization, remote and local loopback
$3,000 ($90-2 yr) plus $100 instal.

PARADYNE LSI-72
Originate/answer type
Sold since 1975
To 4800/7200bps using 3-level PAM, VSB
Synchronous, full-duplex operation
Uses 4-wire line
RS232C or MIL188C interface
Features: alternate voice/data,

FAULT ISOLATION

. . . made easier by the DLM II

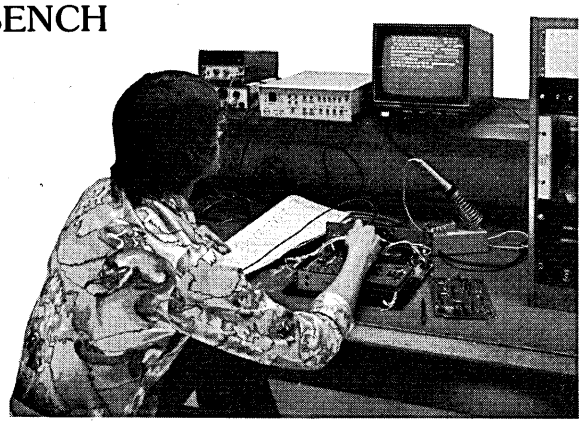
The DLM II is a new tool for isolating and diagnosing problems in data communications networks. It displays on a CRT screen the data characters and the control characters that flow on the transmission line. The DLM II enables the troubleshooter to find the problems fast. The appropriate service person can be contacted without finger pointing, and steps can be taken to get the users back on line quickly.

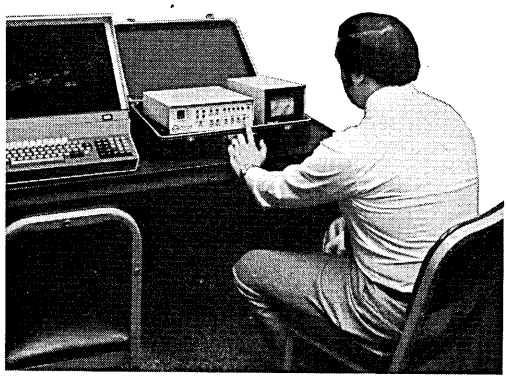
AT THE CENTRAL SITE

The immediate task of the communications manager is to isolate problems in the shortest possible time. Finger pointing cannot be tolerated, and the appropriate service person should be identified on the first try. The DLM II is an excellent tool for the communication center troubleshooter because it monitors traffic on the transmission lines and can quickly direct attention to the problem. Problem symptoms are easily viewed on a large CRT screen of 1280 or 640 characters. The DLM II is very flexible in multi-vendor environments, as it satisfies the need for a large variety of codes, protocols, and data rates. Communication centers must keep their network operational and need tools to make that possible. The DLM II makes it easier. It is a very practical, cost/effective tool.

ON THE WORK BENCH

The visibility of the data stream to engineers and programmers in the debugging stages makes their life easier and produces enthusiatic DLM II supporters. They can easily spot missing or incorrect control characters or improper character sequences in attempting to locate programming errors and hardware failures. Transmitted messages are differentiated from received messages by lower video intensity. Control characters are highlighted by reversing the video image to a white character on a black background. To accommodate transparent binary data streams and make it convenient to read any character set, the DLM II can show the message content in hexidecimal code. Other items of interest to the person on the bench are the interface signals, parity conditions, and synchronization status. These conditions are sensed and indicated on the DLM II control panel. It is much simpler to debug a system when one can see what's happening, and the DLM II makes it easier. It simply displays the problems in black and white.





IN THE FIELD

Getting in, fixing it, and getting out is the name of the field service game. There is no time to perform complex tests, and sophisticated test equipment is often of little use. The DLM II is just the right gear for the job. It is portable in a self contained 21 pound package and simple to attach to the network.The proper codes, protocols and speeds are easily set by switches on the DLM II, and in minutes the problem can be frozen on the CRT screen in context with all the message delimiters, address information, handshaking, and the data itself. Several DLM II users claim they paid for it the first time they used it. Banks can't tolerate any kind of downtime, and one in particular was plagued by an intermittent problem in their data network. DLM II made it easier by allowing the service person to isolate the intermittent problem, trapping it on the DLM II the first time it was used.

The DLM II could be important to you, saving you time or money. It provides rapid fault isolation and won't tax your budget at $2745. Think about that, and send for more information.

DIGI-LOG SYSTEMS, INC.

BABYLON RD. HORSHAM PA. 19044 (215) 672-0800

auto answer, automatic equalization, remote and local loopback
$4,000 ($130-2 yr) plus $100 instal.

PARADYNE **LSI-96**
Originate/answer type
6,000 sold since 1975
To 4800/7200/9600bps, 4-level PAM, VSB
Synchronous, full-duplex operation
Uses 4-wire line
RS232C or MIL188C interface
Features: alternate voice/data, auto answer, automatic equalization, remote and local loopback
$4,500 ($135-2 yr) plus $100 instal.

PARADYNE **M-48**
Originate/answer type
1,500 sold since 09/71
Runs up to 4800bps using 4-level PAM, VSB
Synchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232C interface
Features: reverse channel (150bps), alternate voice/data, auto answer, auto equalization, remote and local loopback, multiplexing
$3,000 ($110-2 yr) plus $100 instal.

PARADYNE **M-96**
Originate/answer type
2,000 sold since 09/74
To 4800/7200/9600bps, 4-level PAM, VSB
Synchronous, full-duplex operation
Uses 4-wire line
RS232C or MIL188C interface
Features: alternate voice/data, auto answer, automatic equalization, remote/local loopback, multiplexing
$6,500 ($165-2 yr) plus $200 instal.

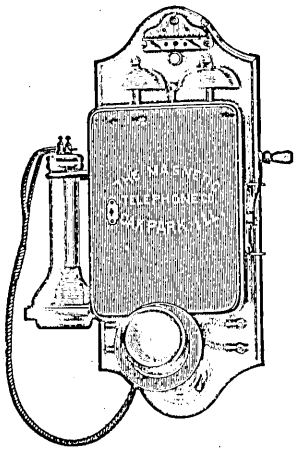
PARADYNE **M-4800**
Originate/answer type
Sold since 1976
Runs to 4800/7200bps using 8-phase DPSK
Synchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232C or CCITT interface
Features: reverse channel, alternate voice/data, auto answer, automatic equalization, network analyzer
$3,000 ($85-2 yr) plus $100 instal.

PENRIL **48/MICRO**
Originate/answer type
Sold since 1975
Runs up to 2400/4800bps using QAM mod.
Synch/asynch, half/full-duplex operation
Uses 2- or 4-wire line
RS232C, CCITT or MIL188C interfaces
Features: reverse channel, alternate voice/data, integral handset, auto answer, automatic equalization, remote/local loop, self-test and addressable remote test
Vendor will not release pricing.

PENRIL **48/MICRO**
Originate/answer type
Sold since 1975
Runs up to 2400/4800bps using 8-phase
Synch/asynch, half/full-duplex operation
Uses 2- or 4-wire line
RS232C, CCITT or MIL188C interfaces
Features: reverse channel (110bps), alternate voice/data, auto answer, auto equalization, remote/local loop, self-test, addressable remote test, integral handset
Vendor will not release pricing.

PENRIL **48/MULTI**
Originate/answer type
2,000 sold since 1971
Runs up to 4800bps using 8-phase DPSK
Synchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232B/C interface
Features: alternate voice/data, manual equalization, integral handset, remote/local loopback, self-test
$2,800 ($85/month)

RIXON **DS-9601**
Originate/answer type
To 3600/4800/7200/9600 bps using AM, VSB
Synchronous, full-duplex operation
Uses 4-wire C2 conditioned line
RS232B/C or MIL188B interface
Features: alternate voice/data, automatic equalization, remote/local loop
$8,200 ($250/mo.) plus $140 installation



RIXON **T208A**
Bell 208A-compatible orig/answer type
Runs up to 4800bps using 8-phase DC mod.
Synchronous, full-duplex operation
Uses 4-wire line with none or C2 cond.
RS232C interface
Features: alternate voice/data, automatic equalization, remote/local loop
$3,750 ($104/month)

RIXON **T208B**
Bell 208B-compatible orig/answer type
Runs up to 4800bps using 8-phase PM mod.
Synchronous, half-duplex operation
Uses 2-wire line
RS232C interface
Features: alternate voice/data, auto answer, automatic equalization, remote and local loopback
$3,750 ($125/month)

TELE-DYNAMICS **7208A**
Bell 208A-compatible orig/answer type
Sold since 1975
Runs up to 4800bps using 8-phase PM mod.
Synchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232C or CCITT interface
Features: automatic equalization, remote and local loopback
$2,750 plus $50 installation

Wideband Modems

BELL SYSTEM **300 SERIES**
To 19,200bps (303B), 50,000bps (303C), 230,400bps (303D)
Synchronous
Uses Series 5000 and 8000 commo channels
Built into terminals, not available separately

CODEX **CT6**
Originate/answer type
Over 50 sold since 06/73
Runs up to 19,200bps using QAM mod.
Full-duplex operation
Uses 4-wire C2 conditioned voice band
RS232C or Bell 303 interface
Features: alternate voice/data, automatic equalization, remote/local loop
$24,000 ($580-2 yr) plus $125 instal.

CODEX 8300 GBM (GROUP BAND)
Originate/answer type
Sold since 05/74
48K/50K/56K/64Kbps using 4-phase PSK mod
Full-duplex operation
Uses 4-wire wide band
CCITT V.35 interface
Features: alternate voice/data, fixed equalization, remote/local loopback
$6,450 ($215-2 yr) plus $125 instal.

GTE LENKURT **26C 40.8**
Originate/answer type
Sold since 1967
To 20,400 bps or 40,800 bps, Duobinary FM mod.
Simplex/half/full-duplex operation
Uses 4-wire wide band
Current switching interface
Features: manual equalization, VF loopback
$1,750 to $2,000

ICC **LINEPLEXER II**
Device for biplexing two modems for doubling effective line speeds.
Sold since 1974
Runs to 4800 or 19,200bps
Full-duplex operation
Uses 4-wire C2 or D1 cond. voice band
RS232C, CCITT or MIL188C interfaces
Features: remote and local loopback
$5,250 ($170-30 mo) plus $1 instal.

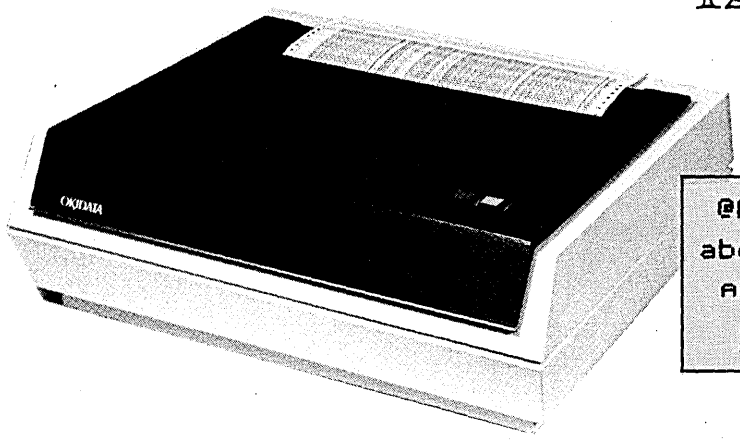
PARADYNE **LSD 19,200**
Device for biplexing two modems for doubling effective line speeds.
Sold since 1976
Runs to 19,200bps
Full-duplex operation
Uses 4-wire line
RS232C or CCITT interface
Features: alternate voice/data, auto answer, automatic equalization, remote and local loopback
$5,150 ($235-2 yr) plus $65 instal.

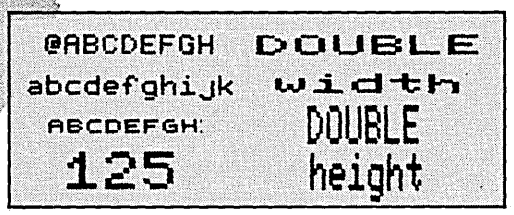
Short Haul (Limited Distance) Modems

ANDERSON JACOBSON **DCM 151**
Originate/answer type
Sold since 1971
Runs up to 150bps using FSK modulation
Asynchronous, half/full-duplex operation
Uses 2- or 4-wire line
IBM interface
$165

Okidata has the best buy in 132-col. matrix printers

125 lpm at $1895*





Unparalleled print flexibility

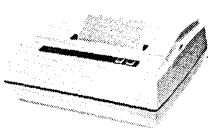
Compare Okidata's standard, no-additional-cost features against your printer's.

Okidata/22 printer		Your printer
☑	**Full 125 lpm (275 cps)** with continuous duty operation	☐
☑	**Lowest total cost of ownership,** unique head with 22 print wires instead of 7 provides longer life without heat problems, no flexing wires and no side-loaded bearings	☐
☑	**Unparalleled print flexibility,** 8 different size characters including *true* lower case with descenders. *True* 5 X 7 matrix that provides more dots horizontally than 7 X 7 matrices. Excellent five-part copy	☐
☑	**Superior paper handling features,** switch-selectable 6 or 8 lines per inch, top of form with 11 switch-selectable settings, 12-channel VFU and 12 ips paper slew speed	☐
☑	**Operator controlled self test,** start up and maintenance checks can be performed off line	☐
☑	**No extras for international power source,** 100, 110, 117, 200, 220, 235 VAC ±10 percent, 50 or 60 Hz standard	☐
☑	**Best buy in 132-col. matrix printers**	☐

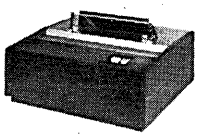
And the Okidata 132-col. printer is available now. *For $1,895.00 in quantity 100. Optional microprocessor-controlled RS232 interface.

From Okidata. Working for the OEM...and the end user.

Two other best buys from Okidata



CP110 Printer, a low-priced 110 cps impact printer that provides hard copy of data stored on a CRT display. It produces 80 columns of 5 X 7 matrix characters, and for less than $885 in OEM quantities. The lightweight tabletop unit offers bidirectional printing on 8½" roll paper (four-ply fanfold paper up to 9½" wide may be used with optional tractor feed). Many interfaces available.
CIRCLE 212 ON READER CARD.



CP210 Document/Passbook Printer, a tabletop serial printer which features "drop in" forms loading that allows all types of forms from 2½" to 28" long (single or multipart) to be printed on an intermixed basis without operator intervention or machine adjustment. It produces 96 columns of 5 X 7 matrix characters at 110 cps or 60 lpm.
CIRCLE 213 ON READER CARD.

See Okidata at the NCC Booth 1533

OKIDATA

Okidata Corporation
111 Gaither Drive
Mt. Laurel, NJ 08054
Tel: 609/235/2600
TWX: 710/897/0792

ASTROCOM **MOS/2**
Originate/answer type
New product
Runs 2400/3600/4800/7200/9600/14,400/19,200bps using 2-phase PM modulation
Synchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232B/C interface
Features: remote and local loopback
$725 ($40/month)

ASTROCOM **SC200**
Originate/answer type
2,000 sold since 04/69
2,000bps-19,200bps using PM modulation
Synchronous, simplex/half/full-duplex
Uses 2- or 4-wire private line
RS232B/C interface
Features: remote loopback and self-test
$920 to $1,525 ($40 to $65/month)

ASTROCOM **SC400**
Originate/answer type
300 sold since 05/69
Runs 10K to 100Kbps using PM mod.
Synchronous, simplex/half/full-duplex
Uses 2- or 4-wire private line
RS232B/C interface
$1,825 ($85/month)

CODEX **8200 LDSU**
Originate/answer type
Sold since 07/74
Runs 2400/4800/7200/9600/19,200bps using 2-phase PM modulation
Asynch/synch, half/full-duplex operation
Uses 2- or 4-wire line
RS232C or MIL188B interface
Features: fixed equalization, remote and local loopback
$995 ($45-2 years)

GANDALF **LDS 120**
Over 10,000 sold since 1970
Runs to 9600bps
Asynchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232C or Teletype interface
$280 plus installation

GANDALF **LDS 200 SERIES**
2,800 sold since 1971
Runs 2400 to 9600bps using PM mod.
Synchronous, simplex/half/full-duplex
Uses 2- or 4-wire line
RS232C or CCITT interface
Features: manual equalization, remote and local loopback
$560 plus installation

GANDALF **LDS 250**
Over 500 sold since 1974
Runs 9600 to 100,000bps using PM mod.
Synchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232C or CCITT V.35 interface
Features: manual equalization, remote and local loopback
$784 plus installation

GANDALF **DNT 300 SERIES**
80 sold since 1974
Runs 2400 to 19,200bps using PM mod.
Synchronous, simplex/half/full-duplex
Uses 2- or 4-wire line
RS232C or CCITT interface
Features: reverse channel, auto answer, manual equalization, remote loopback
$1,000 plus installation

GANDALF **LDS 309**
Over 8,000 sold since 1974
Runs 1800 to 19,200bps using PM mod.
Synchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232C or CCITT interface
Features: reverse channel, manual equalization, remote/local loop
$784 plus installation

IBM **LINE ADAPTERS**
Originate/answer type
Runs to 134.5 or 600bps using FSK mod.
Asynchronous, half/full-duplex operation
Uses 2- or 4-wire line
IBM interface
$432 to $865 ($10 to $21/month)

ICC **COM-LINK II**
Sold since 1973
2400/4800/7200/9600/19.2Kbps, 2-phase PM
Synchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232C, CCITT or current interfaces
Features: manual equal., test generator
$975 ($39-2 years)

PENRIL **PSH HI-SPEED**
Originate/answer type
100 sold since 1975
Runs 19,200 to 1,000,000bps using PM mod
Synchronous, half/full-duplex operation
Uses 2- or 4-wire line
Bell 301/303 interface
Features: manual equalization, remote and local loopback
Vendor will not release pricing.

PENRIL **PSH 24/48/72/96**
Originate/answer type
500 sold since 1975
Runs 2400 to 19,200bps using Encoded FSK
Synchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232C or CCITT interface
Features: manual equalization, remote and local loopback
Vendor will not release pricing.

PRENTICE **ASYNCHRONOUS LINE DRIVER**
Originate/answer type
Runs up to 9600bps using baseband mod.
Asynchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232C or Teletype interface
Features: local loopback
$280

PRENTICE **LIMITED-RANGE ADAPTERS**
Originate/answer type
2,000 sold since 01/72 (all models)
Units for various speeds from 600bps to 160,000bps using 2-phase PM mod.
Synchronous, full-duplex operation
Uses 2- or 4-wire line
RS232C or Bell 303 interface
Features: automatic equalization, remote and local loopback
$800-$1200 ($42.50-$100/mo), installation NC

PRENTICE **SYNCHRONOUS LINE DRIVER**
Runs 1200 to 28,800bps using delay mod.
Synchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232C or Bell 303 interface
Features: automatic equalization, remote and local loopback
$860

SPECTRON **DT-401**
Originate/answer type
50 sold since 1974
Runs 1200 to 19,200bps
Synch/asynch., full-duplex operation
Uses 4-wire line
RS232C interface
Features: remote and local loopback
$400

SPECTRON **DT-411**
Originate/answer type
4 sold since 1975
Runs 19,200 to 460,800 bps
Synch/asynch., full-duplex operation
Uses 4-wire line
Bell 303 interface
Features: remote and local loopback
$1,200

SYNTECH **LDM SERIES**
Originate/answer type
Sold since 1975
Runs up to 19,200bps using FSK mod.
Synch/asynch., half/full-duplex operation
Uses 2- or 4-wire line
RS232C interface
Features: alternate voice/data, manual equalization, remote and local loopback
$690-$795 ($48-$50/mo) inst. NC

TELE-DYNAMICS **7300**
Originate/answer type
Sold since 1975
Runs 1800 to 19,200bps
Synchronous, simplex/half/full-duplex
Uses 2- or 4-wire line
RS232C interface
Features: fixed equalization, remote and local loopback
Vendor will not release pricing.

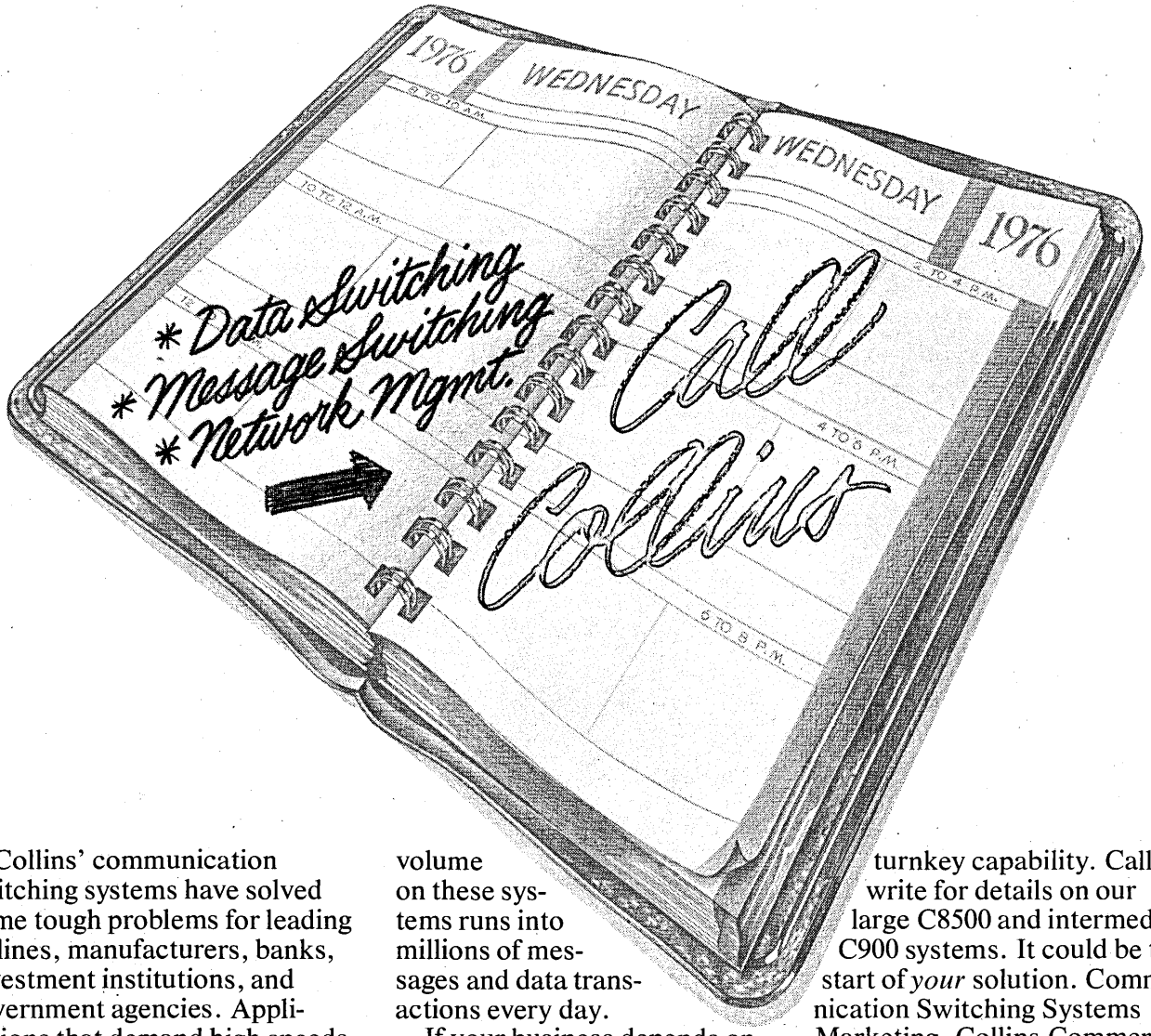
TRAN **CONNECTRAN 650**
160 sold since 11/73
Runs up to 9600bps using baseband mod.
Asynchronous, half/full-duplex operation
Uses 4-wire line
RS232C interface
$295 ($17/mo) plus $30 installation

TRAN **DIRECTRAN**
Originate/answer type, emulates Bell 103/113/202
4,000 sold since 08/72
Runs up to 9600bps using baseband mod.
Asynchronous, half/full-duplex operation
Uses 4-wire line
RS232C interface
Features: remote and local loopback
$325-$520($18-$30/mo)plus $30-$50 inst.

TRAN **INTERTRAN 911/931 SERIES**
1,400 sold since 01/73
Runs 1200 to 19,200bps using PCM mod.
Synchronous, half/full-duplex operation
Uses 4-wire line
RS232C interface
Features: remote and local loopback
$1,150-$1,250 ($69-$87/mo) plus $70 inst.

TRAN **INTERTRAN 916/936 SERIES**
400 sold since 01/73
Runs 19,200 to 250,000bps using PCM mod.
Synchronous, half/full-duplex operation
Uses 4-wire line
Bell 303 interface

Solutions to some of the world's toughest communication requirements started with one simple message.



Collins' communication switching systems have solved some tough problems for leading airlines, manufacturers, banks, investment institutions, and government agencies. Applications that demand high speeds and capacities, utmost reliability, and the know-how to make it all work. The total traffic volume on these systems runs into millions of messages and data transactions every day.

If your business depends on extensive message and data communications over a distributed network, we have the experience to help you. Plus total turnkey capability. Call or write for details on our large C8500 and intermediate C900 systems. It could be the start of *your* solution. Communication Switching Systems Marketing, Collins Commercial Telecommunications Division, Rockwell International. Contact us in one of the cities listed.

Rockwell International

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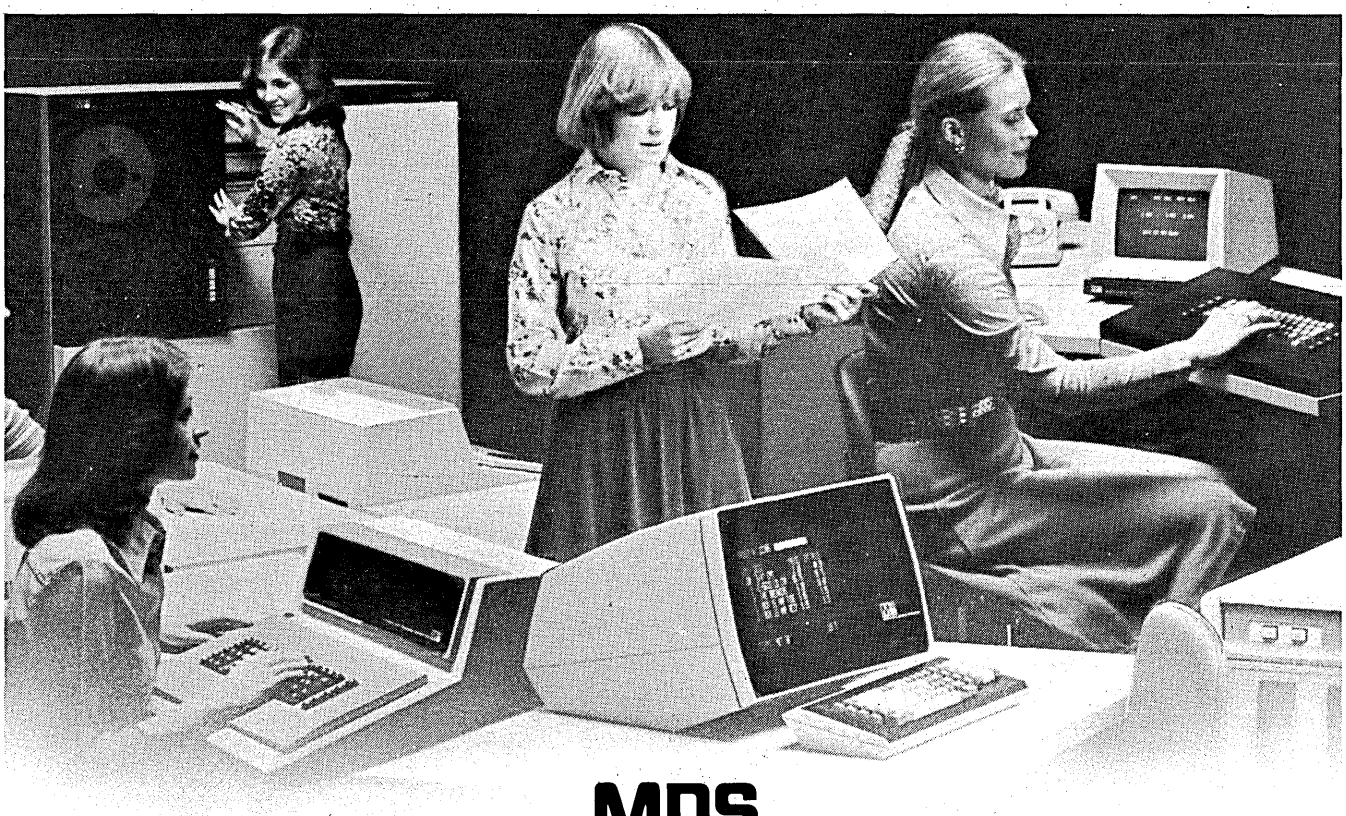

MDS.
Many intelligent answers to your distributed information needs.

Every business is different. And within every business, there are differences — especially when it comes to information flow.

MDS knows that. As the industry's largest non-mainframe system supplier, MDS offers the broadest capabilities to fit the needs of a wide range of information systems users. Not with a single product, but with a series of compatible systems that can be configured precisely to today's requirements. And expanded for tomorrow's.

Data Entry.

MDS offers single-station as well as small, medium and large clustered data entry systems. With ready-to-use software or full programmability. And capabilities ranging from simple validation to powerful editing and pre-processing. At the very best price performance ratio available today.

Transaction Processing.

MDS supports your single unit or entire network needs. With products that range from simple document processing terminals to fully programmable transaction processing systems using high-level languages. All are fully compatible with your planned or existing point-to-point or multi-point communications network.

Remote Job Entry.

Regardless of the method you use, MDS can supply it. 2780, 3780, 2968, 360/20 HASP and more. Local storage of JCL's selectable with a single key depression, device substitution and transparency. A wide range of peripheral devices for the throughput you need. And terminals can be linked to your central site at transmission speeds of up to 56K bps.

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Complete job turnaround using small to large data base structures, high-level languages, and your choice of peripherals to enhance your distributed processing capabilities. MDS products do it all.

Look into Distributed Information Systems from MDS.

Within our product line you'll find the economical System 1200, the powerful System 2400 and the versatile System 2300. And our newest entry, the exciting Series 21 family of distributed processing systems. One, or a combination of these systems, could be The Intelligent Choice for you.

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The Intelligent Choice.

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DECsystem-20™ is a registered trademark of Digital Equipment Corporation.

Concerned about your time-sharing costs?

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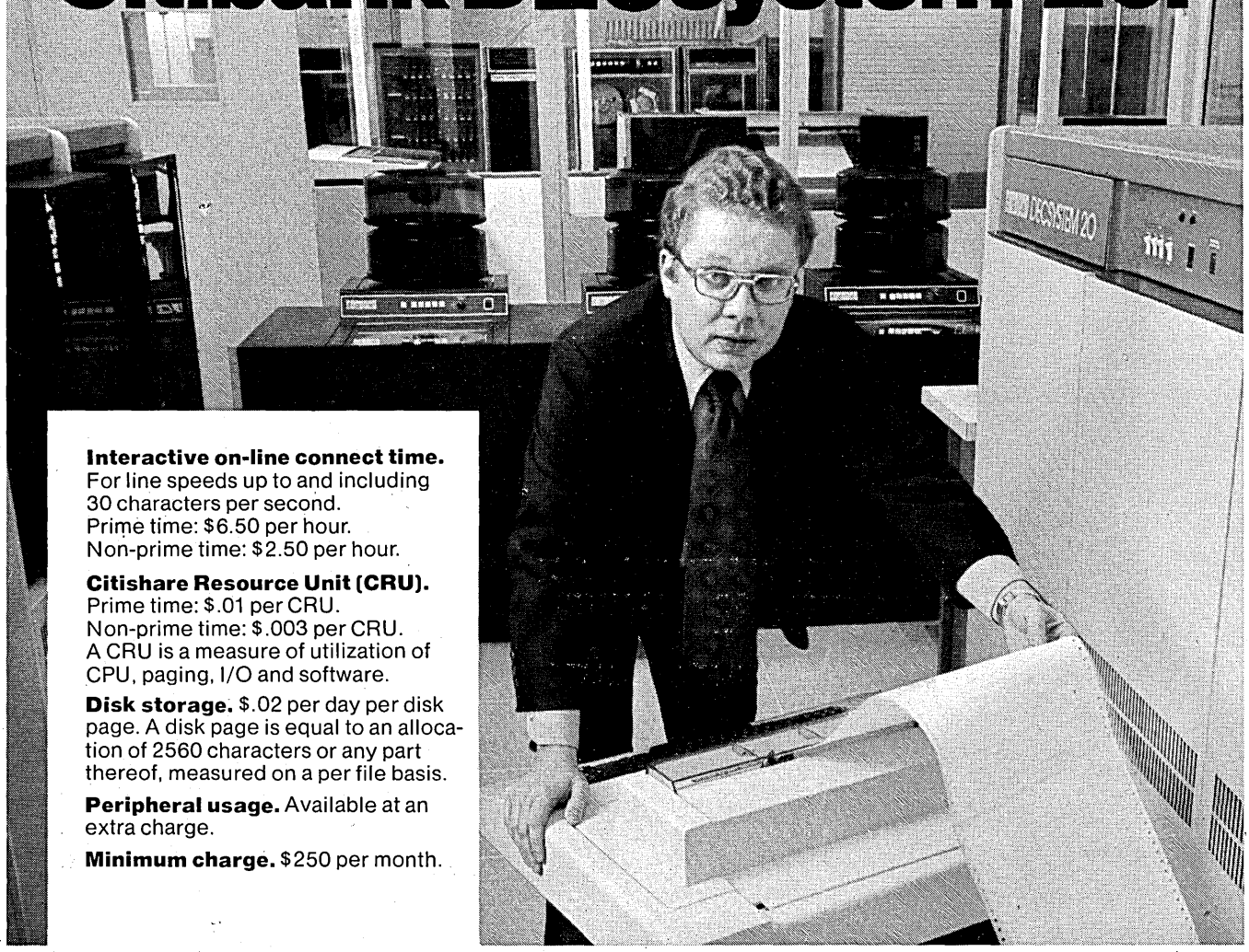

Interactive on-line connect time. For line speeds up to and including 30 characters per second.
Prime time: $6.50 per hour.
Non-prime time: $2.50 per hour.

Citishare Resource Unit (CRU).
Prime time: $.01 per CRU.
Non-prime time: $.003 per CRU.
A CRU is a measure of utilization of CPU, paging, I/O and software.

Disk storage. $.02 per day per disk page. A disk page is equal to an allocation of 2560 characters or any part thereof, measured on a per file basis.

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One of the most advanced systems located in New York City.

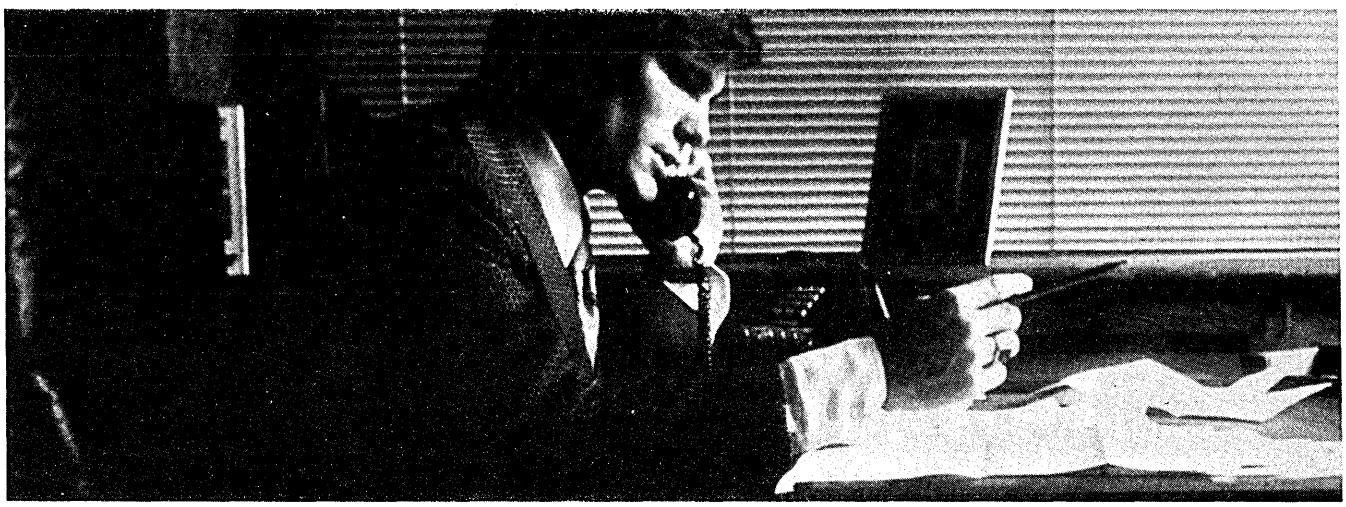
DECsystem-20 is new, efficient and economical. And Citibank's Interactive Computer Center has long been recognized as one of the most advanced time-sharing utilities in the country. This expanded in-house facility can now be made available to you.

Located in New York City. Citibank is the only vendor of DECsystem-20 time whose hardware is actually in New York City. You get the convenience, the savings in time and the rapid availability of output that come from doing business with a nearby source.

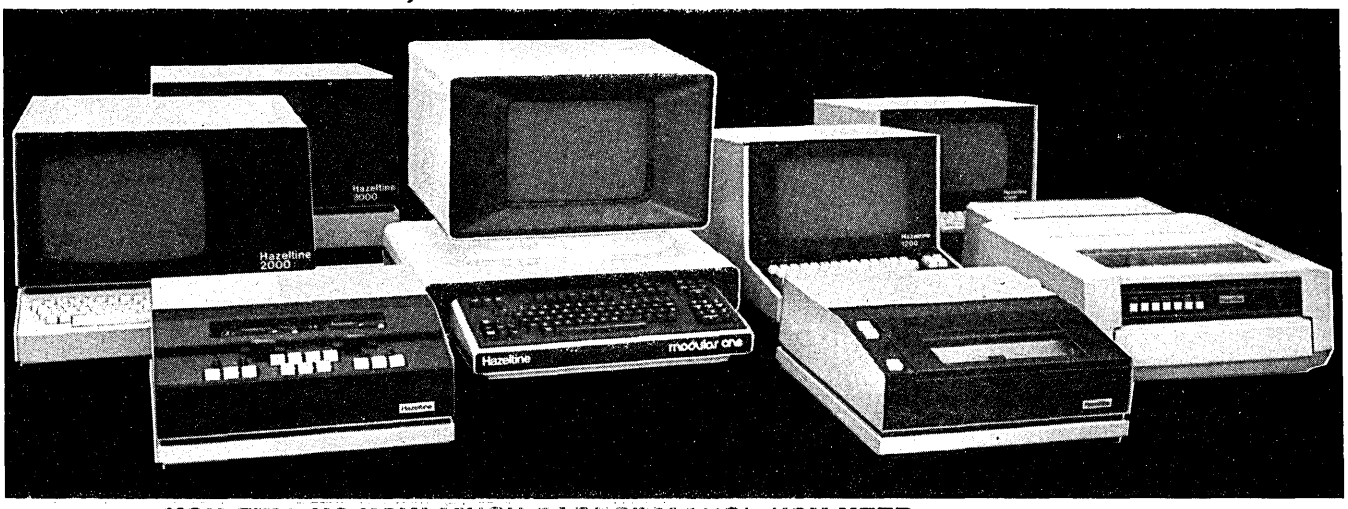
Cut time-sharing costs up to 50%. If you're a large user of outside resources for your time-sharing requirements, you know how your costs have been going up—and the need for keeping a tight rein on this operating expense. Citibank's low rates enable you to cut time-sharing costs as much as 50%—to achieve substantial savings without any sacrifice in performance or results. In fact, you will be utilizing one of the most advanced computer systems currently in operation anywhere in the country.

Alan L. Summers. Manager of Citibank's Interactive Computer Center, Mr. Summers has ten years' experience in time-sharing as both a user and a vendor. He is well qualified to answer any and all questions you may have. Call him at (212) 559-5474. Or write: Interactive Computer Center, Citibank, N.A., 399 Park Avenue, New York, N.Y. 10022.

CITIBANK



HAZELTINE SAYS, "WRITE YOUR OWN TICKET!"



YOU TELL US HOW MUCH PERFORMANCE YOU NEED TO SUIT YOUR SYSTEM REQUIREMENTS.
POINT-TO-POINT. EDITING.
NETWORK COMPATIBILITY. CLUSTERS.
POLLING.

THEN YOU DETERMINE THE FINANCIAL ARRANGEMENTS YOU WANT THAT BEST SUIT YOUR CORPORATE NEEDS.
BUY. LEASE-PURCHASE.
RENTAL TERMS AVAILABLE ON SOME PRODUCTS, FROM AS LITTLE AS $49 PER MONTH, MAINTENANCE INCLUDED, FOR THE "HAZELTINE 1000".

YES, IT'S CLEAR.
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Hazeltine Corporation, Computer Terminal Equipment, Greenlawn, New York 11740 (516) 549-8800 Telex 96-1435

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West: San Mateo (S.F.) (415) 574-4800 ☐ L.A. (213) 553-1811 ☐ Denver (303) 770-6330 ☐ Seattle (206) 242-0505.

Canada: MISCOE Data Communications Equipment Services, Ltd. ☐ Ontario ☐ Quebec ☐ British Columbia ☐ Alberta
England: Hazeltine Ltd. 01-948-3111 Telex (851)-928572. *Germany:* Hazeltine GmbH 0611-590748 Telex (841)-416924 *FOR WORLDWIDE SALES INFORMATION CALL. (516) 549-8800.*

Features: remote and local loopback
$1,300-$1,650($72-$87/mo)plus $100 inst.

TRAN INTERTRAN 918/938 SERIES
110 sold since 11/75
48K/50K/56K/64Kbps using PCM mod.
Synchronous, half/full-duplex operation
Uses 4-wire line
CCITT V.35 interface
Features: remote and local loopback
$1,250-$1,600 ($70-$85/mo) plus $100 inst.

TRAN INTERTRAN 951 & 961
Originate/answer type
400 sold since 06/75
Runs 2400 to 19,200bps using baseband
Synchronous, half/full-duplex operation
Uses 4-wire line
RS232C interface
Features: remote and local loopback
$745-$900 ($49-$55/mo) plus $70 instal.

TRAN INTERTRAN 956 & 966
Originate/answer type
90 sold since 06/75
Runs 19,200 to 250,000bps using PPM mod.
Synchronous, half/full-duplex operation
Uses 4-wire line
Bell 303 interface
Features: remote and local loopback
$1,050-$1,200($62-$69/mo)plus $100 inst.

TRAN INTERTRAN 981
Originate/answer type
125 sold since 12/75
Runs 2400/4800/9600bps using baseband
Synchronous, half/full-duplex operation
Uses 4-wire line
RS232C interface
Features: remote and local loopback
$485 ($39/month) plus $70 installation

TUCK 1652
Originate/answer type
Runs up to 2400bps using FSK mod.
Asynchronous, half/full-duplex operation
Uses 2- or 4-wire line
RS232C interface
Features: fixed equalization, remote loopback
$325

Parallel Interface Modems

AMERICAN SYSTEMS 8403B
Bell 403D/E-compatible orig/answer type
Over 50 sold since 02/75
Runs up to 10cps using FSK modulation
Asynch, simplex receive-only operation
Uses 2-wire line
RS232C or contact closure interface
Features: auto answer, fixed equaliz.
Vendor will not release pricing.

BELL SYSTEM TOUCH-TONE RECEIVER DATA SET 407A
Bell 401-compatible answer-only type
Runs up to 10cps using FSK modulation
Asynchronous, simplex operation
Uses 2-wire line
Voltage or contact closure interface
Features: alternate voice/data, auto answer, fixed equalization, remote and local test
Vendor will not release pricing

BELL SYSTEM TOUCH-TONE RECEIVER DATA SET 407B
Bell 401-compatible answer-only type
Runs up to 10cps using FSK modulation
Asynchronous, simplex operation
Uses 2-wire line
Voltage or contact closure interface
Features: alternate voice/data, auto answer, fixed equalization, remote and local test
Vendor will not release pricing.

BELL SYSTEM TOUCH-TONE RECEIVER DATA SET 407C
Bell 401-compatible answer-only type
Runs at 110/150/300bps using FSK mod.
Asynchronous, half-duplex operation
Uses 2-wire line
RS232C or contact closure interface
Features: alternate voice/data, auto answer, remote and local test
Vendor will not release pricing.

CARTERFONE 403D
Bell 403D-compatible answer-only type
1,500 sold since 02/71
Runs up to 10cps using FSK modulation
Asynchronous, half-duplex operation
Uses 2-wire line
2-of-8 parallel, BCM or voltage interfaces
Features: auto answer, busy out diagnostic facility
$495 ($22/month) per card

GENERAL DATACOMM 402 SERIES
Bell 402D-compatible originate-only type
Sold since 1970
Runs 75 cps using FSK modulation
Asynchronous, transmit-only operation
Uses 2- or 4-wire line
Contact closure interface
Features: reverse channel
$485 to $540

SONEX AUTOTONE
Bell 401J/403D/E/407-compat. ans.-only
2,100 sold since 1972
Runs up to 10cps or 20cps using Touch-Tone mod.
Asynchronous, half-duplex operation
Uses 2-wire line
RS232C, contact closure or logic
Features: alternate voice/data, auto answer, automatic equalization, multiplexing
$325 to $550

SONEX TYPE 21 & 2404
Touch-Tone receiver on PC board
Answer-only type
Over 500 sold since 1971
Runs up to 12cps using Touch-Tone mod.
Asynchronous, half-duplex operation
Uses 2-wire line
User-specified interface
Features: automatic equalization (21)
$175 (Type 21)

TUCK 1810, 1880, 1881
Bell 401A/E/H/J/403-compat. orig.-only
Sold since 1976
Runs up to 20cps using AM modulation
Half-duplex operation
Uses 2-wire line
Contact closure or acoustic interface
Features: alternate voice/data, auto answer, front panel LED
$225 to $595

(VENDOR INDEX, page 230)

Vendor Index

The names and addresses of the modem manufacturers who provided data for this survey are listed below. For further information or clarification, you may contact them directly or by circling the appropriate number on the reader service card bound into this issue.

Acrodyne Data Devices, Inc.
1217 Summit Avenue
Union City, NJ 07087
(201) 865-3220
CIRCLE 495 ON READER CARD

American Systems, Inc.
123 Water Street
Watertown, MA 02172
(617) 923-1850
CIRCLE 496 ON READER CARD

Anderson Jacobson, Inc.
1065 Morse Avenue
Sunnyvale, CA 94086
(408) 263-8520
CIRCLE 497 ON READER CARD

Astrocom Corp.
15012 Minnetonka
Industrial Rd.
Minnetonka, MN 55343
(612) 933-2208
CIRCLE 498 ON READER CARD

Bell System
distributed by local Bell System offices

Burroughs Corporation
Burroughs Place
Detroit, MI 48232
(313) 972-7000
CIRCLE 499 ON READER CARD

Carterfone Communications Corp.
2639 Walnut Hill Lane
Suite 223
Dallas, TX 75229
(214) 350-7011
CIRCLE 500 ON READER CARD

Codex Corporation
15 Riverdale Avenue
Newton, MA 02195
(617) 969-0600
CIRCLE 501 ON READER CARD

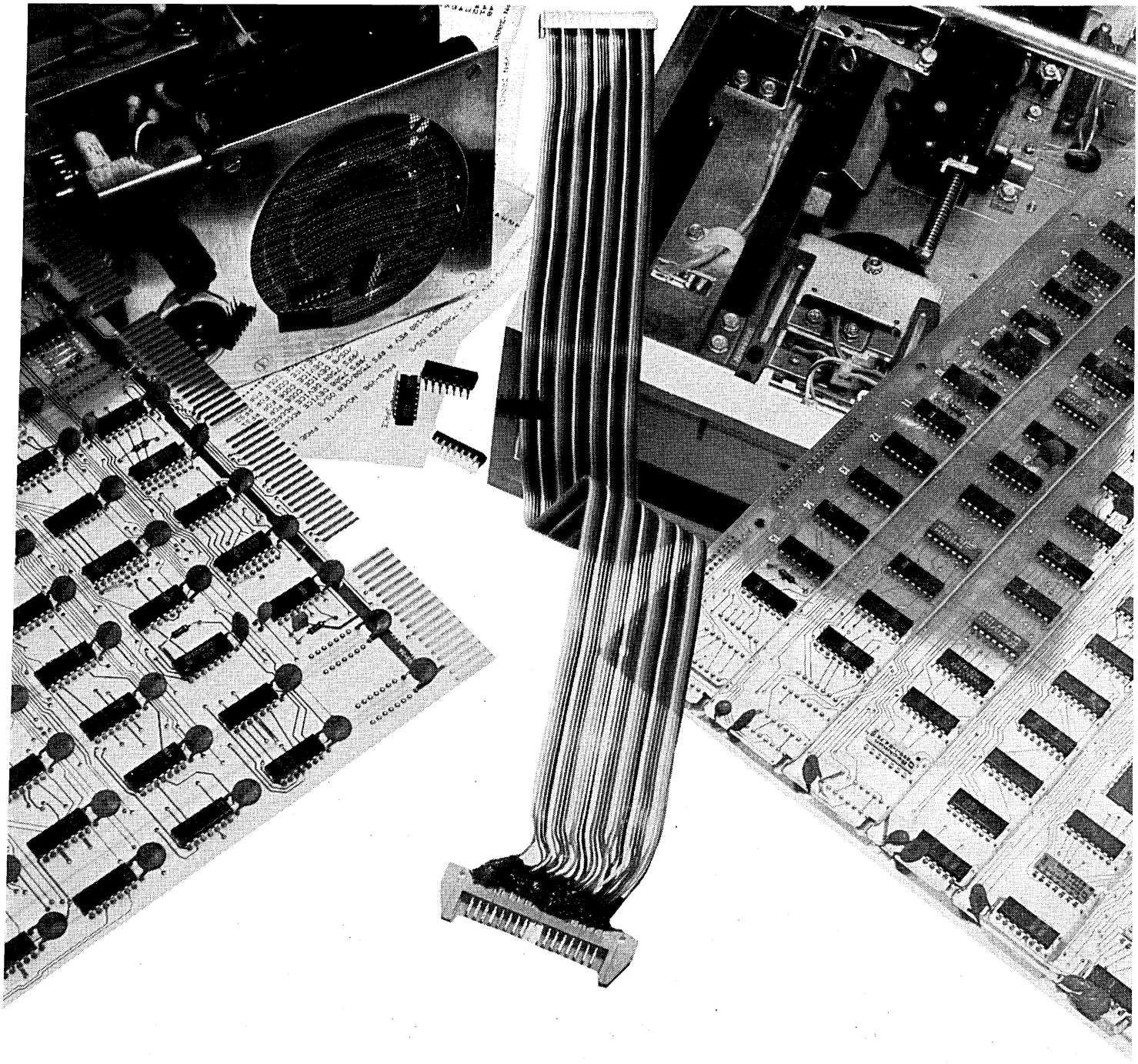
Coherent Communications Systems Corporation
85D Hoffman Lane
Central Islip, NY 11722
(516) 582-4044
CIRCLE 502 ON READER CARD

Collins Radio Group
subs. Rockwell Intl.
19700 Jamboree Road
Newport Beach, CA 92663
(714) 833-4600
CIRCLE 503 ON READER CARD

ComData Corporation
8115 Monticello
Skokie, IL 60076
(312) 677-3900
CIRCLE 504 ON READER CARD

Data Access Systems, Inc.
100 Route 46
Mountain Lakes, NJ 07046
(201) 335-3322
CIRCLE 505 ON READER CARD

Datapoint Corporation
9725 Datapoint Drive
San Antonio, TX 78284
(512) 690-7000
CIRCLE 506 ON READER CARD

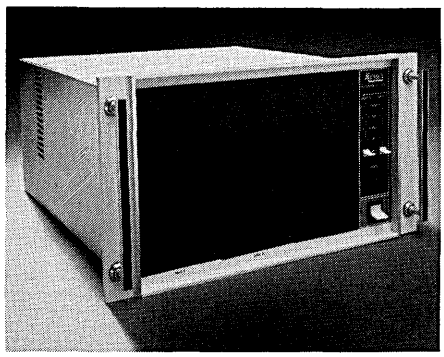


DON'T GO TO PIECES. GO TO REMEX.

A cost/effective OEM flexible disk system can't be pieced together—hardware from one source, firmware from another, software from a third. Getting optimum performance at a low unit price requires design control to eliminate redundancy and volume production to reduce cost.

That's why Remex offers the RFS7500 Flexible Disk System—a complete system designed and built by Remex—including one to four Remex drives, a microprocessor based controller/formatter, software and interfaces for most major minicomputers plus power supply, cable and rack mountable chassis. The RFS7500:

☐ expands data capacity through implementation of IBM3740 format or a user selectable 1, 2, 4, 8, 16, 26 or 32 sector format. ☐ saves computer time by data block transfer of from one to 65K 2-byte words on a single command from the host. ☐ reduces core memory requirements due to automatic track and sector search and auto-initializing without software. ☐ simplifies operation and system integration by 8-command structure. ☐ saves space by housing interface card in the system chassis in some configurations. ☐ speeds access through 6 ms track to track speed plus unit select.



Ex-Cell-O Corporation

REMEX DIVISION

CIRCLE 133 ON READER CARD

The Remex RFS7500 is a better system at lower cost than the OEM can build himself or buy from a minicomputer manufacturer or second level supplier. Don't go to pieces, go to Remex, 1733 E. Alton St., P.O. Box C19533, Irvine, CA 92713 (714) 557-6860.

VENDOR INDEX

Gandalf Data Communications, Ltd.
15 Grenfell Crescent
Ottawa, Ontario, Canada
(613) 225-0565
CIRCLE 507 ON READER CARD

General DataComm Industries, Inc.
131 Danbury Road
Wilton, CT 06897
(203) 762-0711
CIRCLE 508 ON READER CARD

GTE Lenkurt, Inc.
1105 County Road
San Carlos, CA 94070
(415) 591-8461
CIRCLE 509 ON READER CARD

International Business Machines Corporation
Data Processing Division
1133 Westchester Avenue
White Plains, NY 10604
(914) 696-1900
CIRCLE 510 ON READER CARD

International Communications Corp.
(ICC/MILGO)
8600 N.W. 41st Street
Miami, FL 33166
(305) 592-7654
CIRCLE 511 ON READER CARD

Intertel, Incorporated
6 Vine Brook Park
Burlington, MA 01803
(617) 273-0950
CIRCLE 512 ON READER CARD

Livermore Data Systems, Inc.
2050 Research Drive
Livermore, CA 94550
(415) 447-2252
CIRCLE 513 ON READER CARD

MI² Data Systems, Inc.
1212 Kinnear Road
Columbus, OH 43212
(614) 481-8131
CIRCLE 514 ON READER CARD

Multi-Tech Systems, Incorporated
3405 University Avenue S.E.
Minneapolis, MN 55415
(612) 331-5000
CIRCLE 515 ON READER CARD

Novation
18664 Topham Street
Tarzana, CA 91356
(213) 996-5060
CIRCLE 516 ON READER CARD

Omnitec Data Corporation
2405 South 20th Street
Phoenix, AZ 85034
(602) 258-8244
CIRCLE 517 ON READER CARD

Paradyne Corporation
8550 Ulmerton Road
Largo, FL 33540
(813) 536-4771
CIRCLE 518 ON READER CARD

Penril Data Communications, Inc.
5520 Randolph Road
Rockville, MD 20852
(301) 881-8151
CIRCLE 519 ON READER CARD

Prentice Electronics Corporation
795 San Antonio Road
Palo Alto, CA 94303
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CIRCLE 520 ON READER CARD

Pulse Communications
Division of Hubbell, Incorporated
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Falls Church, VA 22041
(703) 820-8000
CIRCLE 521 ON READER CARD

QEI, Inc. (formerly Quindar)
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Springfield, NJ 07081
CIRCLE 522 ON READER CARD

RFL Industries, Incorporated
Communications Division
Powerville Road
Boonton, NJ 07005
(201) 334-3100
CIRCLE 523 ON READER CARD

Rixon, Incorporated
subs. Sangamo Electric Company
2120 Industrial Parkway
Silver Spring, MD 20904
(301) 662-2121
CIRCLE 524 ON READER CARD

Sonex, Incorporated
Data Communication Products
2337 Philmont Avenue
Huntingdon Valley, PA 19006
(215) 947-6100
CIRCLE 525 ON READER CARD

Spectron Corporation
Church Road & Roland Ave.
Mt. Laurel, NJ 08057
(609) 234-5700
CIRCLE 526 ON READER CARD

Stelma Telecommunications
subs. Dataproducts Corp.
Barnes Park North
Wallingford, CT 06492
(203) 265-7151
CIRCLE 527 ON READER CARD

Syntech Corporation
11810 Parklawn Drive
Rockville, MD 20852
(301) 770-0550
CIRCLE 528 ON READER CARD

Tektronix, Incorporated
P.O. Box 500
Beaverton, OR 97077
(503) 638-3411
CIRCLE 529 ON READER CARD

Tele-Dynamics
525 Virginia Drive
Fort Washington, PA 19034
(215) 643-3900
CIRCLE 530 ON READER CARD

Timeplex, Inc.
100 Commerce Way
Hackensack, NJ 07601
(201) 646-1155
CIRCLE 531 ON READER CARD

TRAN
Computer Transmission Corp.
2352 Utah Avenue
El Segundo, CA 90245
(213) 973-2222
CIRCLE 532 ON READER CARD

Tuck Electronics
4409 Carlisle Pine
Camp Hill, PA 17011
(717) 761-4354
CIRCLE 533 ON READER CARD

Universal Data Systems
4900 Bradford Drive
Huntsville, AL 35805
(205) 837-8100
CIRCLE 534 ON READER CARD

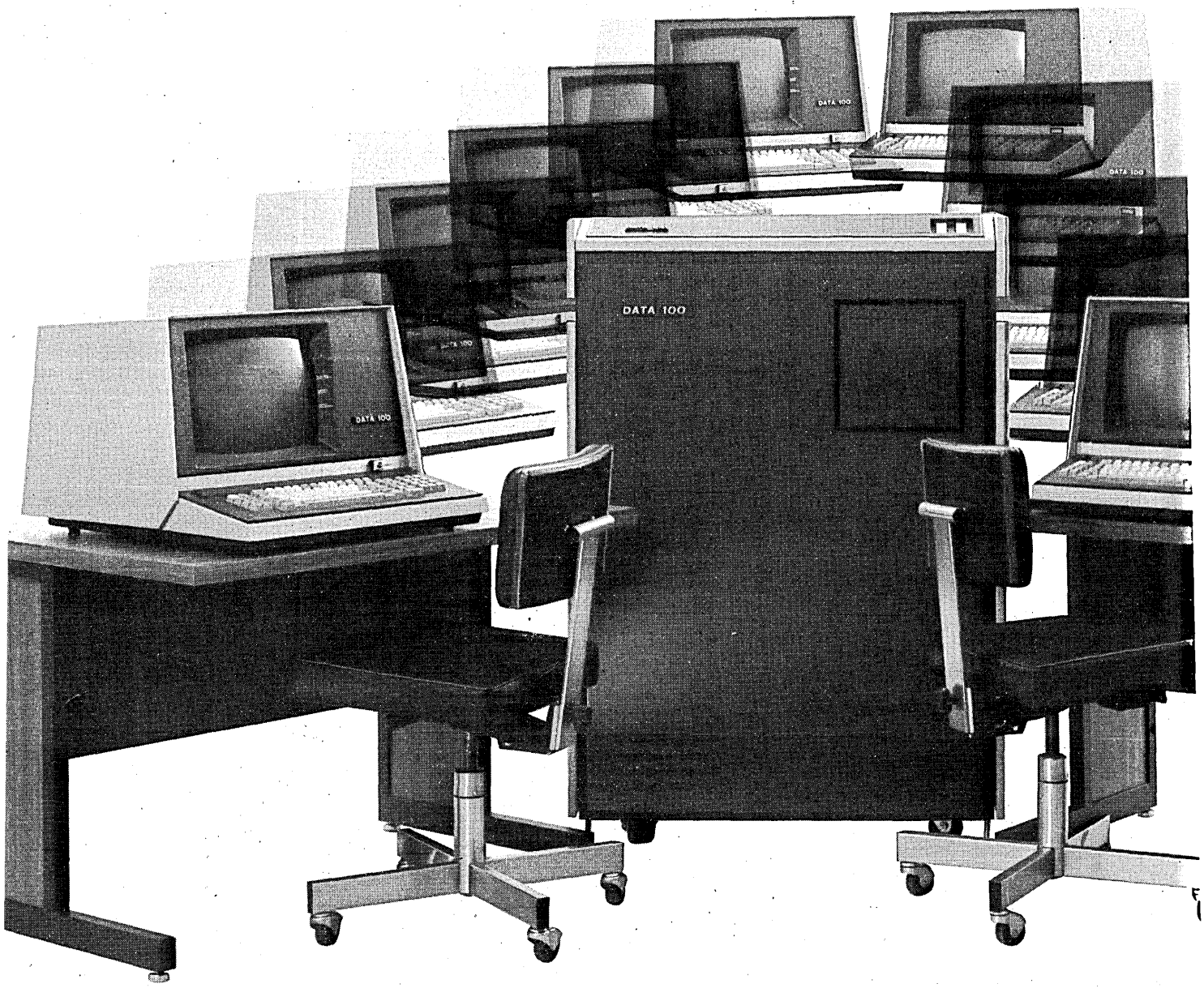
The Vadic Corporation
505 E. Middlefield Road
Mountain View, CA 94043
(415) 965-1620
CIRCLE 535 ON READER CARD

Ven-Tel
2360 Walsh Avenue
Santa Clara, CA 95050
(403) 984-2727
CIRCLE 536 ON READER CARD

Mr. Reagen is the managing editor, data communications services, for Datapro Research Corp. In this capacity, he directs the research and publication of numerous publications, including "Datapro Reports on Data Communications." He has also been Datapro's research director, and has prepared reports on data entry, computer peripherals, and data communications products for "Datapro 70."

DATA 100
CORPORATION
multifunction data processing

Announcing the beginning of the 80's.



Our new Model 82 remote display system.

Meet the first of a new family of multifunction equipment from Data 100.

Model 82, a remote display system with on-line file inquiry capability compatible with host systems using the IBM 3270 information display system communications protocol.

This Model 82 capability can also be added to existing Data 100 KEYBATCH® systems and Model 78 remote processing systems.

Besides industry standard on-line inquiry features, Model 82 offers unique shared display and backup capabilities.

Its shared display capability saves money by permitting individual display/keyboard units to serve both as local data entry and on-line inquiry stations operating from separate Data 100 systems.

Its backup features allow the 3270 emulation program to run in any appropriately configured dual controller arrangement of Data 100 Model 74, 78 or 82 equipment. Ideal for critical on-line applications.

And Model 82 is easy to install. It connects directly to existing IBM coaxial cabling.

Now, may we tell you more? Write or phone Data 100 Corporation:

6110 Blue Circle Drive,
Minnetonka, Minnesota 55343.
612/941-6500.

3 Place du Commerce
Nuns' Island
Montreal, Quebec H3E 1H7
514/761-4595

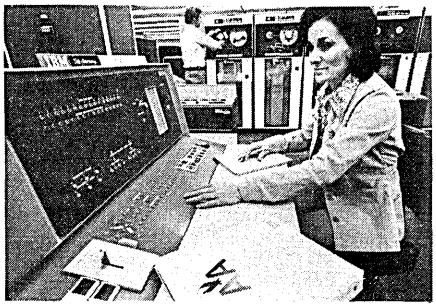
Hamilton House
111 Marlowes
Hemel Hempstead, Herts. HP1 1BB
England
(0442) 69161

hardware

Off-line

Bubble memory technology hasn't touched many of us yet, but it just might be about to. Bel Labs engineers are testing a recorded message machine using magnetic bubble memory technology that operates with no moving parts. The machine, called the 13A, is used to record and repeat 12- or 24-second messages such as "We're sorry. You have reached a non-working number." Each message can be played to as many as 500 phone lines simultaneously. Hopefully the technology won't be used for messages such as "The system is the solution."

The console of the IBM 9090 system, the only one ever made, and the basis of the world's first computerized reservation system, SABRE, is being shipped to the Smithsonian Institution in Washington, D.C., from Tulsa, Okla., where it served American Airlines from 1962 until last fall. The Smithsonian plans to place it in a permanent "History of Computers" exhibit. At least it wasn't thrown away.



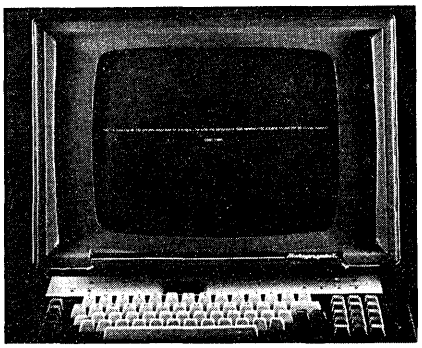
Pollution control has been a pain in the bottom line to many manufacturers, but when Information Terminals Corp. was told to curb solvent emissions used by the Sunnyvale, Calif., firm in the manufacture of storage media, it found that it could make not only better, but cheaper, products. Says Carl Holder, marketing director, "Let's face it: solvent costs were going through the roof since they're petroleum based. Because we could now reclaim the solvent, we could afford the better solvents required to dissolve more complex chemical chains used in high grade media manufacture." A series of new media products manufactured with the new process, called Verbatim, has recently been introduced.

Oops Dept. Media Recovery, Inc., is located in Graham, Texas, and not in Fraham, Texas as we stated in December 1976, p. 176.

132 column crt

The 132A display terminal doesn't figure to compete against other display terminals as much as it will battle for printer dollars. The reason is that it's one of the first 132-column crt terminals ever introduced, and most computer output gets generated in this length to facilitate printing it. An 80-column crt is great for displaying input data, but it's a real compromise on the output side of the dp operation.

This manufacturer's CHARACTRON tube, with an 8½" x 11" screen, is the



basis for the 132A, and may prove to be the underlying reason for the success of the product. The problem in the past, with standard raster scan tubes used for 132-column displays, has been that the display just couldn't keep the characters bright enough to be truly usable. The CHARACTRON, however, is used to working hard—it's the heart of the vendor's COM systems. Character formation and generation time is independent of character complexity in the design, which uses a small disc on which the characters needed for a particular display are etched. The electron beam is then deflected to and extruded through the selected character opening. It's proven and reliable.

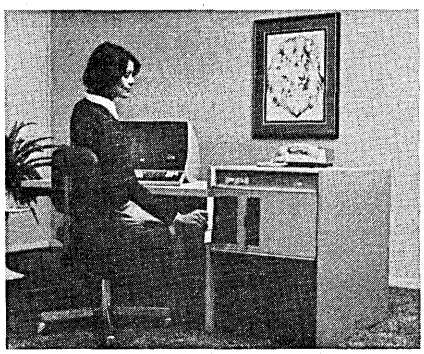
The format is 132-columns by 30 lines (3,960 characters) with 60 cycle refresh (50 Hz optional). The character set is 96 upper/lower case ASCII, with a 60 or 120 line buffer. The microprocessor controller handles functions such as cursor control, single line editing, tabbing, scrolling, dual brightness, multiple asynchronous transmission modes at 110-9600 baud, full- or half-duplex transmission mode, etc. There's also an RS-232C output plug that could lead to a 132-column printer, a diskette device, or another peripheral. The price for the 132A is $3,950, and first deliveries will begin this summer. STROMBERG DATAGRAPHIX INC., San Diego, Calif.

FOR DATA CIRCLE 335 ON READER CARD

Distributed Processing

The company that changed the way data was prepared for computer processing with the introduction of the first key to tape equipment a short 12 years ago has announced the biggest product since that time, the models 21/20 and 21/40 distributed information systems. Mohawk's plan is going to make a lot of sense to corporate planners holding off implementation of distributed processing layouts, because it is reasonable. The pitch is this: "Install a 21/20 at both your central and remote sites to replace existing single keyboard data entry devices such as keypunches, key to tape systems, and even some terminals. This will get your hardware standardized, endow you with compatibility, and cost virtually nothing in the way of development or procedure changes. *Then,* when that's under control, add more powerful data validation routines using a COBOL-like language called MOBOL (think of it as Mohawk's COBOL), and add substantial editing and preprocessing power to your equipment. Later you can add the transaction processing capabilities for sites that require them by getting a 21/40."

A 21/20 consists of a preprogrammed processor controlling up to four 480 character crt terminals, and one diskette drive. It is used for data entry and validation under control of user supplied formats. It's available for



as little as $190/month on rental. The 21/40 looks much the same, but adds 32-64K bytes of memory, the MOBOL compiler, a larger (1920 character) crt option. Bisynchronous and SDLC communications capabilities are resident on both systems. The 21/40 rents for about $232/month, including maintenance. Communication rates on both systems range from 600-9600 baud. First deliveries are slated for May. MOHAWK DATA SCIENCES CORP., Parsippany, N.J.

FOR DATA CIRCLE 327 ON READER CARD

The concept and design of the Printronix 300 Impact Matrix Line Printer/Plotter offers you several remarkable cost/performance advantages.

Like plotting capability ...at no extra cost.

It would seem enough to find a 132 column, 300 lpm printer with print quality others can't match, with an elegantly simple mechanism that assures a greater MTBF, and a modular design that dramatically cuts MTTR. The Printronix 300 offers all of these advantages. But it also offers plotting capability. At no extra cost.

Because of its unique mechanism, it can put a single dot anywhere on paper. It forms characters a dot row at a time when printing. In the plot mode, it can form any pattern a dot at a time upon command. Drawings. Graphs. Bar codes. Large character labels. You name it and you can do it on a Printronix 300.

It's a handy capability to have around, and it comes to you with our compliments . . . at no extra charge . . . along with the other remarkable advantages that make the Printronix 300 your best buy. Send for our brochure. You'll discover why the Printronix 300 prints better, will last longer, and require far less maintenance. That's why it's been sold with a one-year warranty from the beginning.

Printronix Inc., 17421 Derian Ave., Irvine, California 92714. (714) 549-8272.

PRINTRONIX 300

It's your best buy!

CIRCLE 113 ON READER CARD

hardware

Hobby System Cabinet

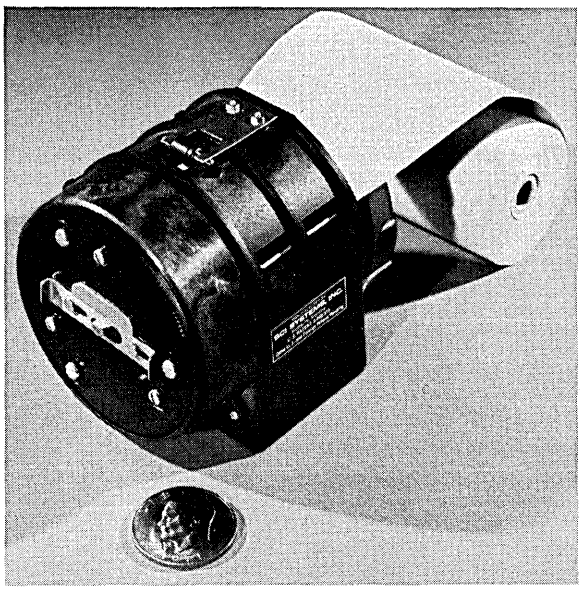
You say your bunkie is afflicted with the computer hobbiest craze, has set up shop in the dining room, and is ogling your breakfront for storing his digital masterpiece? Do both yourselves a favor and send for this set of plans that can be used to construct a suitable and stylish cabinet to hold the system, tools, and other paraphernalia. It's approximately 5' (H) x 4' (W) x 2.25' (D) when completed, and only requires basic woodworking tools and talents. The $6.95 price for the plans might be the best investment you ever made in your relationship. PERSONAL COMPUTING, Albuquerque, N.M.

FOR DATA CIRCLE 330 ON READER CARD

Information Processing

Customers and competitors take note: The IBM Office Products Div. has gone into the "systems" business, and has announced one of the more sophisticated word processing systems seen to date. Actually, the System 6 isn't called a word processing system, though it provides this function in spades. It's called an information processing system because in addition to text processing, it provides help in administrative

product spotlight



2,200 cps Printer: $300

True, it doesn't look like a conventional printer, but then 30 years of developing "conventional printer" technology has only managed to bring the char/sec cost down to around $6.90—and that on IBM's 3800 laser printer system which costs a cool $310K. Using aerospace technology it hopes will help it diversify into the commercial systems marketplace, this $27M/year corporation is offering 2,200 cps performance (1,000 132-character lpm equivalent) for $300 in oem quantities of a thousand. The Quikprint I isn't restricted to oem's either: a fully packaged end user version with RS-232 interface is planned to sell for $995. Those cost-per-character rate of 13¢ and 45¢ are nearly two orders of magnitude better than anything developed to date.

The Quikprint design is beautifully simple, containing only five moving parts. When a page of information (typically crt screen contents) is ready to be written, the motor of the Quikprint is energized and paper moved past a rotating head containing styli. The styli remove the coating of specially treated electrosensitive paper to reveal a black surface which serves as the "ink" for the non-impact device. When the page buffer is empty, the printer shuts down. (There is no odor or even much noise associated with the printing process, and the printing operation is clean.)

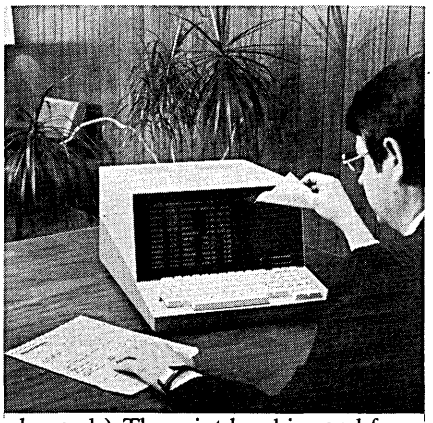
For applications, the most obvious one that comes to mind is hard copy capability for crt terminals, and several manufacturers are preparing to announce terminals that incorporate the Quikprint. Other potential markets would include data communications, mobile communications, facsimile, word processing (for quick edit copies before committing copy to expensive bond paper), the hobbiest market, and electronic mail.

Performance is no bargain if the machine won't stay up, but here, too, the specs of the Quikprint shine. The unit is shipped with two print heads and a mailing envelope. When the first head needs refurbishment, just stick it in the mail with $25, and install the second head. (Installation is easier than any typewriter ribbon we've ever

record keeping, and features communications.

Why System 6? "It's the coming together of the diskette and the magnetic card," says an IBMer wearing a conservative blue tie with little red and white sixes all over it.

The basic model 6/430 comprises a keyboard, a relatively small (for word processing applications) crt screen, magnetic card reader/recorder, and diskette. A 6/440 adds a 96-column ink-jet printer device with automatic paper and envelope feeders and stackers (deleting the card reader/recorder), and the 6/450 includes everything. A firmware-based processor is used containing nearly 100 instruc-



changed.) The print head is good for a minimum of 25 million characters, we're told. The rest of the design is good for 7.5 *billion* characters, say the engineers, but they obviously haven't been able to run one long enough to wear it out.

The Quikprint won't be for everybody—it does have some disadvantages for some applications. For example, it can't be equipped with a tractor feed to handle business forms—but then it can't print multiple copies anyway unless controlling software issues reprint commands. And the special paper has a metallic appearance to it—though the developers are working with paper suppliers to develop a white paper. Also, print quality is not up to correspondence standards, coming from 5 x 7 dot matrix images. But 7 x 9, and even 13 x 17 images are under development. Paper costs $1.35 for a 4-inch by 200-foot roll, but at least there are multiple suppliers for it. The developers will assist interested oem's in developing specialized interfaces for their products from the Quikprint's standard 5- bit parallel spec, for a one-time charge of $9K.

Follow-on models call for 8½-inch paper width, and 4,000 cps performance. Demonstration units are available now, and production units in large quantities are slated for mid-year. SCI SYSTEMS, INC., Huntsville, Ala.

FOR DATA CIRCLE 336 ON READER CARD

tions. The customer maintains information files on diskettes and can revise text by character, word, line, or paragraph. Line endings and page lengths can be adjusted automatically to accommodate revisions. About 130 pages of text fit on each diskette. One nice feature of the machine: the distance between text in the paper holder of the system and the crt character size has been adjusted so that characters always appear the same size to the operator so that no hard on the eyes refocussing action is required when using the system.

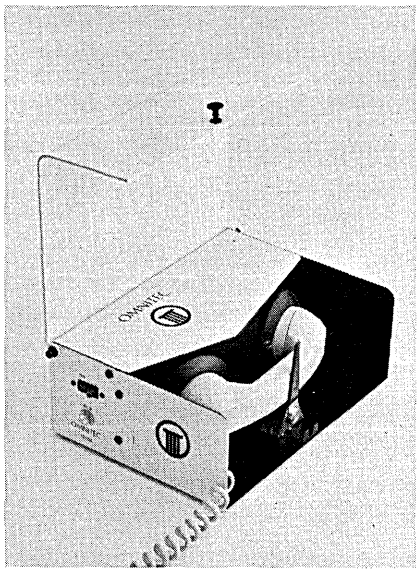
In record processing applications, the 6 can be used to store personnel, inventory, customer, supplier, or any other kind of record list, again on the diskette. The operator can then perform a variety of operations against the file, even nesting sort parameters. More commonly, items can be changed, selected, sequenced, qualified or reformatted for various listings or reports. And information in these files can be used together with text to do things like create personalized mailings. The 6, once instructed to begin this processing, can handle the chores unattended—one can come back from coffee break and find a pile of *completed* work in the output hopper. Should make for happier bosses.

The printer is the ink-jet unit that debuted with the word processing version of the System/32 last year and has been renumbered the 6640 to comply with the new nomenclature. It contains paper drawers, and even an envelope drawer, so that during mailing generations, not only are the documents made up, but so are the envelopes. In the proper order. If the System 6 can be knocked, however, it might be because not more than one work station can be hardwired to work with the printer, though of course you can use it by walking cards or diskettes over to the main workstation and loading them up from there. The minimum configuration can be obtained for $16,450, or $470/month on straight rental. IBM CORP., Office Products Div., White Plains, N.Y.

FOR DATA CIRCLE 331 ON READER CARD

Acoustic Coupler

The model 103/202 just might be a first. There have been a number of modems that were switch-selectable to accommodate a variety of transmission speeds, but this might just be the first time the feature has ever been designed into an acoustic coupler. The actual rates are 110, 150, 300, 600, and 1200 baud. Bell 103/202 protocol is accessable via an external switch, and a



Bell-compatible 5 baud reverse channel is standard with the unit. "The Switchable" can be set up for various features with internal switches, including squelch, 5 baud, 75/150 reverse channel enable, carrier detect times, and clear to send delays. It's priced at $1,698. OMNITEC DATA CORP., Phoenix, Ariz.

FOR DATA CIRCLE 329 ON READER CARD

OCR System

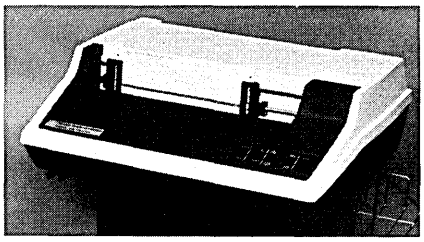
The M9 optical character recognition system consists of a microprocessor controlled electronics box, a document reader, and communications logic. Documents accommodated range from a minimum of 1" x 2½" up to a maximum of 6" x 8¾". Reading of one printed line per document is standard, with a second read head optional. Up to 3,900 documents per hour can be processed. Fonts recognized include OCR-A numeric and alphanumeric, Farrington 7B, Farrington 12F, MICR print, handprint, OCR-B, 407, 1428, and subsets of OCR-A, OCR-B, and handprint selections. A variety of equipment interfaces are offered in addition to standard RS-232 and tty hook-ups, including Datapoint 3300/3600, Computer Machiner Corp. 107/108, IBM 3741, Entrex, and Burroughs offerings.

Software controlled electronics are capable of reading 90% of what other systems commonly reject, claim the developers, meaning that reject rates might fall to less than one % from the usual 3% to 5% average. Basic systems are priced at about $12K. Fonts are priced separately, with the most common, OCR-A alphanumeric, at $4,135, also the most expensive. Handprint is priced at $2,800, with most other fonts generally priced between $1,400 and $1,500. KEY TRONIC CORP., Spokane, Wash.

FOR DATA CIRCLE 342 ON READER CARD

Serial Printer

The serial printer supplier market gains another member—and a significant one—with the debut of TI's model 810. It's a 150 cps bidirectional impact printer with microprocessor logic used



to calculate where the print head should report to initiate printing the next line. The standard printer character set consists of 64 ASCII images printed in 9 x 7 dot-matrix fashion. Options include larger character sets, a compressed character printing feature that enables up to 132-columns of data to be printed on standard 8½-inch wide paper, and a choice of 11 standardized form lengths. The 810 is priced at $2,250 each, before oem quantity discounts are applied. TEXAS INSTRUMENTS INC., Houston, Texas

FOR DATA CIRCLE 341 ON READER CARD

Modem Monitoring

The Circuit Quality Monitoring System (CQMS) supplements the diagnostic functions in this manufacturer's LSI series modems to provide personnel responsible for network operations with a visual analysis of line operating parameters without interrupting data transmission. A microprocessor is used to continuously analyze the signal being received over modems. The incoming signal is compared to ideal values stored in the system, and, when an anomaly is detected, CQMS displays the presence of the disturbance as soon as pre-established thresholds are exceeded. Characteristics monitored include amplitude modulation, phase jitter, harmonic distortion, bandedge distortion, and noise. A second function keeps count on several parameters such as phase hits, gain hits, impulse hits, line dropouts, and modem retrains. The CQMS has inputs for four modems, and can be expanded through the use of an

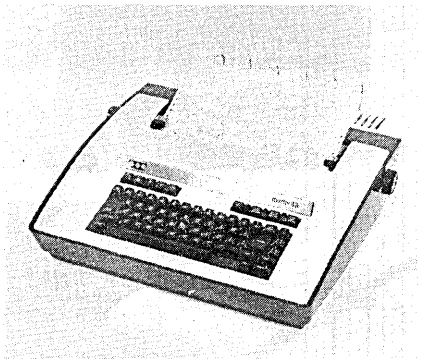
optional unit to monitor 16 modems. Four of these can be appended for a maximum of 64 modems. The CQMS sells for $5,750 or rents for $190/month on a two-year lease. CODEX CORP., Newton, Mass.
FOR DATA CIRCLE 339 ON READER CARD

Flow Chart Aid

This might just be one of those ideas that make one wonder why nobody ever thought of it before. It's a flowcharting kit, consisting of 10 legal size base boards and about 320 various symbols. Instead of hand creating every symbol, one merely peels a symbol from a sheet and sticks it on the base board. Errors are much easier to correct that way, it's less time consuming, and the finished product looks professional. Symbols are A.S.A. X 3.5 size, and base boards are available in legal size (8½" x 14"), B drawing size (11" x 17"), C drawing size (17" x 22"), and D size (22" x 34"). The starter kit costs $8.95 plus $1 postage for 10 base boards and 320 symbols. FICKLED THINKING AIDS., Orange, Calif.
FOR DATA CIRCLE 340 ON READER CARD

30 cps Terminal

Some of the better products in our industry can actually be the hardest for users to get their hands on, and that's going to be the case with Teletype Corp.'s latest terminal, the model 43 teleprinter. We'll give you the good news first, however. It's a 30 cps unit that weighs about 30 pounds and prints 132-column lines on 11-inch wide fanfold paper. The printhead is a 9-wire matrix impact mechanism that makes it possible to print lower case characters with trude descenders for better legibility. It's compatible with



the model 33 tty, but isn't really a replacement for it—the old model is still selling well and will be kept in production, we're told. Switches determine 10 or 30 cps print rates, half- or full-duplex communications, and even parity detection enable/disable. It's claimed that the model 43 is quiet enough for office use.

Even the price isn't bad news. Two versions are offered, one with RS-232 interface logic for $964, and the other with a Bell 103 internal modem for $1,111. These are "functional" prices, meaning that they apply to quantity buyers.

As has happened often in the past with Teletype products, availability is up in the air with the model 43, but the manufacturer should have the details of how many units go to parent AT&T and how many Teletype itself can sell, in the near future. TELETYPE CORP., Skokie, Ill.
FOR DATA CIRCLE 332 ON READER CARD

Touch Tone Interface

The MC-1 is a microprocessor-based communications concentrator especially designed to service up to 32 telephone lines supporting Touch Tone terminals. The unit controls all functions of the communications data sets and decodes/converts incoming signals. Among the data sets supported are the Bell 407A, 407B, 403-type units from independents, and support of Bell's TRANSACTION*-TELEPHONE, automatic call distributor and call director. All transactions between the MC-1 and the host cpu are conducted using standard data formats without requiring elaborate software support. It's claimed that mini users can easily install the MC-1 with the instructions supplied. A minimum 4-line system

sells for $3,950; 32 lines for $15,150. FEDERAL SCREW WORKS, Vocal Interface Division, Troy, Mich.
FOR DATA CIRCLE 338 ON READER CARD

Crt Terminal

Nearly 100 of this manufacturer's IQ 120 crt terminals have already been delivered in kit form, so the developers —ex of Lear Siegler—are convinced they can make good on their promise to deliver terminals for under $1K in quantities of 50. For $998 each, oem customers get 12 lines by 80 characters on a 12-inch monitor, protected fields,

dual intensity, cursor addressability, built-in numeric pad, and erase line/page functions. The IQ 120 is logically compatible with Lear Siegler's ADM-3. Options include 24 lines (1,920 characters), block mode transmission (line or page), RS-232 cords, and a serial printer interface. SOROC TECHNOLOGY INC., Anaheim, Calif.
FOR DATA CIRCLE 337 ON READER CARD

ASCII/APL Terminal

The Execuport 3000 looks like the answer to a terminal user's prayer. It's a 136-column unit with three switchable speeds (10, 15, 30 cps); a built-in acoustic coupler; and full ASCII and/or APL character sets. The language sets can be selected locally or remotely, and the 3000 can do plotting. Also handy for handling charts and graphs is fractional spacing that allows the user to move one-quarter line up or down. The user can also set the unit for 30-column capability, too. There are RS-232 connectors in the back, too, for peripheral hook-ups. The thermal printing unit accepts roll paper and prints 10 cpi and 6 lines per inch. Options include out-of-paper alarm, tty loop, one character ACK/NAK, keyboard inhibit, etc. Prices start at $3,495, or $143/month on a two year lease. COMPUTER TRANSCEIVER SYSTEMS INC., Paramus, N.J.
FOR DATA CIRCLE 326 ON READER CARD

Small Biz System

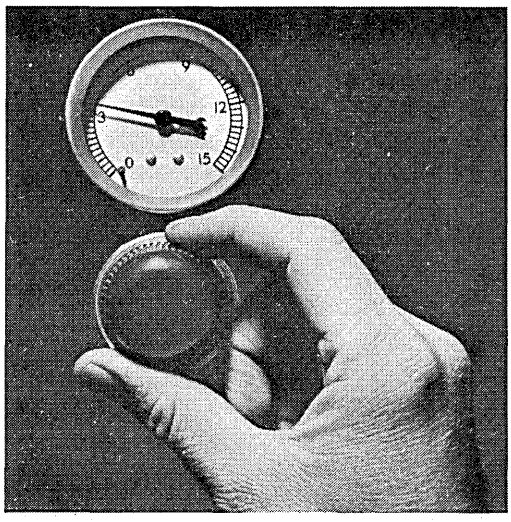
The small business computer system market is expanding so fast it probably doesn't even matter that Univac comes to it late. The company is serious about the effort, however, and has fashioned an entirely new sales and service organization for the support of these systems, the first of which is the BC/7.

The basic components of the BC/7 are stored in a desk-top configuration and include an operator's console, a workstation with system monitoring

display screen, a printer, a cartridge disc drive or diskette drive or a combination of both, and a magnetic tape unit—something you can't always get on a system like this. The semiconductor memory machine can be expanded from 32-64K characters (bytes) in 16K increments. Interestingly, Univac has become an Intel customer for the

RAMIS REPORT #4

How to reduce the pressure without running out of steam



Today, more than ever, the DP department is under pressure for more and more information —to be delivered at a faster and faster pace. Add budget and manpower constraints and the DP department can become a real pressure cooker.

RAMIS takes the pressure off. RAMIS is a fast and comprehensive information processing system. It combines a complete and automatic DBMS with a nonprocedural English-like language.

What are the benefits of this combination? With a DBMS, productivity is improved because files need be described only once. This frees you to spend more time on the real problem. And data need be stored only once, regardless of the number and variety of ways it is used. Thus data accuracy and integrity are increased. And with the RAMIS DBMS, data is secured even when shared among many users.

But even more important, RAMIS is not just a DBMS. It can be nonprocedural. It lets you tell the computer what to do instead of how to do it. And you do it in English. There is no compiling as in Cobol or PL/1. In fact, with RAMIS you don't even concern yourself with I/O operations or housekeeping chores. They're all done automatically.

RAMIS users find that 75 percent of their information processing needs can be satisfied in 1/5th the time required by traditional languages. Therefore, you don't have to spend as much time keeping up with changes...new laws and regulations, new products, new sales objectives, acquisitions and others. In addition, EDP specialists and management staffs find they communicate better because they are both speaking the same language. English.

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processor chips, using the popular 8080A chip as the basis for the system. Instruction execution times vary, but are never less than 2 usec. For printers one can get the standard non-impact workstation printer (300 cps), a 200 cps character printer, a 200 cps bidirectional printer, and a line printer of either 125 or 250 lpm capability. Up to six diskette drives can be appended, and all can be in action simultaneously.

Two language processors are offered: RPG II, and ESCORT. ESCORT is billed as being good for use by non-programmers for specifying data management requirements in a tutorial, conversational fashion. Inquiry, reporting, and file maintenance programs can be written in either direct "program" mode or in the conversational "tutorial" mode. Initial software applications include an accounting management system (AMS), a wholesale applications management system (WAMS), and a manufacturing applications management system (MAMS).

The system really shines when talking about operating system ease of use. The System Control Language (SCL) operates the BC/7 in English commands that specify the desired programs and identify the files to be used. The operator doesn't even have to learn language syntax, for procedures are stored on disk and available to the operator as menu items, and menu selection can be several levels deep. This will go well with first time users, we would think. Minimum systems start just under $30K but can go to more than double that figure. SPERRY UNIVAC, Blue Bell, Pa.

FOR DATA CIRCLE 328 ON READER CARD

Distributed Processing

More than perhaps any other consideration, one estimate is responsible for Honeywell's largest announcement in several years. The estimate? That by

1980, fully a third, or about $5 billion worth, of that year's hardware shipments will go into distributed processing environments, compared to about one-tenth of the total in 1976. The vendor obviously wants as large a piece of that action as it can get, and has announced four new host processors—three medium-scale systems (64/30, 64/50, and 64/60) and a really interesting model, the large-scale 66/85, together with software capabilities for what Honeywell calls the distributed systems environment (DSE).

The 66/85 is this manufacturer's largest ever—at one time you could buy a Boeing 707 airliner for less. The current mode logic circuitry isn't proprietary to Honeywell, but the packaging is. The circuits, some eight to fifteen times denser than bipolar circuits and having gate speeds some five to seven times faster than TTL circuits, are packaged 110 chips to a logic unit, helping to increase performance even more. Water cooling is primarily responsible for dissipating the heat, and the net effect is said to be a very reliable processor. A million word (4K MOS chips) dual processor system with 3.2 billion bytes of disc storage, printers, card equipment, and communication capability lists for $6,207,623, or $128,082/month on a six year contract. A bit-oriented communications protocol similar to IBM's SDLC, and called HDLC, for High-level Data Link Control was also announced. HONEYWELL INFORMATION SYSTEMS, INC., Waltham, Mass.

FOR DATA CIRCLE 343 ON READER CARD

High-speed Printer

This company tried to get in the end-user printer business several years ago but really didn't have the resources to directly market the Mod II, though some were sold out of the country. The approach with the PEP 6510 is considerably different: it's of primary interest to oem's or manufacturers serving the plug-compatible peripheral markets.

The PEP 6510 prints at speeds up to

13,165 132-column lines per minute on standard computer fan fold paper. The printer accommodates a variety of paper sizes, though the manufacturer likes to stress that the 8½ x 11-inch size the Xerox 1200 printing system pioneered is being well accepted, and the 6510 can easily handle that page size. In the 6510, paper moves at a constant rate 720 inches per minute, under a light sensitive drum that has had character images drawn on it by a character-generating drum. Dry ink (toner) is then drawn to the image area and transferred to the plain paper. The 6510 is page buffered and can handle burst I/O loads as high as one megabyte/second.

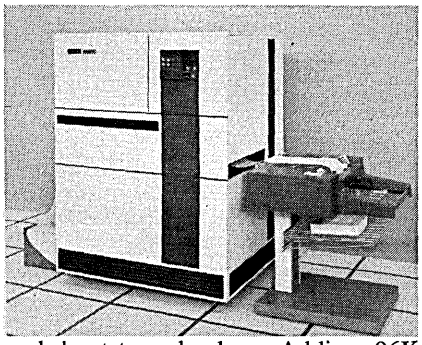
Pricing, especially to oem's, is complicated. With all mechanical gear and necessary logic, prices run something under $50K for single units, but that price may not be truly representative as components of the system can be obtained separately. An on-line IBM 360/370-compatible version is in the works. Evaluation units are available now. UPPSTER CORP., Hauppauge, N.Y.

FOR DATA CIRCLE 334 ON READER CARD

Large-scale Mini

Honeywell's Series 60 Level 6 minicomputer family has been well received in the 14 months since its announcement, with more than 1,000 systems ordered in the U.S. alone. The model 6/43 will probably be welcomed by oem's, system houses, and large end-users, too, as it's the top of the line (so far) in the series.

Some minicomputer! Up to a million 16-bit words are directly addressable on the new system. If that isn't powerful enough, a second model features double-word-access memory, and when equipped with a floating point arithmetic processor, runs FORTRAN three times faster than the previous top end model, the 6/36. There are 28 20-bit registers in the 6/43 to help with the addressing chores. A basic system consists of a processor mounted in a five- or ten-slot Megabus chassis (expandable to 23 slots), a basic or full control panel, hardware multiply/divide, real-time clock, watchdog timer,



and bootstrap loaders. Adding 96K words of memory, a scientific instruction processor, 10-megabyte cartridge disc, mag tape unit, 300 lpm printer, eight crt terminals, and program development software still doesn't bring the price to $80K. COBOL, FORTRAN, RPG, and a disc operating system are available for the level 6 series. HONEYWELL INFORMATION SYSTEMS, Billerica, Mass.

FOR DATA CIRCLE 333 ON READER CARD

There is only one OEM

1. A Wangco Autoload Tape Drive...from Wangco's broad, high quality line of tension arm, vacuum column, and autoload models. Select speeds of 12½, 25, 37½, 45, and 75 ips, 7 or 9 track NRZI, phase-encoded or dual density format and reels of 7", 8½", and 10". Design features include IBM compatible head guide spacing, high efficiency tape cleaning, tri-level read threshold, and plug compatibility with other major industry suppliers' tape drives. The ruggedized Mod 12 shown below is especially suited for large computer mainframe system integration.

1. A Wangco Disc Drive...front or top loading cartridge or fixed disc with data capacities from 2.5 to 20 Mbytes (100 or 200 tpi) in the smallest size configurations available. Wangco designed voice-coil positioners speed access and reduce power dissipation. The new brushless DC motor, forced air cleaning system and two-sensor temperature compensator assure highest reliability.

peripheral for your system

1.

A Wangco Flexible Disc Drive ...with access time of 6 ms track to track for a 164 ms random average seek. Single and dual density encoding can be accommodated in the same drive with selectable sector options including IBM and expanded soft-sectoring, 32 hole hard sectoring, and sector generation. Reliability features include an IBM-type ceramic head, low friction Uni-ball positioning, die cast mainframe and open and closed door interlock. MTBF is 5000 hrs. Power consumption is only 45 watts.

1.

A Wangco Tape or Disc Subsystem...hardware, firmware, and software, for PDP-11 and Nova minicomputers. Wangco offers more subsystem configurations for the OEM than any other manufacturer. To the user this means single source systems with components designed together to work together as well as rapid delivery and substantial cost savings.

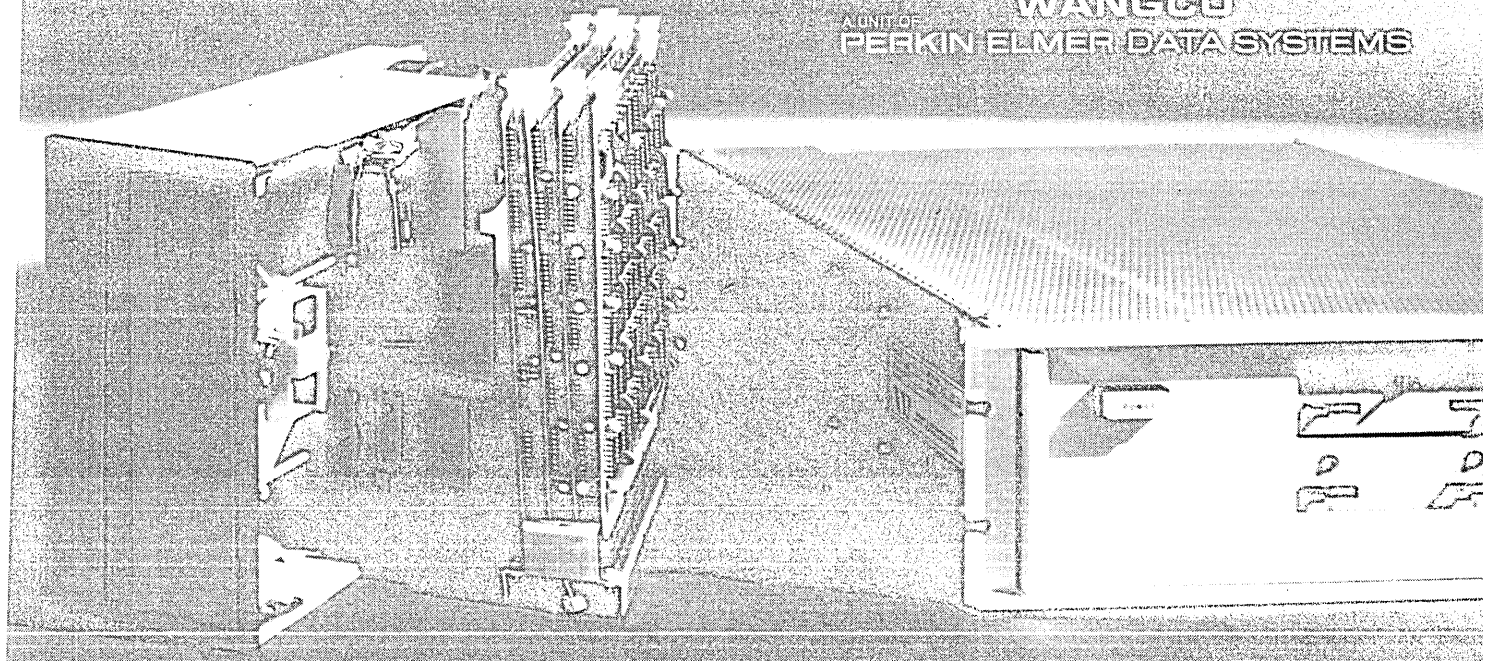
1.

A Wangco Magnetic Tape Formatter...containing all required logic to read and write IBM compatible 1600 cpi phase encoded and/or NRZI mag tape. Requiring only 5¼ in. of vertical rack space, each formatter can control up to four 7 and/or 9 track tape drives.

The one OEM peripheral for your system is from Wangco. For more information contact Wangco, Inc., 5404 Jandy Place, Los Angeles, CA 90066. (213) 390-8081. In Europe write or call Wangco, Inc., Postbox 7754, Building 70, 1st Floor, Schiphol-Oost, Netherlands. (020) 458269.

WANGCO

A UNIT OF PERKIN ELMER DATA SYSTEMS



CIRCLE 24 ON READER CARD

software & services

Updates

One of the sadly ironic aspects of the Argo Merchant's recent grounding off the coast of Massachusetts, which dumped millions of gallons of oil into the sea, was that the U.S. Coast Guard has been keeping an eye on that particular ship because it has been involved in more than its share of pollution incidents. A new computerized service offered by Marine Management Systems, Inc., of Stamford, Conn., has access to the same kinds of information. Prospective charterers and port authorities can now get vessel safety records on tankers and combination carriers over 6,000 DWT and all liquid gas carriers. Let's hope the service will be heavily used.

It's high time the more than 100,000 independent insurance agents joined the computer age "whether they like it or not," says Management Information Corp., Cherry Hill, N.J., in its Jan. edition of Packaged Software Reports. MIC goes on to explain that independent agents are being forced to comply with the continuing pace of automation at large companies, and that there are some 14 good reasons for planning to computerize.

The Institute for Software Engineering has been founded in Palo Alto, Calif., by Ken Kolence, one of the founders of Boole & Babbage. The institute holds workshops and conducts courses for a membership fee of $750 per year. Current courses include an introduction to software physics and one on software physics cost control. Emphasis at the institute is not on performance measurement or improvement so much as it is on capacity management. It's claimed that a number of Fortune 500 members have joined up.

Does your computer ever tell you to slow down? A Data General mini-based biofeedback system at the FDR VA Health Care Facility in Montrose, N.Y., is doing just that. The system provides biofeedback-assisted relaxation therapy by training subjects to reach a deeper state of relaxation than is normally possible. It's claimed that as subjects get better at relaxing, the system's thresholds are adjusted to challenge the patient. At which point they probably become tense and restless.

Data Base Management

Of all the popular data base management systems, including IMS, TOTAL, ADABAS, MARK IV, NOMAD, and FOCUS, one of the least mentioned is RAMIS, despite the fact that something more than 600 systems have been installed—and that with only three U.S. offices.

All that's going to change with RAMIS II, say the developers. The product is not only a logical follow-on to the original RAMIS (Rapid Access Management Information System), but seems to break some new ground, too. RAMIS II essentially combines all the advantages of a nonprocedural language (faster problem definition, little or no debugging, and more general access by less technically oriented personnel) with a data base management system. Not only does the user not have to know where data is stored in the system, it isn't even necessary to know *how* it's stored—and storage modes can include single- and double-word floating point; one-, two-, or four-byte integer; packed decimal; alphanumeric; and exponential representations. Relational structures are stored in third-order normal form.

Programs written in procedural languages can, of course, access RAMIS files. Other nifty features include the ability to control network linking by specifying when files are to be linked, and if they are linked, whether network pointers are to be recorded. For security, one can now specify a one-letter code to indicate that a field cannot be retrieved without following proper security procedures, this in addition to already existing file and level protection features. The report generator seems to offer every possible combination of output formatting a user would ever want, and is controlled by syntax that is very close to everyday English.

Basic systems go for RAMIS I prices until the end of March, meaning as little as $20K, but a more representative system will go for around $50K, with fully configured versions going for $65,500, or $2,270/month for 36 months. RAMIS II is available only for IBM systems—at least for now. MATHEMATICA PRODUCTS GROUP, INC., Princeton, N.J.

FOR DATA CIRCLE 312 ON READER CARD

Scheduling/Routing

Many scheduling, routing, and assignment problems can be viewed as combinatorial problems, says the developer of a package to solve such questions. These types of problems are usually attacked by using linear programming methods, but the method has broken down because the variables must be limited to zeros and ones, which haven't always fitted the model very well.

This developer won't divulge his technique, but the essence of the solution is a self-correcting combinatorial problem solver that attacks the task one piece at a time and makes predictions as to what answer will satisfy the equations next. It's kind of like generating an answer and working back to find whether it fits the question.

As an example of the usefulness of the program, it's claimed that the optimum solution to a 65 x 1,769 airline flight crew scheduling problem can be demonstrated using less than one minute of cpu time on a 370/158. The program is written in FORTRAN IV and has run on IBM 360/370 equipment in batch mode, requiring about 150K memory partition. While no free trial is offered, the developer has something maybe even better to offer: you pay for the system when it is up and running in your application and you are satisfied with the results. The asking price is in the neighborhood of $15K, but special versions might cost somewhat more. ZERO-ONE SYSTEMS, Bethesda, Md.

FOR DATA CIRCLE 313 ON READER CARD

Message Transmission

You can zap both the phone company and the U.S. Postal Service by using ACTION/MAIL to send urgent international messages. Messages are originated by an international concern's home office, edited on the system using almost any hard copy or crt terminal, and dispatched through the system to one or more intended recipients for typically about $1 per paragraph. Hard copy records can be generated for both sender and addressee. One of the nicer features of the service is the lack of a monthly minimum payment or subscriber fee. Messages go out instantaneously to subscribers within the U.S., Canada, and principal cities in England, France, Switzerland, Belgium, and Mexico. Say a user desires to transmit a message to an international firm's home office in London, and doesn't know whether that firm uses ACTION/MAIL. The service vendor supplies a "pen name" identifier if the company is found to be a user, and

asi/inquiry

The IMS DB/DC QUERY LANGUAGE

USED BY MORE IMS INSTALLATIONS THAN ANY COMPETING PRODUCT

ASI/INQUIRY is an IMS DB/DC query language that operates completely as an interactive Message Processing Program. The design of ASI/INQUIRY is such that the *structure of the data base is transparent to the user*. Moreover, one need not have familiarity with DL/1 segment logic or the complexities of multi-pathing. Extremely rapid response time is assured.

MAJOR HIGHLIGHTS

- ☐ End-user oriented
  - —Easy-to-use language
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  - —Comprehensive diagnostic messages
- ☐ Rapid response time for even the most complex queries
- ☐ Dynamic priority scheduling to maximize system performance
- ☐ Availability of default as well as user-defined screen formatting

Recently delivered, Release 2 of ASI/INQUIRY contained a number of major enhancements, including:

- Development of a TSO-supported version
- Full support of IMS/VS secondary indexing
- Open-ended computational facilities
- Ability to SORT display output

In summary, ASI/INQUIRY represents the state-of-the-art product in an IMS DB/DC or TSO-supported IMS environment. It is the only system combining an easy to use language, complete user flexibility, and rapid response time in a single package. If you want to start answering "What if . . . . " immediately, call or write today for further information.

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messages can then be transmitted. There is even a provision for recipients of many messages to specify which messages they wish to read. Messages are sent with time, date, and sender recorded with each message. Some restrictions include not being able to use a Telex terminal, or some APL terminals. THE COMPUTER COMPANY, Richmond, Va.

FOR DATA CIRCLE 314 ON READER CARD

Performance Evaluation

Nearly all computer performance measurement, evaluation, and management services are set up for a relatively short "tuning" period, after which both the hardware and data reduction services are terminated. PERMONET is different, being intended for on-going monitoring of the more popular manufacturers' systems. After the user pays a $9,995 installation and license fee, the vendor installs hardware monitoring equipment. For $2,395 monthly, the user is then provided with real-time threshold checking, daily analysis services, weekly/monthly/quarterly per-

(Continued on page 254)

software spotlight

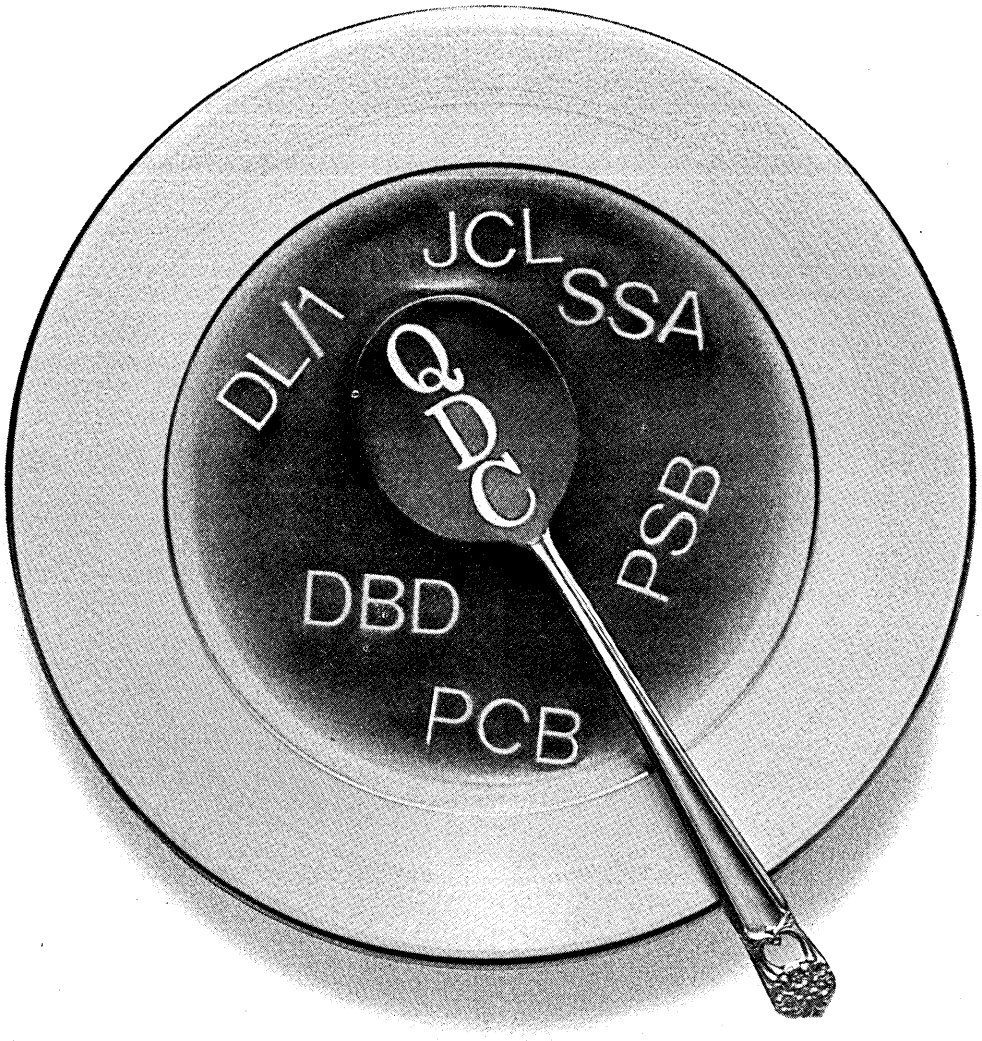
Data Retrieval

In a way, the Storage and Information Retrieval System/vs—Thesaurus and Linguistic Integrated System (STAIRS/VS—TLS) is an answer to the same problem Mark Twain put his finger on when he complained about dictionaries only being of use when you know how a word is spelled. It doesn't help you at all if you're a letter off. Most Data Retrieval systems are the same way: you could just miss information stored in a file under "displayed data" if you went in looking for "display data," for example.

STAIRS/VS—TLS works the same way —and IBM has a name for the impasse reached when an operator knows what the contents of a query should be but can't quite find the right words to say it: the tip-of-the-tongue syndrome. All queries to the system are in ordinary English, with the system listing the words that he or she possibly couldn't think of. Needless to say, the system would be ideal in environments where there's heavy use by inexperienced users, or other operations characterized by excessive researching for query information, specialized jargon or vocabulary, mixed information format, or especially where retrieval barriers are caused by inflected linguistic variations. An inquiry for information in a file that might be entered as CHILD AND PARENT AND ADOPTION AND ABANDONMENT might prompt the user with words such as CHILDREN, MINOR, INFANT, OFFSPRING, JUVENILE for CHILD; PARENTS, FATHER, MOTHER, for PARENT, ADOPT, ADOPTING, ADOPTED, and ABANDON, ABANDONING, ABANDONMENT, ABANDONS, for example. The user then picks which most correctly describes what is sought, and STAIRS/VS—TLS does the rest. The package runs on systems above the size of a 370/125 (135 and up), can be used with 3270 crt terminals or 2740/2741 hard copy terminals, and under either os/vs1 or os/vs2 operating systems, and under either the CICS or IMS monitors, but many users have one of these combinations already. The monthly license fees are $175 for the Thesaurus Generator, and $300 for the RLS Retrieval function which handles user access to the thesaurus. IBM CORP., White Plains, N.Y.

FOR DATA CIRCLE 311 ON READER CARD

Are you finding ims "alphabet soup" a little hard to swallow?



...Informatics QUERY LANGUAGE/DC goes down easy!

You know the problems.

IMS is cumbersome, hard to learn, and prone to long implementation and turnaround delays.

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Now there is. It's QUERY / DC from Informatics — a free-form, user-oriented "English" language that anyone can master in half a day or less. It enables users to query on-line data bases to produce even the most complex reports without having to worry about data structures, IMS, JCL, or any other "alphabet soup." Of course, data-accessing can be done directly or sequentially from any terminal supported by IMS.

QUERY/DC gives you all the power of Informatics MARK IV® to locate, select, and organize information, and allows complete freedom to perform calculations on the data and to specify multiple formatted, sorted reports. Output can be returned to originating terminal or to other remote terminals or printers.

Does it really work? A system analyst reports: "One of our end users produced the exact report he wanted within a couple of hours after attending a QUERY / DC class conducted by Informatics. We had tried for five months to do that job in Cobol. Now he prepares his own IMS queries in less time than it would take to explain his problem to me."

Results like these could give your IMS investment a whole new lease on life. And that shouldn't be hard for anybody to swallow!

CIRCLE 74 ON READER CARD

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software & services

(Continued from page 250)

formance reports, monthly trending and forecasting reports, and quarterly on-site consulting visits. The vendor picks up both the phone charges and modem costs, and also supplies maintenance on a customer performance history data base. It's claimed that these services cost the user far less than if the job had been done in-house, and PERMONET is supplied totally turnkey. IBM, Univac, and some CDC and Burroughs equipment can be accommodated, but in general, the vendor feels that cpu's below the equivalent power of a 370/135 or 370/145 machine are impractical to do. As to what is going to be measured at the site, the customer and the vendor negotiate these points in a contract. XICRON, INC., Reston, Va.

FOR DATA CIRCLE 315 ON READER CARD

Interactive Basic

This particular implementation of BASIC operates under the control of IBM's Coursewriter III program product. It's written in assembler and uses the Coursewriter for I/O purposes. Features include extended character processing facilities, array operations, output formatting options, use of large data files, editing/debugging features, and batched input/spooled output. Set-up for DOS or DOS/VS systems, BASIC/COURSEWRITER works with hardcopy terminals like 2741s and 3767s, and model 33/35 tty's, and the 3270 crt. The price is $1,050. BOARD OF COOPERATIVE EDUCATIONAL SERVICES, Elmsford, N.Y.

FOR DATA CIRCLE 319 ON READER CARD

Mini Structured Programming

It would be hard to say that PASCAL, a language that has been around some 10 years, is making a resurgence. Indeed, the European Univ. developed high level language never caught on with the U.S. users—but all that may change according to CAI, which is now releasing PASCAL to customers working with its LSI-2 series of minicomputers.

Already sporting FORTRAN IV and BASIC on the series, PASCAL was picked to complement them, allegedly because of control structures that lend themselves to the structured programming movement. Think of it as the block-structured organization of ALGOL, the arithmetic expressions of PL/1, and the data structure capabilities of COBOL, say the software managers at CAI. One could add that PASCAL's execution time performance outstrips BASIC. The language was being used in-house as a development tool to bring programming developments, particularly macro assemblers and translators, to completion in short order, and customers have asked the vendor to please release the language to them, it's claimed. A one-time charge of $900 is asked for the software and documentation. A DOS-equipped LSI-2 with an I/O device and at least 32K words of memory and a real-time clock is the minimum configuration required for the foreign visitor to feel at home. COMPUTER AUTOMATION, INC., Irvine, Calif.

FOR DATA CIRCLE 316 ON READER CARD

Security/Efficiency Analyses

Two separate services are offered users to evaluate and improve the security and efficiency of their computer centers. The security/contingency survey determines weaknesses in security, fallback capability, disaster, and contingency planning. It's claimed that every possible problem, including outside penetration, inside jobs, embezzlement, industrial espionage, theft of services or files, fire, smoke, flood, defection of key personnel, etc., are covered.

The efficiency study determines the fit of the hardware/software configurations being used compared to the ap-

plications, the adequacy of existing services offered, personnel effectiveness, etc. Both services are priced at $2,500, with a 10% discount offered if both are contracted for at the same time. BOWERS ENGINEERING CO., Fairfield, Conn.

FOR DATA CIRCLE 317 ON READER CARD

Information Retrieval

FLEXTRACT is the name of this data retrieval program written in COBOL to facilitate its use on a variety of systems, with the name being derived from the words "flexible extraction." Data extraction programs can thus be written for "each and every file or data base" on the system. Any field within any record in the file or entire data base can be accessed. In addition to parameters such as EQUAL TO, GREATER THAN, LESS THAN, and BETWEEN LIMITS, the developers claim an exclusive feature called "ANY X OUT OF N." This option allows the user to specify "X" number of parameters and state that a hit is a record that meets any "N" of them. Questions or statements to programs containing FLEXTRACT are free form English. Parameters can be read from any valid input device and output can be directed to any valid output device. Optional features include the ability to specify ADD, SUBTRACT, MULTIPLY and DIVIDE as parameters ("LIST PRODUCT TYPES 900 THROUGH 905 AND MULTIPLY ON ORDER BY PRICE") and the ability to specify up to 10 variable parameters in a statement. The programs can run on systems with as little as 16K bytes of memory. FLEXTRACT is priced at $5,800. A second version called FLEXTRACT2 is priced at $3K and consists of RPG II source modules and can process only one parameter statement per run. M&P CONSULTANTS, Wawa, Ontario, Canada

FOR DATA CIRCLE 318 ON READER CARD

Batch Balancing

Certain applications, especially in banking, manufacturing, goods distribution, and health care spend a lot of time attempting to balance files containing previous input with current transactions. That's what BABS was developed for. The Batch Automated Balancing System alerts operators to out-of-balance conditions and signals the need for operator correction/restart. Transaction counts and dollar amounts are balanced, and one of the best reasons to consider acquiring the package is to eliminate the tedious, error-prone manual balancing practices. The COBOL program runs on IBM OS systems and has more than 50 pages of support documentation including installation and conversion sections. The price is $620/month for six months. MANAGEMENT SYSTEMS CORP., Salt Lake City, Utah

FOR DATA CIRCLE 320 ON READER CARD

More System/32 Programs

IBM continues to introduce additional software for its System/32. The latest entries include FORTRAN IV, a mathematics subroutine library called SL-MATH, a Statistical System, a Job Analysis System (JAS/32), and a student administration program groomed for large secondary schools or small school districts.

Also announced was an improved System Control Program (SCP) and a Control Storage Increment necessary for running FORTRAN on the System/32. The improved SCP adds capabilities such as scientific macros, job stream support, and better data management and library techniques. FORTRAN symbols are provided automatically on all models with serial printers. On line printer equipped models, the 64-character EBCDIC print belt can be used, or a new 48-character FORTRAN print belt can be obtained ($170). The Control Storage Increment sells for $1,350, or rents for $53/month. FORTRAN IV goes for $75/month.

FOR DATA CIRCLE 321 ON READER CARD

SL-MATH can assist users dealing with matrix algebra and numerical

mathematics, helping to compute functions such as array operations, linear equations, function roots, differentiation, interpolation, and approximation. ($50/month.)

FOR DATA CIRCLE 322 ON READER CARD

The statistical system contains four of the most commonly used statistical techniques, including stepwise linear regression analysis, factor analysis, variance analysis, and polynomial curve fitting. ($50/month.)

FOR DATA CIRCLE 323 ON READER CARD

The job analysis method equips the small-scale user with one of the techniques the larger installations have used for years in developing schedules, the Critical Path Method (CPM). CPM can be used to set up a production line, coordinate the construction of building projects, help develop market plans, etc. It's written in BASIC and rents for $57/month.

FOR DATA CIRCLE 324 ON READER CARD

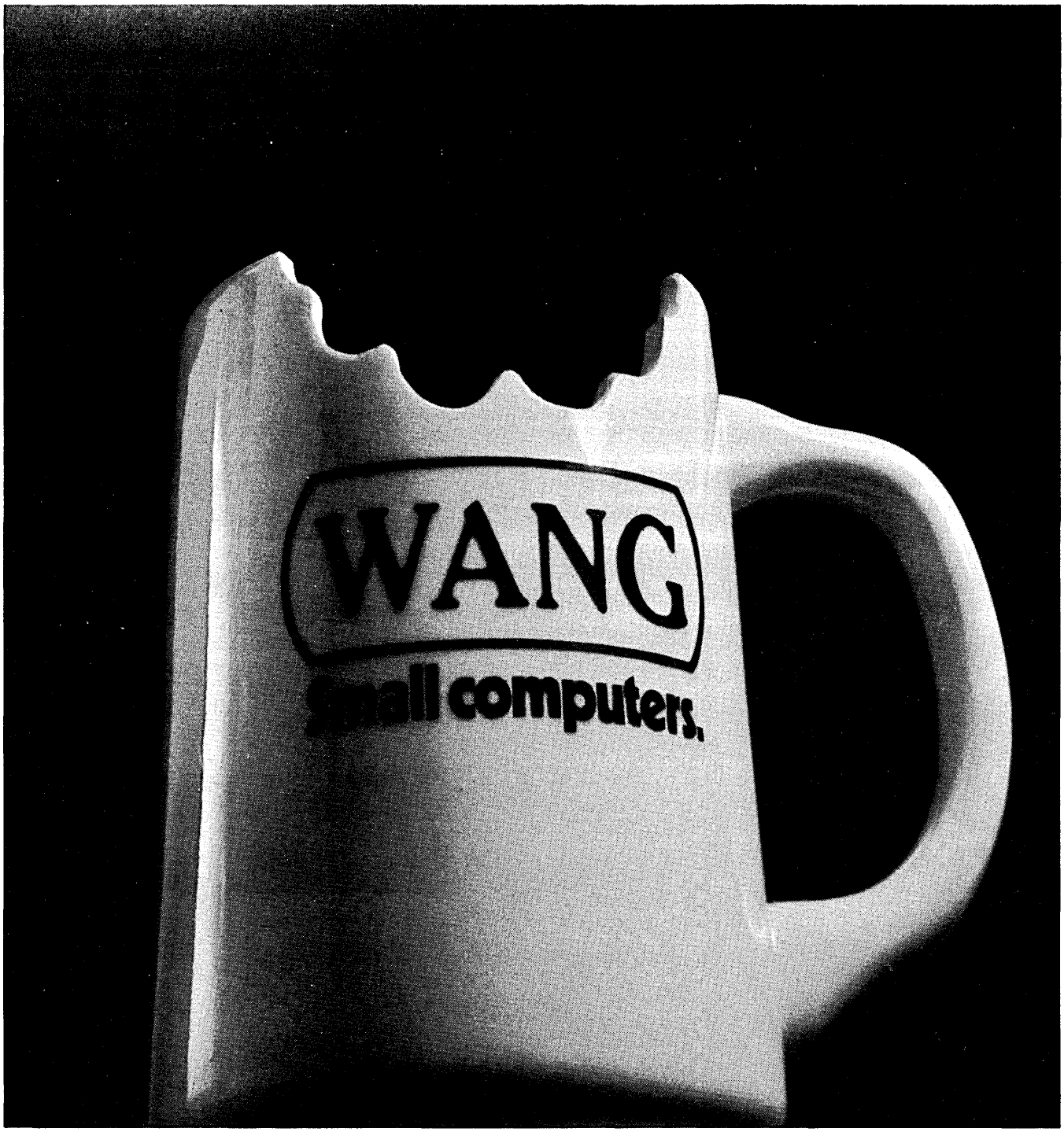
The Student Administration system consists of three interrelated programs: a student records program—which is a prerequisite for the other two programs—a student accounting, and student scheduling programs. Output generated by the student records program includes student profiles and schedules, class rosters, a master schedule of classes, course curriculum lists, instructor lists, instructor/room schedules, and student name/address labels. It is available for an initial charge of $945 plus $45/month. The student accounting program generates daily absence reports and phone lists, unresolved absence reports, school and student attendance registers, and calculations of average daily membership by grade level, special education groups, and out-of-district students. An initial fee of $1,050, and $50/month is charged. The student scheduling programs match students with facilities and time, and costs the user $1,260 and $60/month. IBM CORP., General Systems Div., Atlanta, Ga.

FOR DATA CIRCLE 325 ON READER CARD

Disc Utilization

The Automatic Disc Allocation System (ADAS) allows the sharing of disc capacity between partitions in IBM 360/370 DOS and DOS/VS systems, thereby eliminating the need to reserve separate partition work areas for compiles, sorts, temporary files, SYSLNK, etc. In addition, ADAS further conserves disc space by automatically deleting expired files and by also truncating unused space after a file is created. Other features include automatic file protection, secondary file allocation, automatic volume recognition, and file usage accounting. ADAS provides allocation of sequential, indexed sequential, and direct access files on 2311, 2314, 3330, and 3340 discs. ADAS can be rented for $140/month, or $2,800 for a two-year license. A 15-day trial is offered, and no modifications to the systems of user software are required. UNIVERSAL SOFTWARE INC., Brookfield, Conn.

FOR DATA CIRCLE 344 ON READER CARD ✲



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CIRCLE 222 ON READER CARD

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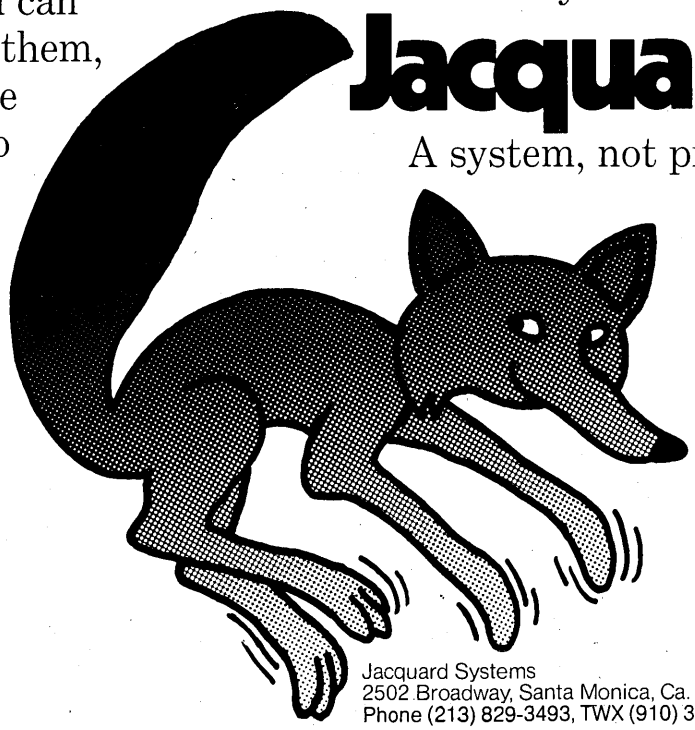

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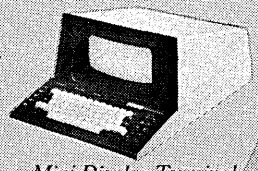

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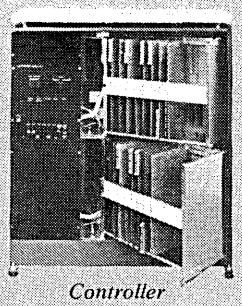

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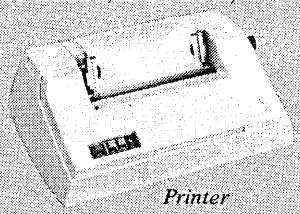

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Why Not PL/1?

A man once told me, while engaged in a long-winded discussion on just about every topic in the data processing world, that even if it were the best language in the world, capable of erasing his entire departmental deficit, he and his company "would never ever go PL/1." He was "not going to be sold a bunch of claptrap by any vendor, no matter how big and impressive."

To be totally honest, he is not the only data processor to use words to that effect over the last eleven or so years.

True, the PL/1 language was designed by a committee made up jointly of members from the user community and from IBM, and I must admit where anything designed by a committee is involved, I immediately become suspicious. But PL/1 has suffered, and continues to suffer, under many erroneous beliefs. Because this is so, many dollars and much effort is wasted.

It is time for a reassessment of PL/1, an examination of some of the myths, facts, and fiction surrounding the language.

There are many reasons why PL/1 has been rejected by companies and institutions. Not all of these reasons are valid. Some of them were once valid, some were never valid, and some reasons for rejection are still valid. Here are what I feel are the six major beliefs held by "opponents" of the language.

1. PL/1 is IBM's language

IBM did have the first commercially available implementation of PL/1, primarily because the company was involved in the design of the language. But even as early as the mid-'60s there were other implementations.

Today, every large scale computer vendor has an implementation of PL/1. Several of the minicomputer manufacturers are in the process of implementing it on their mainframes as well. Many universities, too, have developed PL/1 implementations, such as the PLC debugging compiler produced by Cornell Univ. In fact, one of the language's earliest and most notable uses was in the Multics operating system, which was later marketed by Honeywell.

Work continues on the standard for PL/1. Efforts are also underway to develop a subset standard after successfully producing a total language standard. By restricting the use of PL/1 to those areas defined in the standard, one will be able to move from one vendor's equipment to another. But remember, what locks you to a specific vendor is not so much the language you use, but the methods used to store data!

2. PL/1 is Inefficient

By its very nature, a high level language will be less efficient in using machine resources than an assembly language. You are trading off programmer efficiency for machine efficiency when you decide to write a program in an assembly language.

Anyone who has used PL/1 for a number of years will say that it was inefficient years back. Even considering the high

level aspect, it was inefficient. But PL/1 is different from other high level languages because it does so much more than the others. In fact, in the very early days of IBM's F Compiler implementation, some of the features were so complex that to get them to work at all was an achievement. Never before had commercial high level language provided stack storage, nor complete interrupt handling, nor dynamic block creation.

Yes, many of the features were implemented with a lot of room for improvement. But the implementors were learning, and by the end of the F Compiler days, large areas of improvement could be recognized. In 1971, IBM made available a new compiler that was vastly more efficient than its predecessor. The new product was such an improvement that, depending on the language features being used in the program being compiled, a good programmer could create as efficient a program as an average assembly language programmer could. And it would take less time to develop, and much less time to maintain!

I do not contend that PL/1 programs run circles around assembly language programs. Some inefficiency is certain to exist in a high level language. But at today's rising people costs and decreasing cpu costs, perhaps we can trade some machine efficiency for a reduction in program development cost.

At any rate, even if you are concerned about efficiency, hopefully your efforts are directed towards optimizing the bread and butter applications rather than making every program the ultimate in efficiency.

3. PL/1 is too sophisticated (complicated)

Anything that attempts to be all things to all people is not going to be simple; and PL/1 is no exception. In fact, I once saw a cartoon that very capably illustrated this belief:

A small fish encounters a jar and swims into it. Upon entry he discovers PL/1, and begins consuming aspects of the language, such as ABNORMAL and UNSPEC. After such consumption he finds himself so much bigger that he can no longer leave the jar; he is imprisoned within the language.

PL/1 is a powerful—and complex—language, of that there is no quarrel. It contains sufficient function to enable a shop to use one and only one language for almost all of the programming tasks it may encounter. However, its structure allows for the use of only those features that a programmer needs to accomplish a task. Since there are no reserved words, the programmer needn't concern himself with features he doesn't use. Many shops take advantage of this capability, and use locally tailored subsets of the language which not only makes PL/1 easier to learn, but more importantly, reduces its complexity.

4. It costs too much to train PL/1 programmers

These days it costs too much to train anybody and do it right. Many shops take the easy way out; they buy a programmed instruction course and let the programmer

trainee learn while writing bad code. The training the person receives is not how to write good programs, but what are the proper syntax and semantics of a given statement. He never learns which statements go together well and which don't.

Today in the education marketplace there are several good courses on PL/1; in fact, compared to five years ago, there is a veritable flood. Try to select a course that teaches how to write a good program rather than just how to write a READ statement. It will pay off in the long run because the programs will be better and will eventually cost less to maintain.

It really shouldn't cost any more to train a programmer to write in PL/1 than in any other language. Moreover, because of its powerful debug features (some of which he doesn't even have to learn), the programmer can recognize his errors earlier and with greater ease than in Assembler, COBOL, or FORTRAN.

5. It costs too much to convert to PL/1

When a shop considers conversion to another programming language, it must address the topic from two perspectives: conversion of personnel, and conversion of existing software.

I can't recommend that a shop using COBOL throw away all of its source and rewrite in PL/1. Once a program has been written, the benefits of one high level language over another are difficult to recognize at best. The programmer time and expense to rewrite all existing programs from one language to another just couldn't be justified.

People costs are something else though. Once you retrain your staff to write in PL/1, you will experience greater productivity from them. The language is designed and supported in such a way that much of the effort expended in providing a clean, well-running program has been reduced. For example, you will need fewer core dumps, fewer compiles, and fewer tests because of the diagnostics available.

6. PL/1 is incompatible with the software market

Unfortunately, this is true; but things are changing in some areas.

First, let's define what is meant by "packages." There are principally two types of software: the standalone program product, and the product that works in conjunction with programs written by the in-house programmer. An example of the first type might be Panvalet, and the second would be the data management package Total.

Not many of the standalone packages are written in PL/1. Most of them are written in assembly language, with an increasing number written in COBOL.

The reasons most standalone software packages are not written in PL/1 are most likely the low acceptance of PL/1, plus the necessity of a run-time library—which is not a very expensive feature. (The latter problem is not limited to PL/1; the newest COBOL and FORTRAN products also require such libraries.) Software vendors probably feel that if they did write software in PL/1, they would encounter much stiffer resistance to sales of their product.

Fortunately, though, PL/1 is not *in*compatible with the majority of the second type of software products. All existing data base/data communications software supports PL/1, as well as do many, many other packages. I should caution you however; *support* means many things to many people. If you are contemplating PL/1, check out carefully what you would need to do to integrate it into the software you have. "Support" probably doesn't mean an easy installation but, more likely, much work. Vendors of software tend

to place on the purchaser the burden of putting things together and making them run.

Now isn't the time to look at it

Having clarified some of the issues involved in the earlier decisions concerning PL/1, let's turn to reasons why a positive decision might now be made.

1. Over the last two or three years, you have probably seen and read many articles addressing the subject of structured programming. In many of these works, the authors have stated that PL/1 is superior to all of the other major languages in use today. They state this because PL/1 contains the three major constructs used in structured programming: SEQUENCE, IFTHENELSE, and DOWHILE. In addition, by its nature, PL/1 allows for the nesting of control structure. This can be a valuable aid to writing structured code.

With the newest release of IBM's PL/1 products, the language also supports four additional constructs: DOUNTIL, DOREPEAT, CASE and an escape construct, LEAVE. This means that PL/1 now directly supports all constructs used in structured programming.

It is hard to place a value judgment on this factor. If you are seriously contemplating writing structured programs, then it is of major importance, because it simplifies your task by making the program easier to write and easier to maintain.

2. PL/1 allows the programmer to get code running sooner. This is because of the superb debugging features of the language. Instead of giving a core dump, PL/1 tells you about your error in terms you understand, and then tells you where it occurred.

3. PL/1 will allow your installation to be a one-language shop. It includes features which enable you to accomplish the following without having to resort to some other language:

a. multi-tasking
b. message processing
c. bit operations
d. list processing
e. stack storage
f. VSAM (for IBM shops); in the new release, PL/1 will support MVS VSAM capabilities, including SKIP SEQUENTIAL, INSERT SEQUENTIAL, and Alternate Indexes.
g. array processing
h. stream I/O (a continuous stream of characters, like FORTRAN)
i. record I/O (the writing/reading of a block of storage, as in COBOL)
j. macro processing (which is being substantially extended in the forthcoming release from IBM)
k. string manipulation

The language contains over 40 such built-in functions to aid the programmer as well as reduce his work.

4. Because of the ANSI Standard, PL/1 is likely to continue to receive full support from the principal vendors.

I have tried to objectively present as many of the facts concerning the PL/1 language as I could. The reader can see that this is not an unbiased opinion, however; I am a PL/1 convert. I disliked the language at first, feeling that I would give up too much control over what I wanted to do compared to assembly language programming. What I failed to recognize then was that it was giving me increased speed in getting a program running and more powerful features which required less effort on my part to use.

I challenge each reader to go out and learn about the language. You too might be a convert.

—Lee Milligan

Mr. Milligan has been in data processing since 1959—as an operator, programmer, and consultant. Presently a language support specialist for State Farm Automobile Insurance Co., he has also been named the manager of the languages and standards division of GUIDE.

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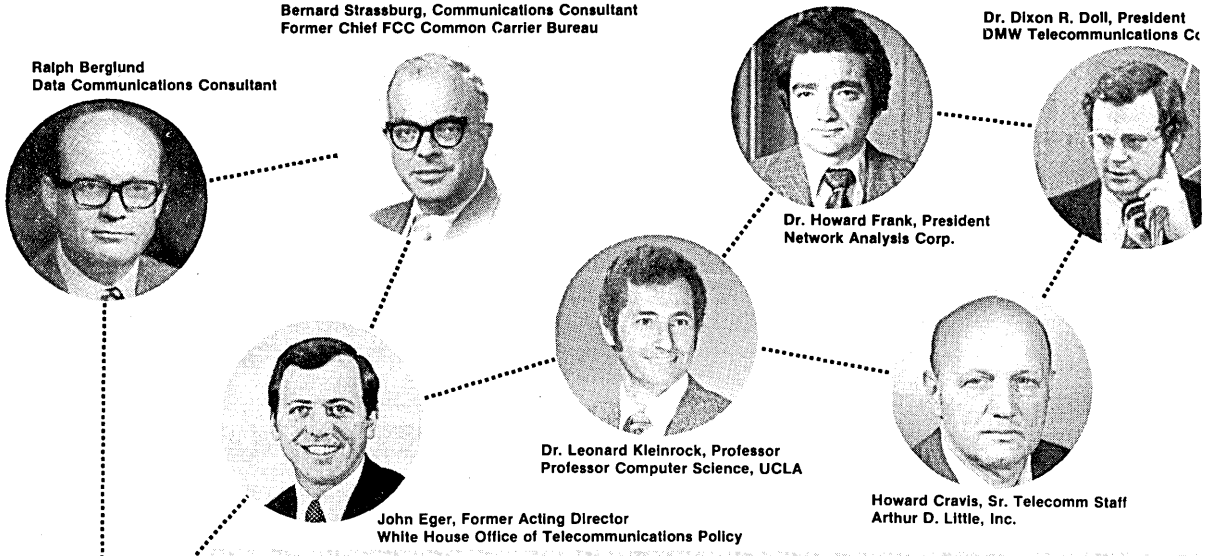

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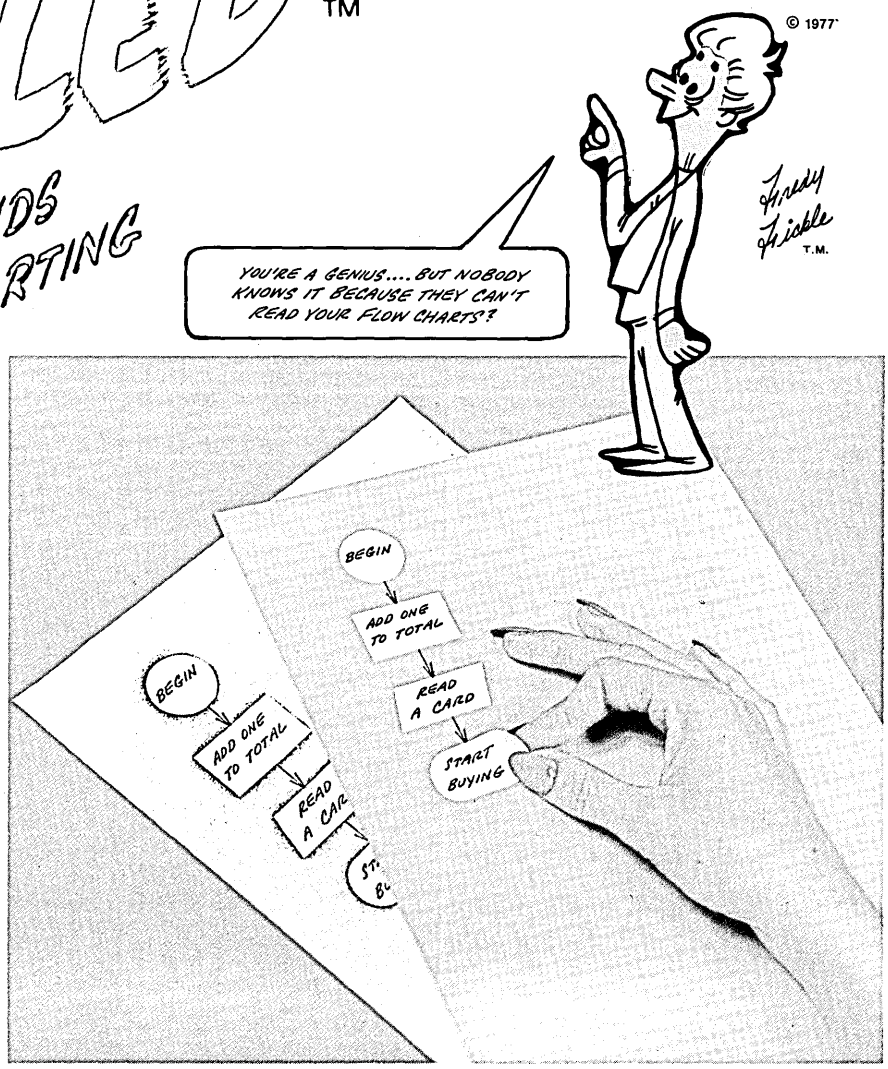

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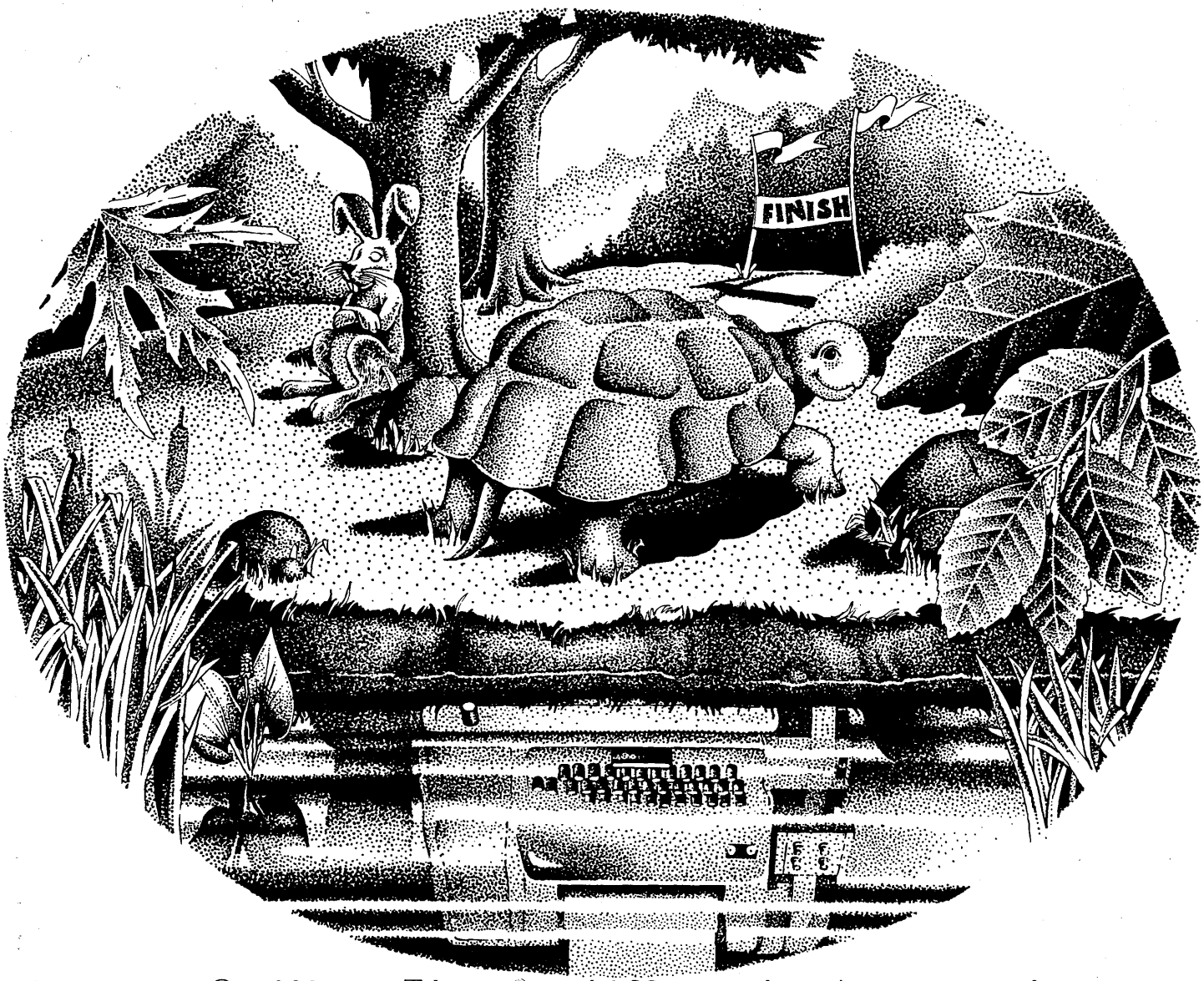

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