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April 15

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CIRCLE 1 ON READER CARD

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A better timesharing and data-base management system at half the cost of the others.

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- **RSTS-11 is inexpensive** . . . You can own a complete system for less than $50,000 ready for interfacing to your terminals. The architecture of the PDP-11 and RSTS software allows easy, modular, non-traumatic growth . . . but, you knew that. Terminals can be teleprinters, typewriters, or CRT's; fixed or removable disks can be plugged in at any time. Peripheral versatility guarantees RSTS-11 a long and useful life.

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digital

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CIRCLE 33 ON READER CARD

DATAMATION 71®

APRIL 15, 1971
volume 17 number 8

GENERAL

22 Ecology... the Start of Something Big
Legislation, expanded budgets, and governmental programs have locked environmental control into our future. But the edp industry must develop new techniques to meet the challenge of this major new market.

26 Simulation: the Road to Coexistence
A rational and comprehensive system of environmental simulation is difficult to achieve, but if we want to stop trying to subdue Nature and get along with her instead, it may be the only way.

30 Is There a System for Pollution Madness?
Congress has passed a bill providing for an environmental monitoring data system. Here are some of the problems involved in building such a system... and some approaches to their solution.

37 The Parfit Payroll
It's possible that that long overdue total revision of payroll may save enough money (and headaches) to put you in the hero league of Chaucer's "Verray parfit gentil knyght."

COMMENTARY

41 Perspective
Senator Sam Ervin's recent hearings on government surveillance activities will probably produce legislation controlling the operation of data banks and the protection of personal privacy.

A look at the method by which the Navy pursues the purchase of independent peripherals and how the commercial user can follow suit.

About the Cover

Belching smokestacks, the personification of industrial strength and full employment, have become symbols for the pollution which has fouled our air and water, and which now threatens to upset the delicate ecological balance upon which all life on this planet ultimately depends. Artist Byron Andrus' colorful city vibrates with power, yet it is clearly vulnerable to the dark and brooding atmosphere it has created.

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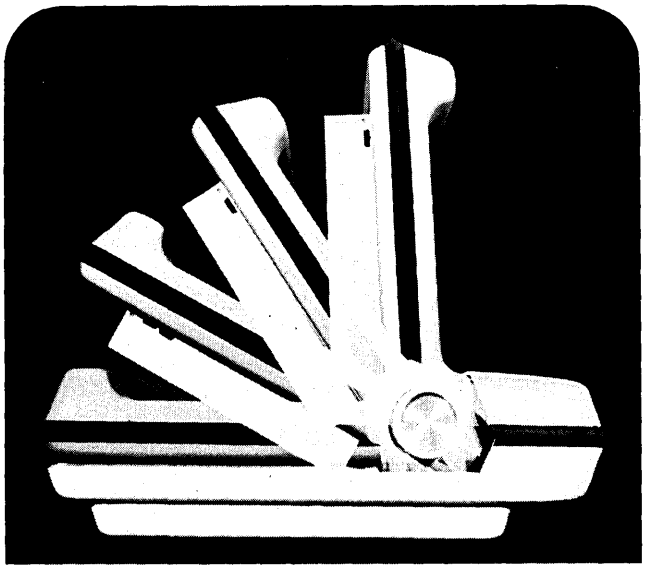

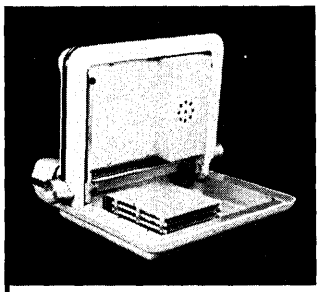

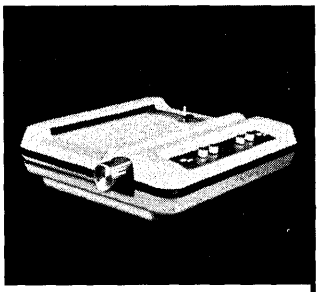

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CIRCLE 31 ON READER CARD

DATAMATION®

APRIL 15, 1971

volume 17 number 8

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ROBERT B. FOREST

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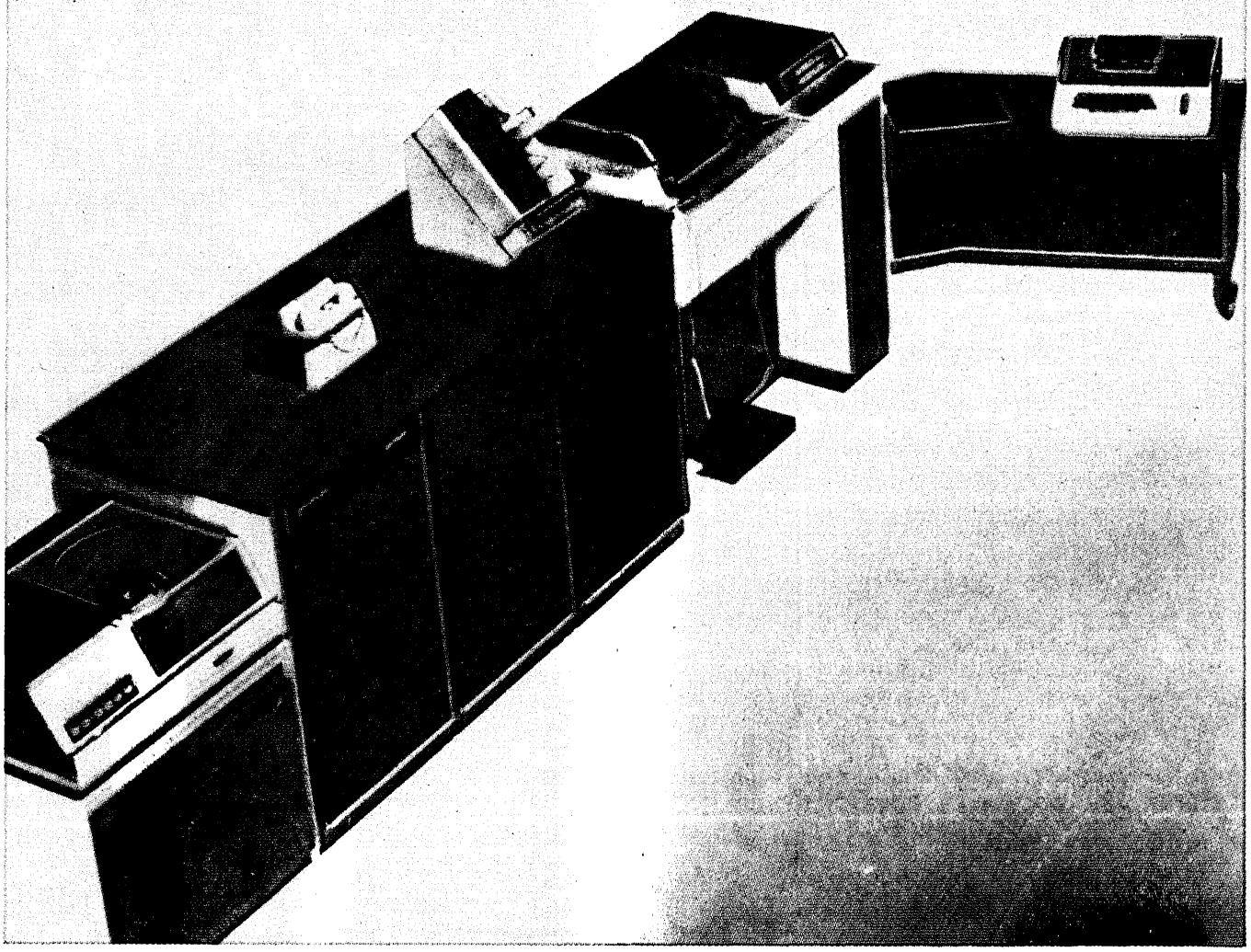
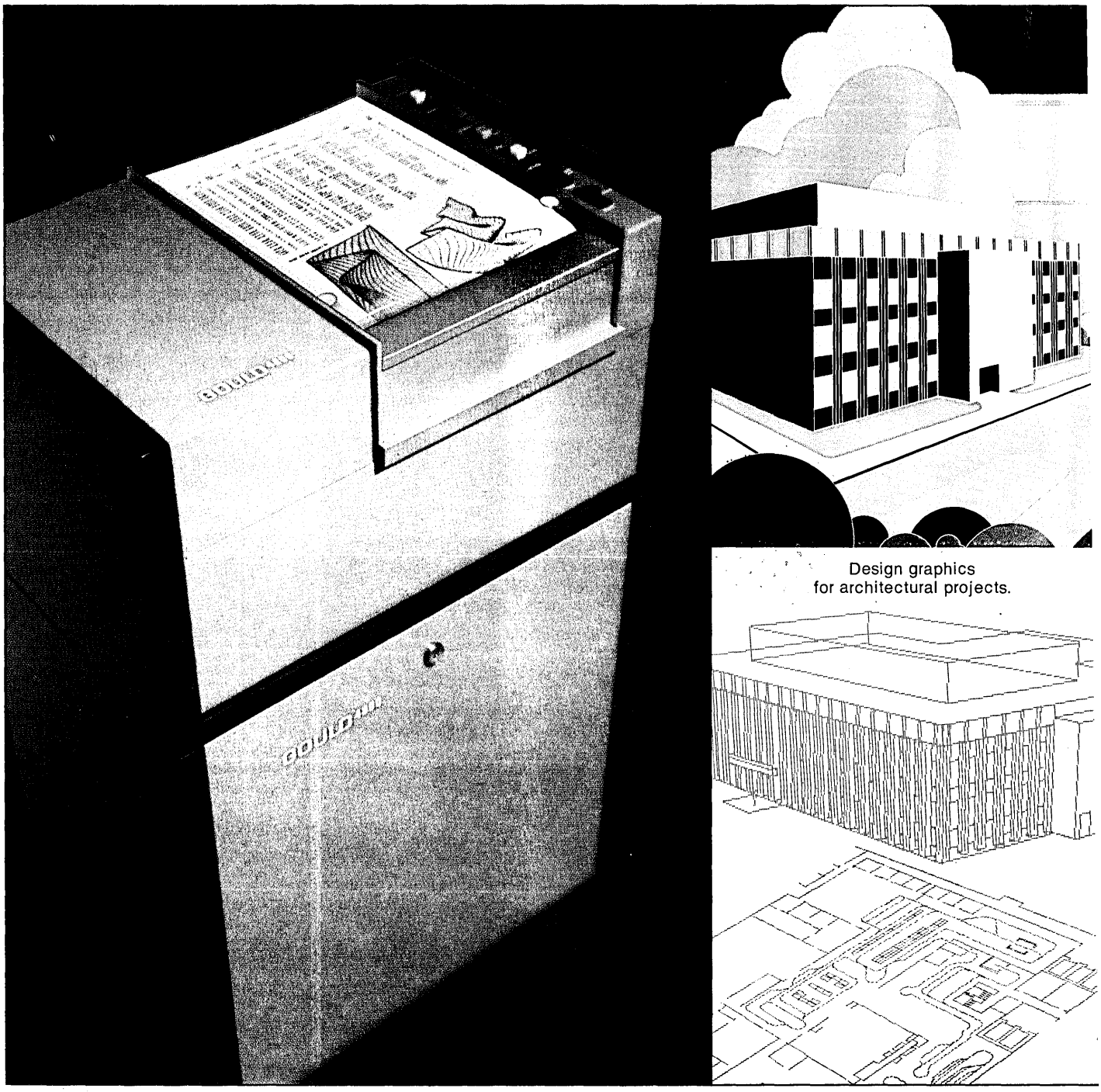


At SJCC Booth No. 1219

CIRCLE 68 ON READER CARD



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for architectural projects.

We helped pull the plug in the computer bottleneck.

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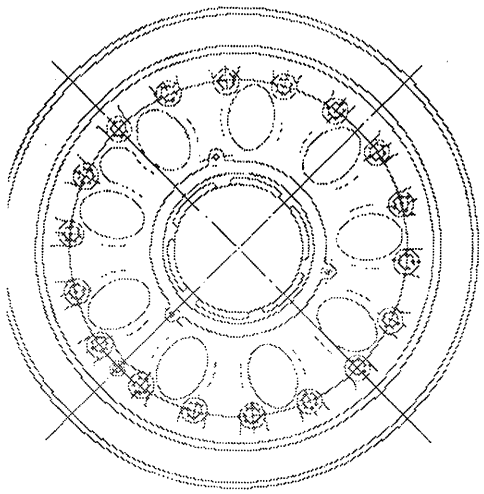
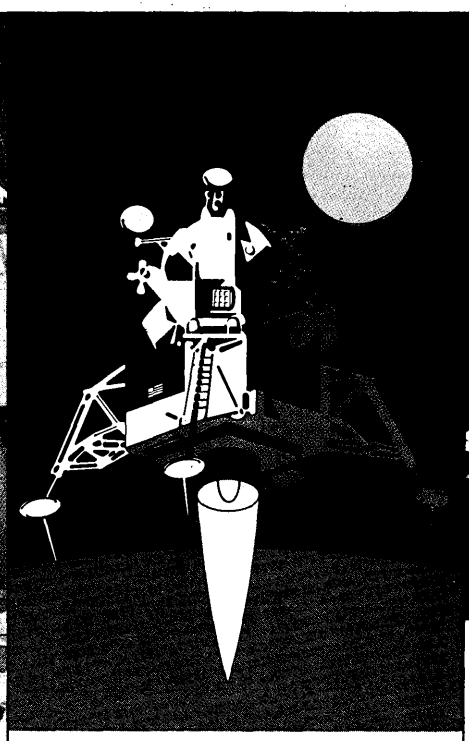
The Gould 4800 is electrostatic. So the

Computerized design for aircraft brake drum.





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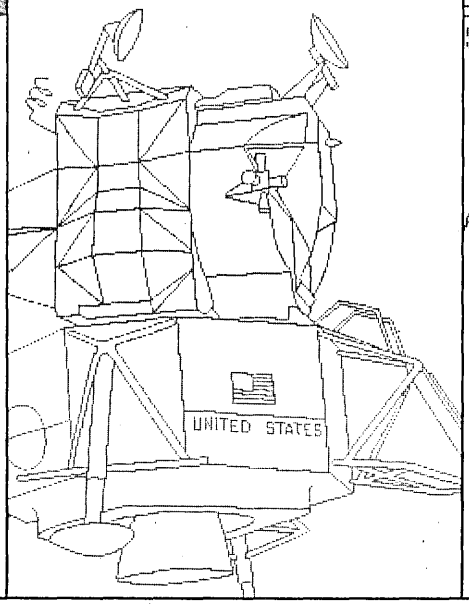

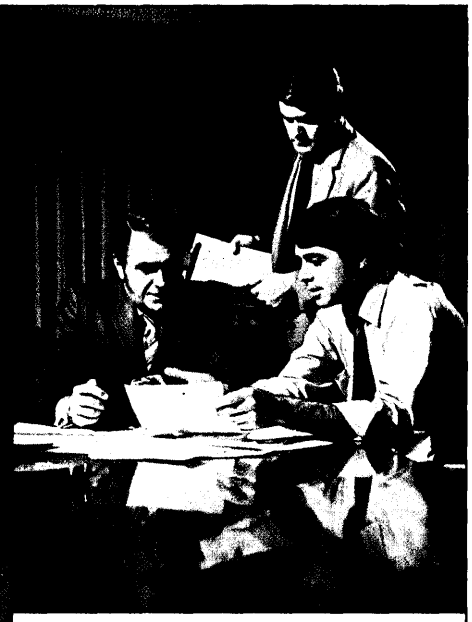

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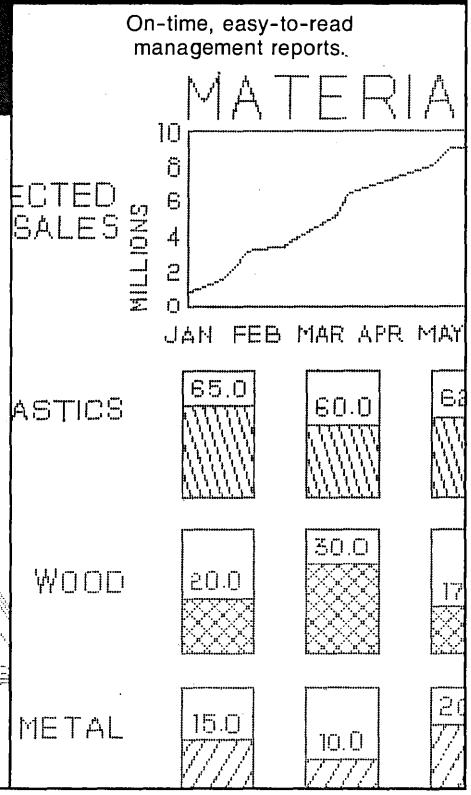

GOULD

clackety-clack of impact printers is replaced by silence. And people who get paid to think, get some peace and quiet for a change.

There are some nice options, too. Like a character generator. And a choice of 8½″ or 11″ format. We'll also supply software. Plus interfaces for almost any major computer.

Anybody who uses a computer can use it a lot more efficiently with a Gould 4800. It's another example of how Gould's Instrumentation Group puts hard-to-get information into easy-to-use form. Gould Inc., 8550 West Bryn Mawr Avenue, Chicago, Illinois 60631.

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LETTERS

U.S. granters

Sir:
I have just read, with dismay, Mr. James C. Hammerton's article on "Credit Clearance—the Slow Change to EDP" (Feb. 15, p. 36).

Mr. Hammerton seems to be misled by his company's sales literature. The facts are:

1. By the beginning of 1970, there were 10 major credit reporting computer centers serving credit granters, other than Credit Data Corporation. Five of these centers are a direct result of the CB360 Project, and the others were developed simultaneously and independently. The goal of 27 centers by 1972 will undoubtedly be exceeded, based on current efforts in various bureaus across the country.

2. It is *not* necessary to junk the existing credit file. This credit file can, and has been, very effectively, efficiently and accurately converted to become an even more valuable asset to the bureau, the credit granter, and most of all, *the consumer.*

3. The poor old tottering staff of the ancient bureau does *not* have to be early retired. These fine people can be easily retrained and phased into a modern reporting system. Our Houston bureau and others are living proof of this.

The article is inaccurate regarding the automation and the nature of the credit reporting industry. A fine example of verbal pollution.

ELLIS B. KIRKS
Associated Credit Services, Inc.
Houston, Texas

Mr. Hammerton replies:
With respect to Mr. Kirk's comments, I have had no opportunity to observe his operation in Houston at first hand. I understand it is a model of what a credit bureau can do, given the right combination of talent, resources, and managerial enthusiasm. However, my conclusion from observation of some 25 credit clearance operations is that the Houston bureau is—alas for edp suppliers—not typical of the industry of which it is a sample.

Shrinking violence

Sir:
I never thought that a company was prepared to stoop to murder to sell its products. Yet an advertisement (p. 79) in the February 15th issue portrayed an out-of-costume robot calmly making a body count of some human corpses using a source data entry device. How convenient and compact and efficient—and obscene. The ad was not clever but depraved and your staff may be in need of psychiatric treatment if human life and death can be played with in such a brutal and tasteless manner.

I am equally surprised that the editors of DATAMATION print any copy for which someone will pay.

EUGENE S. SCHWARTZ
Crete, Illinois

We could say they were making a used arrow, not a body, count, but we're sorry you were offended. Holding life cheaply was not the intention, however prevalent that attitude may seem.

Mich. mash

Sir:
Re the letter from Mr. J. N. Lambrecht in the Dec. 1 issue: I well recall hexadecimal programming of the old MIDAC (Michigan Digital Automatic Computer) at the Willow Run Laboratories of the Engineering Research Center of the Univ. of Michigan at Ypsilanti, Michigan, back in 1955. MIDAC was constructed there after the pattern of SEAC. It was

largely salvaged components from the MIDSAC—a machine especially constructed for trajectory computations some years earlier. Chief memory of MIDSAC was a real-time simulation of a billiard game with crt display. I recall comments on the difficulty the innovators had with selection of suitable coefficients of elasticity of balls and cushions—and wild resulting games.

MIDAC, as a general purpose machine, sported full alphanumeric I/O Flexowriters as well as "high speed" paper tape readers and punches. It had a full system of three address operation codes, 512 words of mercury delay-line memory used as random access and ERA drums as auxiliary memory (with full block transfer commands). Addressing was absolute, relative to the instruction location or relative to an index register or any combination—all in the hardware. Although a compiler/assembler was available (called MAGIC), virtually all of my work there over several years was in hexadecimal machine language. A remote station with full I/O including a Typotron character crt display was frequently used for "hands on" debugging although it was ¼-mile from the mainframe. Hexadecimal characters were: a, b, c, d, e and f. I recall considerable difficulty in maintaining the balance in my checkbook in decimal while engaged full-time in hexadecimal programming.

During one period of a few months, I engaged in hexadecimal programming of MIDAC (a-f), the Bendix G-15 (u-z), and the Royal Precision LGP-30. I think you misprinted the character set of the latter. It was: f, g, j, k, q and w. We chanted: "Flexowriter Groans, Just Keeps Quietly Writing." Reason for "odd" character set of the LGP-30 was that many other letters were assigned as operation codes: a for add, d for divide, s for subtract, etc.

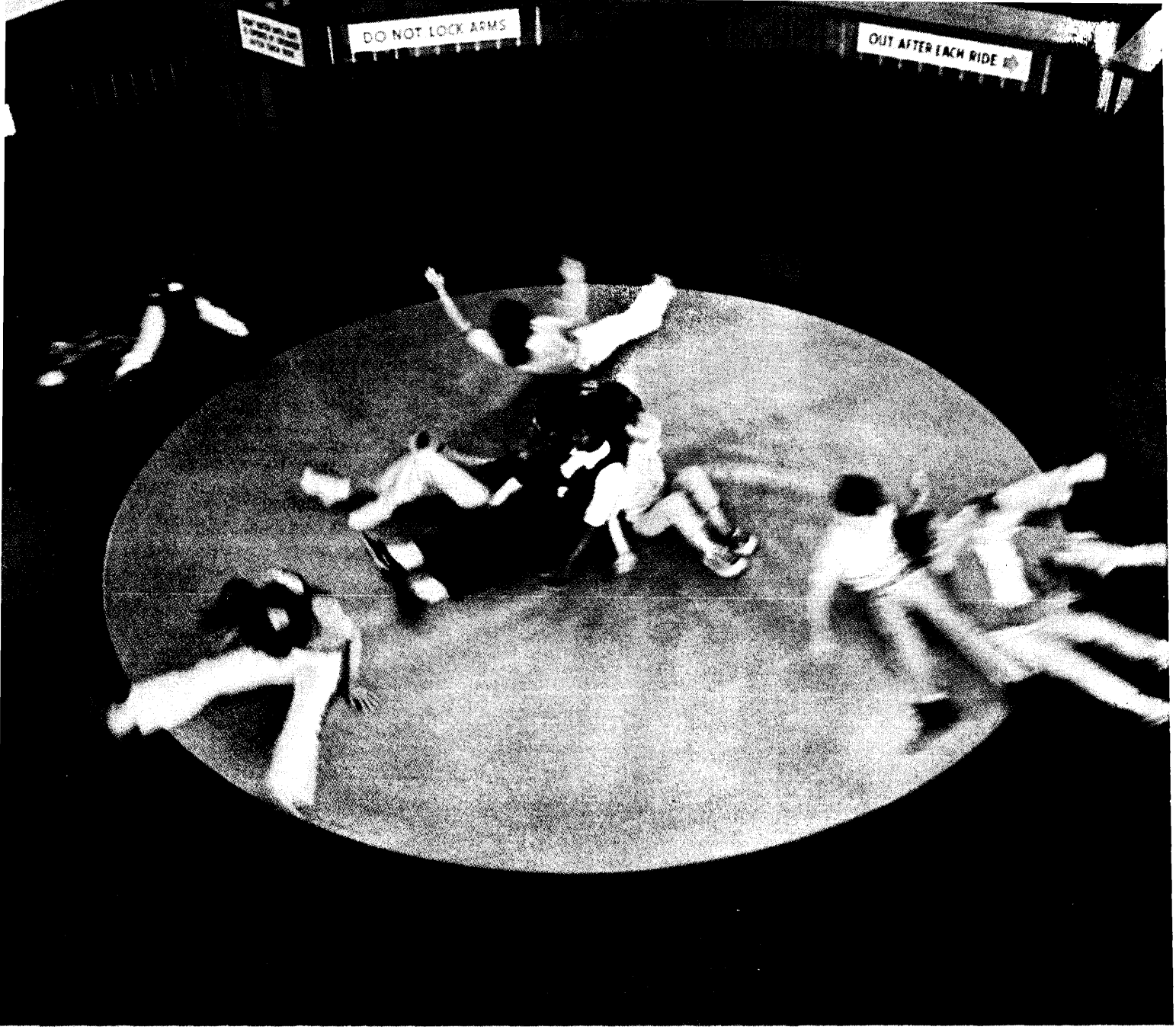
The old hexadecimal language wasn't too bad after one became familiar with it. To this day, I hesitate overlong when adding nine plus one. Takes a microsecond or more to decide between 10, a, u or f.

JAMES L. KLOOSTERMAN
Sault Ste. Marie
Ontario, Canada

Factor fancy

Sir:
I read with considerable interest the article entitled "De Ludi Natura" (Feb. 1, p. 34). In a recent publication, "A Structure of Man-Machine Diagnostic Information Systems: Implications for Human Engineering Research and Design" (Dec. 1968, AD 689766), I argue that the area of "information design" is a rapidly expanding area badly in need of human factors engineering research and applications support. As part of the structure that I presented, I included software.

It is most encouraging to find a nearly identical point of view belong-



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Centrifugal force causes the magnetic oxides to fly off randomly in all directions within the coating. It makes them bunch up in some areas. And fail to show up in others. That's why spinning's not good enough for our disc packs.

We spray our coating on. Our exclusive process is called Uni-Spray.™

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Write for our Uni-Spray brochure. Memorex Corporation, Information Media Group, Computer Products, Memorex Park, Santa Clara, California 95050.

MEMOREX

ing to at least two members of the software profession. It is, however, even more discouraging to note that little progress has been made in this area on the part of human factors engineering. This is due both to the lack of acceptability of the concept by other engineers and the relatively small number of human factors engineers available to do the necessary work.

Readers who might be interested in the field of human factors engineering are urged to contact Mrs. Marian G. Knowles, Human Factors Society, P.O. Box 1369, Santa Monica, California 90406.

ROBERT G. MILLS
Wright-Patterson AFB, Ohio

Up for adaption

Sir:
The observations made by Lucian J. Endicott, Jr., and Peter H. Huyck are interesting and well taken.

They note that ". . . whether a program will in fact perform the function for which it was designed depends on its internal construction and its external environment," and that systems design involves adaptive processes as adjuncts to goal-oriented activity.

An example of this in the aerospace field is the designing of a computer system for the Thermoelectric Outer Planet Spacecraft (TOPS) by the Jet Propulsion Laboratory. This craft is being designed for a 12-year mission time span of virtually unattended operation, a design problem that requires many self-adaptive features (ref. Benn D. Martin, "Data Subsystems for 12-year Missions," *Astronautics & Aeronautics*, Sept., 1970, pp. 55-61).

As Endicott and Huyck point out, in the natural world living systems are adaptive to the environment. But this applies not only to the forces of organic evolution (long-range adaptation), but to the stimulus-response mechanism (short-range reaction) as well. Therefore, systems design should include a time-span factor over which processed information results are expected to be conformable to reality within some limits. To ignore these is to risk "over-designing," i.e., make more sophisticated than necessary, as well as the possibility of "under-designing" for the problem.

Secondly, the flexibility required of a system is closely related to the flexibility required for the organization as a whole, and it is entirely possible that problem representation can never be entirely known. It should be recognized that all information systems designs contain implicit or explicit assumptions about the probable range of responses required, and that these organizational response requirements are as much of an influence on information systems design as problem representation or human factors.

GERALD R. DEMAAGD
Grand Rapids, Michigan

Planning researched

Sir:
There is one small error in the News Scene piece on Planning Research Corp. in the Feb. 15 issue (p. 52). You used the name PRC Data Services as one of the new companies formed from divisions. This should have been PRC Systems Sciences Company, under George Monroe. We do have a subsidiary named PRC Data Services, Inc. This has been and continues to be under Jack Little as president and was not involved in the recent reorganization.

RALPH COURTNEY, JR.
Planning Research Corp.
Los Angeles, California

Made in Japan

Sir:
I am glad you printed a full report of the U.S. '70 Solo Computer Conference in Tokyo (Feb. 1, p. 40) and compared it to a business-like FJCC. Your readers could see that the Japanese are well tuned to the best in U.S. computer technology.

We should not give readers the false security of thinking there was a language barrier at the technical sessions. I saw a flood of questions (written) at one session. They asked many questions on the U.S. market and its competitors.

If the Japanese attendees were quiet, as you reported, we can probably expect a loud response from Japan soon, in the shape of better computer products.

GEORGE W. PATTERSON
Nashua, New Hampshire

Metamorphosis

Sir:
The long, arduous and tactful work of ANSI's Keyboard Standards Committee deserves high praise for the results presented in the March 1 issue (p. 32).

After getting all those code charts, logic bit and typewriter pairings and inboard control modes correct, it is too bad that the authors, themselves, ended up misidentified in the credit box. For those who might be interested, the names under the photographs should read Tropsa, Ancona, Garland, left to right.

Incidentally, Mr. Tropsa is now chairman of the ANSI committee for developing standards for coded keyboards.

FRANCIS L. KAFKA
Micro Switch Division of Honeywell
Freeport, Illinois

Now badgering

Sir:
The purpose of this letter is to call attention to your erroneous statement that I have done consulting work for the University of Michigan. Instead, my biographical sketch in your March 1, 1971 issue should have indicated that I am now consulting with the University of Wisconsin.

EINAR STEFFERUD
Santa Monica, California

Obsoletely useless

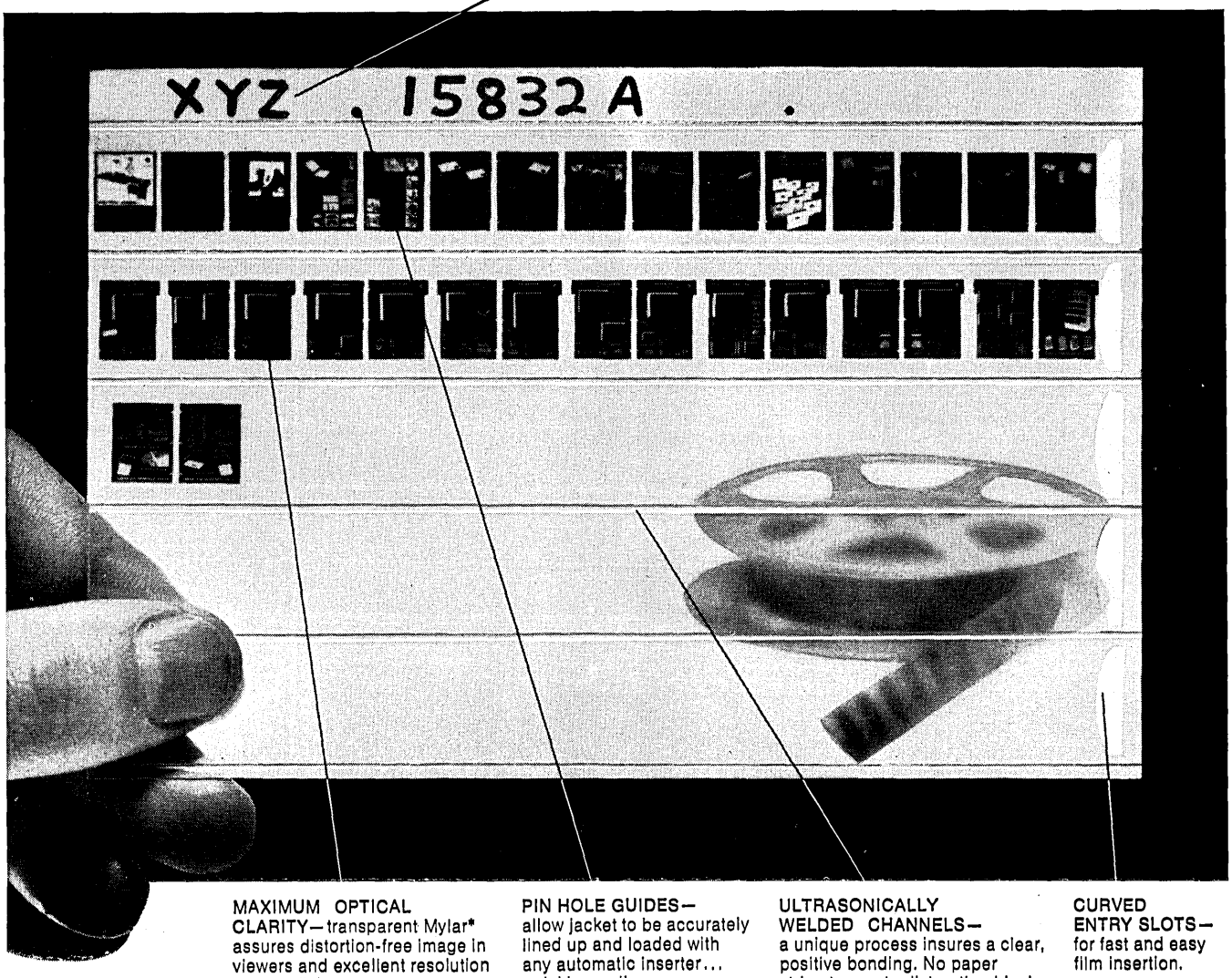
Sir:
One of our programs here at Queensborough Community College (part of the City University of New York) is a two-year career program in Computer Technology, in which we train technicians for careers in computer and related fields. We are fully accredited, and have some excellent study programs as well as first-class laboratories.

But one of the courses is more electro-mechanical in nature, and deals with I/O equipment, which is hard to come by. What we need is any kind of defective I/O gear, such as printers, card readers and punches, tape and disc drives—stuff that is absolutely useless to anyone else, yet which could be disassembled by students and studied. We would like to ask your readers to either contribute or suggest contributors of such defective equipment. If it fell off a truck, was drenched in a flood, barely survived a fire, has been obsoleted by ten newer models—fine; it can still have some educational value.

PETER A. STARK
Queensborough Community College
Bayside, New York ■

"If this doesn't convince you to buy our microfilm jacket...

RIGHT READING INDEX—an exclusive Wilson Jones feature—this special coated area allows an identifying title to be written or typed on the *front* of the film jacket. No need to turn jacket around to identify material. Title remains right reading on copyfiche, too! Saves time, prevents error.



MAXIMUM OPTICAL CLARITY—transparent Mylar* assures distortion-free image in viewers and excellent resolution on copyfiche.

PIN HOLE GUIDES—allow jacket to be accurately lined up and loaded with any automatic inserter... quickly, easily.

ULTRASONICALLY WELDED CHANNELS—a unique process insures a clear, positive bonding. No paper strips to create distracting black lines in viewer or on copyfiche. Exclusively Wilson Jones.

CURVED ENTRY SLOTS—for fast and easy film insertion.

maybe a free sample will!"

Wilson Jones M16B 16 mm Microfilm Jackets are competitively priced—immediate delivery in bulk quantities. See your Office Products or Data Processing dealer today. For a free Microfilm Jacket sample and informative catalog describing Wilson Jones complete line of Microform Retention and Retrieval Systems, simply fill in the coupon on the right.

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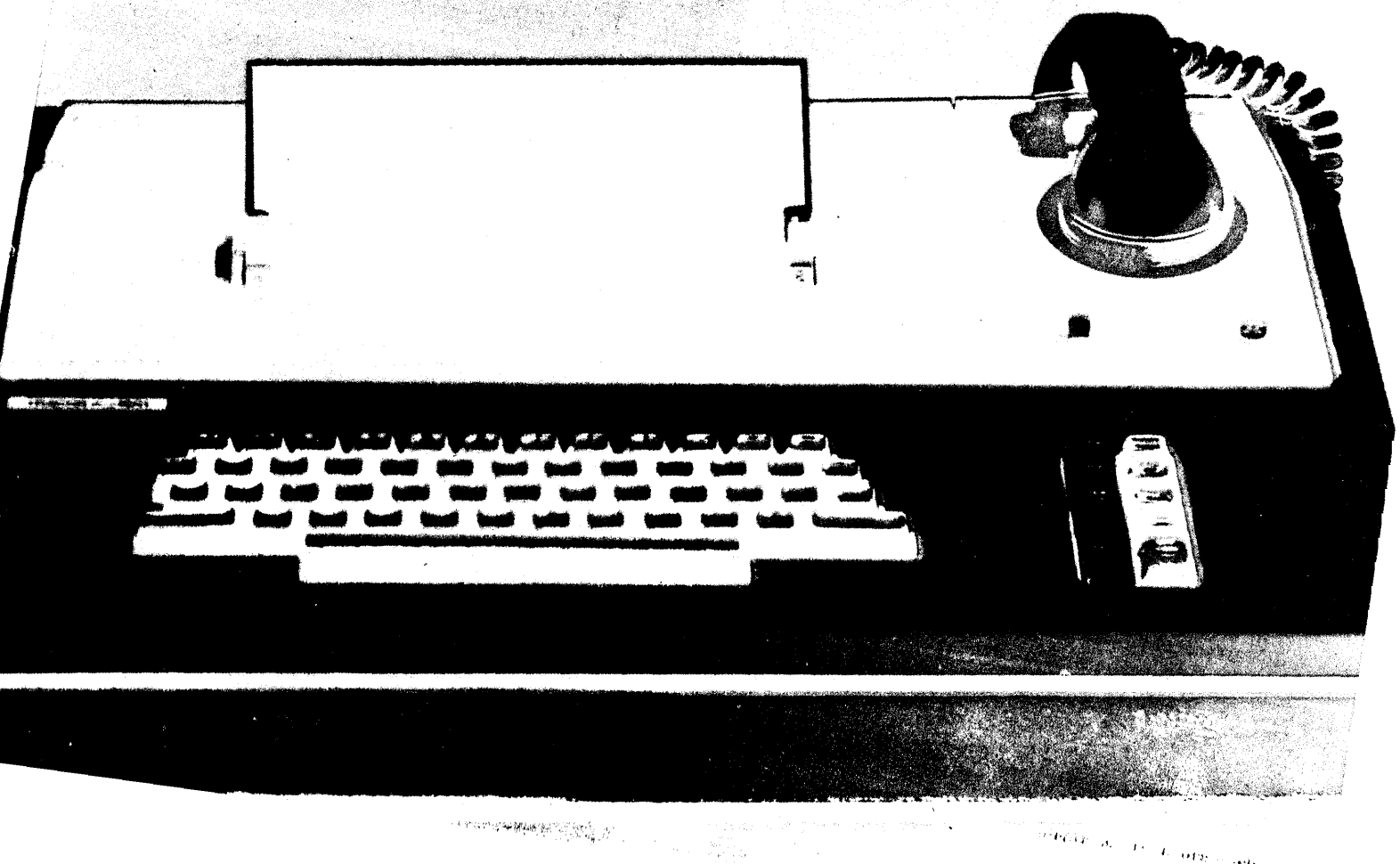
You ought to have our printhead examined



TRACOR DATA SYSTEMS

At SICC Booth No. [illegible]

...try a Teletype® 37
...and look
into mag tape!

We don't have a crystal ball. And rarely resort to mystic means in recommending what terminal should be used for a particular data communications application.

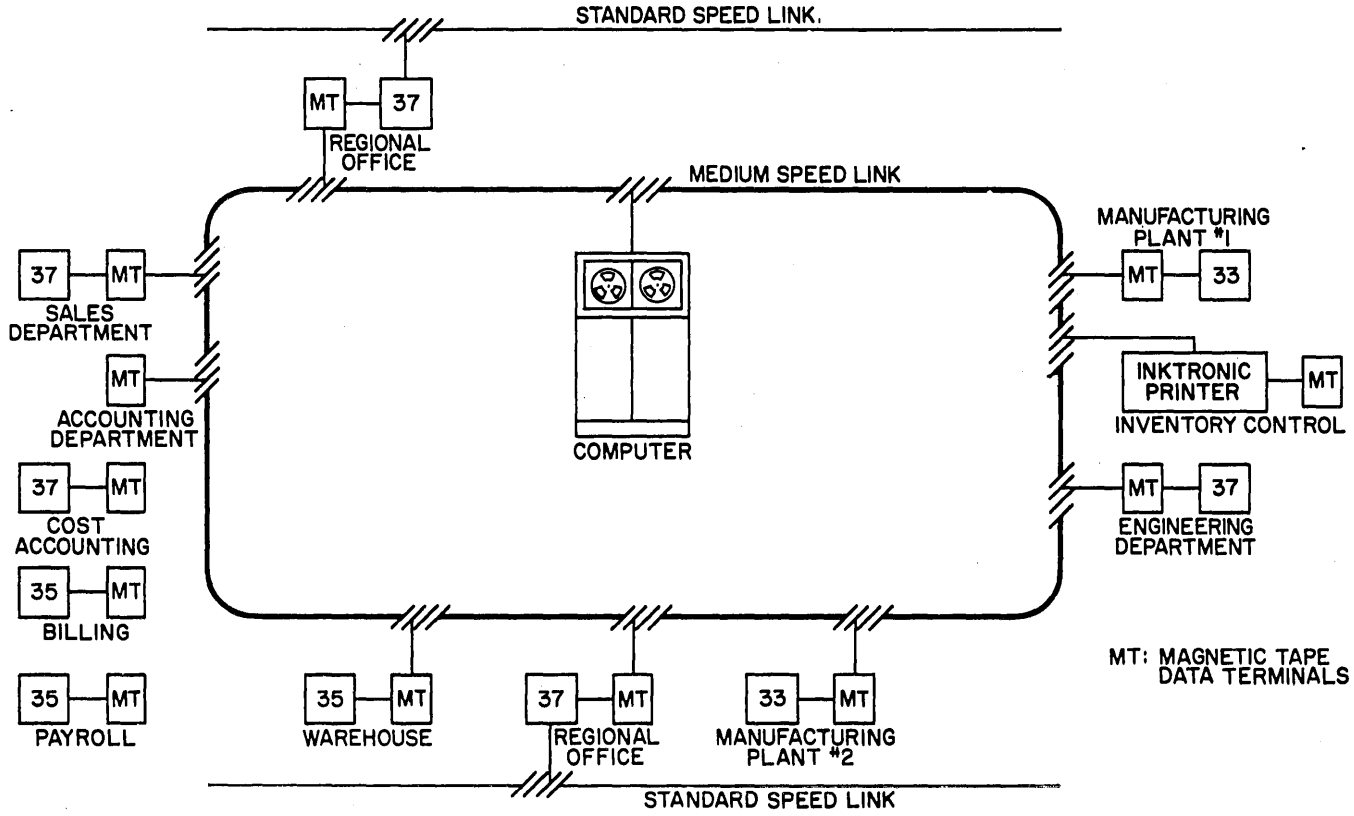
Some of the things, we at Teletype look at, that make the job a little easier are these:

Distribution	Volume
Urgency of message	Language
Frequency of use	Accuracy

The diagram below demonstrates how you can fit a number of Teletype terminals into a system based on function and usage requirements. Magnetic tape makes the speed and language of various terminals compatible. In this hypothetical case we use one computer program, one major line control procedure, one computer port, one type of data set per link. And deliver greater data through-put per on-line dollar. Using terminals that offer the best capabilities within each station's communication situation.

Using Teletype magnetic tape data terminals, combined with various Teletype keyboard send-receive sets, you obtain some unique system flexibility. And the on-line time saving aspects of operation are really dramatic. Magnetic tape data terminals can keep data flowing on-line at up to 2400 wpm.

In the example shown, the manufacturer has linked sales, engineering, accounting and inventory control departments to a central office computer. As well as manufacturing plants, warehouse and regional offices. He's covered all critical data points with a common medium speed link, using a variety of terminals. Magnetic tape data terminals make it possible.



DATA COMMUNICATIONS

equipment for on-line, real-time processing

Routine aspects of the system are maintained in standard speed links. Branch offices are tied into the regional office terminals on standard speed networks. Regional offices batch routine branch office data on one magnetic tape. Transmit the data to the central office processor at one time. Saving a number of additional computer port requirements.

Since data generated at manufacturing plants is urgently needed, but volume is low, low-cost model 33 terminals are used here. The warehouse data volume is higher, but not complex, so a heavy-duty model 35 is working here.

Volume requirements are heaviest in the accounting department. Cost accounting, payroll, billing and invoice payment functions generate data all day long. Here magnetic tape is prepared off-line at various terminals. And an on-line stand-alone magnetic tape terminal is used to transmit data to and receive data from the central processor.

Sales and engineering departments are equipped with Teletype 37 terminals. But for different reasons.

This terminal offers engineering people some unique format flexibility. Half-line and full-line forward and reverse line feed can be used to communicate complex equations and engineering formulae to the processor. It is possible to add special graphic engineering symbols to the normal compliment of letters, numbers and punctuation marks found in the typebox (up to 32).

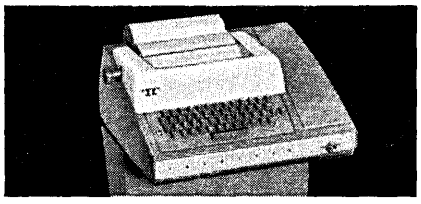
The sales department uses the model 37 for order processing. It has on-line vertical and horizontal tab set control, and form feed platen (optional) which makes data transmission and reception on multiple copy business forms easy and economical.

At the inventory control point, this manufacturer has an urgent need to obtain printed page copy of large volumes of inventory items. Magnetic tape is used to feed data to the processor and a Teletype Inktronic® KSR set receives data and prints page copy on-line up to 1200 words per minute.

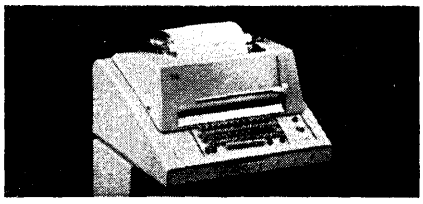
As you can see, Teletype's modular terminal design allows you to use various units as building blocks to meet the most demanding system needs. Teletype also has the station and error control accessories necessary for more efficient and economical data communications operations. Since cost is a very important part of the mix, Teletype offers greater terminal capabilities on a price/performance basis than any other manufacturer.

If you're involved in designing a teleprocessing, time-sharing, remote batch or computer switched system; looking into a multi-point private line, point-to-point private line or switched data communications network; talk to Teletype about terminals. For ideas, equipment and understanding, you'll find no better source. Anywhere.

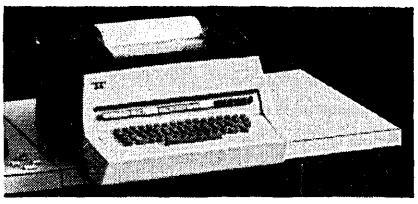
Teletype data communications equipment is available in send-receive capabilities of up to 2400 words per minute. If you would like specific information about any of the equipment described here, write: Teletype Corporation, Dept. 81-16, 5555 Touhy Ave., Skokie, Ill. 60076.



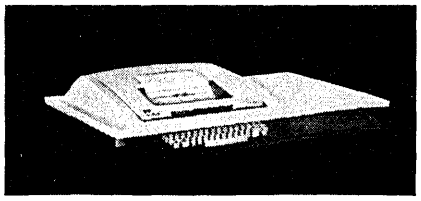
model 33 series: *An extremely low-cost 100 wpm terminal line. Uses ASCII. The most widely used terminal in time-sharing systems today.*



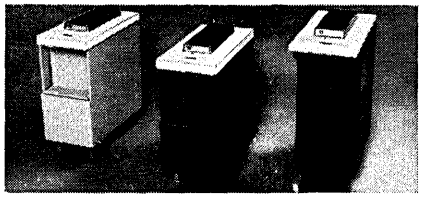
model 35 series: *A rugged, heavy-duty line of 100 wpm terminals. Uses ASCII.*



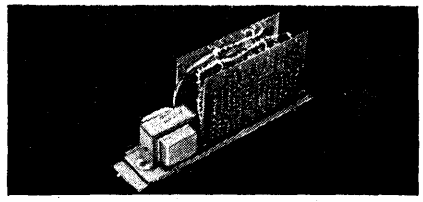
model 37 series: *One of the most versatile heavy-duty terminal lines going. Generates all 128 characters of ASCII. Operates at 150 wpm. Prints in upper and lower case.*



Inktronic® data terminals: *A unique electronic, solid state terminal. Prints up to 1200 wpm. Forms characters through electrostatic deflection (no typebox). ASCII compatible.*



magnetic tape data terminals: *Use compact reusable tape cartridges. Operate on-line at up to 2400 wpm, and connect "locally" to lower speed Teletype terminals using ASCII.*



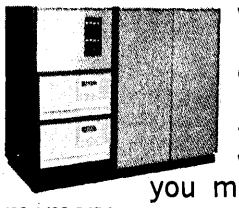
Stuntronic™ accessories: *Electronic solid state terminal logic devices offering many control options. Such as, automatic station control, error detection and correction capabilities.*

Teletype is a trademark registered in the U.S. Pat. Office

machines that make data move

TELETYPE

CIRCLE 16 ON READER CARD



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We've found another way to save you money on your memory.

This time it's the Bryant 2200. A direct access storage facility that could be the greatest thing in memory systems since the elephant.

It's plug to plug compatible with the IBM 2314 and 2319.

It's a perfect match for the IBM 360.

It can use IBM discs or anybody else's, for that matter.

You can get service in less than two hours.

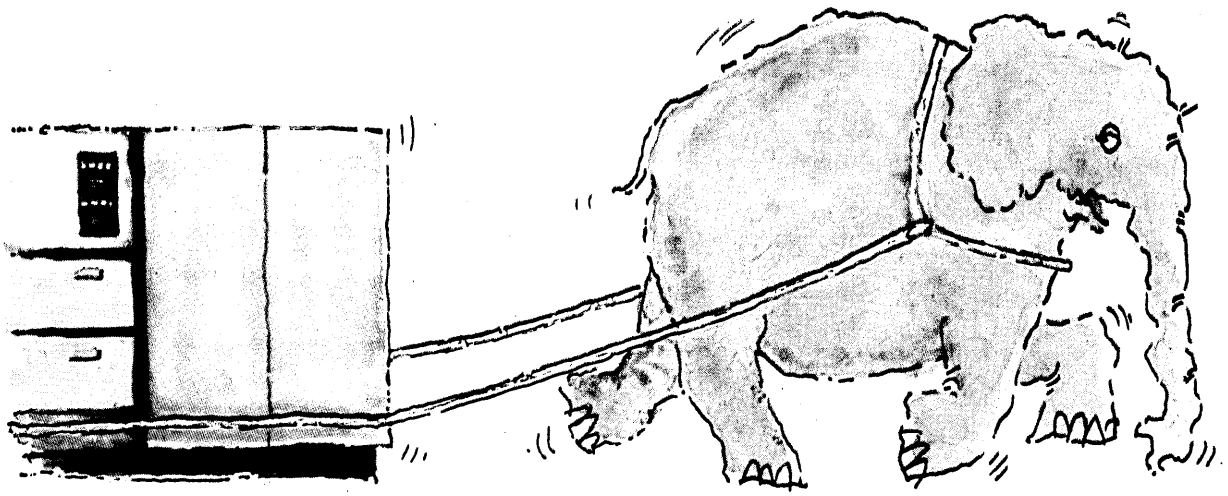
You can get the 2200 with a controller and a single drive unit. Or, if you really think big, a controller and up to four dual drive units, with a single drive unit as a spare. If you have a mind for the 2319, we also offer a three drive version.

And you can get them for substantially less than the IBM 2314 or 2319.

A fact that should make your accounting department leap for joy.

If you'd like to look before you leap, remember to call your local Bryant representative. Or write to 850 Ladd Road, Walled Lake, Michigan 48088. He'll show you why, when it comes to memory systems, the people who build brains, usually pick ours.

The new Bryant 2200. Another great leap forward.



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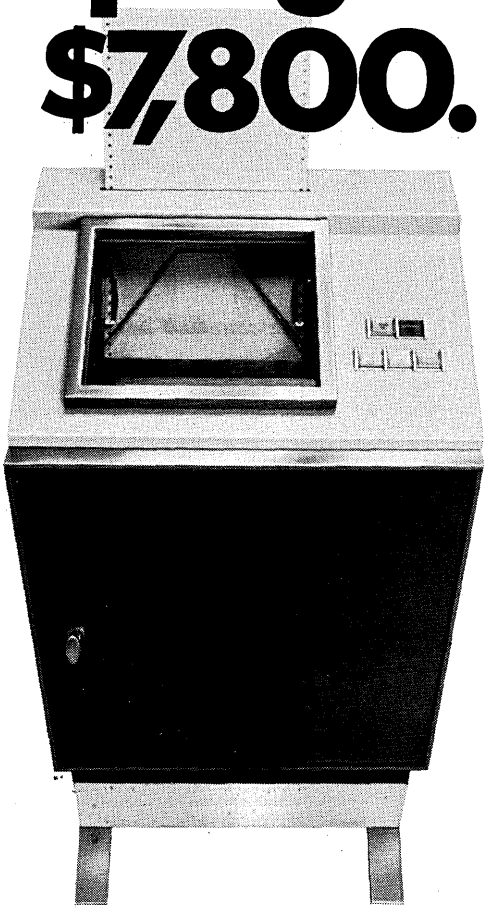
If your mini-computer is a PDP-8, HP-2116, Varian 620, Honeywell 316, 516, etc.

Just plug us in. $7,800.

Our low-priced Vogue/Shepard 880 Series Printers come equipped with a full 80 column line memory and complete interfacing, including software, connectors, cables and computer interface cards for immediate connection to your mini-computer. All for the price of the printer itself.

What's more all of our 880 Printers incorporate our uniquely designed combination of ink roller reliability and patented, drum-impact, ballistic hammers that gives you six clear copies of data. Five copies more than you get with non-impact printers at no extra cost.



And at $7,800 installed, our 400 lpm printers cost a lot less and do a lot more than any competitive printers around. Without interfacing, complete system is available for only $7,000. Quantity pricing available, of course.

For information about the printers with the extras built-in, write: Shepard Division/Vogue Instrument Corporation, 131st Street at Jamaica Avenue, Richmond Hill, New York • 11418 (212) 641-8800. TWX 710-582-4796

The Vogue/Shepard 880 Series Printers

Don't pay extra for the extras.

Good news! Kodak KOM microfilmers now give you microfiche.

The microfiche you see above holds 208 pages, plus title, that were recorded from magnetic tape by the Kodak KOM-90 microfilmer in less than thirty seconds. And with remarkable clarity, thanks to the new Kodak Versaform camera.

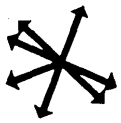
It lets you convert tape data to 16mm, 35mm, 82.5mm, and 105mm film at 24X and 42X reduction ratios. The camera is retrofittable to KOM-90 microfilmers already installed.

Whether your application requirements call for roll, strip, fiche, or tab-card-size formats, all are possible using the Versaform camera. Couple this with one of several available computer-generated indexing systems, and you have one more reason to select Kodak for all your COM needs.

Find out more about Kodak's total COM systems responsibility. Ask your Kodak systems expert for details or write Eastman Kodak Company, Business Systems Markets Division, Dept. DP 540, Rochester, N.Y. 14650.

Kodak Microfilm Systems

CIRCLE 64 ON READER CARD



TSO DELAYED FOR TESTING OR CODING

Close on the heels of Burroughs' concession that some 6500 software was late (for which Wall Street mercilessly whipped its stock), IBM has told users that the time-sharing TSO system delivery has slipped from March to June. (Note to Wall Street: software delays, while no virtue, are not unusual.) IBM said the TSO system, which operates under the recently delivered Release 20 of OS/360, needs more testing. But a user says the problems of "unspectacularly slow performance" call for coding changes.

CAMBRIDGE ENTERS 360 MEMORY LANE PARADE

Latest entry into the "extend 360 life" sweepstakes with a main memory extension product is Cambridge Memories, Inc., of Newton, Mass. The product, like that of such other suppliers as Data Recall, Fabri-Tek and Information Control, is a core memory upgrade for models 30, 40, and 50 of the IBM 360 line. (See March 15, p. 48). Cambridge, by the way, will show a 500K bit block oriented random access memory at the SJCC. It uses a new high density domain top technology (DOT).

Meanwhile, Information Control plans to bring out Corpak 3, a memory upgrade for the System 3, model 10. The company says it knows of 56 users who need more memory on their mod 10s.

RCA-BASED HILTON RESERVATIONS SYSTEM

The first internal, automated reservations system for large hotel chains and the basis for a full-fledged automation package for hotel chain use has been developed by a Transamerica subsidiary. It's called NORTH and is the first offering of the firm, Compass Computer Services Inc. Developed jointly with the Hilton Hotels, it will be based initially on two RCA 2s.

Plans call for serving the entire 60-unit Hilton Hotel chain and some 75 franchised Hilton Inns by the end of the first quarter of '72, only then to be made available to other large chains. The next step, says president Pat Morrison, will be to automate hotel back office accounting and guest ledger processing, followed by modification of the system for use by hospitals.

IBM DOESN'T WANT TO SPEAK THE LANGUAGE

Although IBM may continue to fight it, another step closer to a universal data description language independent of all processing languages has been taken. After 17 months and 179 proposals for change, the revised proposal of the data base task group has been completed, approved, and sent on to the programming language committee of CODASYL. Almost all 14 members, including the Navy and foreign member ICL, approved it. The resounding "no" came from IBM, whose 71 proposals for change, since the first DBTG report in October '69, contributed mightily to the delay of the revision, we hear. Said one observer, "IBM's stand, especially since it had every opportunity to make changes, indicates it will continue to be against standards efforts which lead to program transferability

and hence to less user dependence on one vendor's product." A user who disagrees with the report also disagrees that IBM has been a stumbling block to standards.

In addition to containing the foundation for a universal data description language, this extremely important report also contains COBOL language extensions for describing the data in a data base and a COBOL data manipulation language. The committee hopes this work will be the basis for such extensions in other languages.

Sources think the report, still subject to many steps and votes before getting CODASYL and ANSI approval, will be fought by IBM, which nevertheless is investigating implementation of the DBTG specs. Other manufacturers who have approved the task group's effort, like Univac, are implementing data management systems based on it.

OPTICAL MEMORY PRICE IS CUT

Lower component costs are being credited in price cuts for a read-only optical memory system announced only a year ago. A 25% drop, to 3¢/bit for a 100K-bit model in quantities of 100, is due this month by Optical Memory Systems, Santa Ana, Calif. Prices will get down to a penny a bit two years from now, according to OMS's Don Foster, with even lower prices in volume. Foster says it's due to lower costs for the light-emitting diode, on which the system is based.

FRONT-ENDER TO BE BUSINESS BOOSTER

To boost business, an 1108-based remote batch service bureau has plans for a new front-end processor and a new service for distributor organizations. Soon offering an on-line order-taking/inventory system is Computation and Systems Corp., L.A., once part of Jacobi Systems. Under new president Tony Meterna, the company will be one of the first users of the front-ender being developed by Time-Zero Corp. of nearby Torrance. The processor uses some of the technology developed by Jacobi when it was working on a mini t-s system called Minits and when Time-Zero was supplying the controller.

RUMORS AND RAW RANDOM DATA

We hear Burroughs has already built three B-1500s, which should be announced within a few months. It probably won't be a stand-alone system, but operates as a satellite processor to the B-3500, and is a "soft" machine that will emulate IBM 1400 series and other systems...There are rumbles of price-cutting by systems engineering vendors, some rates dipping down to the $16-18/hr range but these may be for marginal quality SEs. IBM's rates stay unchanged, one observer notes, but they're now estimating time requirements below those of competitors...An answer to Inforex competition is due this month from Computer Machinery Corp: the System 5. The computer based data entry system will handle up to seven 105-key stations and offer tape and disc storage...We erred. IBM did exhibit at IEEE (an 1130) and will be at DPMA in Houston.

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Environmental control is locked in to our future – but new edp techniques are needed

Ecology...the Start

In the latter half of 1970, a new domestic issue emerged in American life. Words like "ecology" and "environment" suddenly entered our everyday vocabulary—the ecology movement was born. The skeptics were not far behind, asking: Is ecology just a new motherhood issue? How does one get a handle on something as broad as ecology? And (as the readers of DATAMATION might ask) what possible impact can something as nonspecific as ecology have on such a highly disciplined activity as data processing?

Ecology talk will die out, as all clichés do. ("Ecology" is probably a misnomer in relation to what is intended by this term—it is a branch of biology which is not always applicable to the engineering and political gut issues involved.) But it also is more than talk—it is an expression of the general awareness of the vulnerability of the environment and the fact that population, pollution, and water and land use problems are far more prevalent, more visible and better understood than ever before.

> **. . . environmental control is now locked in to our future by legislation, expanded budgets, and governmental programs.**

This awareness is not the result of accident. It is partially a result of the growing sophistication of the public and the increasing visibility of our cities, wildlife areas, and the earth itself resulting from travel and mass communication media. It is also partially a product of many years of public relations on the part of pollution control and conservation groups. As a result, environmental control is now locked in to our future by legislation, expanded budgets, and governmental programs.

As recently as December 1970, a new federal superagency was created, the Environmental Protection Agency (EPA). EPA was constituted from agencies, formerly located in other branches of government, concerned with air pollution, water pollution, solid waste management, pesticides, and radiation standards. The combined budgets of these agencies, which ran at $300 million per year, has recently been increased to well over a billion dollars. Total federal expenditure by all branches of the government specifically earmarked for environmental pollution is now almost $2 billion dollars, and is predicted to increase by $100 million/year over the next three years. Comprehensive environmental agencies have been created in such states as New Jersey, Illinois, Washington, and Oregon—and others are following. Funding by state and local governments is now running 40% of federal expenditures, and industrial expenditures may reach $10 billion in the next ten years.

The ecological imperative now emerging works by

# of Something Big

by Mel Weisburd

imposing environmental protection requirements on the functions of almost all branches of government, particularly the Department of Transportation, Department of Interior, Department of Housing and Urban Development, Department of Commerce, and Department of Agriculture, many of which maintain environmental quality councils, committees, and operating units. The imperative states that whenever a transportation system, airport, trash disposal system, a building complex, or a commercial product is designed and produced, the effect on air pollution, water pollution, waste, noise, aesthetics, and the surrounding environment must be considered in a meaningful way. Ecology, therefore, is not only a viable movement, but a market diversified by many customers, products and services.

The information processing industry, however, is faced with a paradox. On the one hand, data processing is clearly the only basic technology by which society will ever be able to comprehend and secure control over the environment. On the other, the nature and direction of environmental control technology presents an ominous sign that the information processing industry, particularly "software-only" houses, as presently oriented, may not fully participate in the market. One reason this observation may be true is the priority given to industrial hardware development and the difficulty of factoring information processing requirements out of the basic engineering, scientific, and administrative context of the environmental field. Indications are that firms which combine engineering with computer processing may benefit most from the ecology windfall, although large centralized and network facilities are clearly coming in the future. (See the article by Dr. Ouellette, et al. on page 30.)

. . . environmental control technology presents an ominous sign that the information processing industry . . . may not fully participate in the market.

Basically, the name of the game is preventing and controlling pollution at the *source* by a change in fundamental technology (improved vehicle transportation and propulsion systems, improved fuels, recycling of waste materials, etc.) by restricting, curtailing or otherwise regulating pollution-causing activities; by wholesale changes in the physical location of pollution-causing activities; by regulating human activity and life-styles (urban planning, new towns, highway planning, transportation systems, zoning, etc.); or, as will be the case, various combinations of all of the above.

(Continued on page 24)

Massive control efforts in the foreseeable future obviously are not likely to be 100% effective. We cannot change our way of life, or the basic technologies on which we depend too radically or too quickly. The cost of control to *everybody*, by whatever method of control we choose, increases geometrically as the 100% control level is approached. The degree of control possible at any time is a function of feasibility and economics. Control practices, therefore, are based on cost/benefit considerations which, as everyone knows, are sometimes resolved scientifically, sometimes politically.

The uncertainties surrounding this procedure create a demand for large quantities of data to quantify trends in deteriorating environmental quality, to identify the contributors to pollution, to write laws, and to evaluate progress. Data are needed to establish the effects of pollution on man, animal, and materials; the prevalence or occurrence of pollution in any environmental resource; the factors causing pollution-accumulation (meteorology, hydrology); the pollutant interactions involved (chemistry, biochemistry); and the relative contributions from the diverse industries and activities responsible. The last is particularly noteworthy. Every major human and economic activity contributes to pollution problems. These are classified and inventoried; the contributing engineering and behavioral parameters are identified and analyzed to establish where controls can be most effectively applied. Every major aspect of our industrial economy is thus subject to data collection, data processing, and data analysis applications.

Four general levels of information systems may be defined:

1. *Scientific information management systems.* These are systems designed to collect, store and retrieve information primarily on the toxic effects of a growing number of chemicals and other substances being introduced to the public and to the environment. These are essentially scientific, bibliographic, and combined file search systems which access host-agent-response factors associated with any substance. The information classification systems used, in effect, are based on a biological-ecological framework. Systems of this type are used at the highest level of integrated environmental protection agency organizations, particularly in the federal government, for standard setting, planning, and policy-making purposes.

2. *The management information systems.* These are no different in principle from other management information systems known to the industry. Fully implemented systems of this type, however, are not markedly evident in the environmental protection field as yet, due to rapidly changing organizational structure. But they will very likely be introduced in the near future as a necessity to deal with problems of data aggregation at various reporting levels, report standardization and summarization, and upward reporting procedures (from state to federal) arising from the bringing together of many agencies and functions with differing histories and practices under one operating framework. Prior to the institution of such a system it will be necessary to determine the common technical, administrative, and program structures (as between air and water pollution, for example) not only for improving organizational efficiency, but also in the development of common software. Obviously, there will be problems, but the MIS route is the primary means by which a responsive comprehensive approach to the environment will be possible.

3. *Environmental surveillance systems.* This class of information system, as well as those described below, represent the operational systems applied mostly by state and local governments. These are systems applied to the continuous or intermittent monitoring of pollutants to determine air/water quality; pollution damage to health, organisms, vegetation, or property; pollution trends and as a means of evaluating the effectiveness of pollution control programs. Monitoring is accomplished by means of automatic or manual chemical-specific sensors. The data may be reduced from strip charts or processed through an analog/digital device. The monitoring stations may be linked in a region-wide network and the data telemetered and stored in a central computer system. Only a few systems of this latter type exist now. The number of monitoring sites will continue to undergo a rapid increase in the next five years.

4. *Environmental control systems.* These systems are used primarily in establishing and implementing an enforcement or pollution reduction strategy particularly on the part of local and state agencies. They include collection and stor-

© DATAMATION®

age of inventories of pollution sources and their emissions or discharges; equipment licensing and permit procedures; inspection scheduling systems; and legal case files. Pollution sources are registered by means of a questionnaire, physical inspection, and engineering review. Actual field testing of emissions and discharges from factories and other sources are also frequently conducted—the data collected becomes a part of the routine data processing function.

The greatest application of information systems may occur in this area. Source registration operations, for example, may be required in more than 200 regions in the United States which do not have them now. Some of these will be integrated air/water pollution functions, most will be single purpose programs.

While the above represent the primary types of information functions, a multitude of other special purpose software applications will be involved, including environmental simulation models on both the micro and macro-scale, econometric and resource allocation models, process control systems, computer graphics, emergency response and real-time systems, vehicle inspection systems, continuous stack gas monitoring systems, epidemiological data banks, poison control centers, and so on.

From the standpoint of the data processing industry, doing business in this field in the next few years will be difficult. Despite its great potential the market is indecisive and presently unresponsive to the usual vendor promotional and marketing appeals. General purpose software and the use of proprietary software are practically unknown in the field. The application of data processing is currently on a reinvent-the-wheel basis. Line items for software expenditures cannot be found in the budgets of the operating agencies. Here are a number of reasons for the current reluctance of the market:

. . . the market is indecisive and presently unresponsive to the usual vendor promotional and marketing appeals.

1. Pollution organizations are primarily engineering and chemically oriented, and demand that contractors have experience in these areas. Software projects in many instances tend to go to organizations which have a prime engineering and applied science capability.

2. Pollution control organizations as a whole are not experienced software consumers and by and large do not know how to accurately specify software, or to take advantage of sophisticated data processing technology. This situation should change as the field grows and younger people move into the administrative ranks.

3. Political and administrative decisions relating to legally prescribed planning procedures must be gotten out of the way before the scope and functions of applied software can be defined. These involve decisions concerning the method and degree of control, delegation of the power to control, and the costs of control.

4. The initial requirements in many instances are small and relatively unsophisticated, particularly with respect to smaller agencies.

5. Many traditional pollution agencies do not have direct access to a computer, or currently are low priority users of a government-owned centralized computer center and must accept unreliable service. This situation is likely to improve.

6. State and local buying practices are, for the most part, geared to the purchase of hard goods and services. Existing software projects run generally below the $150K level and are frequently let on the lowest price, responsible bidder basis.

Facing these difficulties head-on is the price that must be paid in moving from the military and commercial applications area into the environmental control field. While there are great risks, these are not necessarily insurmountable, and are similar to others that the software industry has faced in other application areas.

The price that must be paid is the price of commitment and relevancy and the recognition that aerospace and commercial accomplishments are not always directly or immediately transferable to the environmental area. (The fault lies more in the attitude towards the customers and selection, packaging and marketing of software.) Many software firms are perhaps beginning to realize that they may not be able to survive by software alone in many market areas but may have to acquire or develop a field testing, engineering, chemical, biochemical, instrumentation or other capability in order to get in on the ground floor or to compete in the future.

From the standpoint of data processing, the environmental field has barely begun. Many of the current attempts to build software for the field will predictably fail because of unrealistic funding and procurement practices, lack of in-house experience, and inability to define requirements. Also, the state of the art may not be quite up to the ability to deal with ecological requirements which are global in scale and which call for large, complex data bases and the use of simulation models. Both hardware and software development is called for. Organization of the new Environmental Protection Agency, and subsequent program integration, however, are a clear indication that large-scale computer projects are in the offing. ■

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Environmental simulation is difficult, but how else can we learn to get along with Nature?

Simulation: the Road

In 1970, the environmental crisis became a major concern of people in virtually all of the industrialized nations of the world, and especially in the great metropolitan centers of those nations. In the United States, the recognition of an environmental crisis came somewhat suddenly; following the occurrence of a massive oil spill in the Santa Barbara Channel, which caused serious disruption of fishing and resort businesses in the affected area, popular movements demanding better protection of the environment burgeoned and gained momentum. This impetus was to a large extent responsible for the creation, on January 1, 1970 of the Council on Environmental Quality, and the establishment, at the end of the year, of the Environmental Protection Agency.

These events constituted an historical breakthrough, in that they reflect the first official recognition, by the federal government, of the global ecosystem as a power in the world of nature. And they implied an intention, on the part of the government, to seek a *modus vivendi* with that power. The policy of conquering and subduing Nature at every turn was to be replaced; henceforth, *mirabile dictu*, the policy would be to seek coexistence.

. . . the belated discovery that Nature has ways of fighting back . . .

The new attitude may have been fostered especially by the belated discovery that Nature has ways of fighting back, to the sometimes acute discomfort of her adversaries. But the determination to call a truce, to give up some if not all of our profligate ways, is only the first step in what must become an important priority in western society—the restoration and protection of the global ecosystem, and of the many local ecosystems constituting man's local environments.

The course of reconciliation will not necessarily be smooth. As Barry Commoner[1] has pointed out, "Ecologically faulty technology is now so massively embedded in the nation's system of productivity that any effort to change it is bound to cause very serious economic disruptions. For example, if all of the sulfur dioxide were recaptured from smokestacks, the reclaimed sulfur would be sufficient nearly to wipe out the nation's present sulfur-producing industry."

But the effort is long overdue, and we may hope the tools of system analysis will be cogently employed, as a part of that effort.

To envision methods for halting or reversing environmental deterioration, it is appropriate to explore both the basic causes and the detailed symptoms of deterioration. According to Commoner, one reason for the current critical scale of this deterioration is that most of our technological processes – modern agriculture, industry and transportation – have achieved a scale which matches that of the corresponding natural processes of the ecosystem. Thus, current methods of sewage disposal introduce into our waters enough organic matter to consume a major fraction of all the oxygen contained in all the river systems of the nation in the summer. Further, although modern sewage treatment plants dispose of the organic matter in sewage, they thereby enhance the concentrations of inorganic nutrients, threatening rivers and lakes with eutrophication, another result of ecologic imbalance.

Clearly, if the environment is to be, in any real sense, protected and preserved, it must be studied as a system, in the full realization that man's activities

1. B. Commoner, **World Almanac and Book of Facts**, 1971.

to Coexistence

by Dr. Lowell G. Wayne

have major effects on it, and that the ramifying consequences of our technologies, both old and new, may not be neglected.

In studying how to coexist, environmental modeling can be an important learning device. It is certain that many of the types of human activity which cause environmental deterioration cannot, in fact, be abandoned without dire consequences for the health and safety of today's tremendous urban populations. Nevertheless, there must be many ways of modifying the methods used in pursuing these activities, to reduce adverse impacts on the local or global ecosystems. Environmental modeling, in principle, facilitates the evaluation of the likely environmental consequences of proposed changes.

It is certain that many of the types of human activity which cause environmental deterioration cannot, in fact, be abandoned . . .

Proposed changes are likely to encounter resistance, for various reasons. The costs involved in modifying activities may be high. Even if the costs are not high in a social context, they may be obvious enough to engender automatic opposition by some segment of society. If the benefits to be expected from the proposed modifications appear speculative, it may be very difficult for their advocates to overcome the inertia of established modes of behavior in order to implement new, unfamiliar and undemonstrated procedures. Environmental modeling can offer a means of conceptual testing of the proposals, and a method of ranking alternatives which will be valuable not only in the process of evaluation, but also in building the degree of technical and public acceptance necessary for implementation.

Basically the environmental model should offer the environmental protection administrator or task force a way to generate scientifically based estimates of future states of the environment after due consideration of the influence of various plans and contingencies. To utilize such a tool to best effect, attention must be directed to the problem of specifying environmental quality, in quantitative or semiquantitative terms, to the extent possible.

The rigorous approach requires that all relevant aspects of environmental quality be identified and explicitly incorporated in the model. The output of a well-specified model, then, can be looked upon as an environmental quality vector which represents the state of the environment after a selected period of time as it would be expected to result from a realization of the chosen plans and assumed trends. The components of the environmental quality vector would be estimates of the degree of achievement of desired conditions for each of the identified relevant aspects of environmental quality.

To produce useful predictions, an environmental model must be structurally similar to the environment, in the sense that basic units of the model correspond to basic entities of the real world, and that discernible laws which govern the relations between these entities be represented by appropriate algorithms within the model. It is important to recognize the superior predictive capabilities of relations representing physical or biological laws, as compared with empirical relations or such statistical devices as extrapolation of trend lines or regression relations. Scientific laws are properties of nature and, when accurately known and correctly applied, cannot introduce extraneous sources of error to the predictions of the environmental model. On the other hand, empirical relations and

statistical devices are mathematical artifacts which in most cases reflect no real cause-effect relationships; they can given rise to very misleading predictions, especially when applied to environmental conditions which are outside the range of the data from which they have been derived.

To be useful to the administrator, the output of the environmental model must be sufficiently precise to permit comparison of predicted states of environmental quality with each other, or with the desired criteria of environmental quality. Models which estimate only simple statistical parameters of time- and space-varying distributions of important variables may need to be supplemented by others giving more detailed distributions. This is particularly likely if significant stratifying factors or recognizable associations have been omitted from the basic model.

. . . empirical relations and statistical devices are mathematical artifacts which in most cases reflect no real cause-effect relationship . . .

An associated problem in the application of statistically based environmental models is one of obtaining reliable and adequate validation. Since the output of such models allows for a certain amount of "unexplained" variance, the problem is to provide confidence that the causes of this variance are under control, so that under foreseeable circumstances the variance will really remain within reasonable bounds.

Model output must also be demonstrably sensitive to changes in the input factors which represent the natural or artificial factors known to cause environmental effects. Natural factors obviously affecting environmental quality would include season, latitude, climate, flora and fauna, hydrologic processes and others. Artificial factors would encompass emissions, effluents, wastes, irrigation, agriculture, noise, heat, water diversion, and urban land use, as well as other determinants of the urban environment.

One important device in environmental simulation is the partitioning of proposed systems into subsystems, each sufficiently independent of the others to be dealt with in substantial detail with relatively infrequent need for consideration of the interrelations between them. For the global environment, the principal types of partitioning usually encountered are: (a) into realms defined by particular physical characteristics, e.g., atmosphere, hydrosphere, oceans, watersheds, terrestrial ecosystems; (b) into realms defined by particular biological limitations, e.g., arid lands, jungles, tundra, freshwater lakes and river systems, tidal lakes, bays and estuaries; (c) into realms defined by particular relevance to human activities, e.g., urban atmospheres, shoreline and wilderness preserves, urban environments; (d) into geographical areas defined by natural or political boundaries, as environmental quality regions, waste disposal districts, deserts, islands, mountains. Such subsystems may be further subdivided; thus the atmosphere, divided by natural characteristics, may be treated as upper and lower atmospheres; divided by reference to man's activities, it may be discussed in terms of urban, rural, or exotic atmospheres; divided for administrative convenience, it gives rise to air quality regions (sometimes misnamed "airsheds") and sometimes even "subregions."

This conceptual partitioning of the global environment is a practical necessity if, indeed, practical problems associated with the environmental crisis are to be dealt with in any reasonable span of years. In terms of the environmental quality vector, which we defined above as a set of estimates of degree of achievement of desired environmental conditions, the effect of choosing environmental subsystems can be seen as defining an environmental quality subvector, a vector of lesser dimension in which only a subset of environmental desiderata are represented. In this sense an air quality model yields an air quality vector, a water quality model, a water quality vector, and so forth.

In the most general sense, the appropriate components of the air quality vector (that is, the output of an air quality model) would be measures of the status of the simulated atmosphere reflecting its effects on human health and welfare. These would include both direct effects, such as those evidenced by physiological and psychological reaction to atmospheric quality, and indirect effects, such as cumulative deterioration in the physical and biological environment which may not be readily detectable by the senses. Thus, for air quality, a partial list could include effects on human health, on growth of plants (both agricultural and native), on materials of commerce and construction, on atmospheric clarity, and on human safety, comfort and morale.

Similarly, a water quality vector would be specified in terms of effects on human health, on productivity of agricultural land, on availability and suitability for industry, commerce, agriculture and recreation, and other factors both directly and indirectly related to human needs and desires.

Although desirable in principle, models which generate environmental quality vectors or subvectors . . . are very difficult to achieve.

Although desirable in principle, models which generate environmental quality vectors or subvectors in terms of such experiential effects are very difficult to achieve, due to the elaborate and extended chains of causation which intervene between the observable and partly controllable input factors and the effects which are to be studied. In the case of air and water pollution studies this situation has led to the practice of separating the causal chain into two quasi-independent parts: first, the determination of physically measurable changes in the environmental medium (air or water), referred to the recognized natural and artificial change factors; second, the determination of the relevant effects of the environment on human society, referred to the observed or estimated physical

changes in the medium.

The first part of the causal chain may be represented by simulation models which, in this context, can be called physical parameter models. Various such models are in existence. They are usually referred to as air or water quality models, although they fulfill only partially the purposes of environmental quality modeling as described above. For an atmospheric simulation model, the physical parameter output vector deals mainly with concentrations of contaminants, simulating these as functions of weather variables and estimated contaminant emissions. For a water-system simulation, appropriate components may include concentrations of various dissolved substances, both mineral and organic; dissolved oxygen, biological oxygen demand and chemical oxygen demand; temperature; loadings of particulate matter and various organisms.

The rest of the causal chain, leading to the estimation of effects based on the physical parameter estimates, is a part that has received far less attention in terms of simulation than the prior section. The problem of specifying effects in a somewhat quantitative manner has been generally regarded as rather intractable, and administrators have tended to retreat from it. The commonly used alternative approach is to identify, qualitatively and intuitively, some of the physical parameters as causes of some of the major effects attributed to environmental deterioration; then goals are set in terms of these physical parameters. Air and water quality standards, as set by the federal government and by various states, exemplify this approach, which is really only a matter of providing benchmarks for the guidance of local administrators. By monitoring local air and water resources and checking findings against these standards, those responsible may readily determine whether these resources are acceptable in regard to these particular aspects.

Providing standards as benchmarks for evaluation of local air and water resources is a useful, even necessary, function, but it does not approximate the kind of systematic approach that will be required for an integrated environmental simulation model, nor even for a cogent environmental effects submodel. One closer step has been implemented by the National Air Pollution Control Administration (now the Air Pollution Control Office, Environmental Protection Administration) in the issuance of Air Quality Criteria documents, which are compilations of authenticated information relating possible environmental effects to concentrations of individual air contaminants, with due consideration of time factors involved. In some cases interactive effects of different contaminants are also taken up in the criteria documents, e.g., the synergistic effects of sulfur dioxide and particulate matter on the human respiratory system, and the interaction of oxides of nitrogen, organic gases, and ultraviolet light in the production of photochemical secondary contaminants and their effects.

Pursued to its logical conclusions, the Air Quality Criteria approach could lead to the development of a rational submodel for simulation of effects of atmospheric contaminants which, when joined to an adequate physical simulation submodel, would provide an initial approximation to a comprehensive environmental quality simulation.

Present trends in discussion of environmental protection measures, both in the public prints and in legislative circles, suggest the near future will see a de-emphasis on the concept of controlling environmental factors by means calculated to produce pre-estimated benefits. It is being argued that control is too urgent to allow the time necessary for implementing such an approach. Furthermore the admitted urgency of control, combined with obvious factors of administrative convenience, provides persuasive reasons for establishing controls in terms of uniform statewide or national emission standards or technology restrictions, independent of any quantitative estimates of the benefits to be derived from such measures.

Two main considerations suggest, however, that it is now urgent to develop a rational and comprehensive system of environmental simulation for use in testing environmental protection strategies. First, there is the notorious fact that, in the political arena, available alternatives tend to be evaluated in terms of political criteria, to the virtual exclusion of any but the most obvious and most qualitative considerations of effectiveness and freedom from environmental side-effects. Consequently, proposals of major scope, which may involve major adjustments in activities and modes of management current and customary in our society, tend to receive short shrift in our legislative halls. Yet, these very activities and modes of management, in many instances, are responsible for the insidious environmental deterioration which is now increasingly recognized as critical.

Second, people generally are beginning to realize a fact that ecologists have always tried to emphasize—namely, that man is a part of the global ecosystem, in which changes imposed on any essential component produce effects of greater or smaller consequence on other components throughout the system. Thus the attempt to build a comprehensive environmental simulation model should come to be seen in the light of striving to understand the workings of the real world. Eventually, man must accomplish this task if he is ever to be able to anticipate the effects of his activities on his environment or on his societies. In fact, he must do so if he is ever to understand and achieve his appropriate place in a stable, natural world. ■

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Everyone agrees a system is needed, but what form will it take?

Is There a System for

In December 1970 the U.S. House of Representatives passed a bill to provide for an environmental monitoring data system to "serve as the central national coordinating facility for the selection, storage, analysis, retrieval, and dissemination of information, knowledge, and data relating to the environment so as to provide information needed to support environmental decisions in a timely manner and in a usable form." The bill did not come to a vote in the Senate in the closing days of 1970, but some environmental data bill is likely to be brought up early in 1971 in both houses.

Some basic questions need to be asked, given the need for a national environmental data system or a set of comprehensive systems. How much of the total environment should the system encompass? What measurements should be included? What format should the output take? How can such a system be organized, implemented, and fully developed.[1]

The problem in environmental data handling is not a technological one, but an institutional one where the legal, organizational, and coordination problems between all the parties involved are the most important barriers. This is not to say that technological problems do not exist: immediate access storage has a physical limitation; transmission speed is a bound on the entire system; and much needs to be learned about data manipulation techniques. The technological boundaries are wide enough, however, to make a variety of environmental data management systems feasible.

The problem in environmental data handling is not a technological one, but an institutional one . . .

A comprehensive data system is made up of at least the following components: data acquisition, data transmission, data storage and processing, and data usage. The diverse concepts of environmental data systems will be discussed under each separate heading.

Data acquisition. A large volume and a variety of data are collected by local pollution control agencies (often within the local county health department) and state operated pollution control agencies. The diversity of purpose, measuring instruments, analytical techniques, storage media (paper, cards, paper tapes, magnetic tapes) and format make the integration of the data a most challenging task. The absence in many fields of standardized methods, instruments and techniques, compound a universal lack of validation procedure. While the volume of data is large, its quality is, at least, in severe doubt.

Local and state agencies collect data within their own political jurisdiction and while in the field of air pollution this represents the greatest volume of data and the most extensive coverage, the same is not true for other functional areas.

The federal government operates many networks of its own. Examples are the Continuous Air Monitoring Program (CAMP) and the National Air Surveillance Networks (NASN) which are air pollution networks operated by the Environmental Protection Agency (EPA). The National Weather Service, the U.S. Geological Survey, and the Forest Service also collect a great deal of environmental information. In fact most environmental information is collected by such large agencies which are not part of the Environmental Protection Agency.

Data transmission. Environmental data communication calls for two systems separate in concept but possibly using the same communication channel: a chronic conditions system and an episodic conditions system. Furthermore, data can be moved along communication channels in three forms: raw data, summarized data, or a catalog of the kind and location of environmental data.

A decision must be made as to the volume and kind of data to be transmitted upward from the local agency, to the operating agency (regional or categorical implementation agency), to the federal regula-

tory agency. Three modes of data transmission are discussed below.

In the few cases in the environment where data flows in some organized fashion, the flow is from local agency to state agency to an operating agency. Data also flows upward to other federal agencies and in some cases some kind of return of summarized data to the collection points is part of the system. Various alternatives are possible depending on the levels to which primary or raw data are to be transmitted and the ways in which the data are to be handled or summarized at each level.

Under the first mode, raw data would flow along the channels outlined above and the data base would increase up to the operating agency when it would decrease in a pyramidal fashion up to the highest planning and coordinating agencies, such as the EPA superstructure and the Council on Environmental Quality.

Under the second mode, data would be aggregated and summarized at each node in the network such that a more or less constant volume of data would flow.

Under the third mode the raw data would remain at the source (the collection points) and a catalog of data would be transmitted and aggregated upward to the operating agencies. The data would be accessed as required over communication channels based on the contents of the continually updated catalog.

In the air pollution field the first concept is being adopted by the Air Pollution Control Office of the Environmental Protection Agency. The expected input data volume is of the order of 50 million characters of raw data per year with a basic data base of some 5 billion characters. This new system concept is termed NADIS (National Aerometric Data Information Service).[2] A feasibility demonstration is scheduled to take place in the next few months and the system is scheduled for full-scale implementation by 1976.

Data storage and processing. There are three basic approaches to storing and analyzing the vast amount of environmental measurements that are now collected and will be gathered in the future. We have called the three approaches central, categorical, and geographic.

A *centralized* system configuration would have all environmental data stored in a national environmental data bank. A *categorical* system configuration would have environmental data in each category of air, water, land, resources, health, social-aesthetics, etc., reported to the responsible federal agency for storage, analysis, and calculation of the indices. A *geographical* system configuration would have data gathered at the local level, validated and reported to state agencies who would summarize and forward the data to the regional agencies who would in turn send aggregated data to the federal agencies for calculation of the indices.

In the centralized system, all federal, state, and local agencies together with private institutions and industrial organizations would transmit their validated data to the national environmental data bank. The flexibility of this system configuration would be excellent because of the centralized control of the data. However, its responsiveness would be poor because of the separation of the data bank from the responsible operating agencies and also from the sheer physical size of the data base to be handled. Because of the large environmental data bases already existing in the federal government to meet particular operational uses, a centralized system would still require a large number of storage memories within an interconnected network. The computer network of the Advanced Research Projects Agency (ARPA) of the Department of Defense is an example of a large-scale, interconnected system. An operational goal of the ARPA network is to allow a person sitting at a console connected to any one of the computers in the network to use the hardware and software of any other computer of the network with the same facility with which he could use his own. Thus, many different and separate computers appear to each user, in fact, to be a dedicated computer. The ARPA network, however, is still in its initial stages as a research tool and is at least five years away from being useful as an operational tool for the sort of programs considered here. An alternate in this direction is to set up a central data repository, with interconnected data banks, to handle as much of the data as is technically possible. This would have the effect of forcing the operators of the system to decide which of the data are most important for acceptance into the bank.

However, present experience with remote access and time sharing systems serving a large number of users requiring access to large data bases has indicated extensive "down-time," significant delays during peak daytime periods, and high cost of rapid access storage. Also, the organization difficulties of establishing a central data bank would be quite large. Discussions with federal, state, and local personnel have made it clear that transferring all of the environmental data to a group not within their responsibility is acceptable only under extensive constraints to permit the originating agency to analyze and publish its own data before transmitting it to the central data bank. Therefore, the apparent dollar economies of

Pollution Madness?

by Robert P. Ouellette, David M. Rosenbaum, and Richard F. Greeley

While the volume of data is large, its quality is, at least, in severe doubt.

scale and flexibility of a centralized configuration may be outweighed by the technological and organizational difficulties.

Categorical configuration is the closest to the way most environmental monitoring is now accomplished. The "environment" is divided among the various federal agencies within categories of air, water, health, etc. Each agency gathers data directly from private institutions and industrial organizations, or from local and state agencies within its own category of responsibility. This configuration has excellent response within categories, but there is poor coordination across categories. For instance, "land" data gathering is divided among Office of Solid Wastes in EPA, the U.S. Geological Survey, Bureau of Recreation, Bureau of Land Management, Bureau of Mines, National Park Service, and Bureau of Reclamation in the Department of Interior, the Forest Service in the Department of Agriculture, and a number of bureaus in other departments. This type of system has not been responsive historically to the needs of local and state agencies for information. The flexibility of such a configuration will also tend to be poor since changes in the type or amount of data required by the Council on Environmental Quality, for instance, will involve changing capabilities among the agencies or reassignment of responsibility. Most of the information stored by the agencies will be used to support operational needs rather than national policymaking and over-all environmental control. Such a configuration is technically within the current state of the art and the cost to upgrade current capability into a national environmental information system is probably moderate.

. . . the apparent dollar economies of scale and flexibility of a centralized configuration may be outweighed by the technological and organizational difficulties.

In geographic configuration the basic data originates in the field with private institutions, industrial organizations, and with local agencies. The local agencies forward validated data to the state agency so that the state is aware of all environmentally related conditions within its boundaries. It is envisioned that the ten federal regions recently formed by the Office of Management and Budget and shared by EPA, HEW, and HUD, Department of Labor, Department of Interior, and Department of Transportation will become strong organizations with sufficient computer power and professional data processing personnel. Eventually, the regions may be interconnected with an ARPA-type computer network. Each state is entirely within one of these federal regions, and categorical areas such as river basins or air quality control regions could be assigned to whichever of these federal regions is most convenient. The federal regional centers would receive appropriate processed data from the states and in turn would process and transmit to the parent federal agency aggregated data. The advantage of this concept is that information would be stored in the area and at the level at which it was generated and would be most useful; at every level there would be an agency which had an overall grasp of conditions at that level and below. One disadvantage of this scheme is that a categorical area such as weather, with a nationwide observing system and a centralized electronic processing center supporting regional forecast offices, does not fit appropriately. The geographical concept would have excellent response within categorical areas at each level of data aggregation and responsibility. To the extent to which local, state, and regional agencies were established in categories to consider the over-all environment, this system would become more responsive and flexible in providing the information needed. The system is technically within the state of the art and its dollar cost would depend primarily upon the degree of sophistication of the data acquisition and processing capability provided.

Data usage. All of the data being stored is not raw data by any means. Most of it represents the results of calculations from the raw data. While a case can be made for keeping all the raw data because we do not know what need there might be for it in the future, processed data should be kept only if there is a demonstrable need for it in the near future. Much of the data stored is processed data and a large part of the processed data is never used at all. This is symptomatic of a common problem with data banks: they become ends in themselves. The incidence and severity of this problem increases with increasing size. In very large data banks it is common to find large amounts of data being stored for reasons which no one remembers.

The environmental data cover the entire spectrum in terms of diversity, accuracy, timeliness, volume, and so on. An environmental data system must be user-oriented. The sheer diversity of users and their requirements make this design of an environmental data bank a most challenging enterprise.

Current environmental monitoring activities of federal agencies include the National Aerometric Data Bank (SAROAD)[3,4] system of the Air Pollution Control Office/EPA; the STORET[5] system of the Water Quality Office/EPA; the National Center for Health Statistics/HEW; and the Environmental Data System of NOAA which includes the National Weather Records Center, the National Oceanographic Data Center, and the National Geophysical Data Center. The Census Bureau maintains a wide variety of environmentally related data. The U.S. Geological Survey and other bureaus of the Department of Interior maintain extensive data banks. The Department of Agriculture maintains perhaps the largest store of environmentally related activities.

Typical parameters to be measured with respect to the total data flow expected from a comprehensive set of environmental data systems include: quality, quantity, and pollution effects, natural effects, resources, and social-aesthetic factors. By 1976 the number of measurement sites for each parameter is expected to be in the thousands. For instance, each county would report natural effects and resources. As many as 10,000 stations are expected to be needed for full coverage of the nation for air and water quality, quantity,

and pollution effects. Each neighborhood is expected to monitor for social-aesthetic factors. The data rate per site has been estimated, in a very general way, from the number of characters required per measurement (100 to 1,000), the number of measurements per month (1 to 720), and the number of instruments at each site (1 to 20). The maximum number of characters per month to be reported per site would be 10^4 but generally lower figures are expected. If original data is forwarded to the federal level for storage and processing by the responsible agencies, the data rate for most parameters would be 10^8 characters per month, but might reach 10^9. Present monitoring in assuming a minimum allowable storage space of a factor of 100, then upward to 10^{11} characters.

These figures do not include multispectral imagery from air- and space-borne sensors for monitoring natural resources. Also these numbers do not include a wide variety of data needed by each agency to carry out its operational responsibilities. In fact, the total amount of environmentally related data already existing at the federal level in a file of data banks is probably 10^{12} characters. Therefore, from a system requirements standpoint, very effective data acquisition, data transmission, and data storage capabilities will be required in the very near future.

A new federalism with regard to environmental data is currently taking place encouraged by recent legislation and by the decentralization and regionalization of capabilities and responsibilities in data collection, maintenance, and management as a vital part of a localized pollution control and resources management program.

At the present time data gathering and storage is largely by environmental function. Since different data banks are in different formats, a good deal of thought will have to be given to the format in which each output information is needed.

Virtually all air data is available from EPA and NOAA. Most water data can be found at EPA, NOAA, Geological Survey and the regional water agencies such as TVA, Bonneville, etc. More than 50 federal agencies have land and land data is potentially available from these as well as hundreds of state agencies and many private sources.

A group should be set up in which thought is continually given to which data needs to be collected and how it should be processed, stored, and made available in order that the data which is needed should not be submerged in a sea of irrelevant numbers.

The first thoughts, and rightfully so, of a new agency serving as umbrella to a disparate collection of data systems, is to look in the direction of standardization, commonality, cohesiveness and coordination. While intelligent coordination is essential and while standardization should be encouraged in terms of sampling strategies, analytical techniques, protocols, and measuring instruments, the same does not necessarily apply in data processing, or it applies along different lines.

Some of the key issues are to assure that the totality of the data collected is needed, verified, validated and comparable. Another question to be answered is the general applicability of general and specialized software and data management systems. Much money has been invested in such systems as STORET and SAROAD and it is unlikely that the software developed would be abandoned in favor of a uniform data management system.

Fortunately, the recent organization of the Environmental Protection Agency should help to assure that total system requirements will be precisely defined and pave the way for the establishment of a national environmental data system. ■

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Dr. Greeley, associate technical director of the Systems Development Division of the Mitre Corp., has recently directed program planning studies and the development of information systems for the U.S. Department of Housing and Urban Development, the Air Pollution Control and Water Quality Offices of the Environmental Protection Agency, and the Environmental Sciences Service Administration. He holds a BS from Harvard, an MS from Northwestern, and a PhD from Tennessee in physical chemistry.

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CIRCLE 25 ON READER CARD

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Parfit Payroll

by Jackson W. Granholm

G Robert Gordon, the noted sage of University of California, Irvine, has a favorite ploy when he lectures to laymen on the mysteries of commercial applications of computers. Noting the computer population of the U.S. as 50,000, with 80% (or 40,000) of these devoted to business uses, he blandly asks his audience to guess how many different programs have been created to write paychecks. To date, the largest number guessed is 500 (the average closer to 50)—so he invariably makes a splashy point when he trots out the true figure: a number in excess of the number machines. Which ought to tell us something about the reported high cost of software.

Payroll has a near-universal application, since most everyone in the world is, hopefully, on some kind of a payroll. Yet a close look at the real world of payroll programs reveals some interesting, if not provocative, facts.

There comes a day in the life of every company (and this day is now pretty long ago in many instances) when the first computer is delivered, and the in-house crew is in business with their very-own installation. What is the first program put on the air? You guessed it—payroll. Management has a warm feeling that it is all going to be worthwhile when the machine-printed checks with their machine-printed withholding stubs roll out of the printer, and are secretly embossed in the back room with the signature of the corporate treasurer.

Since payroll is the first program written by the in-house crew, it is not too surprising to find that it is rather scantily documented. Of course, if it was first written 15 years ago, it may be a bit more distressing to find its documentation still scanty today, if, indeed, one can find the documentation at all.

If one can find the documentation, one is not always sure of exactly what has been found. After all, payroll usually has to operate once every two weeks at minimum, and in some industries, like the motion picture industry, it has to operate daily. This makes changes to the payroll program assume the status of hasty patches, and the author of a hasty patch is all too prone to forget to write down what he patched and what brand of rubber cement he used. Some of the more astounding examples of in-house-generated payroll software literature thus come to resemble a battered shoebox full of notes of the type, "I changed the word in location 4632, and got back on the machine."

With this kind of approach to what is facetiously called payroll design, we find that major modifications are required to accommodate new deductions and new taxes or tax rates. Since one thing that all governments love to do is to change taxes (typically upward) and rates, and limits, there is an annual disaster in the in-house software activity. This disaster stems from the pressing need for answers to two near-insoluble questions which are, respectively, "What the hell did we do last year?" and "What the hell are we going to do next year?"

A minor adjunct to the flap surrounding rate and deduction changes and additions, is that there is seemingly never time to do any file redesign on a payroll program. There is only the rush effort to move the file boundaries ever outward in order to accommodate more glop in the same old structure. Old payroll programs never die, they just get fat around the middle.

Old payroll programs never die, they just get fat around the middle.

To tie up the problem of how to get another mile or so out of an old payroll program, there is the bad news that the original authors have departed for greener pastures, and are, probably, at this very instant, writing a new "first" payroll program for some other fortunate company.

Payroll programs, all too frequently, do not share a common input with such manifestly related applications as labor distribution and personnel records. Thus we achieve the remarkable situation in which the same employee may appear as different people with different characteristics in as many as three different pieces of in-house software. This distressing ability of the computer to add to the world population explosion has, most fortunately, been overlooked so far as a point of attack by the birth control promoters and the neo-ecologists.

Because payroll stands among the "life-blood" applications of the company, it cannot be shut down while we update the computing installation. Hence we find that those few old payrolls which have been promoted to third-generation processors, have been so promoted under considerable duress. We find them

either operating under emulation, running out of the same old shoebox, or else translated laboriously in a one-for-one machine language conversion. This latter feat gets pretty tricky with some modern-day machines where it is tough, even for the head system architect, to come forth with a clear definition of what machine language actually is.

In view of the prime nature of payroll as an important program, it might seem unreasonable for it to remain in the status of a continual cobble. However, there seems not to be time nor money to invest in a new shoe.

Requests for improvements to payrolls, or modifications thereto, are frequently relegated to the bottom of the stack of work to do. When a high-ranking, in-house programmer was quizzed as to why this was so, he replied, "It's simple. We know we're going to have an annual rhubarb updating the payroll. We can just stack up all these lacy fringes and things that people think they want, then we can add them all in one big operation, if there's time this year."

Therefore payrolls, if they grow in mechanism and stature, tend to grow by the rule of the squeaking wheel. The work is done under reaction to pressure, and demonstrates little planning, and, sometimes, even less purpose.

A quick survey of payroll programs around the world reveals a cross section of useful features that ought to be included in payrolls, but seldom are. It would be nice, for instance, to write a payroll in such general-purpose fashion that the changing of rates and limits in existing tax, earning, and deduction calculations is reduced to the insertion of the applicable parameters. Further, the program should minimize the effort required to accommodate new taxes, earnings, and deductions.

Payroll programs, to serve their intended purpose, ought to allow for unrestricted combinations and numbers of earnings, taxes, and deductions for each employee. The deduction category of "other" is the kind of thing that causes tax accountants to gnash their teeth and rend their garments, and it raises the suspicion of the employee spouse who suspects that a rival may be the hidden recipient of the unidentified funds.

One might well expect a payroll program to provide previous period and previous year histories in enough detail to be useful to those who use such things.

There are a number of administrative niceties that could be included in payroll, but seldom are. The fact that they are not reflects the rather narrow and Orwellian viewpoint that the computer *is* the system, and that everyone must abide by it and suffer its asininities. This is in contrast to the too-seldom used viewpoint that computers are flexible machines which are designed to serve people. Further, batch processing, which payroll is for very good reasons, is a most efficient method for all the general cases, but leaves a bit to be desired in coping with the day-to-day foibles of the real world.

Almost no one would today suggest that large corporate payrolls ought to be put on on-line systems, but it would be handy if, for instance, the payroll program were structured to provide vacation prepayments. It might also be structured to provide for easy processing of handwritten checks and of void checks. If we want to get really up-to-date, let the payroll program provide single pass processing of all such exceptional items as are gathered at run time.

Payrolls might further supply monitoring of such things as deduction and tax limits, and be prepared to view with alarm such things as the 34-hour work day. By no means do all of them pay attention to such things today.

Perhaps the answer to the problem of the archaic in-house payroll is to buy an outside service. The placing of payroll in the tender hands of the friendly local branch of the First-Giant Commercial Bank is, however, a step beyond that which many managements are willing to take.

Another answer may well be to buy an outside package, install it, and use it. However, a look at these packages seems to indicate that many of them are about as strictured as the current in-house effort, except that, usually, they were not written for operation on Univac I.

It seems reasonable to expect that, if the in-house troops are always too busy running payroll to rewrite payroll, placing them somewhat in the situation of a man who ought to change his tire while driving, the outside experts, who have nothing to do except design and write payroll packages, ought to be able to consider all the problems dispassionately, and act accordingly.

Instead, some of the packages apparently being marketed as general-purpose and world-beating payrolls bear the earmarks of actually being rehashed or modified in-house jobs from somewhere. The somewhere, in the startling instances, appears possibly to have been North Bulgarian Poultry and Yogurt Co-operative, Inc.

So, ye inhabitants of Paycheckland: It may well be time to put your first program first once again. Take the time to determine how to get it to run properly on the installation you have today, not the one you had when the corporate founder was elected to the Junior Chamber of Commerce. Turn your payroll department into a thing of beauty and a joy forever. The time you spend may well be less than the integral of the annual flap to update the old horse. Further the money and migraine pills you save may turn out to be a true cost saving. In these cash-short days, that can make you a hero. ■

Mr. Granholm is currently a consultant in Thousand Oaks, Calif. His 23 years of computing experience includes stints with Informatics, TRW, and Boeing, among others. He is a prolific and versatile author, writing a weekly newspaper column and contributing regularly to the Gardeners Abstracts Quarterly, as well as professional edp publications. His BS in physics is from the Univ. of Washington, where he has also done graduate study.

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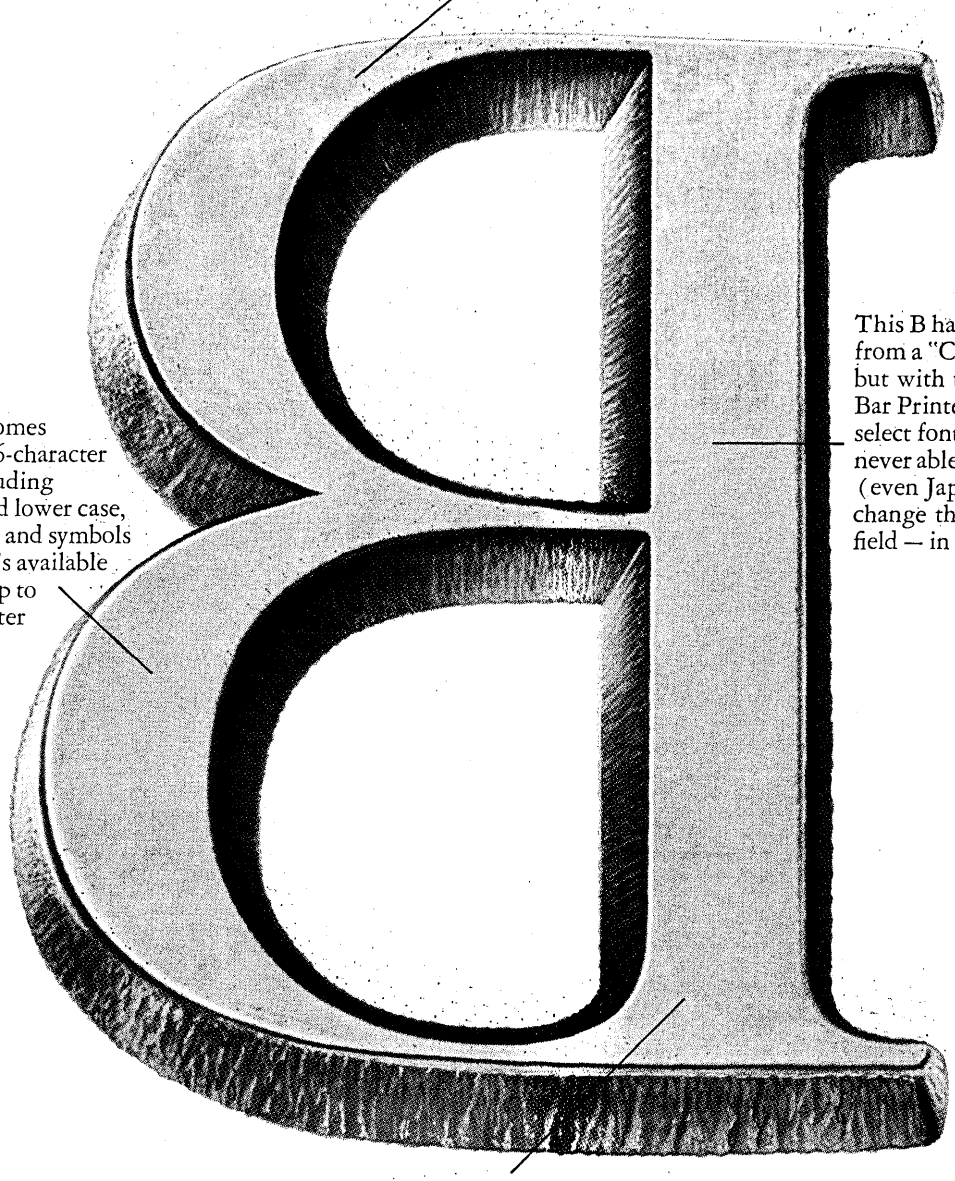

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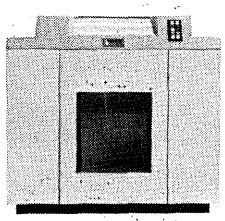

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an interpretive review of significant developments

Not Just Army Snooping Came Up at Ervin Hearings; EDP Examined, Too

What started as a hearing into government surveillance activities is almost certain to result in legislation affecting the edp business. Interspersed through the official record of Sen. Sam Ervin's hearings last month are references to data banks operated by nonmilitary government agencies — and to private systems.

While Sen. Evin, a renowned constitutional lawyer, got two officals from the Defense Department to agree that their authority to engage in domestic surveillance is severely limited, another senator testified there is a need to control criminal justice information systems. That witness, Sen. Charles Mathias of Maryland, said, "state and local law enforcement agencies do not necessarily have fewer scruples than federal bureaus about keeping personal histories confidential."

Mathias said contents of the Justice Department's dossier-type data banks "with the exception of some intelligence data, are made available — not just within the Justice Department, but also to other federal agencies who have marginal law enforcement mandates, to state and local agencies, and in some cases to private establishments such as national banks."

The Maryland senator last year persuaded Congress to enact legislation requiring the Law Enforcement Assistance Administration to recommend ways of protecting the constitutional rights of persons "covered or affected" by criminal justice information systems developed with federal funds. The recommendations are due next month. They probably will be submitted to the judiciary committees of each house. Ervin and Mathias are both members of the Senate Judiciary Committee.

It only intimidates

The Nixon administration apparently opposes the kind of restraints favored by Mathias and Ervin, which could lead to a major Congressional confrontation. Assistant Attorney General William Rehnquist, when he appeared before the Ervin subcommittee, said "... self-discipline (by) the executive branch will answer virtually all of the legitimate complaints." He added that the Justice Department, which administers the LEAA program, "will vigorously oppose any legislation which ... would effectively impair" the current surveillance and information-gathering activities of law-enforcement agencies supported by federal funds. Later, in a dialogue with Ervin, Rehnquist made it clear that spying on law-abiding citizens doesn't violate anyone's constitutional rights so long as the agency doing the spying "does not take ... any action affecting an individual's status." Asked by Senator Ervin whether surveillance, *per se,* "would have the effect of stifling activities (protected by the Bill of Rights)," Rehnquist said that the surveillance might intimidate "many" people, but "I don't think you can lay it down as a general principle."

Dr. Robert Gallati, Director of the New York State Identification and Intelligence System — generally considered to be more sensitive to the personal privacy problem than any other in the criminal justice field — described some of the safeguards which NYSIIS has imposed. Information is classified according to level of sensitivity, for example, and the user is cleared to search only specified levels. Also, NYSIIS refuses to acquire some types of personal or sensitive information, even though it could be legally used, because of the management's determination that this "is in the best social interest," said Gallati. His basic point was that "the efficiency and functional effectiveness ... implicit in large-scale computerized information systems can be achieved without violating personal privacy ... if such systems (are) properly designed for optimum security and dedicated to human liberties."

It may be significant that eight detective agencies and two airlines pleaded guilty in New York City recently to buying confidential information that came originally from NYSIIS. The police officers who sold the data obtained it from a manual "rap" file, derived partly from NYSIIS data, which is located within the New York City police department.

One bill has been introduced already to control data bank operations. The House measure, HR 4375, was drafted by Congressman Ed Koch of New York; the Senate version, S975, was authored by Birch Bayh of Indiana. Basically, this legislation requires federal agencies to inform an individual when they have a dossier on him, and not disclose its contents to anyone without getting the subject's permission. Also, the agency must keep track of who is allowed to access the record, and must permit the subject to inspect, copy, and supplement the information if he desires.

Senator Ervin has indicated he will introduce a privacy protection bill based on the record accumulated in his recent hearing.

If Congress does eventually enact a privacy protection bill, it seems likely — based on what was said at the hearing — that the legislation will give an individual the right to access his own file, find out who else has accessed it, and update as well as supplement the information. Probably, the legislation will also make the data bank operator responsible for keeping track of who looks at the dossier, informing the subject of these searches, and expunging obsolete information.

One unresolved question is how much these safeguards will cost. Bob Bigelow, chairman of ACM's special interest group on Computers and Society, indicated in his testimony before the Ervin subcommittee that the current state of the art allows computerized files to be protected more economically than manual files. "The rules on data banks can therefore be more stringent and still permit an economically feasible operation."

Bigelow advocated establishing a centralized, separate federal agency to regulate data banks. There seemed

to be general consensus on this point, at least among the academicians who appeared at the hearing. But spokesmen for two computer makers indicated they had reservations about the scope of regulation.

Former Attorney General Nick Katzenbach, now IBM's general counsel, implied that legislation should be limited to curbing *government* use of dossier-type data banks. He also thought it would be "difficult to establish and legislate specific security features."

Robert F. Henderson, associate group vp for Honeywell, was even more specific: "Some concerned individuals have urged strict controls on the technology of data banks. I think that such action ... would not be in our best interests. We are dealing with a very complicated subject, and one which is still in its formative years. Even we in the industry would like to know much more ... about the technology of data banks. I believe that any legislation which would seek to control the data bank itself would be premature ..."

— Phil Hirsch

How Navy Does, and User Can, Buy Peripherals Independently

How does a user go about procuring peripheral replacements from independent suppliers? Some good guidelines were provided by Captain W. Fred Weihrich, director of the Navy's ADP Equipment Selection Office, at the American Management Assn. Systems Management Conference in New York, Mar. 8-10.

Also in this session on "Competitive Computer Peripheral Decisions," both Weihrich and Edward J. Mahoney of the Government Accounting Office (GAO) indicated that the government is going full bore after economic alternatives to *all* installed peripherals. Not the least of its efforts toward that end is that it is putting "full weight" behind the development of standard interfaces, according to Mahoney.

The selection guidelines were implicit in Capt. Weihrich's description of the Navy's massive procurement of 1,411 IBM-compatible tape and disc drives from five different vendors. The 1969 award was highly justifiable economically: savings vs. IBM prices amount to from $8,300,000 to $13,280,000 (if options are exercised) over the three-year system life. But the inherent difficulties were that 50 Naval installations were involved and six different kinds of drives were needed. The Navy couldn't expect one vendor to provide all equipment and all the force needed to install and maintain the units at the various locations, but it had to protect itself from multiple-vendor havoc that could turn savings into operational losses.

Thus, it divided its installations into three U.S. regions and permitted the vendors to bid by region and category of equipment. It further limited each installation to a maximum of three vendors, including the mainframe supplier. And to insure relatively high performance, the uptime requirement was raised from the 90% required by GAO to 95%.

After soliciting vendor opinion on the plan, the Navy issued a final Request for Proposal (RFP) to 69 vendors, 14 of which responded. Mandatory RFP requirements: plug-to-plug interchangeability, full compatibility including features, equal or better performance, no program modifications, and deliveries varying from 30-300 days. Ampex, Potter, Memorex, CalComp, and Telex were each awarded contracts worth $10s of millions over system life.

Among Weihrich's list of advantages not figured into the savings noted earlier: vendor-paid transportation costs, unlimited usage, guaranteed uptime of 95%, one-hour prime-shift and two-hour extra-shift response time on maintenance, guaranteed prices, and a free performance period of one month.

One user in the audience complained that the 95% uptime demand was far too low, since on a 24-hour usage basis that means the equipment could go down one full hour each day. Upwards of 99% was what the user should expect with current technology, he said. Weihrich retorted that actual performance of the drives has exceeded 95%, 98.7% being the high. And Mahoney said that the GAO's 90% standard was actually set several years ago, and it will certainly consider raising that standard in the next contract go-rounds.

As to the problems of a mixed-vendor installation, Weihrich praised the relations among the engineering forces as "more harmonious than could reasonably be anticipated."

The Navy has actually made three series of peripheral replacement awards (the others also involving tape and disc drives), which will all result in over $14 million in savings. It is about to release an RFP for replacement of Univac FASTRAND II drums.

More interesting, "perhaps the next prime target should be core memories," he said, because of their high reliability (over 10,000 hours MTBF, according to one vendor), absence of mechanical requirements, and nationwide availability from several firms. A "distinct advantage" is that firms are beginning to offer core add-ons in excess of the size limitations imposed by mainframe makers. The Navy "will identify one or two sites" to test core replacements and, if successful, "we will do an accelerated competitive procurement," which could mean another set of contracts for millions of dollars.

"Future considerations," according to the Navy director: replacement equipment for peripherals of all mainframe makers, not just IBM; replacement of all categories of peripherals; development of interface standards; the offering of enhanced or better systems, not just Confederate copies; and "emergence of replacement processors by the peripheral manufacturers," like the FACOM 230. The mainframe vendors may counter by restructuring their pricing alignments. What may evolve, he said, is "an outright charge for preparation of bids and benchmarking of full systems in original acquisition efforts, or a shift in the manufacturer's overhead costs, being applied more against the central processing units than the peripherals."

— Angeline Pantages

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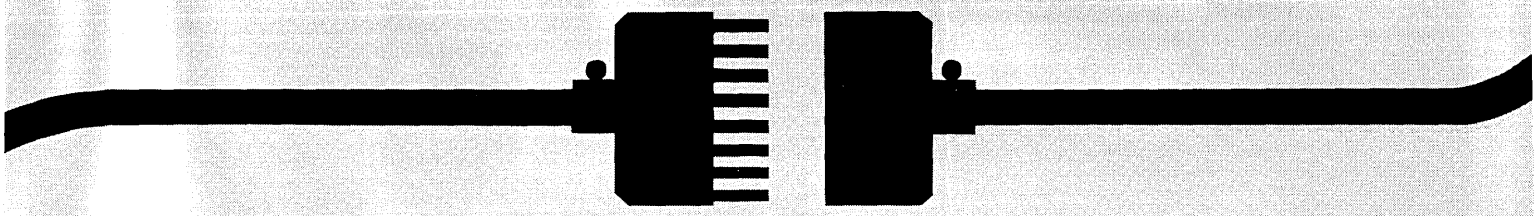

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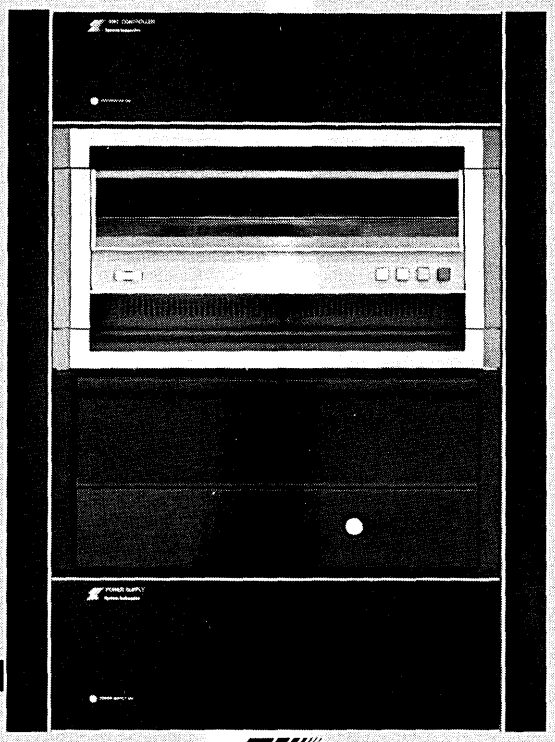

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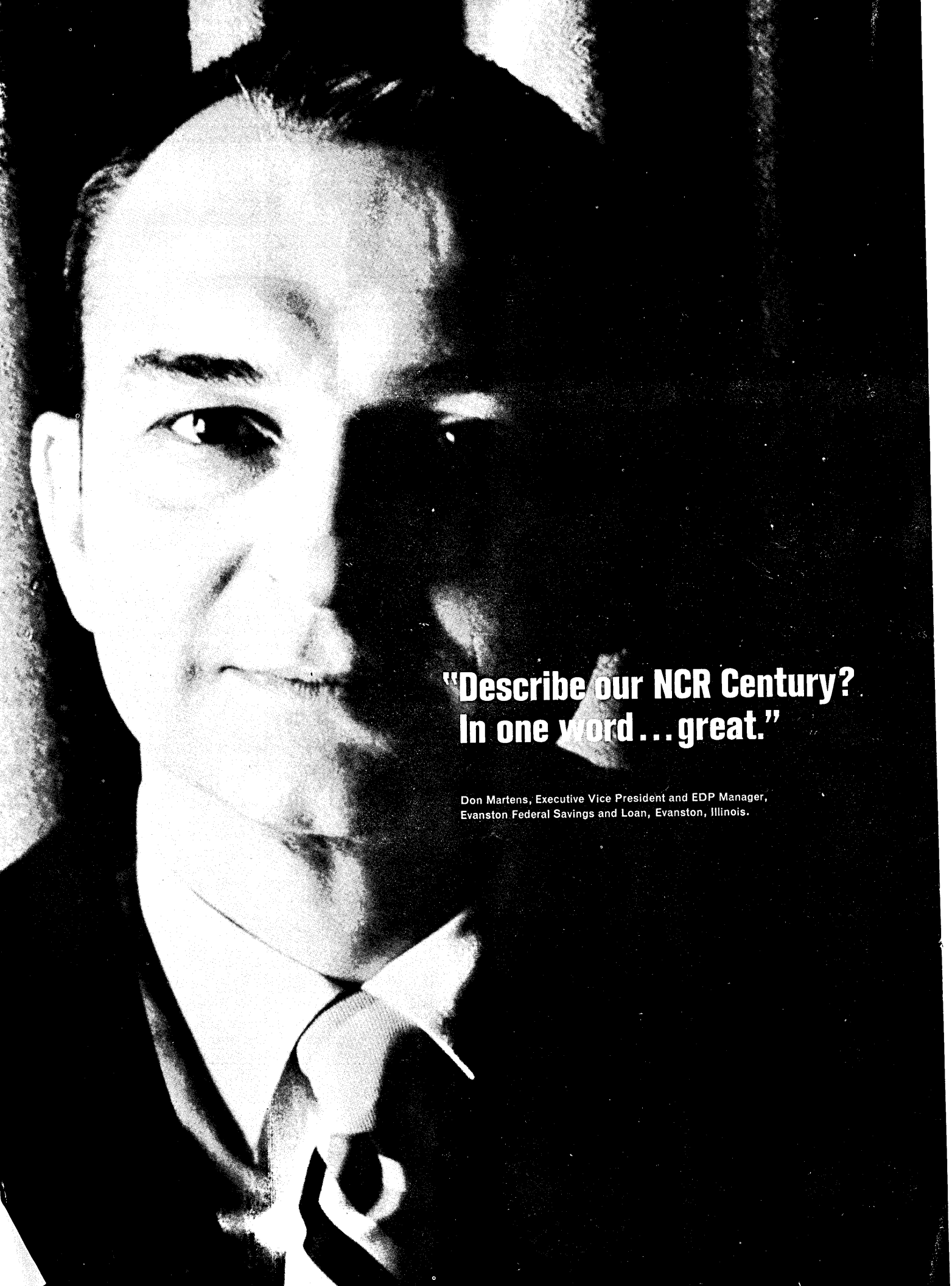
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NEWS SCENE

Paley Helps Find Raytheon the Way

While many companies have been gearing up for the predicted boom in data communications during the 1970s, at least one company — the Raytheon Co. of Lexington, Mass. — surveyed the market and found that it already had the wherewithal in-house to become a power in the commercial side of the data communications market. There was a problem, however: The giant electronics based firm knew that its data communications capability was housed largely in Raytheon units that served military operations. The problem was solved by the formation of Raytheon Data Systems Company (RDS), which will concentrate on commercial markets.

That, in a nutshell, is how Maxwell O. Paley, president of RDS, describes the formation of the new subsidiary.

"This operation is strictly commercial," said Paley in a recent interview. "We will, of course, lean very heavily on the work that's been done in the military area, though."

Paley, who says there are some 1,000 people in the new subsidiary, sees the data communications market taking off in the mid-1970s. Raytheon will mount a three-pronged thrust from the new subsidiary. In the data communications field, Raytheon will be active in the telecommunications and teleprocessing markets. The third thrust will be a continuation of the firm's effort in small computers.

"We'll be configuring systems under the turnkey concept," says Paley. "Some systems — particularly where microwave communications are involved — will run into millions of dollars. Smaller systems will be in the hundreds of thousands of dollars category."

While Paley stressed that RDS will use the turnkey approach for now, he did hint that the firm someday might examine entering the facilities management area of data communications.

Paley said that the suppliers in the data communications market tend to do more software than the user and, as a result, Raytheon is beefing up its software capability in the subsidiary.

"We'll be doing a lot of custom contract systems," says ex-IBMer Paley, "but we're certainly not a systems house. Raytheon is looking to see a very high content of Raytheon equipment go into these systems."

Although RDS will install systems on a turnkey concept, the maintenance and servicing of the systems will be supported by Raytheon's world-wide installation, training, and maintenance network.

Paley believes that Raytheon can

Maxwell O. Paley

grab a big chunk of what he calls the dedicated data communications market. (He believes that dedicated computer networks within individual companies will offer a higher growth rate than the large time-shared networks that serve many companies.)

Paley worked at IBM for more than 20 years, serving most recently as director of advanced computing systems at Menlo Park, Calif. The new subsidiary is headquartered at Norwood, Mass., where Raytheon's Equipment Division is located.

NCR Claims 15 Buyers for New 280 System

The NCR 280 retail information terminal, a computerized cash register, was introduced only last fall, but about 15 customers already have been signed up. Montgomery Ward is installing 1,530 terminals, and the Hecht Co., a Washington-area department store chain, is buying more than 700. An NCR spokesman reports, perhaps unnecessarily, that "we're beyond our sales projection."

Another customer is J. C. Penney, which will put the new system into a store in Hamilton, O. this summer. About two years ago, Penney's ended a lengthy, expensive, and unsuccessful attempt to make GE's Tradar system work (Feb. 1970, p. 163).

The Hecht installation will cost about $2.5 million. A store official said the cost of the new terminal "is about the same" as the cost of a conventional cash register equipped with an optical font journal tape printer.

NCR's new system includes, besides the terminal, a fiber optics scanner roughly the size of a ball-point pen; a printer which produces color bar-coded price tags the scanner can read, and a mag tape "data collection" unit which stores prices and other codes, manually input through the terminal keyboard or automatically input by the scanner. Each collection unit can service up to 48 terminals. The tapes can be read directly into a remote computer by connecting the storage unit to a phone line.

Hecht's is installing a stripped-down version of the system initially. The optical scanner and the price tag printer won't be added until 1973 at the earliest.

Plot Thickens in Plotting Program "Theft"

Late this month a young San Francisco bay area programmer will face a Superior Court judge in Alameda County, Calif. for a preliminary examination into charges of grand theft/computer program.

At least at this writing Palo Alto attorney Richard Mansfield, representing the 29-year-old programmer, Hugh "Jeff" Ward, expected the hearing to take place in late April. It had been scheduled for March 22 following entry by Ward of an innocent plea in a Municipal Court arraignment proceeding but Mansfield said he would

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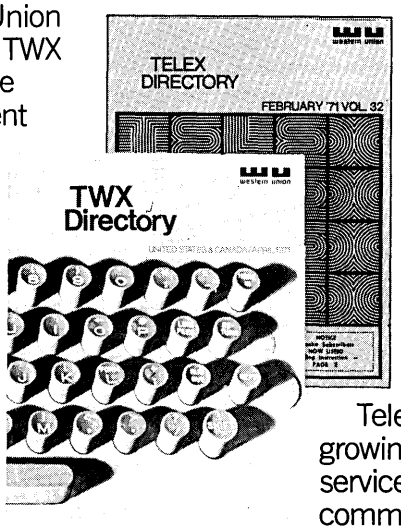

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ask for and expected to get a continuance until late this month.

Ward has been employed as a programmer by University Computing Co. in its Palo Alto, Calif. service bureau since June of '69. The program he is charged with taking belonged to Information Systems Design, Inc., an Oakland time-sharing company. UCC and another of its Palo Alto service bureau employees, Jerry Gaylor, are codefendants with Ward in a separate bay area action, a civil suit filed March 3 by ISD in Santa Clara County Superior Court seeking injunctions and $6 million for "theft of trade secrets ... intent to adversely affect business of a competitor ... and exemplary damages."

Mike Ford, ISD's vice president/marketing, says it all started on Jan. 19. The ISD computer, a Univac 1108 (UCC also has an 1108 in Palo Alto) produced a program on punched cards for delivery to a customer, Shell Development Co. in nearby Emeryville, Calif. It was a program for remote plotting. "We couldn't figure out why Shell would want this and when we asked them they said they didn't want it and hadn't asked for it."

"Somebody had dialed us up and asked for the program and we had to figure out who it was. Our only customer using it was Aerojet General in Palo Alto. We knew both Aerojet General and Shell also were customers of UCC's Palo Alto bureau. Shell used a common terminal site code for the terminals that hooked them into our system and the UCC system. UCC could have gotten into our system using this site code and, through their association with Aerojet, could have obtained the name of the file that was accessed."

"Their mistake was in not knowing that we don't have facilities for remote printout. They got a printout of the program without realizing cards were produced here for physical delivery to the customer."

Having figured this far, Ford said, "we asked the Oakland police to check with the telephone company to see if calls had been made from UCC's dial-up data sets to our dial-up port number on Jan. 19 at approximately 6:15 when the punched card program was produced. The phone company log showed three such calls

(Continued on page 50)

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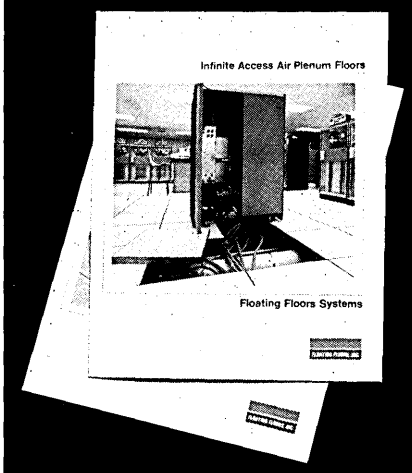

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had been made at about that time."

This was enough, he said, to cause police to ask the district attorney's office for a search warrant. One was obtained which allowed investigators to obtain printout cards and tapes from the UCC computer. The seven hour search on Feb. 19 yielded evidence which led to Ward's arrest and presumably to the ISD civil suit against Ward, Gaylor, and UCC.

Ford said the value of the plotting program is $15K based on man hours of development but "it was worth much more in terms of the competitive edge it gave us." He said the computer time involved was paid for by Shell but "this was a trivial amount."

The issue involved, he said, was of "security of data . . . this belonged to us." He said he had heard that Gaylor had claimed to Aerojet General that he "could access ISD's program any time he wanted to." Some consumer press reports said evidence had been found that UCC had been removing information from the ISD computer since "at least April of 1970."

Ford said this was not the case. He said police did find a large binder labeled "ISD" which contained runs made at ISD in April 1970 but "we don't know what it was. It could have been a benchmark run or something else they had legitimately, but it was on UCC printout paper."

ISD, Ford said, does have a protective keywording feature through which they protect some of their own files and which they make available for customer files. Bob Larribeau, ISD operations manager, described this as a cryptographic encoding technique using a random number generator and a 12-character keyword which the customer (or ISD in the case of their own programs) writes in with his program but which isn't stored. It can be changed at any time. Anyone trying to access a protected file without the keyword, he explained, gets back meaningless data.

Larrabeau said not all ISD customers elect to use the protective feature. There is no charge for it, but it does involve work and where files aren't sensitive it isn't worth it. In the case of the plotting program, he said, "it was an oversight that we didn't protect it."

Whatever the results of both the criminal and civil actions which came out of the ISD incident, they have focused considerable attention on the questions of file security and proprietary ethics. Use of and need for security safeguards for computer files vary as widely as the files themselves and the considerations of cost and time must be weighed against the nature of the data and the likelihood and/or significance of its being accessed.

Richard Reinhart, executive vice president of Computation & Systems Corp., Los Angeles, currently studying a variety of security safeguards for possible use in its time-sharing operation, weighing cost against necessity, sees the kind of violation ISD described as "a breach of propreitary ethics."

The president of a Southern California software house called it symptomatic of "today's programmer ethic," something he described as a tendency of programmers to disregard the proprietary nature of any program. This kind of attitude, he says, led him to require any programmers he hires to sign a statement relinquishing any personal rights to any program they work on for his firm.

He feels, too, that some companies lack respect for the proprietary nature of programs, putting software firms in a precarious position. A company could invest thousands in a proprietary program, he suggested, lease it to a user who could turn around at the end of a contract period, decline to renew, then peddle a thinly disguised version of the program himself. "Theft would be hard to prove."

ISD considers its plotting program proprietary. A UCC spokesman said he didn't think "it was unique" and said UCC has plotting capabilities and didn't need this program. UCC suspended Ward on full salary pending its own investigation of the case. The company also is paying the young programmer's attorney's fees. The progress of the two actions in which he is involved will bear watching.

4th Software Patent Is to an Employee

Charles O. Forsythe is hardly the sort of person you'd expect to be issued the industry's fourth software patent. He's 64 and does actuarial work for

an insurance company in New York. But he has also programmed for the past six years and claims he has written an ingenious debugging system that can easily be adapted for use on any computer with any symbolic or higher-level language, and is so simple that patenting was necessary to prevent its unauthorized duplication. In fact, Forsythe wrote the program more than three years ago, and waited for the patenting of software to become feasible before announcing his work.

Forsythe's debugging system continues the processing of each test run to its logical conclusion despite errors that normally would terminate the run, and records all errors it detects for later correction by the programmer in source language format. It isn't claimed to be perfect, but almost. A sample program with 13 known errors was run, and 12 were detected. Further, error messages were issued, thus saving the programmer's analysis time as well as the machine time for the 12 test runs that were not needed.

The system is in use on an IBM 1410 at Forsythe's place of employment. It has not been sold and no price has been determined. Forsythe is nearly at retirement age, and has no desire to form his own company to exploit his product but is looking for a firm which might market it. Software marketers may contact him at 892 Helen Street, Teaneck, New Jersey 07666.

NEWS BRIEFS

Greyhound Wants Trial

Greyhound Computer Corp. has asked St. Paul Federal Court to return its antitrust action against IBM to an Illinois federal court for trial. The motion, which will be argued April 19 and 20, claims Greyhound has completed the discovery portion of the antitrust suit and is ready for its day in court. The GCC, IBM action began as an Illinois State antitrust complaint in October 1969. After completing discovery, GCC amended the suit to include federal violations and in August 1970 filed a complaint in the U.S. District Court for the Northern District of Illinois, Eastern Division. As the result of an IBM motion the suit was consolidated with the Control Data Corp. suit in the Federal District Court of Minnesota earlier this year. CDC is the surviving member of the antitrust class action established in St. Paul following the flurry of IBM suits in late 1968 and early 1969. It has been pursuing discovery with interruptions for settlement of the suits of Applied Data Research and Data Processing Financial & General Corp. There is now the possibility of another delay should IBM file a counterclaim it has prepared (April 1, p. 19). IBM also is being sued for antitrust violations by the Justice Department and VIP Systems Corp., Washington, D.C.

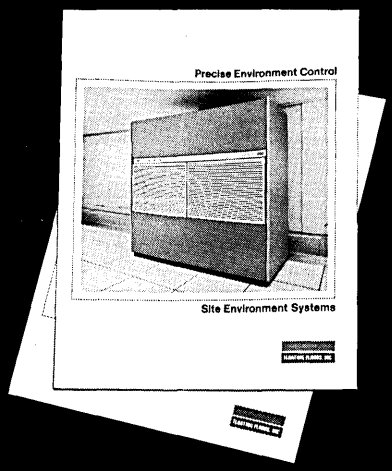
A Phoenix Unfrequent

About 85% of the firms that file for bankruptcy under Chapter 11 ultimately go under for keeps, so it's heartening to note that Dicom Industries, Sunnyvale, Calif., maker of cassette magnetic tape systems, is now out of bankruptcy after filing for Chapter 11 last August. The 97-employee company has become a 30-employee company in the process, and chairman Jerry A. Cain and president Robert L. Stubbs are no longer there, but current president T. A. McChristy has announced new financing amounting to $500K, and the firm has secured oem orders for its minicomputer cassettes from Hewlett-Packard, Fairchild, and Varian Associates. McChristy describes himself as a tight-fisted nickel watcher, but the company will exhibit at the SJCC (booth 2444), and is developing a new higher-speed cassette. Creditors, have faith.

Cops and Robbers

Memorex Corp., accused of theft of trade secrets by IBM in a pending lawsuit (Jan. 15, p. 43) was itself the subject of an attempted trade-secret-theft last month — or so the Santa Clara, Calif. police report. A Memorex public relations spokesman, Hank Conlon, said all he knows of the case is "what I read in the papers."

Alvin Leal Farr, a self-styled private eye accused of the attempted theft, appeared in Santa Clara Municipal Court March 15, but refused to plea pending advice of an attorney and was granted a continuance until



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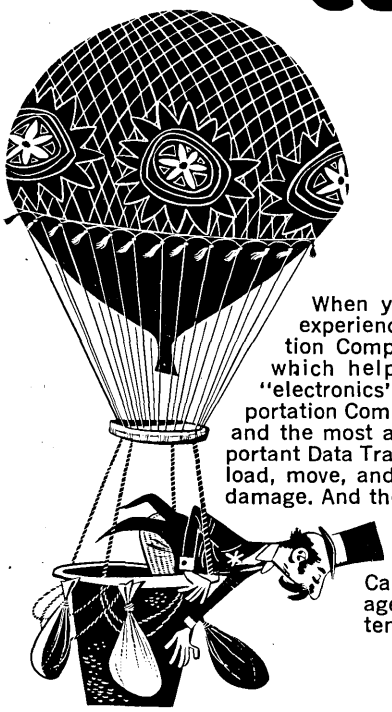

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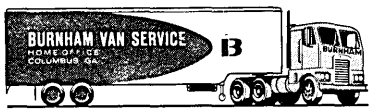

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NEWS SCENE

March 22. Farr was arrested following a staged "buy" of phony Memorex documents overheard by an investigator hidden in the trunk of a car, police said. They said photos and technical papers from IBM were found in Farr's car along with a loaded .22 caliber pistol and several amphetamine tablets. Sounds ominous.

Deflated Symbology

The lexicon of credit rating has yielded to the pressures of edp and inflation. Dun & Bradstreet, Inc., has reduced the variety of symbols it uses in its credit rating, while it has expanded the rating range. Where "up to $3,000" and "over $1 million" once seemed sufficient to designate a company's financial health, it is now thought that "up to $5,000" and "over $50 million" are more suitable. For symbology the trend is in the opposite direction. AAA-1 had indicated a highly rated company; now the designation is 5A-1. According to D&B the new symbols with fewer numbers and letters and no fractions, plus signs and lower-case letters, are more acceptable to the range of I/O equipment used by its customers.

The Fair Is a Ball

A computer fair for the delight and education of school children will be held at the Lawrence Hall of Science, Univ. of Calif, Berkeley, May 19-23. The idea is "to demonstrate to parents, children and educators the desirability of using computers as educational aids, the ease with which they can be used by children, and the fascination they provide."

An extensive area of the hall will be used for the fair and the sponsors of the show are soliciting contributions (for the fair, only) in the form of visual displays, computer art, music, and games, and t-s terminals for student use. The man to contact is Hesh Wiener at the hall.

Olsen Named Science Advisor

A second computer specialist is advising President Nixon on matters scientific with appointment of Kenneth Harry Olsen, president of Digital Equipment Corp., Maynard, Mass., to the President's Science Advisory Committee. ■

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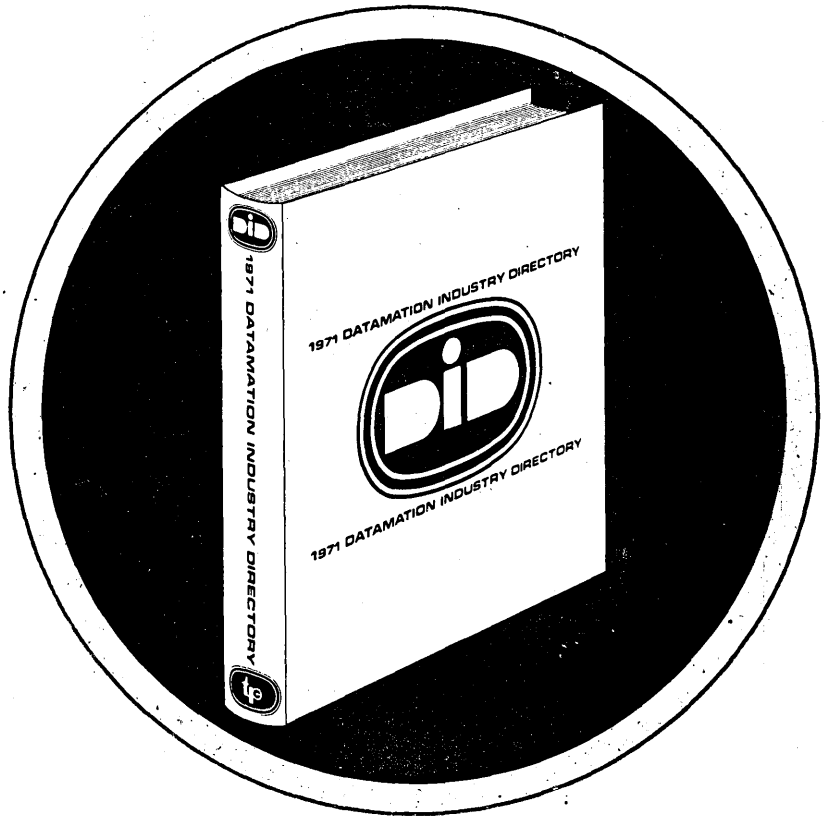

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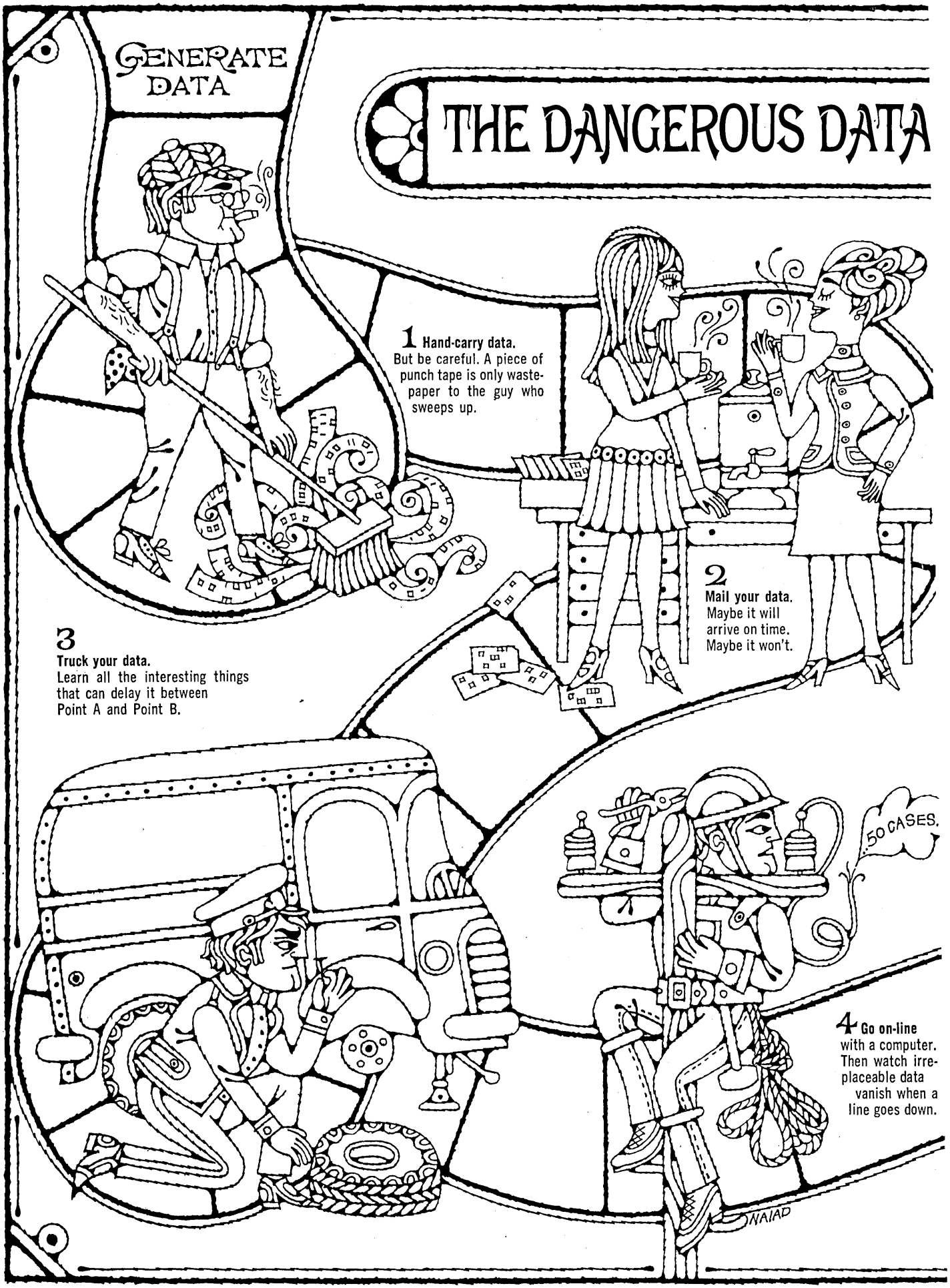
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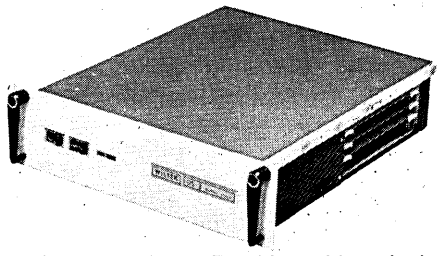

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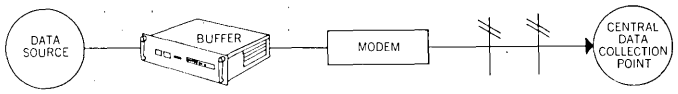

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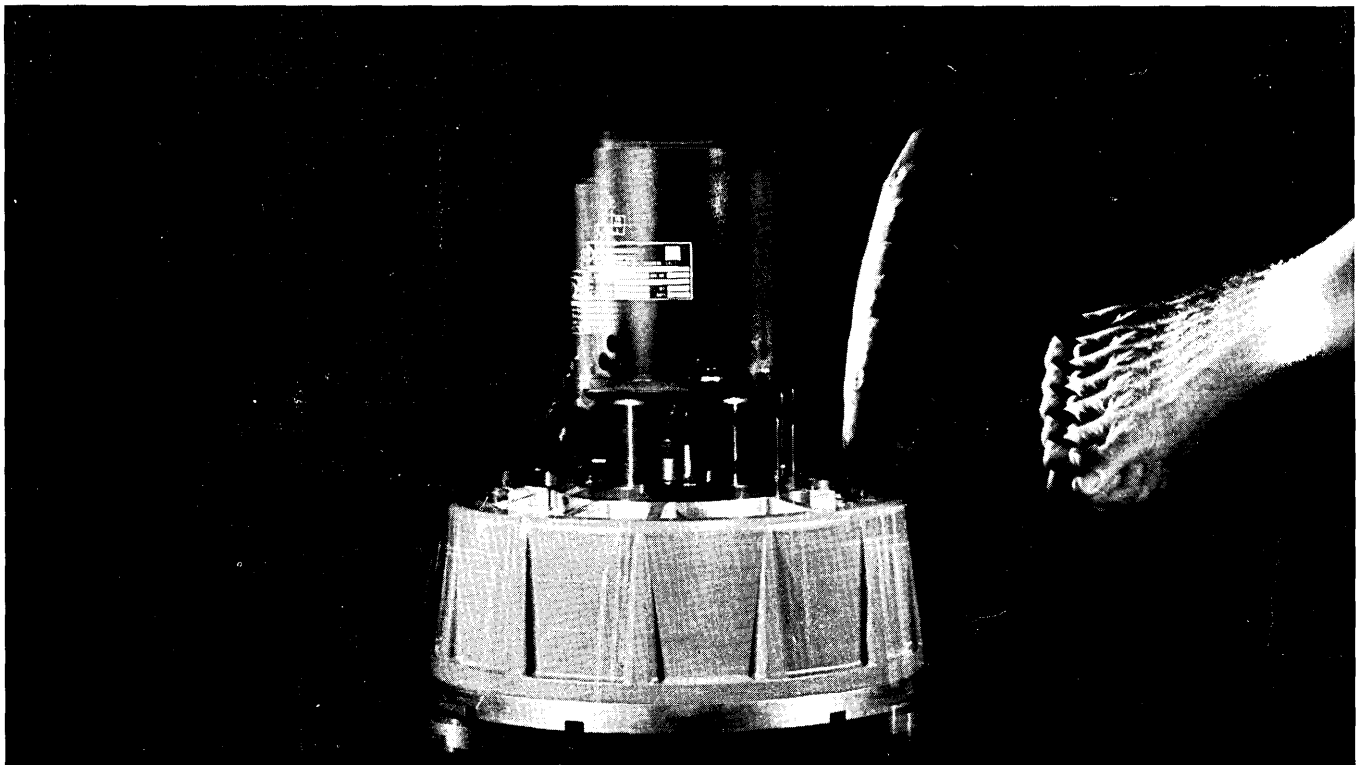

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*We'd be happy to show you an engineering report by an independent laboratory which conducted temperature, shock and vibration tests. Excerpts: *"The memory was subjected to shock forces as high as 15 G's—without incurring bit errors."*

"The memory was operational without error throughout the frequency spectrum—"

DATUM CPD CALIFORNIA PERIPHERALS DIVISION

170 E. Liberty Avenue, Anaheim, California 92801. Telephone (714) 879-3070. TWX 910-592-1289.

PRODUCT SPOTLIGHT

Terminal System

Alternative terminal systems offered to replace the IBM 2848/2260 display configurations in the past have generally required some software changes that users were unwilling to risk. They liked the idea of lowering the rental on their data collection function, but didn't want to change anything in their dp system to get it. Much effort and time has been expended on the system 40/80 to insure that it can be installed and operated completely transparent to the 360—with a reduction of up to 39% in monthly rentals in some configurations.

Four models of crt terminals are offered, ranging from three lines of 40 5x7 starburst EBCDIC characters, to 12 lines of 80 characters/line. The 12-inch screen is refreshed at 60 Hz. Cursor controls include space, backspace, cursor up, cursor down, home, and carriage return. Other standard features include clear to end of line, clear to end of page, clear page, cursor repeat, tab, and character insert, delete, repeat, and carriage return. A choice of full alphanumeric, numeric, or data entry keyboard is offered.

The standard remote data transfer rate is 9600 baud, and the local data transfer rate is 125 Kilobytes/second maximum. The system 40/80 controller, which can handle up to 32 display terminals, can be attached to selector or multiplexor channels, or to the communications controller. Optionally available for the 40/80 are up to two read/write magnetic cassettes, and up to four 15-cps printers.

The price break is probably due to the fact that a separate controller is not required to control each group of eight crt's. Looking at a typical installation of 16 crt's for displaying 960 characters each, the monthly rental is $1752/month on a one-year contract, including maintenance. It is said that the comparable IBM configuration now rents for $2860. The 40/80 terminal system is currently being evaluated by a large banking institution in the Los Angeles area, and deliveries are currently 60 days ARO. TRIVEX INC., Orange, Calif. For information:

CIRCLE 500 ON READER CARD

Printer/Plotter

Initially this manufacturer will concentrate on the numerous end users of Hewlett-Packard, Varian, Digital Equipment, Honeywell 16 series, GRI, IBM 1130's and 1800's, and most of the XDS Sigma lineup. An audience that large will probably buy quite a few Matrix 1300 printers, 1100 plotters, or 1100A printer/-plotters. The units are extensions of the Matrix line of electrostatic printers announced about a year ago—the extensions consisting of 52 more columns on which to draw and print. (Previous members of the series had only 80 columns.) Common to the three units are 11-inch wide paper (fan-fold paper accessory with top-of-page formatting optional), synchronous or asynchronous transmission rates up to 9,600 baud for ASCII or other characters, and availability in July.

The 1300 printer prints 7x9 dot-matrix characters from a 64-character font at 300 lpm. This unit is priced at $6700 or will rent for $230/month. The 1100 plotter operates at 75 scans/second, with each scan containing 128 bytes. Each bit relates to one nib on the writing head which has 100 nibs per inch across 10.24 inches. An 8½ x 11-inch page is drawn in approximately 13 seconds. This unit is priced at $7200, or rents for $240/month. Optional are software graphic packages. The 1100A combination printer and plotter also can print at 300 lpm, plot at the same rate as the 1100, or do both on the same page. This unit, like the 1300 printer, comes with a standard 64-character set, and a 132-character buffer. The 1100A is priced at $8800, or rents for $290/month. VERSATEC, INC., Cupertino, Calif. For information:

CIRCLE 501 ON READER CARD

(Continued on page 59)

For people who can't wait 90 days for their next data set.

The 48-hour alternative.

Forty-eight hours. Two days.

That's how long it takes to ship an Ultronic data set after receipt of order. Right off the shelf and into your system.

You can have just about any operating capacity you need, too. 1200, 2400, 4800 bps. All operationally compatible with telephone company equipment and EIA Standard RS-232 interface.

Like to hear more? O.K. Let's take them one by one.

Our Data Pump Series 202/1200 has something extra built in. Troubleshooting test switches which quickly tell you the source of any data transmission problems. Not that you'll ever have much trouble with an Ultronic 202/1200. It's completely solid state in construction. Transmission of up to 1200 bps is over unconditioned 3002 voice-grade telephone lines.

The Data Pump 201/2400 data set also transmits over 3002 voice-grade lines. Frequency shift keyed with duo-binary encoding, it has built-in test switches. It works even better than it looks. And that's saying a lot. Because the 201/2400 comes in an attractively designed beige and walnut case that is attractive enough to put on your desk.

No matter how you use it—point-to-point, multipoint, or for remote batch processing—the 4800 Data Pump is the workhorse data set with the capacity to do any job. It uses modified duo-binary coding to eliminate the d.c. component in the transmitted signal and compress the bandwidth, so more power is concentrated in the effective part of the spectrum. Short turn-around time provides efficient multipoint operation. Which means you can transmit error-free data and do it faster. Transmission is over standard Series 3002 lines with C2 conditioning. Operation can be two wire in simplex or half-duplex and four wire for half-duplex or full-duplex.

That's what we've got. In standard cabinets or in custom designed card modules in OEM quantities. And you can have any of them on lease—or own them outright.

You also get another benefit. Our own service organization. Some 250 technical experts in 56 cities all across the country. If something goes wrong, you won't have to go very far to get help.

We have everything you want in data sets. The same goes for the rest of your telecommunication needs. Time Division and Frequency Division Multiplexers, video and hard-copy terminals, plus the experience to put them together in a complete system.

Ask us. You won't have to wait around for an answer. Call Lee Shrout, Director of Marketing at (609) 235-7300. Or, write to Ultronic Systems Corp., Department DA-4, Box 315, Moorestown, New Jersey 08057.

☐ I can't wait! Send me__of Model _____data sets right away!

☐ I'm in a hurry, but I can wait a few days until your sales representative calls.

☐ No rush. Send me literature.

Name _____

Position _____

Company _____

City _____ State _____ Zip _____

Ultronic Data Sets

GTE INFORMATION SYSTEMS

Data Entry

Out of the hurley-burley of the crowded data entry market two verities have dropped. The customer wants communication capabilities, and a basic, inexpensive system is needed to cut competition and possibly grab a few more keypunch conversions.

The low-cost system, Model 85, comes in at about $90 a keyboard. Between 20 and 32 keyboards can be linked to a 12K processor and supervisory control console and combined with seven- or nine-track tape and either 700K characters or 5.6 million characters of fixed-head drum storage.

Record length for the 85 is 80 characters. Standard system functions include program loading, error recovery and restart, and drum dump, load, and initializing. Supervisory control functions are load, stop, position peel tape, list, peel, release, peel and release protection, summary, stop, status of storage drum, and timed operator statistics. Keystation functions are enter, verify, batch open, suspend, close and reopen, record deletion, insertion and search, back space, duplicate and skip, and reproduce and copy. Up to 64 formats can be stored in the program library. The only option is the check digit feature.

Communication capability for the

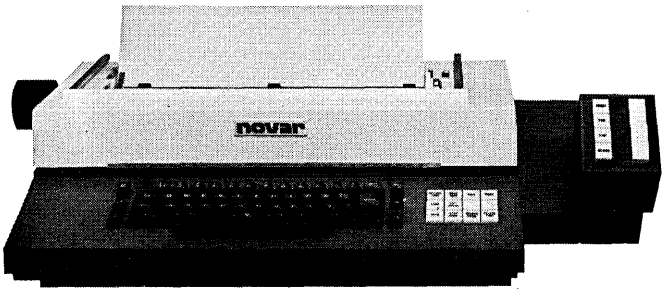
Key-Edit is embodied in Model 145, a "terminal/processor." Many of the options on the vendor's original system, the Model 100, are standard on the 145. Significant additions include on-line remote job entry and a variety of peripheral device options, mainly printers and card equipment. Model 145 can be connected to other Key-Edit systems or to a central processor. The system processor is a 16K unit that will handle from four to seven keyboards and the tape drives and drums.

Standard record length for this system is 160 characters. A 240 character record length is optional. Any number of format programs can be stored in the system. Standard supervisory control functions are those of the Model 100 plus untimed operator statistics and batch totals. Additional standard features include signed numbers for keystations and check digit.

Deliveries of both Model 85 and Model 145 systems are scheduled for July 1971. Lease price for a 20 station Model 85 system is $20,000 and a Model 145, four station system has a $975 monthly rental. CONSOLIDATED COMPUTER SERVICES INTERNATIONAL, INC., Waltham, Mass. For information:

CIRCLE 502 ON READER CARD

(Continued on page 61)



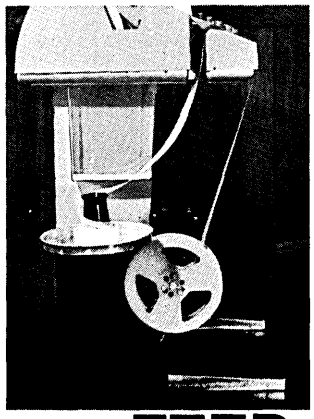
This NOVAR terminal will work side-by-side with 2740's and 1050's, and they'll all look alike to your computer. Except that the NOVAR Model 5-50 can be equipped to transmit and receive data up to 2400 bits per second—that's 2400 words per minute!

novar

Novar Corporation • 2370 Charleston Road
Mountain View, Calif. 94040 • (415) 964-3900
Offices In Principal Cities

GTE INFORMATION SYSTEMS INCORPORATED

CIRCLE 29 ON READER CARD



IN/OPAC's Data Center, designed specifically for Teletype Model 33 terminals with time-share users in mind, provides continuous, simultaneous winding and unwinding without operator attention. The Data Center fastens to the terminal in seconds. Write for details. Let us send you our new data processing input-output accessories catalog.

FEED, COLLECT TAPES IN ONE OPERATION

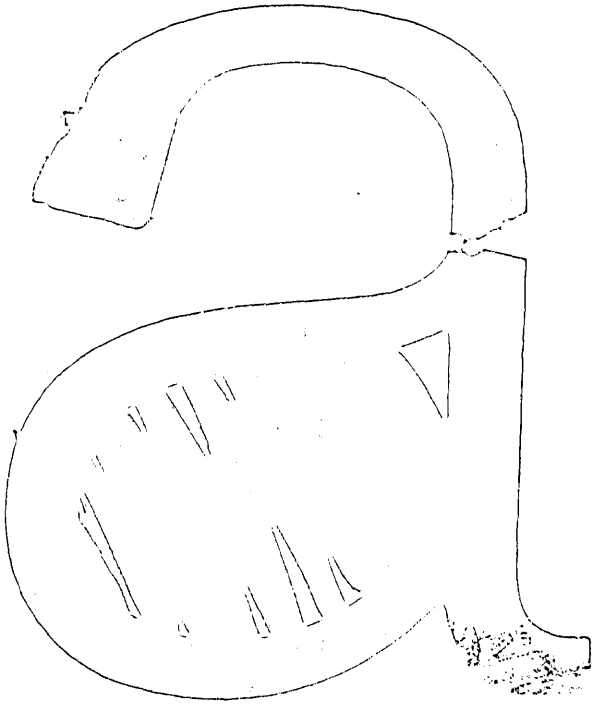
in/opac DIVISION

Numeridex Tape Systems, Inc., Dept. D
4711 W. North Ave./Chicago, Ill. 60639/312-772-6400

Your most complete source of supply for data processing peripherals and expendables

CIRCLE 56 ON READER CARD

SCAN-DATA brings you the letter "a"



And any other consistently degraded character, no matter what the condition.

It's a "show" no other OCR manufacturer can offer.

Because their equipment just can't handle degraded material the way ours can.

Which means that optical character recognition has come of age . . . and is ready to do what everyone thought OCR would do, someday.
But hasn't, until now.

Like be able to read virtually any consistent font, even degraded characters—directly from source documents. And that means anything from handprint to Hebrew. Direct from pages or documents. On practically any weight or grade of paper. All of which makes direct data capture a thing of the present.

In other words, eliminate the need for costly re-creation of source documents.

Three things make it possible:

☐SWAMI, Software-Aided Multifont Input, the world's first, and only self-teaching OCR system.

☐Our new Page/Document Readers, which handle source documents from 3″ x 7″ through 11″ x 14″.

☐And our commitment to make Scan-Data OCR equipment the last word in data entry.

And every word.

SCAN-DATA CORPORATION

"Someday" is here. Now.

800 East Main Street / Norristown, Penna. / (215) 277-0500

Multiplexor

A multiplexor for leased or private line systems features channel speed intermix capability for operation of high and low speed equipment within a single network, allowing older terminals to be phased out over a period of time without replacing all network terminals simultaneously. Modular construction of the unit, called the DIGINET 160, permits individual channels to be moved, without disturbing others. The multiplexor operates over four-wire voice grade circuits in systems where permanent connections are needed between terminals and computers. No data set is required as the 160 connects to the telephone lines.

Internal diagnostics permit operators to isolate trouble in local equipment, line, or remote components. The diagnostics also can be used to check individual modules. Each DIGINET 160 is transparent to data codes with speeds of 110, 150, 300, and 600 baud. Correspondingly, the voice grade channel capacity is 17, 12, 6, and 3. The price is about $925 per channel, with delivery requiring 30-90 days, depending on quantity. GE, Lynchburg, Va. For information:

CIRCLE 516 ON READER CARD

Hardware Floating Point

PDP-8 installations doing lots of floating point arithmetic with software routines might want to consider the hardware box supplied by this manufacturer. It does 36-bit floating point arithmetic in a format identical to that used on the old IBM 7090 series computers (and other computers) with the range of floating point values being $\pm 10^{38}$ and a resolution of eight decimal digits. The unit is IOT driven (DEC jargon for input/output transfer) with computations said to take between 10 and 50 usec. Options to the floating point box include three word integer arithmetic operations in addition to floating point and level conversion for negative level machines. The unit can be adapted for use on other DEC 16-bit machines, but as offered for PDP-8s its price is $6600. The firm also has software available to optimize the unit's operation. Delivery of the floating point box takes 120 days. SOFTWARE ENGINEERING, Ann Arbor, Mich. For information:

CIRCLE 515 ON READER CARD

(Continued on page 63)

PAST AND FUTURE TIMES

The past is where you've been. The future is where you will be. How to get from one to the other—how to forecast reliably—has been a subject of deep concern from board room to computer room and in between.

LAMBDA'S TIMES program now makes available a new and powerful computer-based aid for forecasting on the basis of past data. With it, the analyst is able to examine past data, develop a model that adequately represents the underlying process, and then create optimal forecasts of the future.

TIMES implements the recently published Box-Jenkins technique, acknowledged as an advance in the state of the art. The program carries out all calculations and tests automatically.

If your board room and computer room are concerned about forecasting sales, inventory, or production . . . write or call:

Lambda Corporation
1501 Wilson Boulevard
Arlington, Virginia 22209
(703) 528-8200

LAMBDA

CIRCLE 41 ON READER CARD

You can't afford to miss

"Infographics Update"

20th Annual Convention

NATIONAL MICROFILM ASSOCIATION
Washington, D.C. May 25-28, 1971

Biggest Show in NMA History

Balanced Programming

- Trade show boasts largest number of exhibitors ever . . . in ⅓ more space than last year
- Four action-packed days of education—unbiased seminars, provocative papers, technical sessions on systems, hardware

Plan to be where the action is!

For information write **National Microfilm Association**
8728 Colesville Road
Silver Spring, Maryland 20910

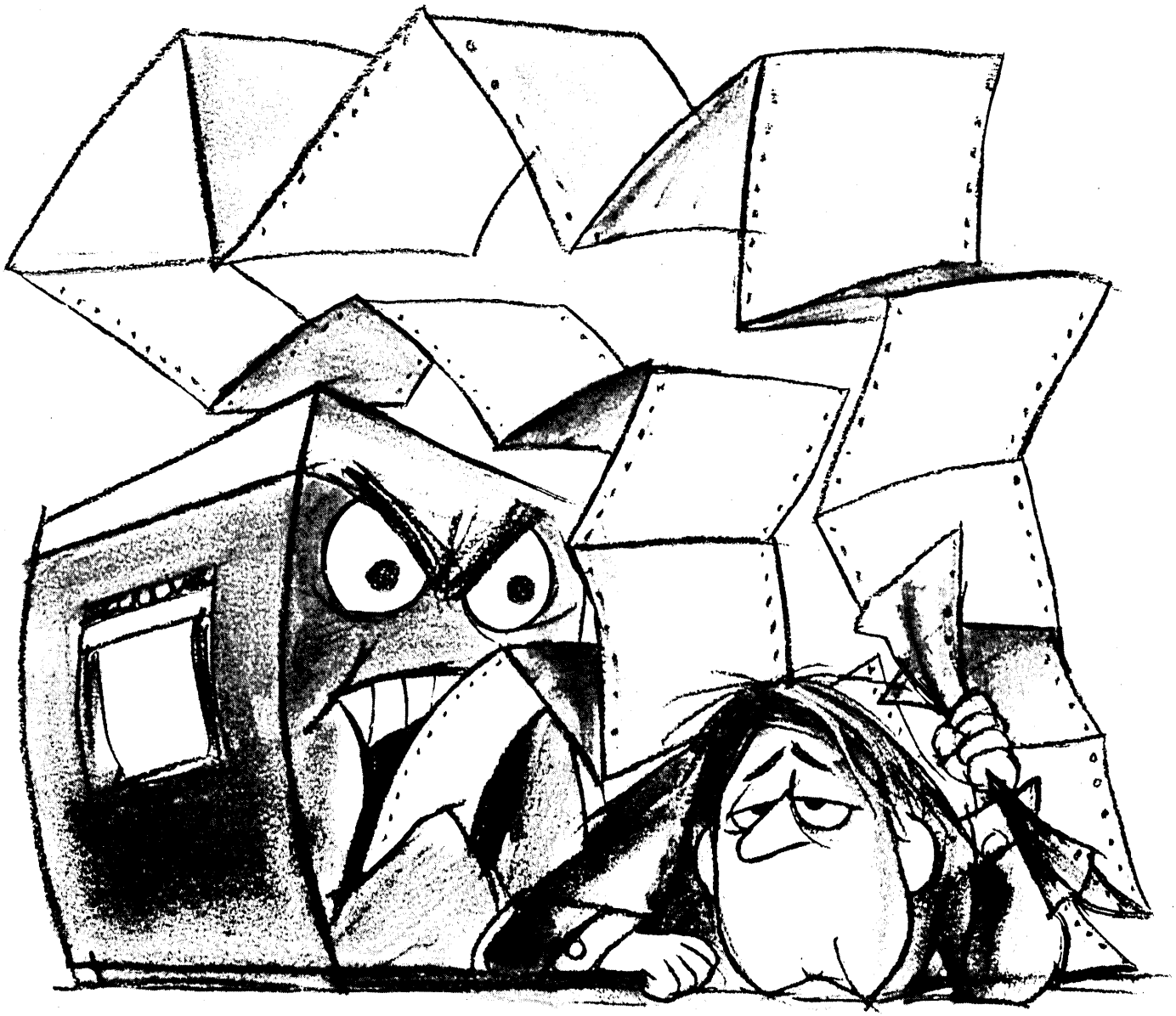
CIRCLE 61 ON READER CARD

Smothered by "paper pollution"? Reproduction Systems will save you overnight!

If you're being buried by reams of computer printout and are wasting time and manpower on slow lookups, Reproduction Systems has news for you: *help is on the way.* It is COM—computer output microfilm—the simple, convenient, money-saving system that completely bypasses the printer "paper pollution" stage by converting tape directly to microfilm!

An RS COM program also

- Provides overnight service to fit your particular need
- Gives you the benefit of costly equipment and skilled technicians *without capital investment*
- Guarantees complete reliability and financial security as the world's largest COM center network and a member of Transamerica Corporation



Fight "paper pollution" and boost profits by freeing your computer to compute. Call today for details.

Check your phone directory for the Reproduction Systems COM offices in these cities: UNITED STATES: Salt Lake City, Utah; Minneapolis, Minnesota; San Francisco, California; Tulsa, Oklahoma; Los Angeles, California; Philadelphia, Pennsylvania; Hartford, Connecticut; Boston, Massachusetts; New York, New York; Dallas, Texas. CANADA: Montreal, Quebec; Toronto, Ontario. EUROPE: Frankfurt, West Germany; London, England... soon to open in other major cities.

Reproduction Systems

One California Street, Suite 1940
San Francisco, California 94111
(415) 397-6428

A Microfilm Service of Transamerica Corporation

Tape Units

Not only does the series 934 IBM-compatible tape drives include this firm's first self-threading and 200-ips models, the price schedules would seem to make the three-member series especially attractive for 360 and 370 users. The 934-3 is a 75-ips unit with a transfer rate of 120 KB for 9-track 1600-bpi tape, and 60 KB for 800-bpi density. Both 7- and 9-track models are available. This unit sells for $14,500 or rents for $375/month, which includes unlimited use and full service, according to the manufacturer.

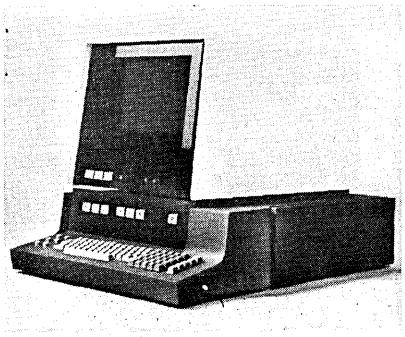
The 934-5 is a 125-ips model, with a transfer rate of 200/100 KB for 1600/800 bpi tape, respectively. The 934-7 is the 200-ips model, with a transfer rate of 320 KB for 1600 bpi and 160 KB for 800-bpi 9-track tape. These units can also be ordered as 7-track versions. The 934-7 sells for $18,100 and should rent for approximately $450/month. That appears to be substantially below what some other manufacturers are asking for 200-ips drives.

The 9803 dual-density controller sells for $16,100 and leases for $625/month. Multiyear leases are available. The tape subsystems are scheduled for delivery early next year. TEXAS INSTRUMENTS, INC., Stafford, Texas. For information:

CIRCLE 503 ON READER CARD

raphics Display

Conography is what this manufacturer calls its proprietary method of using conic sections to produce any



curved contour regardless of its mathematical function. The technique debuts with the firm's first product, the Conograph/10. Among the characteristics of the unit is the 10-inch diagonal screen for displaying 2K x 1,520 resolvable points. The vector generator is rated at 4 msec to construct a corner-to-corner line.

A sonic pointer is used for a light pen, and a joystick is available, as is hard copy output. Scaling ratios for alphanumeric information go up to 15X, allowing up to 158 lines of 341 characters/line to be displayed. Image translation, rotation, and deformation can be performed without having to access any other data base. Curves can be dynamically manipulated until the desired wave form is attained.

For end users, interfaces for H-P, Varian, Data General, and Digital Equipment computers are available. Delivery is quoted as 30 days ARO for the Conograph/10, which is priced under $9K. CONOGRAPHIC CORP., Cambridge, Mass. For information:

CIRCLE 504 ON READER CARD

24-Bit Minicomputer

Latest in a series of three 24-bit computers for scientific and industrial applications is the 6024/5, a minicomputer. Once known as the Series 6000 (Oct. '68, p. 143), the line has progressed downwards, using the same basic cpu and software, but declining in speed and size of memory, expansion capabilities, and price.

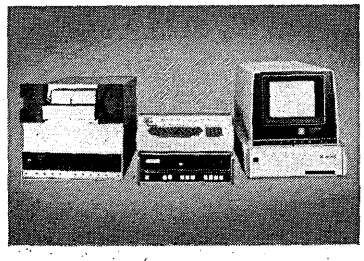
The minicomputer has a cycle time of 1.2 usec with an operation speed of 2.4 usec to perform an addition. The basic 4K memory is the firm's DC-38 planar core memory, expandable in 4K increments to 32K. There are five general purpose, programmable registers, three of which are hardware index registers. Operation codes comprise 582 instructions. Priority interrupts are external, 2 to 16 true levels, and internal, up to 4 executive traps. I/O channels include direct memory access, and up to 14 channels, with up to 16 devices or device controllers per channel.

Software includes previously announced 6024 series capabilities, such as FORTRAN IV math routines and a resident operating system. The 6024/5 sells for $15,500 in its basic 4K configuration. Deliveries are scheduled to begin in August, with about 45 days ARO thereafter. DATACRAFT CORP., Ft. Lauderdale, Fla. For information: ■

CIRCLE 506 ON READER CARD

Winston Churchill

would have loved Xebec.



Uncommonly versatile—that was Winnie. That's us too. When we started in business, our aim was to make and market *versatile* mini-computer peripherals—to offer the industry quality systems and equipment that would be compatible with the minis of *all* major OEM companies.

So we did.

Today we market such products as advanced operating cassette systems, moving head disk systems and controllers, line printer interfaces, and many more.

Look for us at the upcoming Spring Joint Computer Conference. We'll have a hospitality suite manned by people as versatile as our products, with displays and product literature — and answers to 'peripheral' questions you probably haven't even thought of yet.

xebec

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918 North Rengstorff Avenue
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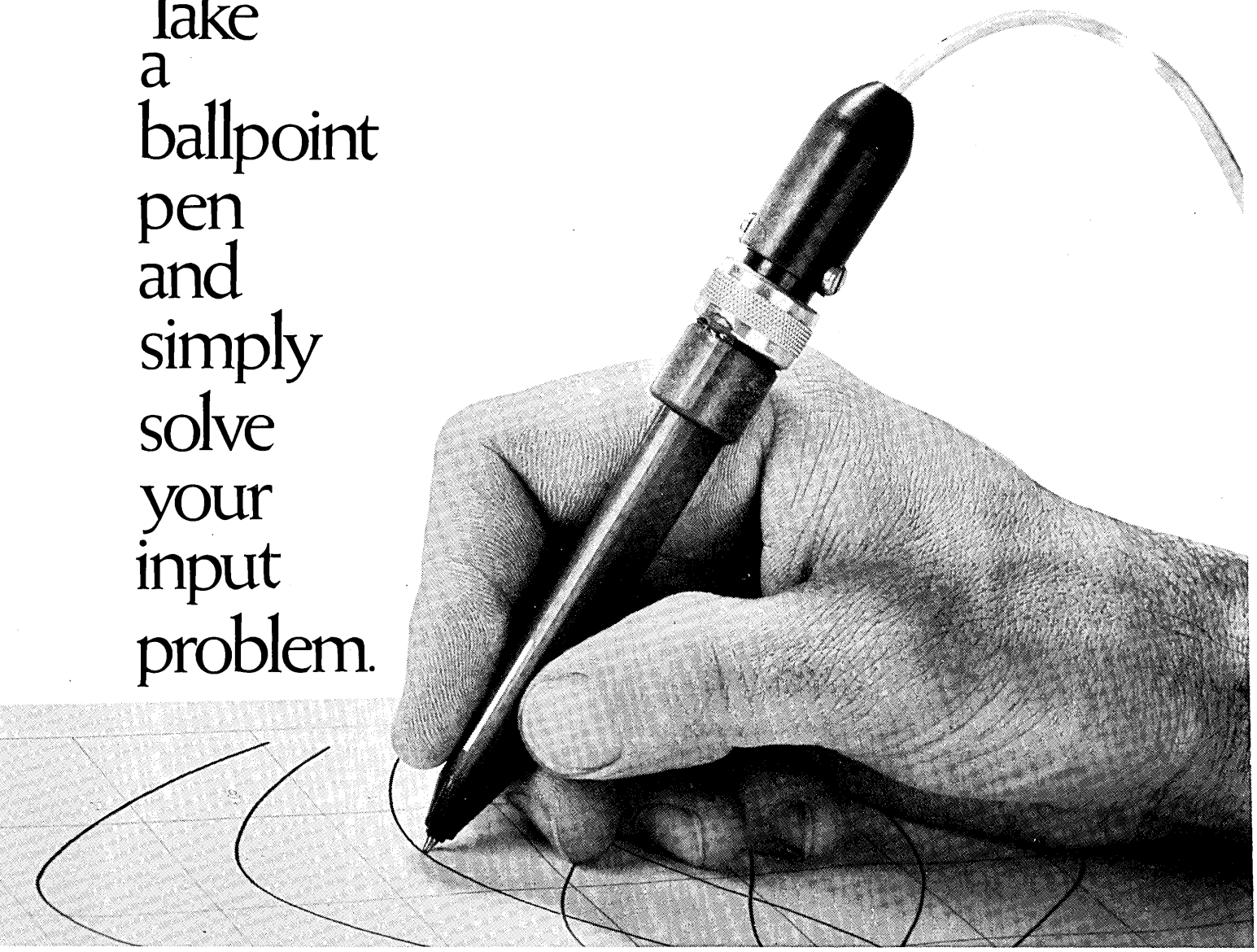
TWX 910-379-6942

CIRCLE 32 ON READER CARD

Take a ballpoint pen and simply solve your input problem.



Four major computer suppliers did.

Two of the nation's largest computer companies wanted a flexible graphic input system to support new product developments in their research laboratories. Another wanted to offer its mini-computer users a one-of-a-kind, low-cost data entry capability. And the fourth needed an easy way to capture data from the face of a CRT during manufacturing test operations.

They all chose the Graf/Pen.

Graf/Pen is a ballpoint with a difference. It uses a tiny spark that sends sound signals to strip microphones that record X and Y coordinates. Because sound is used, data input is very simple. No software, no costly interfaces, none of the start-up problems often associated with data input.

If you have a data entry problem involving written, drawn, formatted or graphic information, chances are that Graf/Pen can help solve it. Simply. And at a very low cost.

Let us hear from you.

Please tell me more about Graf/Pen. I have an input problem I want to solve, simply, in the following application area:

_____

_____

Name:_____

Title:_____

Address:_____

_____

City:_____ State:_____ Zip:_____

SAC SCIENCE ACCESSORIES CORPORATION

65 Station Street, Southport, Conn. 06490
Telephone: 203-255-1526

Science Accessories Corp. is a subsidiary of Amperex, a North American Philips Company

It shoots 132 characters at a time.

On the scarred and battled plains in the war of peripherals, Versatec wheels out Big Bertha . . . a printer/plotter whose big noise is that she makes no noise at all.

Her output sends shudders in the ranks: 132 characters per line on 11" paper.

She is also known under the code name of Matrix 1100A . . . a versatile, non-impact, hard copy output device that combines a 480 line-per-minute printer with a raster-scan plotter.

She has a 64 character set ROM that decodes standard ASCII input into perfectly formed 7 x 9 dot matrix characters.

And she plots with 100 nibs per inch.

All for $8800.

If the pounding of peripherals is making your office sound like Normandy, our big gun can silence that.

For details write the Leader of The Silent Generation: Versatec, Inc., 10100 Bubb Road, Cupertino, California 95014. (408) 257-9900.

VERSATEC

THE MATRIX 11" PRINTER/PLOTTER

Currently, our biggest gun

CIRCLE 27 ON READER CARD

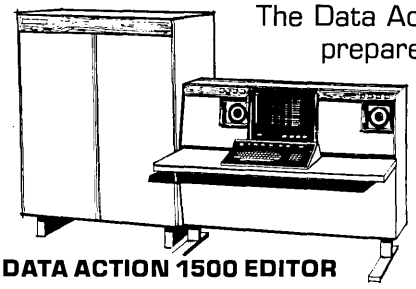
Demonstrated at SJCC—Booths 2412-2414

DATA ACTION CHALLENGE

WE CAN SOLVE MORE OF YOUR INPUT COST PROBLEMS BETTER THAN ANYBODY CAN!

Data preparation is our business: finding easier, faster, more accurate ways to do it.

Every person at Data Action is committed to computer input—with one goal—to cut your input costs. We make our living doing it. And we do it with a system approach that can save you, in hard dollars, up to 50% of your total data preparation cost—and as much as 30% of your total data processing dollar.



DATA ACTION 1500 EDITOR

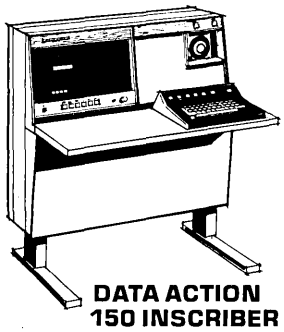
The Data Action system prepares information for your computer—from the time your source document is created until you address your master file.

The system gives you faster, simpler data preparation. It can eliminate pre-processing runs on your computer. You make one trip to your computer room with completely accurate information.

Two Data Action entry units are available with the system: The 150 Magnetic Data Inscriber and the 220 Typescribe. Choose the one best suited for your requirements.

The 150 Inscriber is a key-to-tape entry unit for use in a central data preparation location. It operates like the keypunch, but without its mechanical limitations. The operator can work faster and more efficiently.

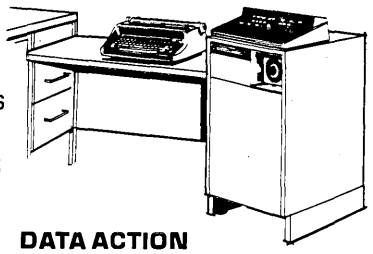
The Data Action Typescribe captures data on magnetic tape at its source. Any typist can use it. It employs a standard IBM Selectric typewriter.



DATA ACTION 150 INSCRIBER

Data is recorded on tape as the operator types hard copy. The Typescribe eliminates two costly, slow steps in standard data preparation: keypunching and key verifying.

Data keyed on the 150 Inscriber and the 220 Typescribe (as well as the IBM MT/ST) can then be processed by the 1500 Data Editor. The Editor handles editing of input data automatically, to your criteria. It puts data into final computer-ready form. It eliminates expensive pre-processing runs on your mainframe and eliminates costly machines and operators for entering verified input data.



DATA ACTION 220 TYPESCRIBE

The ability to perform conditional verification adds to the unique advantages of the Data Action system approach. You eliminate up to 100% of key verification.

The Data Action input system also makes available a tape unit for output on 7 or 9 track compatible tape in all densities (including 1600 BPI)—and a full line of printers from 300 to 1200 lines per minute.

We believe we can solve more of your input cost problems better than anybody else. Why not make us prove it?

Contact your nearest Data Action Sales Office. Or write; DATA ACTION, Dept. A9071, 4445 West 77th St., Minneapolis, Minn. 55435 Phone 612/920-9200.

DATA ACTION
THE INPUT COMPANY

Loading your computer system with erroneous keyed inputs not only chews up main frame time but bogs down your data preparation group with re-checking source documents, re-punching, re-verifying, and re-comparing.

The Entrex 480 system cleans up that mess. At the front end is a deceptively simple CRT keystation, or rather 64 keystations if you need them. At the output end is a single industry-compatible tape, verified, edited, blocked, and formatted for your computer. In between is a computer with up to 65K bytes of core and 8 million bytes of disk.

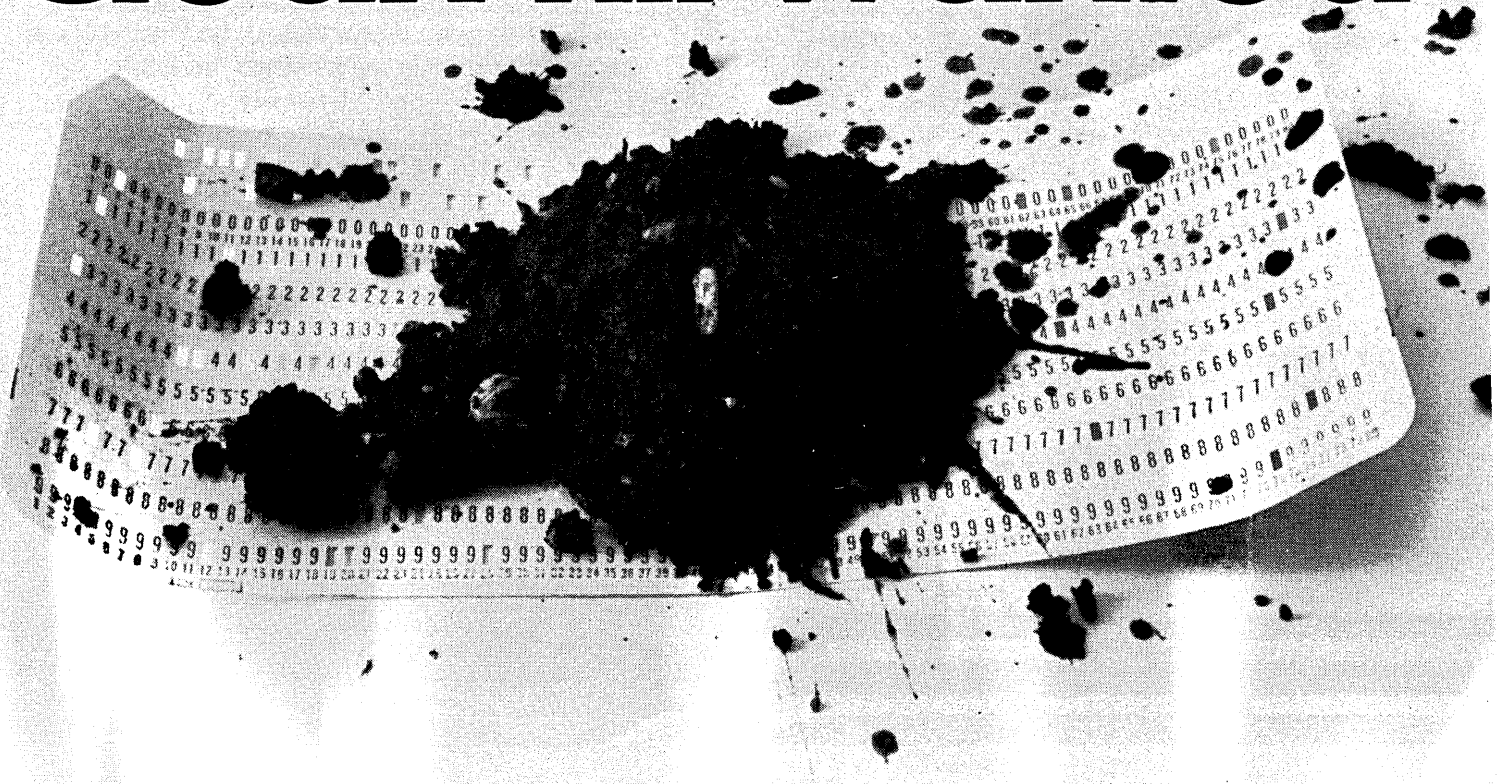
It's the thing in the middle that makes both ends so simple. It tells the operators what to enter by displaying instructions for each field on the CRT. It lets her correct an error and it tells her if she makes one. She can visually verify, recall records, and examine whole records (in any length). If she is having a really bad day, pressing the HELP! button brings her displayed instructions telling her how to get out of the box. And she learned how to do it all in less than 2 hours.

The output is further edited during transfer from disk to tape. Fields are resequenced and rearranged into records, records grouped into blocks, and labels put on. Your labels.

Reprocessing keyed entry data is a dirty trick on everybody. End it with an Entrex 480 system. Start by calling or writing for literature and/or a demonstration. Entrex, Inc., 113 Hartwell Ave., Lexington, Mass. 02173. (617) 862-7230.

ENTREX

Clean fill wanted



CIRCLE 38 ON READER CARD

OCR Software

The user of IBM's 1287 or 1288 ocr units can get three packages that may simplify his operation. CORRECT (Customized Optical Reader Random Error Correction Technique), VAT (Visual Automation Technique) and Optical Character Reader Executive Program are the products of a relatively new ocr service company.

CORRECT is a series of programs that generates scannable error correction documents. Nonreadable characters, designated by an asterisk, are printed on a turnaround document along with readable characters of the same field. The document holds up to 15 fields each identified by document number and field description. Corrections are written in by hand, the document read by the 1287 or 1288, and the data automatically inserted in its proper place in a disc or tape resident error pending file.

VAT, also a series of programs, is aimed at promotional mailing for the pharmaceutical business, but can be used to handle mailings for other businesses. It provides direct recording of responses to promotional literature and generates mailing labels and a taped list of recipients along with history file tracer numbers. VAT reduces sample accounting to two journal entries, the first and last tracer numbers for each sample lot. Should a recall of the samples be necessary, this range of numbers is accessed and labels for the recipients they identify are produced.

Both packages are in IBM assembler language and can be used with 360 Model 25 and up computers under DOS. They operate in a 12K partition.

The ocr executive program is a 4K addition to the DOS library. It takes care of ocr program calls, relieving the system supervisor of this chore. According to the producer it is of particular interest to 1287 and 1288 users with multiprogramming systems.

The prices of the basic CORRECT and VAT packages are $5500 and $5000 respectively. Customization is extra and the company handles installation. Lease terms are available. VISA, INC., Valley Forge, Pa. For information:

CIRCLE 507 ON READER CARD

Applications Language

SIRE (Symbolic Information Retrieval) is a user-oriented application language resembling COBOL which automatically performs functions such as defining file structures, file maintenance, sort and merge routines, graphic display, and reporting. The system consists of more than 130 FORTRAN subroutines which are activated through an interpretive process by the SIRE vocabulary. Programs written in SIRE are executed in two phases. Interpretation is the first phase, processing the SIRE commands, and translating them into machine language. Coding is checked for accuracy, and then assembled into a command string. The actual execution phase scans the command string and the necessary routines are called in for processing.

A reduction in lead time of up to 99% is claimed for getting an application program operating. Another feature of the system is the inherent self-documenting quality of the source statements. The system can even be supplied in French, German, Italian, and other languages. Additionally, SIRE can be used to input, manipulate, report, and graph data directly from (or to) non-SIRE files and systems.

Currently available are versions for Univac 1100 series cpu's and IBM 360/370 mainframes above the model 44. Fully interactive t-s operation is planned for the near future, but for now batch, and remote batch operation is accommodated. Approximately 64K words of storage are required on the Univac equipment, and typically 300K bytes on IBM gear.

Including installation, documentation, and training for three user personnel, the price of SIRE is approximately $50K. Versions for CDC, RCA, GE and DEC PDP-10 computers are planned. SIRE was developed at the Boeing Co. and is marketed only from this vendor. SCRIPT ASSOC., Bellevue, Wash. For information:

CIRCLE 508 ON READER CARD

Appropriation Accounting

Local, state, and federal government agencies, school systems, and other organizations that use an appropriation vs. expenditure accounting system can utilize this general ledger and budget status reporting package. Written in RPG for the 360/20, the system produces a transaction listing by type of input document, a general ledger, a budget status report, an equipment listing, and a listing of outstanding purchase orders. It conforms to U.S. Office of Education format. The minimum core required is 8K. The price of $2500 includes seven programs, but not installation. CONTRACT COMPUTER SERVICES, INC., Atlanta, Ga. For information:

CIRCLE 509 ON READER CARD

Series 400 Software

DAPS (Direct Access Programming System) for what is now the HIS Series 400 computers has been updated. The original version of the COBOL system came out in 1967. DAPS/70, the new version's designation, features an ANSI COBOL language processor, faster initiation of object programs, increased I/O queuing for printer and punch units, and modifications to the Integrated Data Store which allow simultaneous update, preretrieving, and disc queuing. The modifications also allow maximum use of simultaneous channels in multichannel disc systems. HONEYWELL INFORMATION SYSTEMS, Phoenix, Ariz. For information:

CIRCLE 510 ON READER CARD

Payroll

PAY-35 is a payroll system for use with minicomputers, large computers and time-shared systems, mainly because it is designed so that the employee master file can be created on paper tape and updated using an ASR-35 for I/O. The FORTRAN IV system operates in 8K of core with disc storage. All reports—period wage accrual, labor distribution, checks and registers, summary, W-2 and 941, and employee records—are designed for printing on the smaller teletypewriter carriage. A basic PAY-35 system is priced at $950 for a source deck and a year of updates. AMERICAN DATA CONTROL SYSTEMS, Cincinnati, Ohio. For information:

CIRCLE 511 ON READER CARD

(Continued on page 70)

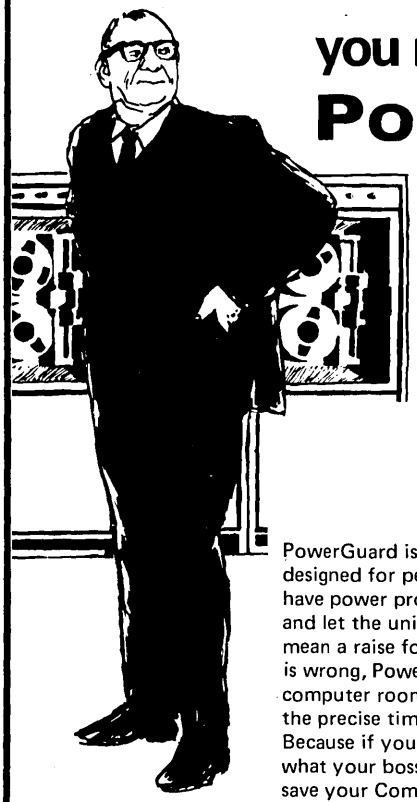
Business Programs

Two more programs have been added to the TSBP (Time Sharing Business Package) and MCBP (Mini Computer Business Package) libraries which contain 34 programs to perform A/R, billing, A/P, payroll, labor distribution, and financial reporting. The first program called ANALYZE, permits statistical analysis of a permanent data base using a single logic statement. The user expresses his criterion for counting, selection, retrieval, and printout from any logical combination of information on the file. The FORTRAN program requires generally 20K bytes, and is supplied with a user and system manual, flow chart, etc.

The second program, called INCOMP, performs analysis of commercial income property to determine profit, cash flow, and yield on investment. Input data can be altered to view the effect on the model. The FORTRAN program requires approximately 10K bytes. The prices for the TSBP and MCBP are $14K and $9K, respectively. COMPUTING CORPORATION INTERNATIONAL, INC., Englewood, Colo. For information:

CIRCLE 512 ON READER CARD

If your boss doesn't think you have power problems



you need...

POWERGUARD

PowerGuard is a complete high speed analysis system designed for people with bosses who don't think they have power problems. All you do is plug it in, sit back, and let the unit show how smart your boss is. That could mean a raise for you. But on the slight chance your boss is wrong, PowerGuard will record all your plant's or computer room's power malfunctions clearly showing the precise time each occurred. That's even better for you. Because if you really do have a power problem instead of what your boss presumed was faulty equipment, you'll save your Company time and money. That will impress your boss's boss. Maybe then you'll be your own boss.

Each unit can be purchased for $1,175

Lease plans are available

If power isn't your only problem, and fluctuations in temperature and humidity are costing your company unnecessary dollars and time . . . prove it with EnviroGuard, and find out in time to do something about it. No other equipment is necessary to obtain a full and accurate record of your environment. EnviroGuard continuously monitors the temperature and humidity for fluctuations that violate your own preset values, sounding a warning and permanently recording the temperature and humidity when the environment falls out of your desired ranges.

WESTERN UNION COMPUTER UTILITIES INC.
2601 E. Oakland Park Blvd., Suite 401
Fort Lauderdale, Florida 33306
PHONE: (305) 563-8885

Please send me more information about POWERGUARD☐ENVIROGUARD☐ D

Name_____ Title_____

Company_____ Phone_____

Address_____

City_____ State_____ Zip_____

CIRCLE 26 ON READER CARD

Inventory Forecasting

PICM (Production and Inventory Cost Minimizer) is a management tool designed specifically to determine the optimum solution to the problem of balancing production and inventory levels. Input consists of 12 periods of demand forecast data; initial regular and overtime daily production levels; initial inventory level; cost of holding one unit of inventory/day; regular and overtime increase and decrease production cost/unit; number of inventory and work days/period; desired safety levels; and the maximum amount that regular and overtime production can increase over each of the next 12 periods.

The output is a report showing the input data, the minimum cost of the optimum solution, plus a tabular listing of the anticipated demand and desired production and inventory levels for the next 12 periods. PICM is written in FORTRAN IV, requires typically 52K bytes of storage, and is priced at $5K, including source deck and documentation. JOHN MUELLNER, Business Consultant, Chicago, Ill. For information:

CIRCLE 513 ON READER CARD

Accounts Receivable

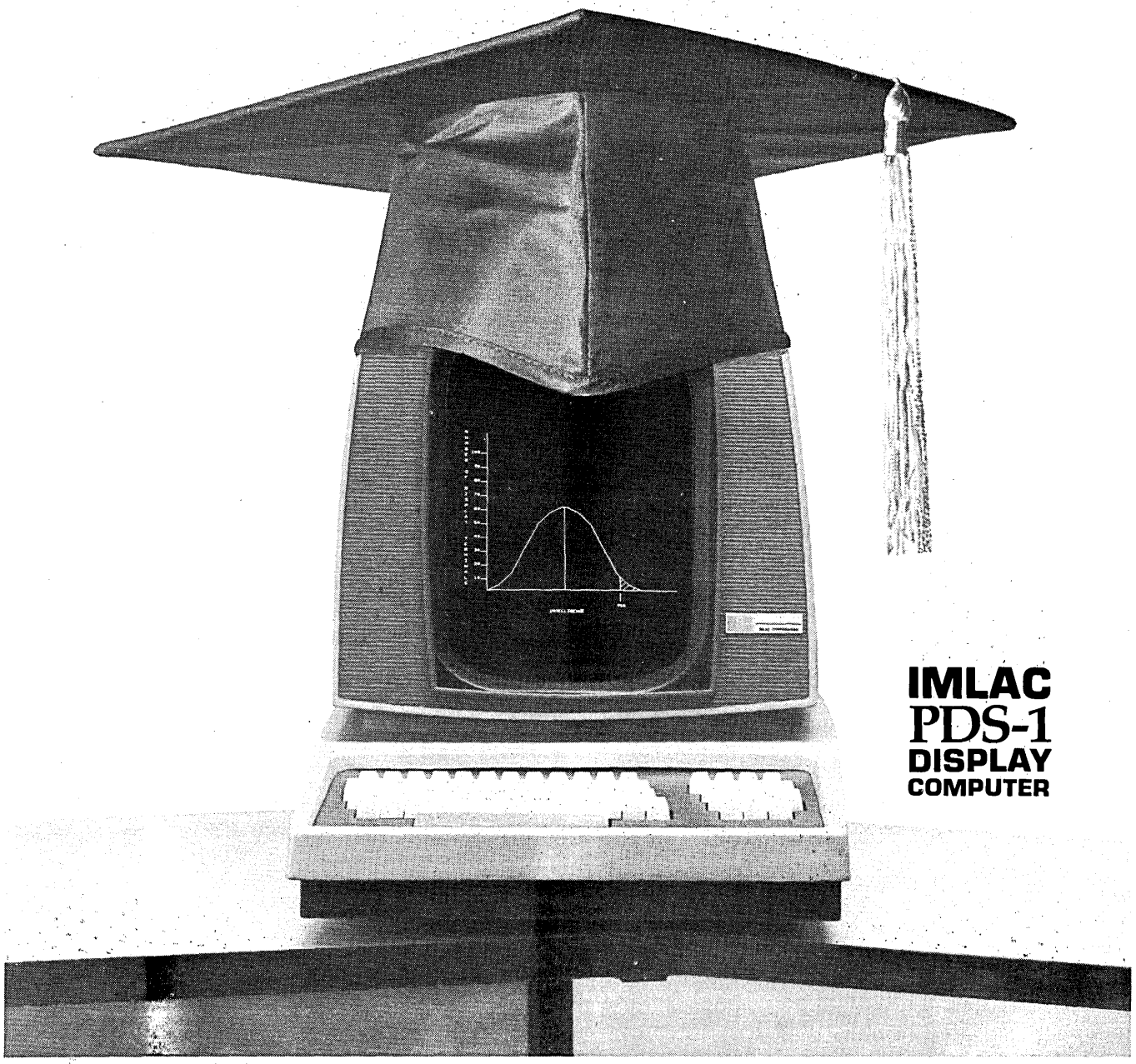
An accounts receivable package including automatic aging, debits/credits, balance forward, and optional dunning report generation is available for $960. The package is available in either COBOL F or D and requires a machine with at least 64K bytes of memory. Other features characteristic of A/R programs, such as file management and updates, are also included in the program. The price includes the source coding and documentation. PDA SYSTEMS, INC., New York, N.Y. For information:

CIRCLE 514 ON READER CARD ■

IMLAC wears many hats.

Studious IMLAC, the terminal display computer with a bent for graphics. What makes IMLAC so smart? It's the software. Including Fortran graphic sub-routines for the host machine, and programs for text and graphics editing on the terminal's own internal computer.

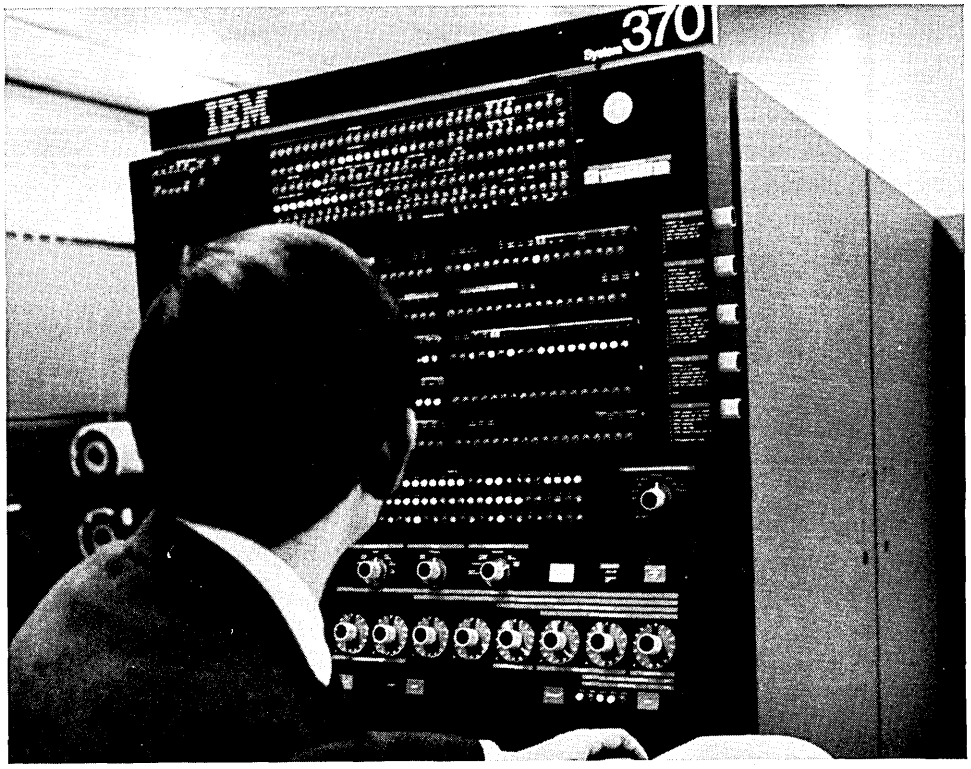
IMLAC performs most functions of systems four times its quiet price range of $10,000. And, as an option, delivers the best text and graphics hard copy output available. Unlimited potential for academic and industrial users in MIS, interactive control or monitoring, computer aided design applications and more. Interested in flexible intellect? Consider IMLAC, the scholarly mind with the expressive face.



IMLAC
PDS-1
DISPLAY
COMPUTER

Write for information.

IMLAC CORPORATION 296 NEWTON ST., WALTHAM, MASS. 02154 / TEL. 617 891-1600 TWX 710-324-0466



The IBM System/370 is already at work...

We introduced System/370 last June. And promised first delivery in eight months.

We're ahead of schedule.

The first System/370 Model 155 is already on the job. At the Zayre Corp. in Framingham, Massachusetts, a leading retail chain.

Installation was completed on Friday, January 29. And Zayre immediately put the Model 155 to work on inventory, billing, sales, and accounting without altering their existing System/360 programs.

Zayre's computer professionals say the Model 155 is everything they expected and more.

It's already processing their work 2.5 times faster than the System/360 Model 50.

In its first week the new system prepared reports on sales from 200 stores in 70 cities and tracked a 5-million-item inventory.

Among other things, it also prepared 20,000 payroll checks. Payments for 30,000 vendors' invoices. Accounting and statistical reports for management. And processed information from 3,000 cash registers.

Zayre will use IBM's powerful Operating System (OS), which permits the Model 155 to perform up to 15 different jobs simultaneously.

Last month nine other businesses got the speed and economy of Model 155.

A merchandiser will use it to process orders and inventory control information up to four times faster.

A manufacturer will use it to help put plant-floor production on-line.

A banker will use it to handle a growing number of accounts.

When we designed System/370, we designed a computer that would work faster and better.

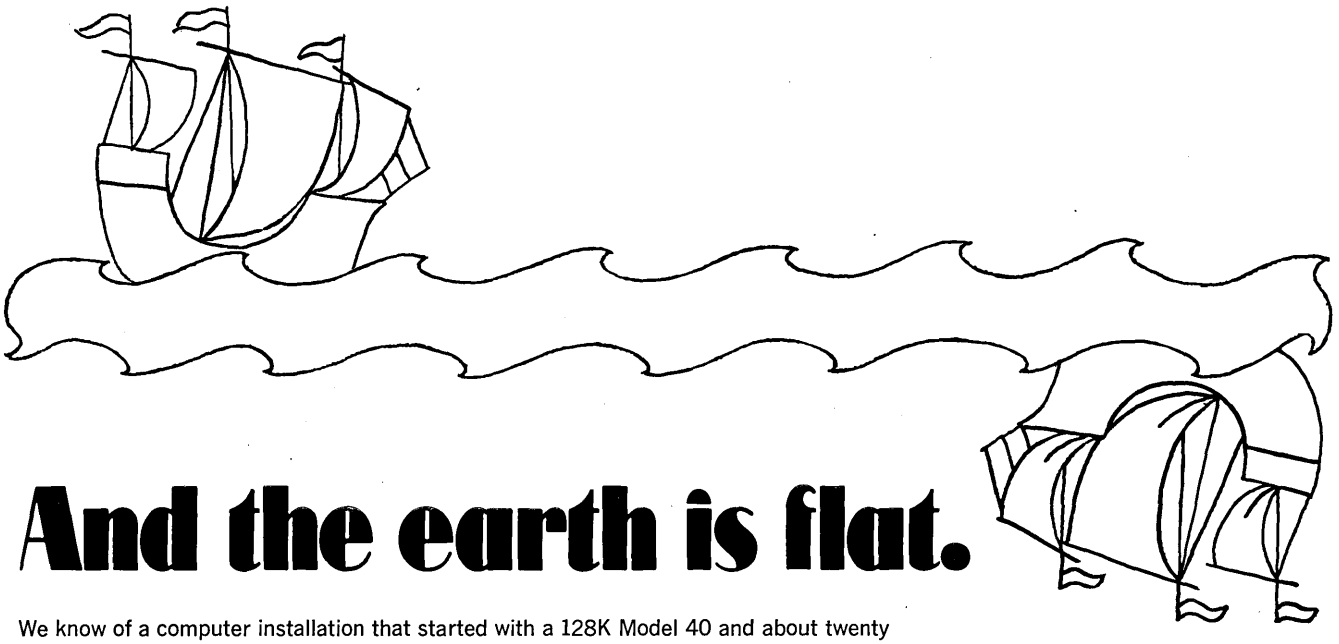
And would be easier to put to work.

That's another reason we're the company behind the computer.

IBM. CIRCLE 7 ON READER CARD

The company behind the computer.

When a terminal-oriented 360 takes 30 seconds to answer your question, the solution is a bigger computer.



And the earth is flat.

We know of a computer installation that started with a 128K Model 40 and about twenty terminals. They added ten more terminals and the response time jumped from three seconds to thirty. It took 128K more core at $3800 a month to get response time back to normal.

But then they added ten more terminals and went right back to thirty-second response time.

Spending another $3300 a month for a Model 50 didn't help either. They had to add *still* more core to restore response time—but after adding another ten terminals, they were back in the soup again.

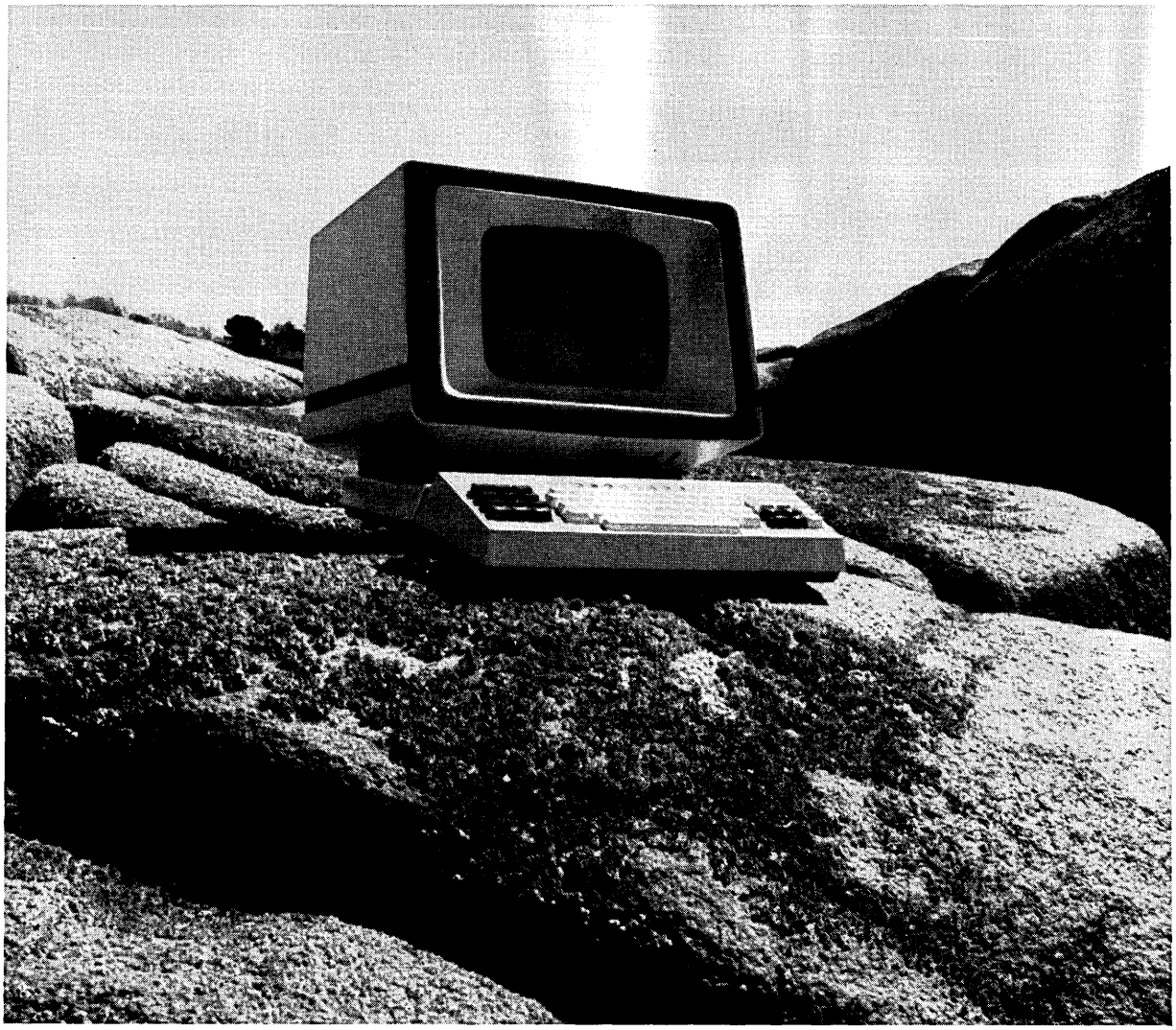
There's a solution to this paradox but it doesn't come from IBM. It's called ENVIRON/1—a real-time system that makes a/360 respond in a few seconds *regardless of the model or the number of terminals.*

If you'd like to get your terminal system out of the dark ages and see the response time you were promised, contact us.

ISS **Information Storage Systems, Inc.**

SOFTWARE PRODUCTS □ 10435 North Tantau Avenue □ Cupertino, Ca. 95014 □ (408) 257-6220

When our terminal becomes obsolete...



it replaces itself.

Fully programmable, the SPD™ 10/20 is the world's first computer terminal designed to anticipate its own obsolescence.

The secret is a small, extremely powerful computer . . . 2K memory (16 bit words) . . . *within* the display itself. The resulting flexibility is absolutely unique.

The SPD 10/20 is currently on line to IBM, Honeywell, Univac, RCA and Burroughs mainframes — all without a single modification in central site software . . . and it also talks to the "minis," but with the SPD 10/20 you might not need one.

It means that every time you want to move ahead, you don't have to start all over again.

Think it over.

Then ask about leasing or buying — we do it either way, and we can save you some money there as well.

For further information, contact: Director of Marketing Support.

INCOTERM™ CORPORATION

. . . the international computer terminals people

Hayes Memorial Drive / Marlborough, Massachusetts 01752
Tel: (617) 481-2000

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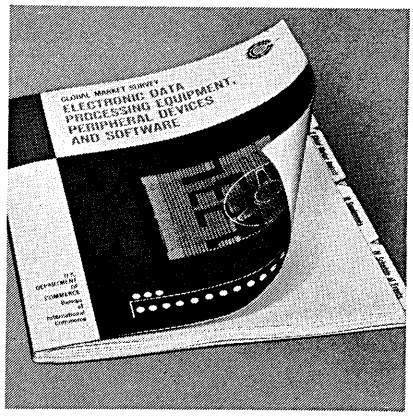
See you in Atlantic City – Booths 1975 & 1977

We can get the wheels turning to get you a piece of the $4 billion EDP market overseas.

This survey starts them rolling.



When it comes to EDP equipment, America is the world leader. Yet the time has never been better to cultivate new markets than right now.

Just look overseas!

Potential customers abound abroad for American EDP hardware, software, peripheral equipment.

A special market study—more than a year in the making—tells the whole story. It has been specially prepared by the Department of Commerce's Bureau of International Commerce for the computer industry as part of the Global Marketing Program.

It can tell you who's looking to buy what now and over the next five years in 25 countries around the world. For new installations. Expansions.

It can tell you what EDP products are most in demand. How to sell them most effectively.

The Bureau of International Commerce will help you in more ways than you can imagine...and so will Sea-Land, the international intermodal transportation company. Sea-Land can show you how containerization can put your EDP machinery and related equipment right on the doorsteps of overseas customers.

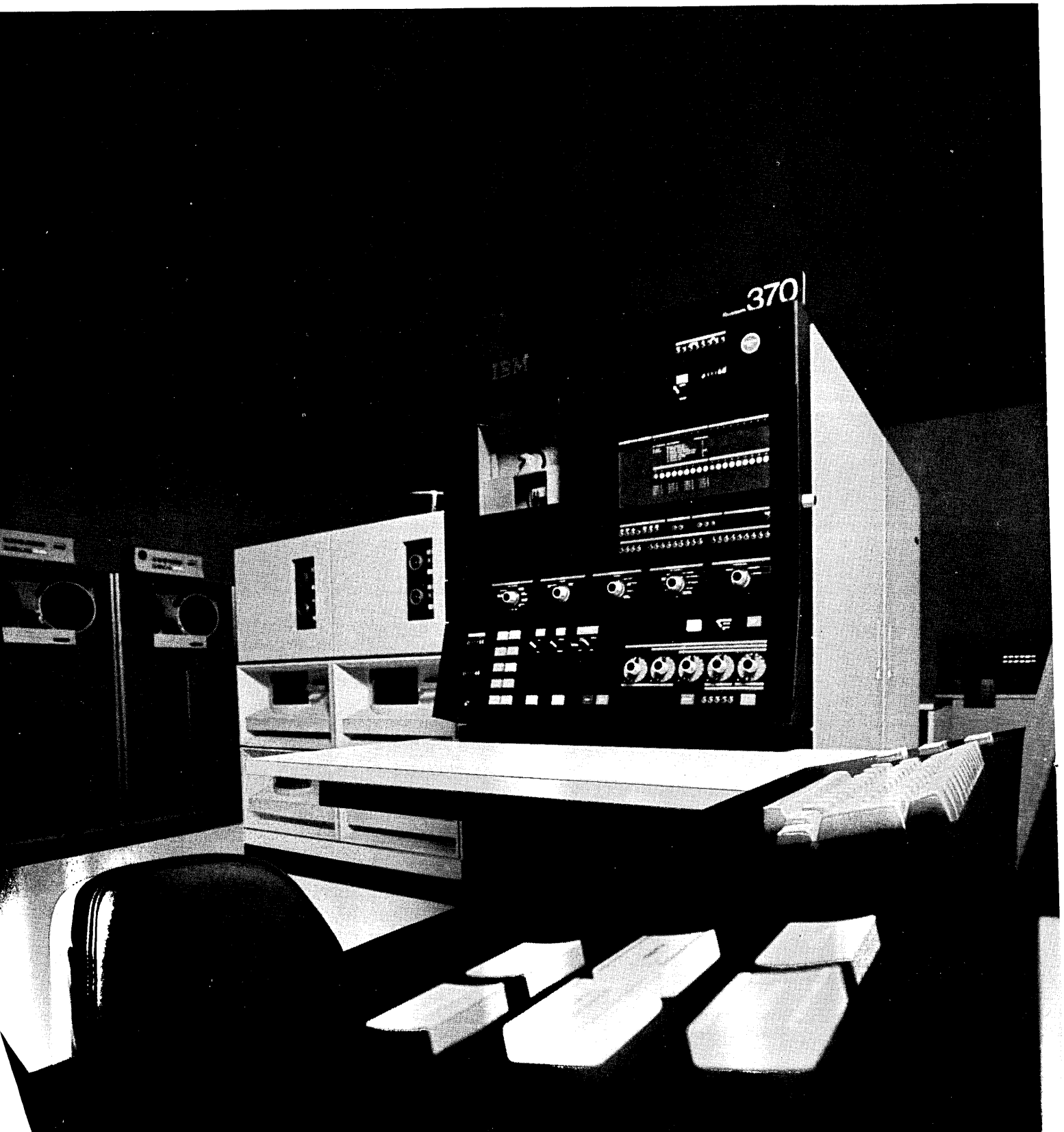
Write today on your business letterhead for your copy of the EDP Global Market Survey and find out how really easy it is to expand your marketing horizons. Copies may be obtained from your local Department of Commerce field office or from Sea-Land Service, Inc., Dept. A, P.O. Box 1050, Elizabeth, N.J. 07207.

U.S. DEPARTMENT OF COMMERCE · BUREAU OF INTERNATIONAL COMMERCE
GO GLOBAL

SEA-LAND

Partners in expanding U.S. exports.

MORE POWER TO YOU. SYSTEM/370 MODEL 135.



You've probably heard a lot about System/370.

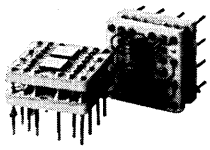
That it's faster. That it gives you more capability. That it's more reliable.

And now IBM announces the most advanced intermediate computer on the market.

System/370 Model 135. Just the right size for System/360 Model 25 and 30 users.

Model 135 is everything System/370 is all about. It's designed to give you a computer that's easy to use, easy to afford, easy to move up to. And at the same time it opens up to you many more computer applications. Including remote computing.

New technology means greater speeds, greater performance.



Model 135 uses monolithic circuitry throughout its memory and logic. This means it's more compact. More reliable. And faster.

In fact, Model 135's Central Processing Unit is up to 4½ times faster than Model 30's. Just the kind of speed you'll need, not only to process data, but to control many aspects of your business. The kind of speed to handle applications such as remote computing, scientific computing, data base applications, and time-sharing.

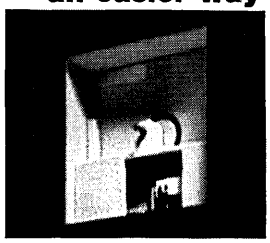
In short, Model 135 means your entry into more sophisticated kinds of computing.

If you're a retailer, you can use its inquiry capability to speed credit approval to your stores.

If you're a banker, you can use its remote computing capability to get the status on accounts from dozens of different branches.

Manufacturers will want to use it on-line to reduce the time it takes to process customer orders. Distributors will want to use it to keep them updated on what's in stock and to make their warehouses more efficient.

New storage technique means an easier way to do more computing.



Model 135 also has reloadable control storage. This means most of the instructions for the system's features are on a tiny disk that slips behind a window in the control panel.

It allows you to attach terminals and disk drives without a separate control unit. Perform floating point calculations. Emulate 1401, 1440, 1460 programs.

Three new products mean more performance out of your Model 135.

By using any or all of our three new computer peripherals, you can get even more performance from Model 135.

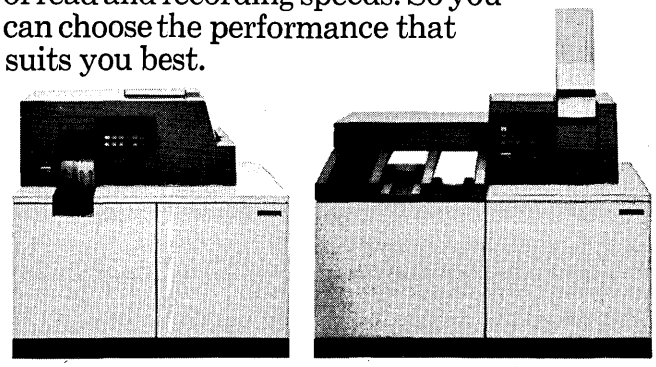
Our 3735 Programmable Buffered Terminal has a familiar typewriter-like keyboard and is controlled by its own programs. These are stored on a disk that holds up to 146,400 bytes or characters of information.

This terminal can prepare documents such as invoices; or operate alone to send and receive data.

Then there's our new 3505 Card Reader (below right). It races through 1200 cards a minute—faster than any other IBM reader. Its ability to read ordinary pencil marks will simplify the data entry procedures for many jobs, such as taking inventory.

Our new 3525 Card Punch (below left) lets you print and punch at the same time. You can print up to 25 lines of information on a card.

Both these new machines come in a variety of read and recording speeds. So you can choose the performance that suits you best.



It's easy to move up to Model 135.

A lot of medium-sized companies will have good reasons for moving up to Model 135.

Like other System/370 computers, Model 135 is compatible with System/360.

You'll be able to use all of Model 135's computing capabilities almost from the day it arrives.

Our products change. But our philosophy doesn't. We want you to get the most out of your computer system.

IBM®

THE COMPANY BEHIND THE COMPUTER.

New

HARD COPY UNIT

4601 HARD COPY UNIT with T4002 GCT

Permanent copies from the Tektronix T4002 Graphic Computer Terminal and . . .

This New Hard Copy Unit produces copies *directly* from Tektronix Storage CRT's. Operation is easy. At the push of a button or upon programmed command, your computer outputs are permanently recorded on reproducible copies. In just 18 seconds a high resolution copy of even complex displays is ready for use.

Now, information from your computer is quickly copied for distribution to management and office personnel. These copies are ideal for portfolios and permanent records—and serve as a quick, inexpensive method to keep business clients and associates informed with current information.

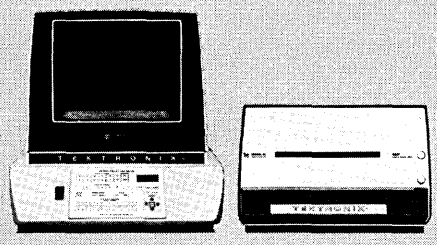
COPY COST is less than 8 cents per 8.5 x 11-inch copy, depending upon usage.

When people who have a need to know can't come to see the computer display, send them a copy. With the 4601 Hard Copy Unit you'll have a quick, easy, low-cost way to record and send information when and where it's needed.

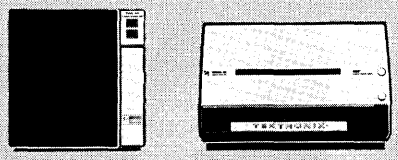
For additional information, contact your Tektronix Field Engineer or Application Engineer: or write to Tektronix, Inc., P. O. Box 500, Beaverton, Oregon 97005.

4601 Hard Copy Unit	$3750
T4002 Graphic Computer Terminal, less interface	$8800

Available in U.S. through the Tektronix lease plan
U.S. Sales Price FOB Beaverton, Oregon



. . . the T4005 Graphic Display



. . . the 611 Storage Display Unit

TEKTRONIX®
committed to technical excellence

FCC REAFFIRMS CARRIER RESTRICTIONS

The FCC last month reaffirmed its tentative decision in the computer/communications inquiry and, in addition, banned carriers from obtaining "any dp service" from their affiliates; barred a carrier dp affiliate from using its parent's name or identifying symbols; forbade the carrier from showing its affiliate any favoritism. A carrier providing communications for a hybrid service offered by its affiliate must submit "a full description" of the service to FCC and get the arrangement approved beforehand. Another provision, aimed straight at WU's Sicom Service (see Feb. 1, p. 50), requires a carrier, before adding dp features to a tariffed communication service and de-tariffing it, to submit extensive justification to the commissioners and get their approval.

BILL PROPOSES SINGLE GOVERNMENT R&D AGENCY

A bill to merge most U.S. civilian and military R&D operations (S.1184) has been introduced by Senator Joseph Montoya (D-N.M.). The new Dept. of Science & Technology would absorb all of NASA, AEC, NSF and NBS along with research, development, testing, and evaluation functions of all federal depts. and agencies. Pentagon weapons system development would be included. The bill provides for developing a national science plan and an annual R&D budget. According to Montoya, the dept. would have a $16 billion budget and 600-700 labs.

COPYRIGHT STUDY TO EXPLORE ADP USES

A new copyright revision bill (S.644) introduced by Sen. John McClellan (D-Ark.) would create a National Commission on New Technological Uses of Copyrighted Works to study their reproduction and use in conjunction with "automatic systems capable of storing, processing, retrieving, and transferring information" and the creation of new works through such systems. It would report within three years.

CAPITOL BRIEFS

A staff proposal to impose higher rates on all non-voice customers of Pacific Tel has been shelved, at least temporarily, by California Public Utility commissioners. They may decide to investigate further, however. The outcome will affect AT&T's efforts to establish ISALs (Information System Access Lines) as a new class of service. If AT&T wins, on-line computer users would pay much more...The Joint Chiefs of Staff want the Defense Intelligence Agency to stop development of a machine-transferable dms named MIDMS (formerly CDMS). DOD's Comptroller wants the work to continue. The final decision will help determine whether one or more systems makers supply the hardware to update the World Wide Military Command and Control System (Wimmix)...Western Union has expanded its foothold in the dp services market by acquiring Distronics Corp., a Cherry Hill, N.J. service bureau that does OLRT and off-line processing for wholesale distributors, using proprietary packages.

Priced the software for those "low-cost" computers?

Anybody can sell you a "low-cost" box of hardware for processing data, but have you considered that it might take another six months and $20,000 for the software to get it on-line?

That's why Raytheon Computer developed an extensive software library for our 700-Series 16-bit processors. With over 600 fully documented programs available off-the-shelf, you'll never have to write a systems program again.

We have operating systems for even the minimum configurations of all our processors. As the system grows, the modular software expands. Each system contains an assembler, a system-fitted I/O monitor and executive program, PREP, Symbolic Program Editor, FORTRAN (Confort or FORTRAN IV) and the System Editor.

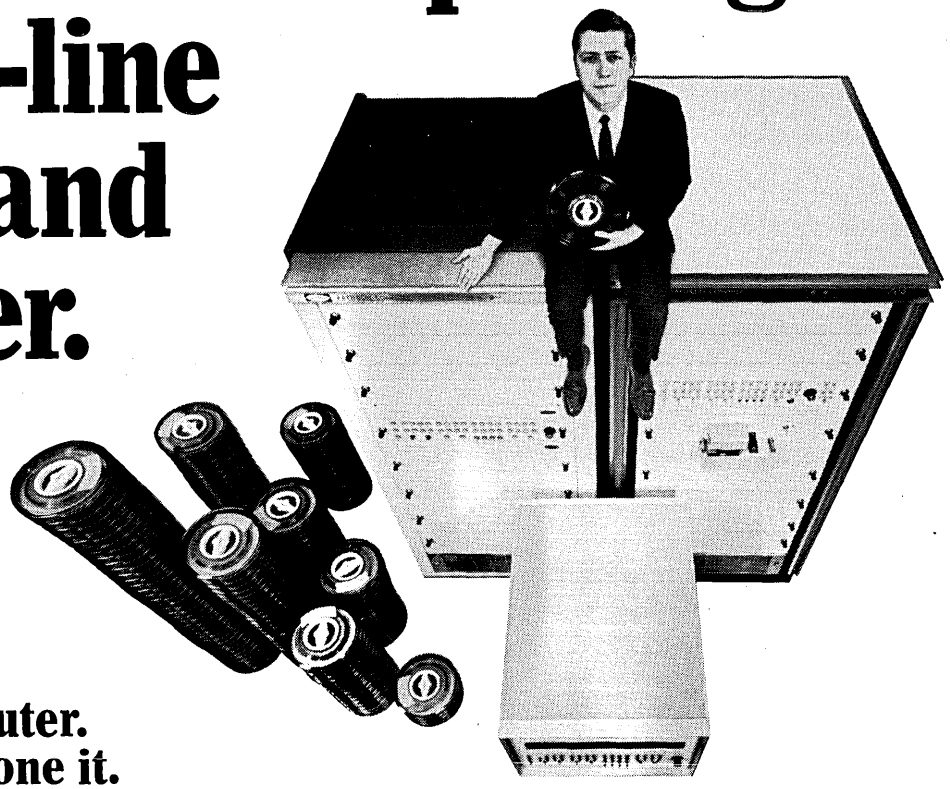
Some are custom packages. Like our Multiprogramming System with facilities for dynamic task-swapping, hardware inter-task protection and time-shared job scheduling. Our Real-Time FORTRAN IV with the fastest execution time of any other FORTRAN in the 16-bit class. A 360-compatible superset of USASI FORTRAN IV. And a specially developed package for finding and identifying hardware faults.

For more details about our software and our hardware, write today for Data File C-203. We'll send you the facts and figures you need to help get you on-line faster, cheaper . . . and fully programmed. We know . . . because we've already done it.

Raytheon Computer, Raytheon Data Systems Company,
2700 S. Fairview St., Santa Ana, California 92704.
Phone 714/546-7160.

RAYTHEON

With 600 programs, Raytheon Computer gets you on-line faster and cheaper.



Raytheon Computer.
We've already done it.

CIRCLE 48 ON READER CARD

PEOPLE

In his 24 years with Burroughs Corp., **Richard O. Baily** had risen from a salesman in Sioux City back in 1947 to head of the company's Business Machines Group last year, the largest revenue producing part of the company. Then, last January, in a series of "promotions" announced in a press release, Baily was shuttled all the way down to head of the firm's smallest revenue producing operation, Business Forms and Supplies. It didn't take him long to react. Soon the 47-year-old executive had a "for sale" sign on his Bloomfield Hills home in Michigan and was moving west to a new challenge as president of the Singer Co.'s Friden division in San Leandro, Calif. Baily brings his big-time business machines marketing knowhow to a relative newcomer in the computer-related business field —the division has only 400 sales branches in the U.S. and overseas, but plans some major announcements this spring at the JCC in Atlantic City, and recently formed an Information Systems Group, headed by Dr. Donal B. Duncan, who had also been acting president of the Friden division.

Meanwhile, back in Detroit, Baily's vacated post was filled by Manuel Garcia who had been southeastern district manager for the Business Machines Group. His new post takes him to Rochester, N.Y., where the Business Forms and Supplies

J. McGeachie R. Baily

Group is headquarters for some 12 manufacturing plants and 117 sales offices. It employs 3,000.

Allen J. Perlis is going to Yale as the first Eugene Higgins Professor of Computer Science. Yale tried in 1967 to get him to head development of its Computer Science Department. He declined that honor, explaining that he had already set up one at Carnegie Mellon University. Perlis, recognized for his work in programming languages and systems, is an ex-president of ACM and winner of the Turing Prize in 1966. He has been at Carnegie Mellon since 1956 . . . He'll join the Yale Computer Science Department in July and in the 71/72 academic year will teach "Introduction to Computing."

Dr. Julius Aronofsky took a leave of absence from Southern Methodist University, where he is professor of management science and computers, to become acting manager of corporate development planning for University Computing Co., Dallas . . . URS Data Sciences Co., San Mateo, Calif., promoted **Joseph J. Strnad,** general manager of the Federal Data Systems division to senior vice president and **Dr. Thomas B. Malone,** manager of the Human Factors Branch of the Matrix Div.; **Dr. Edgar L. Shriver,** manager of Matrix's General Systems Branch; **W. Scott McClary**, manager, Defense Branch, Federal Data Systems Div.; and **Ronald L. Olsen,** manager, Ft. Hood Sub-Project office to vice presidents . . . **Armas "Mike" Markkula** was named marketing manager, North America, for Intel Corp., Mountain View, Calif. producer of semiconductor memories . . . **Paul A. Araquistain** was appointed vice president of finance for Intersil, Inc., Cupertino, Calif. . . . **Thomas W. Harleman** rejoined Ampex Corp. as national sales manager for end user systems in the computer products division . . . **Alex J. Durr** has assumed responsibility for marketing computer graphics products for Milgo Electronic Corp. as product manager, Computer Graphic Div. . . . **Francis J. Ostronic** is the new vice president and director of program development for the Systems Div. of Computer Sciences Corp. . . . **Anthony J. Fennelli, Jr.** was elected to the Board of Directors of Programming Sciences Corp. and named chairman of the executive committee . . . **John D. Sessions** is the new president of Clary Datacomp Systems Inc., San Gabriel, Calif. Clary Corp. recently dropped about half of its 88% interest in Datacomp, a manufacturer of computers, selling it to Business Machines and Computers, Inc., Los Angeles. Business Machines had been a distributor of Datacomp equipment in Los Angeles. ■

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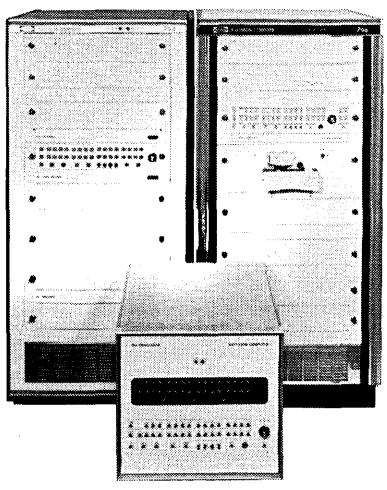
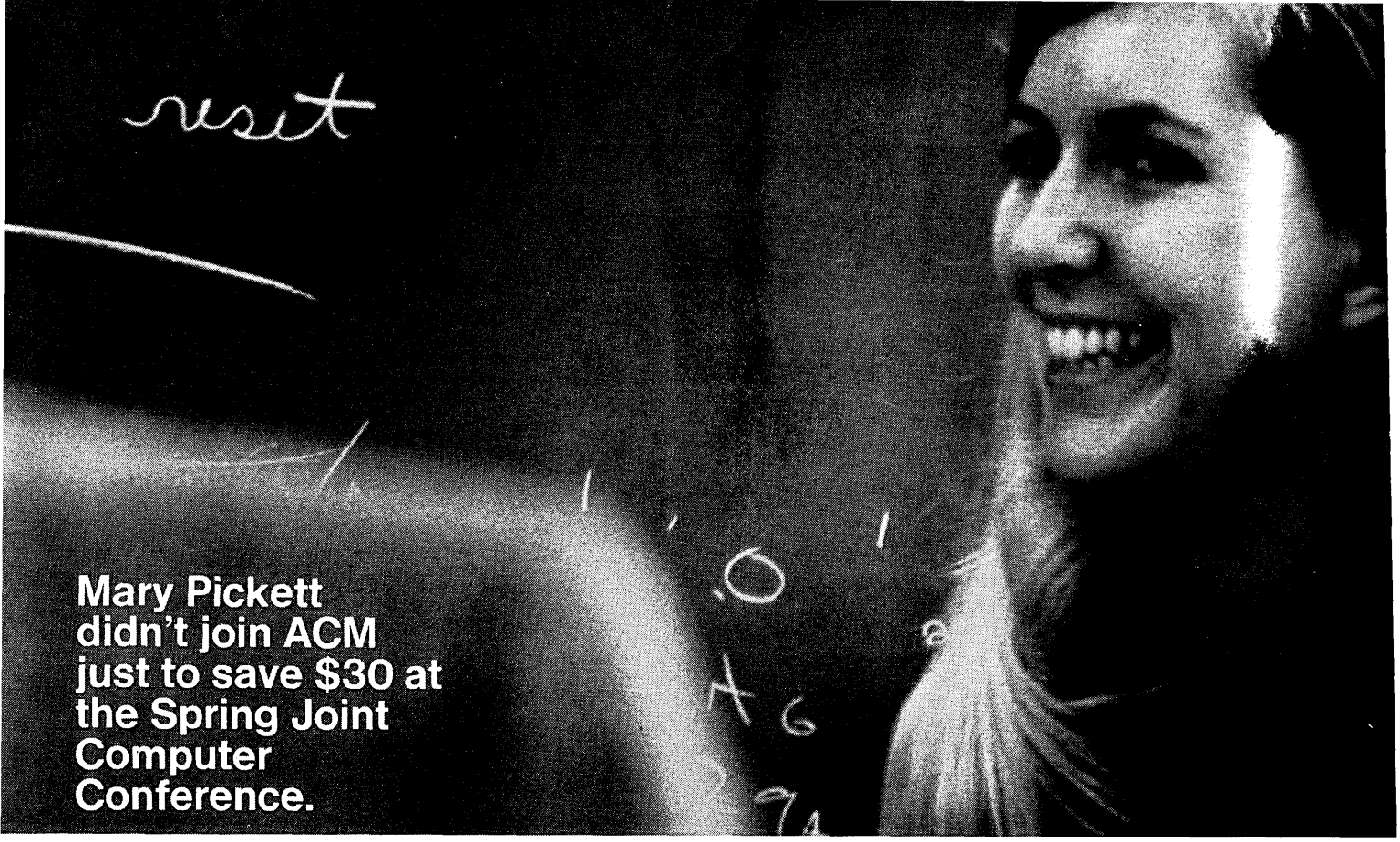


CIRCLE 48 ON READER CARD



But it helped.

Mary Pickett is an associate systems programmer with RCA Computer Systems in Cinnaminson, New Jersey. Not too far from Atlantic City, site of this year's Spring Joint Computer Conference. She joined ACM in 1969, while a student at Purdue. With RCA since last August, she's getting involved in our Delaware Valley Chapter and recently switched from student to regular membership.

She's looking forward to the Spring Joint. "It's a chance to attend good lectures, see the exhibits and renew a lot of friendships," says Mary. "And my ACM membership helps. I save $30 on admission, more than enough to cover my annual dues."

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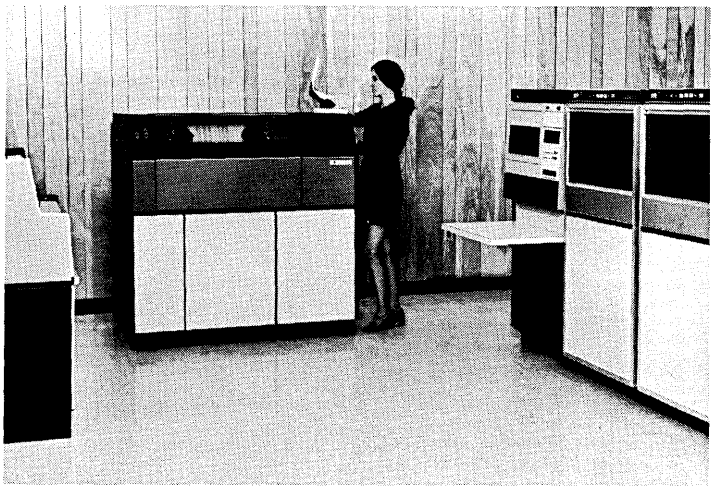

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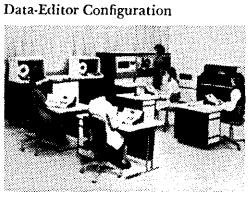
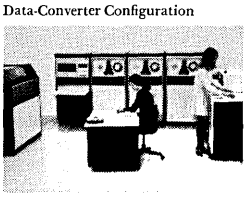


Data-Communicator Configuration

Data-Converter Configuration



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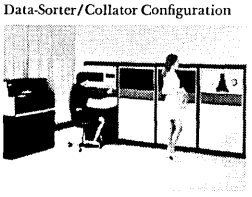

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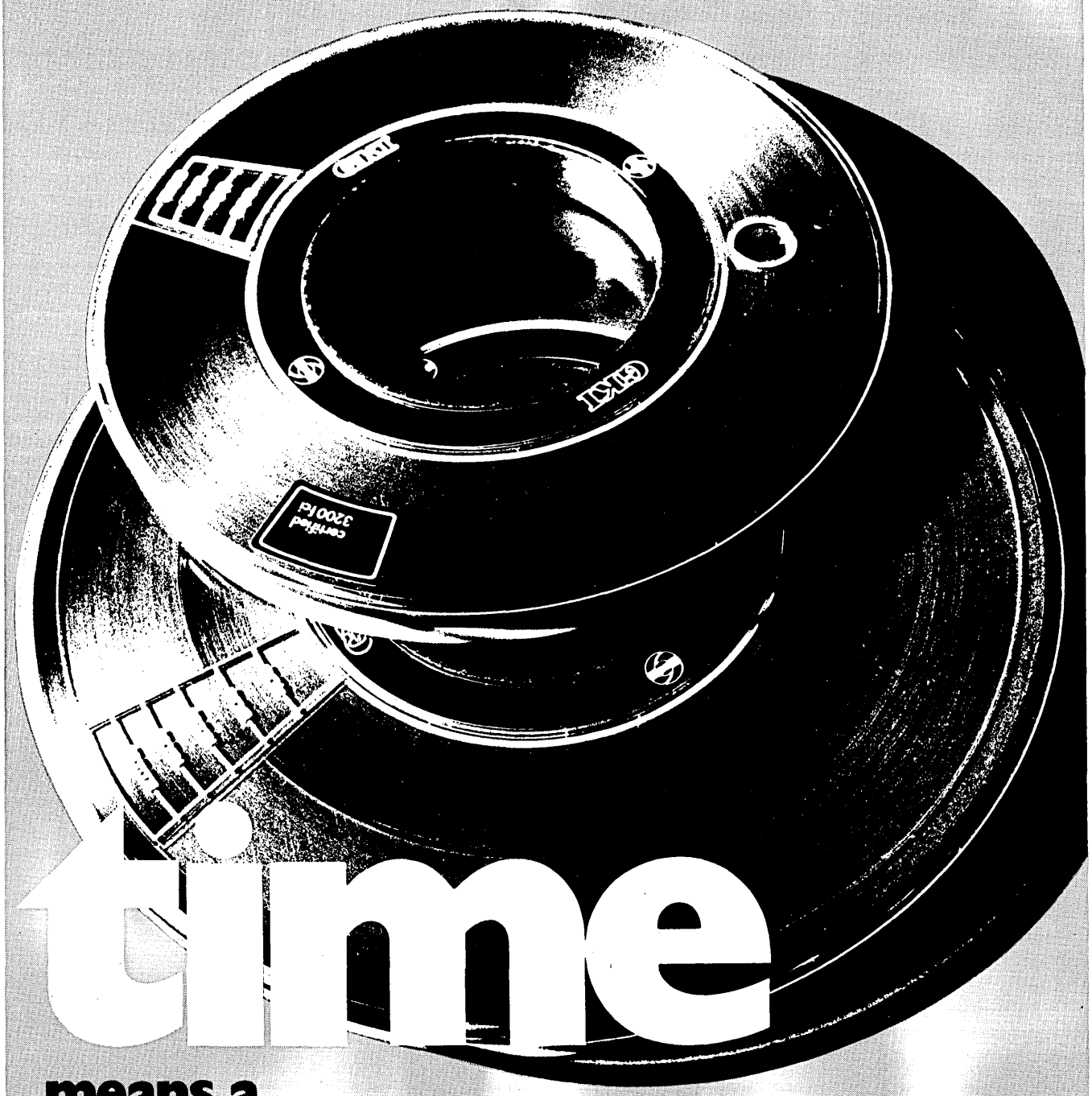

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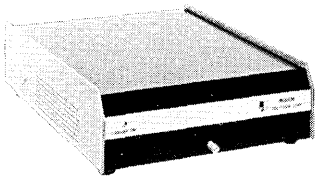

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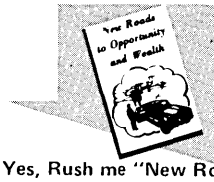

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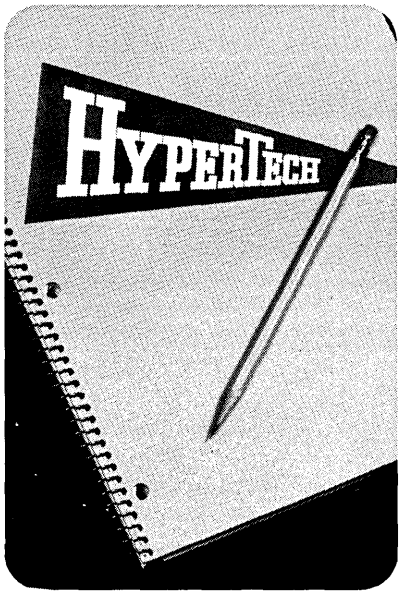

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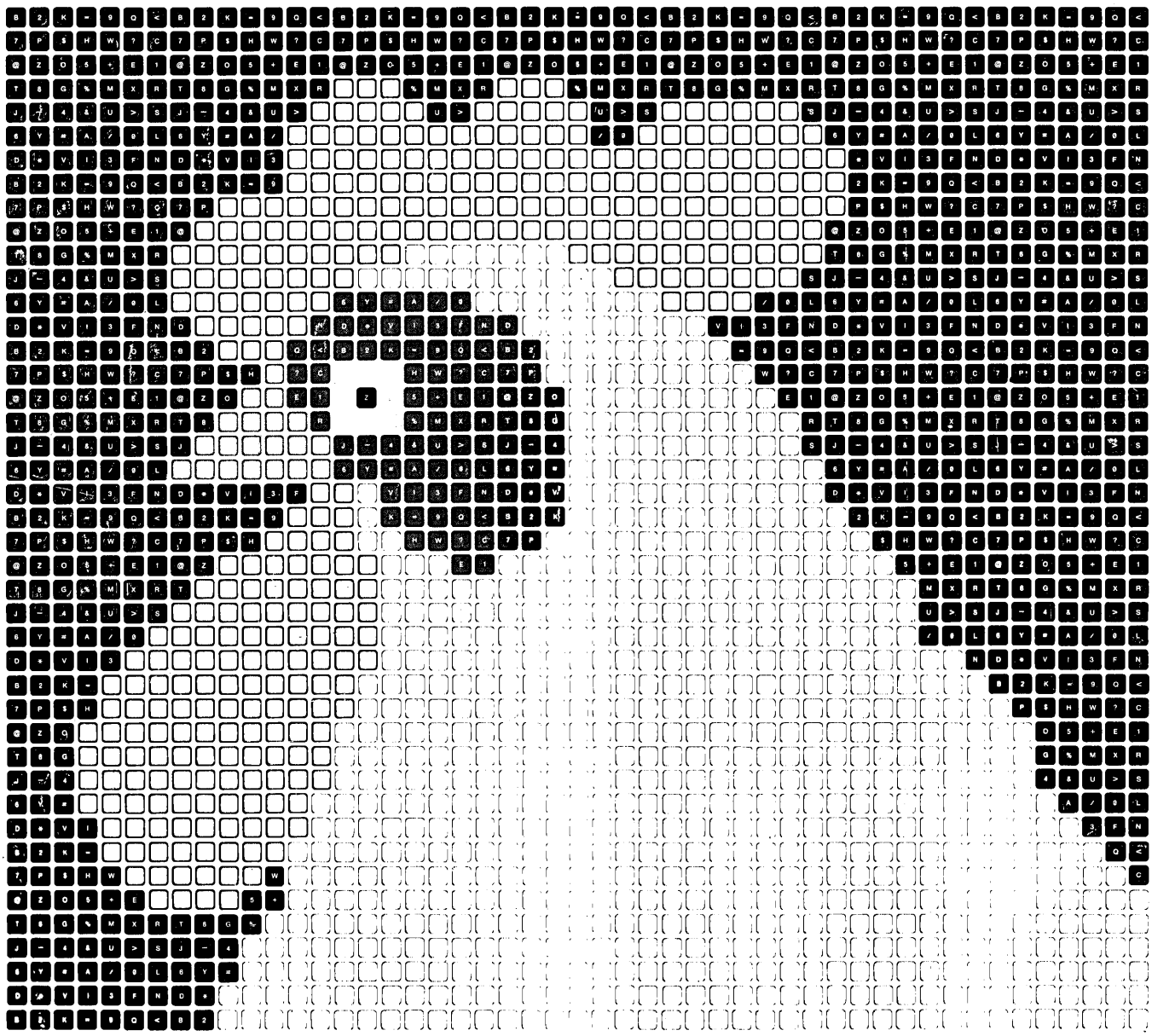

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