

DATA MATION⁷⁰®

June



**KEYBOARD
DATA ENTRY**

**It's faster.
It's better.
It's Varian's 620/i.**

Varian Data Machine's new "superfast" computer has a 750-nsec cycle time. That means it executes two and a half times faster than the well known 620/i.

And check these other outstanding features:

- 100% upward compatible from the 620/i.
- All 620/i software executes on the 620/f — you can take advantage of the extremely large library of software field-proven on the more than 1,200 620/i's in worldwide use.
- Fastest I/O in minicomputers.
- Powerful new addressing modes and instructions.
- Read-only memory.
- All 620/i peripherals plus a new low-cost line.

For full details, request the new handbook. The 620/f — another

development that keeps us the big company in small computers.

U.S. Sales Offices: Downey, San Diego, San Francisco, Calif.; Washington, D.C.; Atlanta, Ga.; Chicago, Ill.; Waltham, Mass.; Ann Arbor, Mich.; Albuquerque, N. Mex.; New Rochelle, Syracuse, N.Y.; Fort Washington, Pa.; Dallas, Houston, Tex. Other offices worldwide.

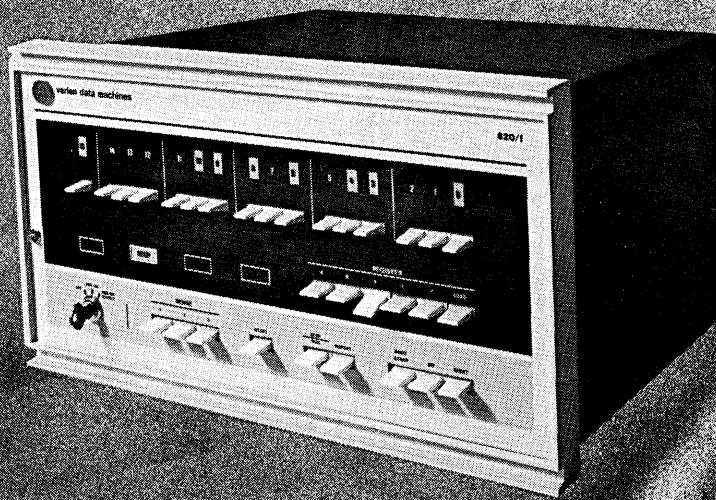
Varian Data Machines, a Varian subsidiary,
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Telephone 714/833-2400.



**varian
data machines**

The Big Company in Small Computers

CIRCLE 1 ON READER CARD



Breadth of line is only one advantage when you choose Tally.



No "Johnny-come-lately" to the data communications market, we offer you the advantages of proven equipment, immediate nationwide service and the benefits of "mixed bag" approach (paper or magnetic tape) to meet your exact needs without extensive systems engineering.

Select the system that solves your data flow problem best—perforated tape or magnetic tape. Select a low cost 60 characters per second parallel system or a high speed 120 characters per second serial system (over 400,000 characters per hour) with full error detection and correction routines. Or select something in between. Tally equipment operates over voice grade lines.

And you can rent, lease or buy outright.

When the best way to move data fast, economically, and efficiently calls for batch terminals, talk to Tally. We've got the broadest line of batch terminals on the market today.

For the complete Tally story, contact the nearest regional office or us directly. Tally Corporation, 8301 South 180th Street, Kent, Washington 98031. Phone (206) 251-5500.

Regional offices:

San Francisco: 420 Market Street, 94111. (415) 989-5375.

Los Angeles: 501 N. Golden Circle Drive, Santa Ana, Calif. 92705.
(714) 542-1196.

Chicago: 33 North Addison Rd., Addison, Ill. 60101. (312) 279-9200.

New York: 45 North Village Ave., Rockville Centre, Long Island, N.Y. 11570.
(516) 678-4220.

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TALLY®

Sanders total data systems mean hardware, software &...



Among Sanders wares, "anyware" is what separates us from so many of our competitors. Particularly when it comes to service. One of our 40 service locations is close enough to put a Sanders field engineer in your office in (at the very worst) just hours. A man who was trained by us and works for us. Who feels the same responsibility toward customers that we feel.

"Anyware" means experienced

systems analysts in each of our 24 sales locations. And systems engineering professionals that can put Sanders hardware and software to work on your data handling problems whatever—and wherever—they are.

And Sanders is growing. We've gone from 22 to 40 service locations in a single year. There'll be more, of course. When we design and sell a system, we want to make sure it keeps going.

Otherwise it's "noware."

And that reminds us too much of the competition.

For more information, write or call Mr. Raymond A. Zack, Vice President and General Manager, Sanders Data Systems, Inc., Daniel Webster Highway South, Nashua, N.H. 03060. Tel. (603) 885-4050.

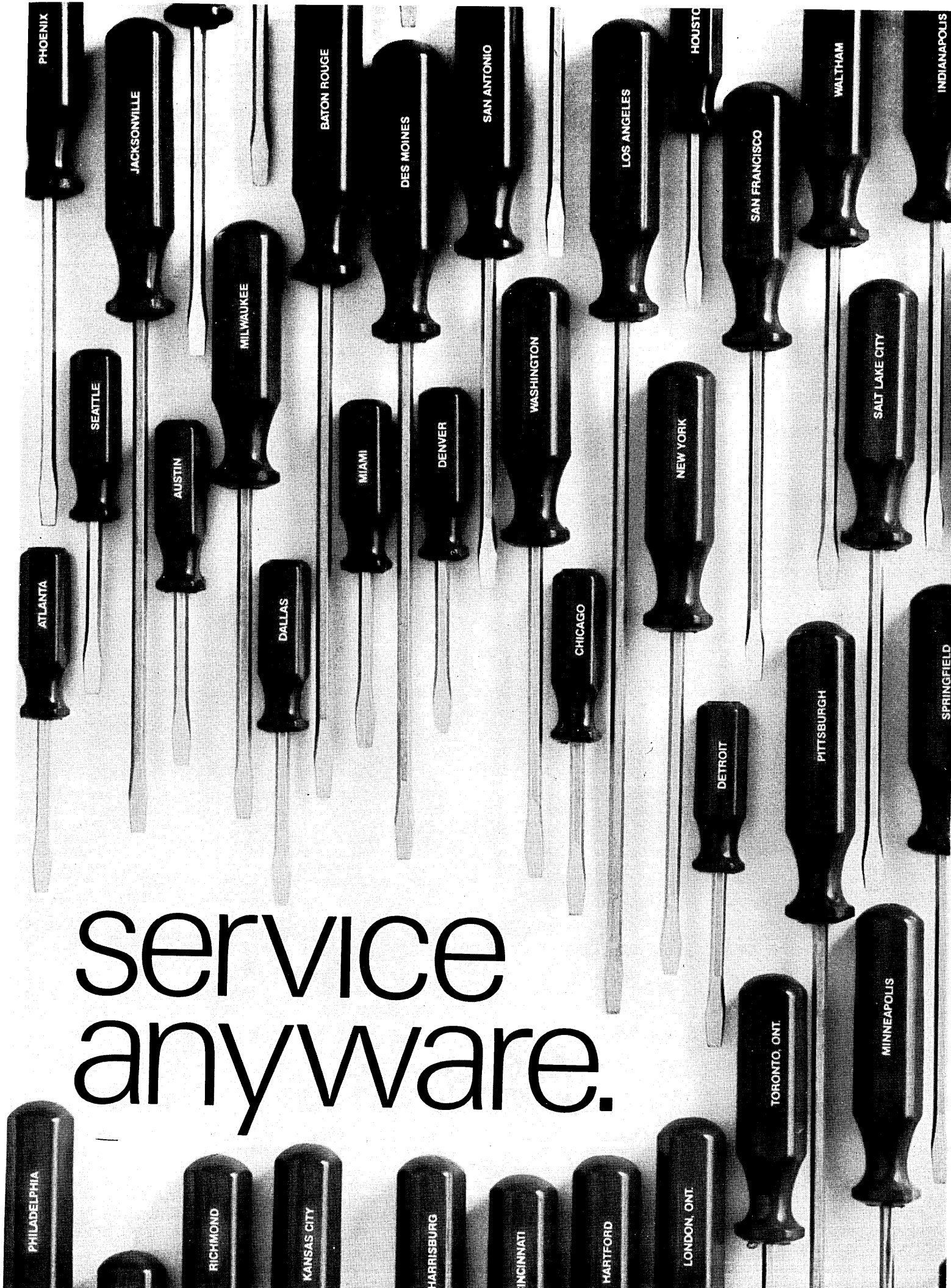


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service
anywhere.



MARGEN™

Management reports in hours. Would an on-site demo convince you?

If you're seriously interested and your decision-makers are ready to buy, we'd like to demonstrate MARGEN — RCC's Management Report GENERator — right in your own DP department.

With MARGEN you can select, integrate and coordinate data from your existing data files into simple, easy-to-read reports in hours, not days.

For use on IBM and RCA systems. Does not require the creation of intermediate files — any standard file which can be read sequentially can be used with MARGEN.

It's so easy that even non-DP people can set up and use it. Just lay out your report form, punch your program directly from the form, load and go. MARGEN is ideal for one-time and non-repetitive reports, and shows dramatic time savings on cross-tabulated reports.

For leisurely evaluation, write for literature. But for immediate action on getting request-to-answer in hours, get your decision-makers together and phone for an on-site demo. You'll be convinced.

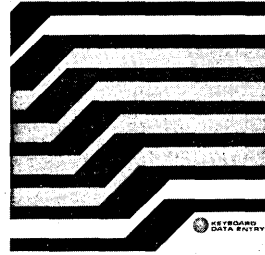
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CIRCLE 187 ON READER CARD

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MATION.



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DATAMATION



"Get the hell out of here, she's gonna go up!"

And boy, did she go up.

On November 13th, 1969, a single engine plane came in for a landing at Princeton Airport. Suddenly it nosed down and crashed into the ADR offices. Miraculously, no one was hurt.

The quote above came from the pilot of the plane. His prediction was correct. Gasoline splashed over the roof and walls and within seconds flames were roaring across the frame building. The photo above gives you some idea of extent of the fire and destruction. What you cannot see, however, is the remarkable story of what was saved, not lost. ADR came through the crash, fire and flood with 95% of our software libraries intact and operable. Thanks to two of our own proprietary products, Librarian and Autoflow. We use Librarian as a source program retrieval and maintenance system. All major source programs are stored on tape in the Librarian master files. These tapes were removed from the burning building before they could be harmed. The equivalent of over a quarter of a million cards had been placed on Librarian tapes. It would have taken four 20-drawer file cabinets to hold this many cards. These files could never have been saved. Even though innumerable card decks and vast quantities of printer output were totally destroyed, the work they represented, safely stored on Librarian tapes, was easily rescued. The information on these tapes, including commentary on the historical development of the source programs, enabled our programmers

UNPLANNED DEMONSTRATION

to get back to work in a fraction of the time that would have been necessary without Librarian. Autoflow, our computerized flow-

charting and documentation system, was the second hero of our saga.

Autoflow made it possible to immediately regenerate flow-charts lost in the fire. Without Autoflow, manual re-creation would have been needed.

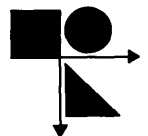
Try to explain what this costs to the fire insurance people. We did it the hard way, but we think our unplanned demonstration proves quite a bit. Not all accidents, mishaps and losses will be as dramatic as ours.

But you never know what will be lost, torn, mishandled or misplaced.

Librarian and Autoflow saved us inestimable time, money and effort. We never used the term before, but both products served as vital "insurance" in continuing our normal operations. But possibly in your business, this aspect is not important. After all, things like accidents and fires only happen to the other guy. For a planned, peaceful demonstration of Autoflow or Librarian, call or write:

Applied Data Research, Inc.

Route 206 Center, Princeton, N.J. 08540
609-921-8550. Offices in principal
U.S. and foreign cities.



Powerful as PDP-11's CPU is, it is right down with the peripherals, plugged into the UNIBUS[®] just like they are.

Now the devices are independent, asynchronous. They can send data to each other—or direct to memory—along the bus without addressing the CPU. Memory can transfer to memory. New devices, or memory, can join the system by just plugging in.

The UNIBUS makes PDP-11 infinitely variable, infinitely expandable. Even the pluggable CPU can be replaced. Altogether, PDP-11 is the most versatile small computer system ever made.

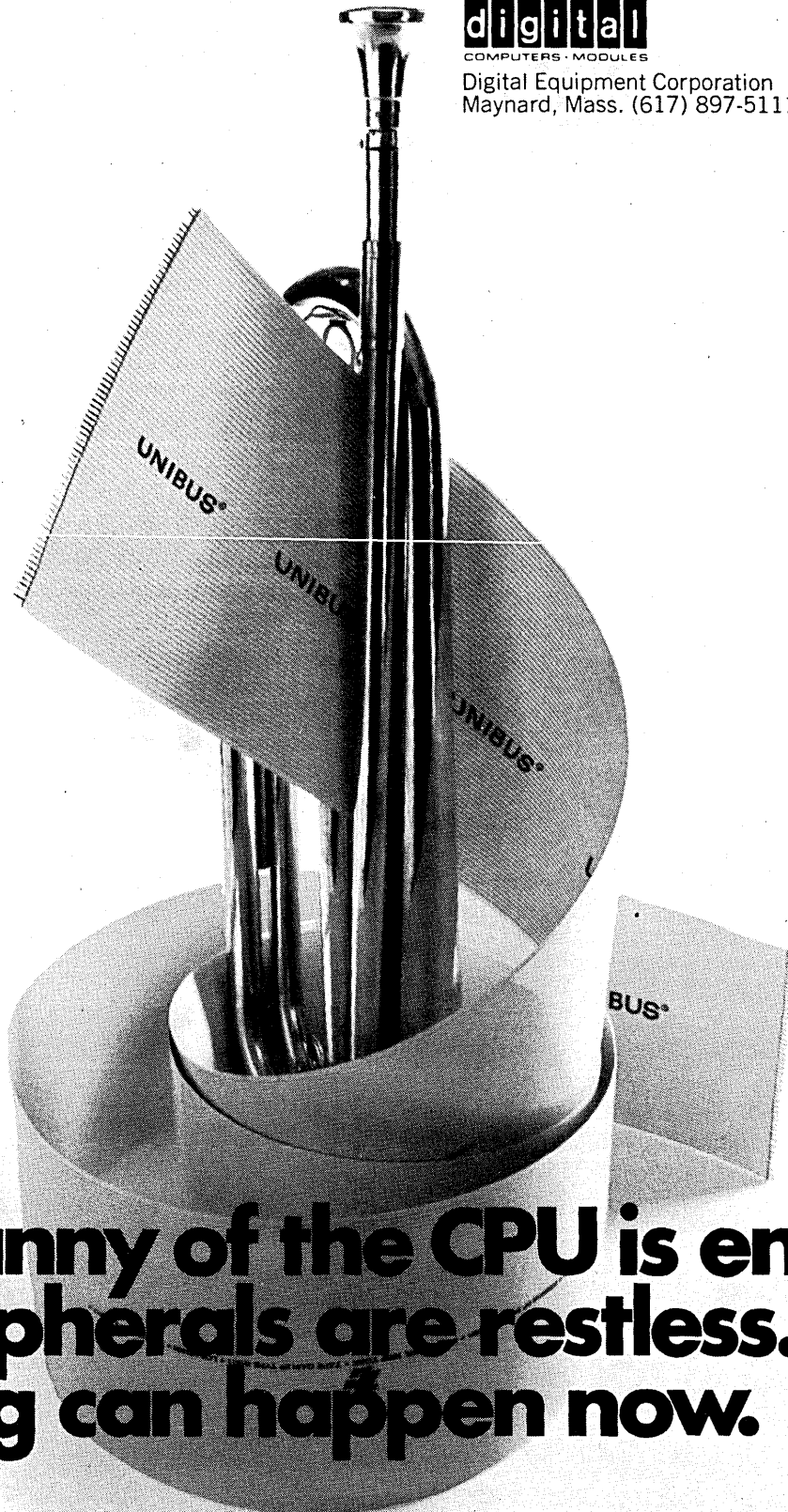
Small? Over 400 instructions. Eight general registers: bit, byte, word, and multi-word capability. Up to 32K 16-bit words, 64K bytes, optional to 128K 16-bit words, 256K bytes. Hardware stacking capability. Automatic nesting of interrupts and subroutines. Re-entrant and relocatable code. Multiple channel DMA. Prices starting at \$10,800 including Teletype and 4K of core.

Actually, PDP-11 can be small when you want it to be. But only in memory (dedicated 1K read-only, plus 256 words of read-write) and in price: \$7700.00.

The mini-computer bureaucracy will never be the same again.

digital
COMPUTERS · MODULES

Digital Equipment Corporation
Maynard, Mass. (617) 897-5111



**PDP-11:
The tyranny of the CPU is ended.
The peripherals are restless.
Anything can happen now.**

DATA MATION⁷⁰®

june
1970

volume 16

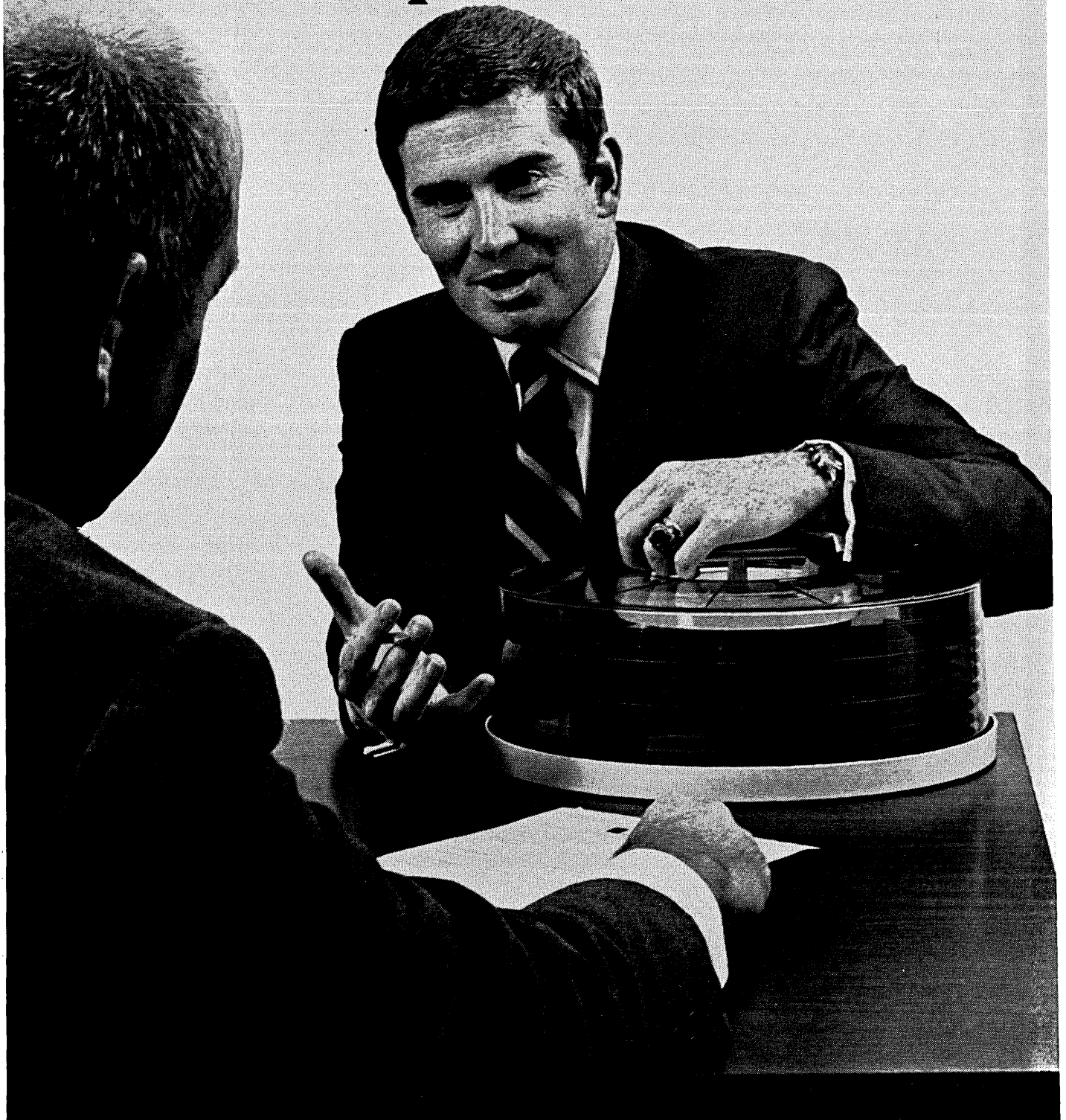
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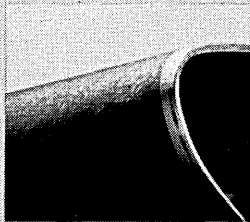
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An Automated Want/Warrant System helps the Los Angeles Police Department to identify and apprehend wanted persons.

The salesman who says all disk packs are alike



may not want to talk about the differences.

You can't blame him. Unless you want to be selfish. Unless you're concerned about the "typical" problems that go along with typical performance.



Competitive disk surface.



CDC disk surface

Unretouched photos of bent disks shows a difference you get with CDC

If you're going to be that one-way, you'd be better off with a CDC man.

He *wants* to talk about problems, because he has a way to solve them. He'll tell you what makes a CDC disk pack different. And makes it the highest performance, most reliable, longest lasting pack available anywhere.

You'll find the discussion brief and interesting. Then he'll tell you the cost. You'll find that surprising.

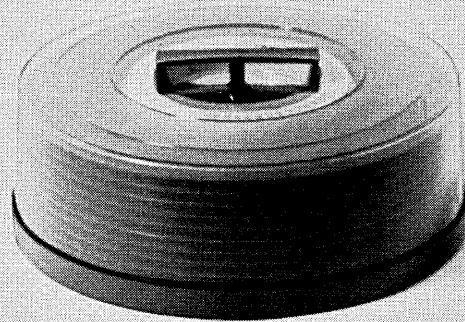
To find out the difference, get our free booklet. Circle

the number below, or phone our main office on our "hot line." Call, collect, (612) 884-8195.



CONTROL DATA
CORPORATION

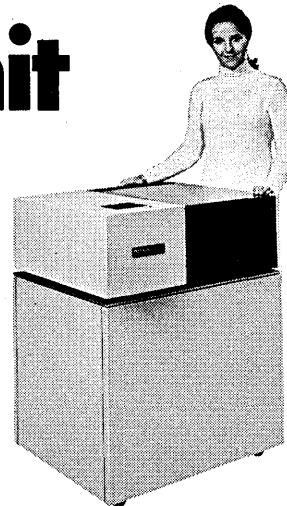
Business Products Group
Dept. 311
Control Data Corporation
P.O. Box 1980
Minneapolis, Minn. 55111





The disc drive unit that will make you think twice.

And unbundle your 2311

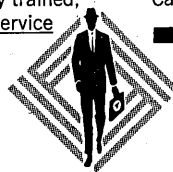


First, think about savings. The Talcott 9311 Disc Drive is a direct-access storage device that gives them to you in abundance. Based on one to three year leases, it can start by saving you up to 50%. Saves you more because there are no premium charges for extra shift work.

Second, think about quality and service. Manufactured by The Singer Company, Friden Division, the 9311 has a unique

servomechanism instead of a hydraulic system. That means higher reliability. You can plug it into an existing 2841 control unit with complete confidence—without altering disc packs. Or immediately intermix the 9311 with other similar disc units. Should service be needed, you can always count on the highly trained, worldwide Friden Customer Service Organization.

The 9311 is backed by the leasing specialists of Talcott Computer Leasing—offered with a variety of lease programs to bring you the greatest possible savings. Get the details now. Contact your local Friden office or write to: Friden Division, The Singer Company, San Leandro, Calif. 94577.



Talcott

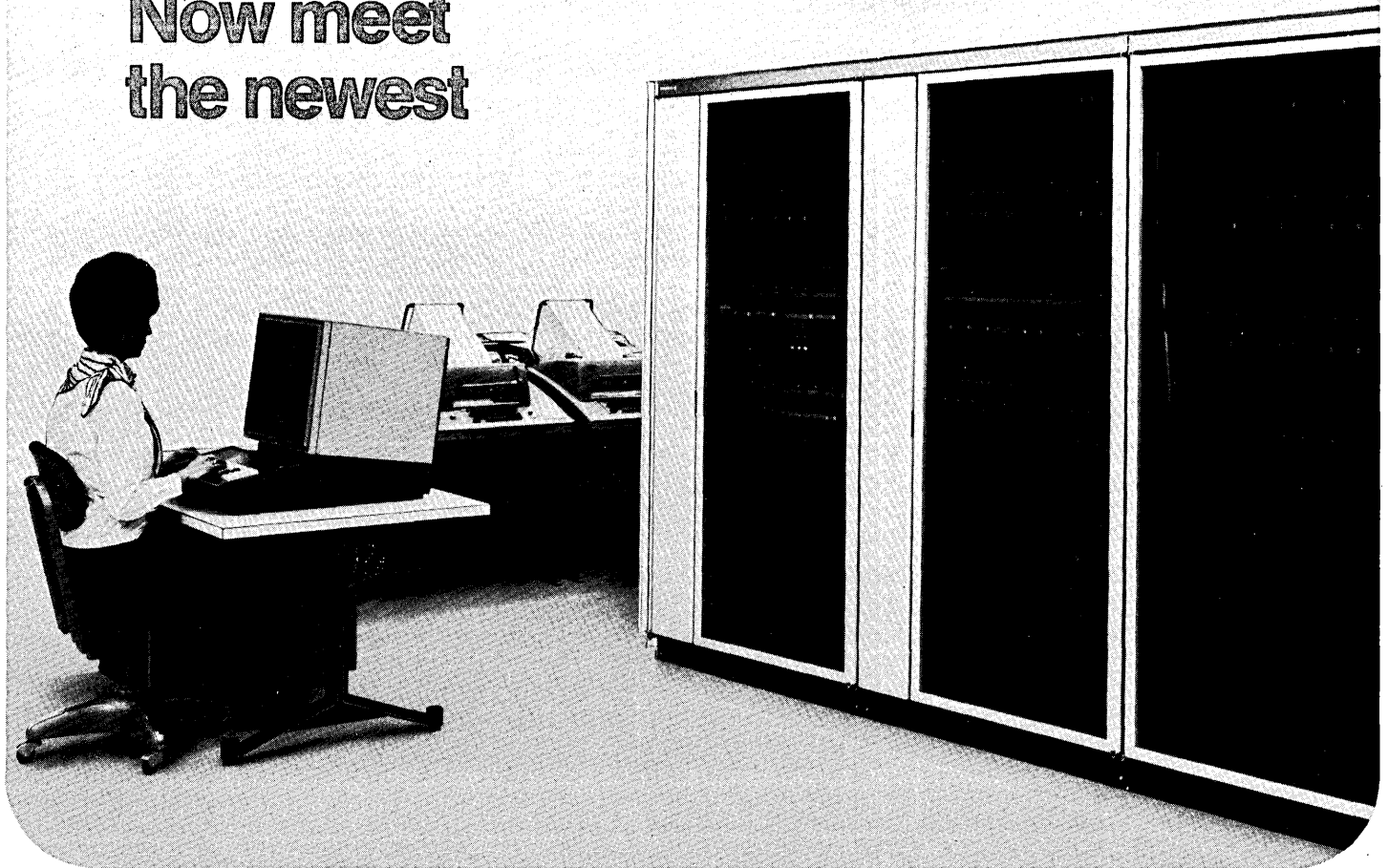
TALCOTT COMPUTER LEASING

Division of James Talcott, Inc.
1290 Avenue of the Americas
New York, N. Y. 10019

Billions of messages ago

Collins introduced computer switching systems

Now meet the newest



Billions of messages ago Collins introduced computer-controlled message switching systems. Acceptance of these systems by airlines, railroads, and government agencies has given Collins the most extensive message switching experience in the world, both in hardware and software.

Collins now offers a new high-speed, high-volume, computer-controlled communication system to handle both message switching and data communication requirements. The system employs Collins C-System computer concepts.

This latest advance in communication control systems economically combines reliability and expandability through employment of advanced design, production, and testing techniques.

RELIABILITY. Continuous system up-time is achieved with advanced circuit technology, modular packaging, automatic switchover, and recovery without manual intervention or loss of messages.

EXPANDABILITY. System design permits easy expansion as requirements change. And the communication system hardware can serve as the initial configuration for a total management information and control system. A multiplexed input/output

system provides high speed interconnection facility between all processors, storage devices and peripheral equipment, permitting the addition of processors, storage units, and terminal adapters to accommodate changes in system configuration. Low- and medium-speed circuit terminations interface the processor(s) via a lower speed, multiplexed channel.

ECONOMY. The C-System message switch with standard programming for various size systems is available now at competitive prices. New manufacturing techniques along with advanced computer technology have been combined to produce smaller system size and increased throughput.

Whether your application requires store-and-forward message switching, communication network control for a distributed data network, or on-line data retrieval, investigate the Collins C-System.

For more information on how Collins can solve your communication problems, write Dept. 300, Collins Radio Company, Dallas, Texas 75207. Phone: (214) 235-9511.



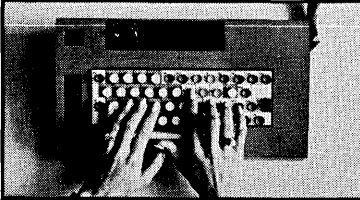
CIRCLE 24 ON READER CARD

COMMUNICATION / COMPUTATION / CONTROL

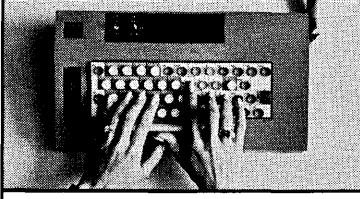
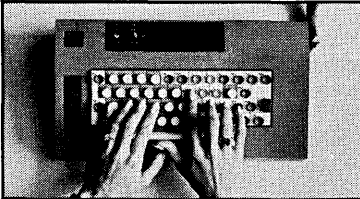
Key-to-tape data preparation is a waste of time.

Key-to-tape

Mount reel, thread tape and begin keying.



Stop keying. Rewind tape and dismount reel. Turn in for pooling. Mount new reel and thread tape. Begin keying.



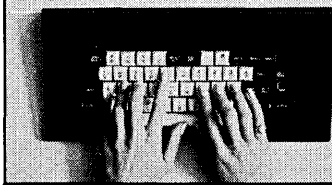
Stop keying. Rewind tape and dismount reel. Turn in for pooling. Mount new reel and thread tape. Begin keying.



Stop keying. Rewind tape and dismount reel. Turn in for pooling. Mount new reel and thread tape. Begin keying, etc., etc., etc.

KeyProcessing System

Begin keying.



On the left side you see the keying time wasted by a key-to-tape operator. (Not including coffee breaks.)

On the right side, uninterrupted keying with the KeyProcessing System.

This totally new approach eliminates the tape mounting, threading, rewinding, dismounting, remounting, rethreading that waste operator time. And it makes expensive, time-consuming tape pooling just a bad memory.

Because all the data from up to 32 key-stations is stored on a magnetic disk. And automatically pooled, in any desired sequence, by a small computer built right into the system.

When will this amazing breakthrough be available?

Last year.

That's right. KeyProcessing Systems have already replaced over a thousand keypunch and key-to-tape units. In less than a year. Giving users a lot more productivity for the same money. Or the same productivity for a lot less money.

Hooray for our side.



Computer Machinery Corporation
2231 Barrington Avenue, Los Angeles, California 90064



What can a service bureau with a Kodak KOM-90 microfilmer offer?

COMplete Service.

Many service bureaus, nationwide, are now equipped to convert magnetic tape data directly into sharp, clear microfilm images using a KOM-90 microfilmer. For lower cost print-out, faster data retrieval, lower distribution costs.

Kodak provides important back-up support to help these bureaus do a complete job for you. In personnel training. In software programs to prepare your tapes for microfilm. In film processing. In providing the most efficient retrieval systems to suit your requirements.

For COMplete service...and for the nearest service bureau equipped with a KOM-90 microfilmer, check with your Kodak microfilm systems representative. Or write Eastman Kodak Company, Business Systems Markets Division, Dept. DP661, Rochester, N.Y. 14650.

The Kodak KOM-90 microfilmer, product of Eastman Kodak Company, may be one of the components used in...

Kodak Microfilm Systems

CIRCLE 90 ON READER CARD

How will you sell against the New Systems?

New computer systems will soon be announced. Systems built around monolithic memories. Five times as fast as today's machines. And five times as reliable. To stay competitive, you'll need monolithic memories for your own equipment. You'll need them soon. How are you going to get them?

The

1. You could make your own monolithic memories. But monolithics are a new breed. Batch processed instead of assembled. You'll need a new team of specialists in Large Scale Integration. Scientists, development and manufacturing engineers. Scarce talents, found one at a time.

And you'll need a unique facility. With specially designed continuous process equipment for masking, diffusion, epitaxial growth, chip packaging. It's a big investment. Say \$10 to \$15 million.

Most of all, you'll need about a year before you have your first component. And at least another year before you're producing a reliable product in quantity.

If everything goes well, you'll be two years behind the competition. Two years back on the learning curve. With little prospect of ever catching up.

Can you afford to risk two years in the competition for the New Systems?

2. Or, you could buy memory components. From one of the old-line semiconductor companies. Or the newer memory suppliers. And assemble your own memories.

But will they really work as your memory? The characteristics will be those of a group of components. Not necessarily those of an integrated memory design.

And you won't find enough profit in assembly. The more complex the component, the less opportunity there is for any significant value added.

Not enough to offset the components inventory you'll be carrying. Without knowing whether the components work together until you've got them mounted on cards. Not enough to pay for thermal analysis, reliability and stress testing and all the complex test equipment involved. To cover the cost of field servicing memories made from available components.

Is this really the place to add value?

Options.

3. Maybe you should buy complete memory systems. Not components. But a functionally designed memory ready to plug into your computer system. A memory already well along on the learning curve. A memory fully tested to the interface you specify.

A system produced by memory specialists already functioning as a team. At a new memory facility already producing memory systems economically. A highly specialized factory built from the ground up to handle high volume production. To turn out billions of bits of memory a year.

Shouldn't your New System use a Cogar memory? A high speed memory with 40ns access. Or a large memory with all the capacity you need. As much as five million bits in a cubic foot. Designed to the exact requirements of your system. A reliable memory. Fully guaranteed for five years. By us. Not by you.

Cogar memories are ready now. Ready

to plug into the design you've got on your drawing board. Our systems engineers will meet with you, learn your requirements, and help you put together the memory system that will optimize your design. Without setting you back in your development schedule. And we'll deliver the memory. In quantity. Ready to install in your first customer-shipped New System. Ready to install in each New System as it comes off your production line.

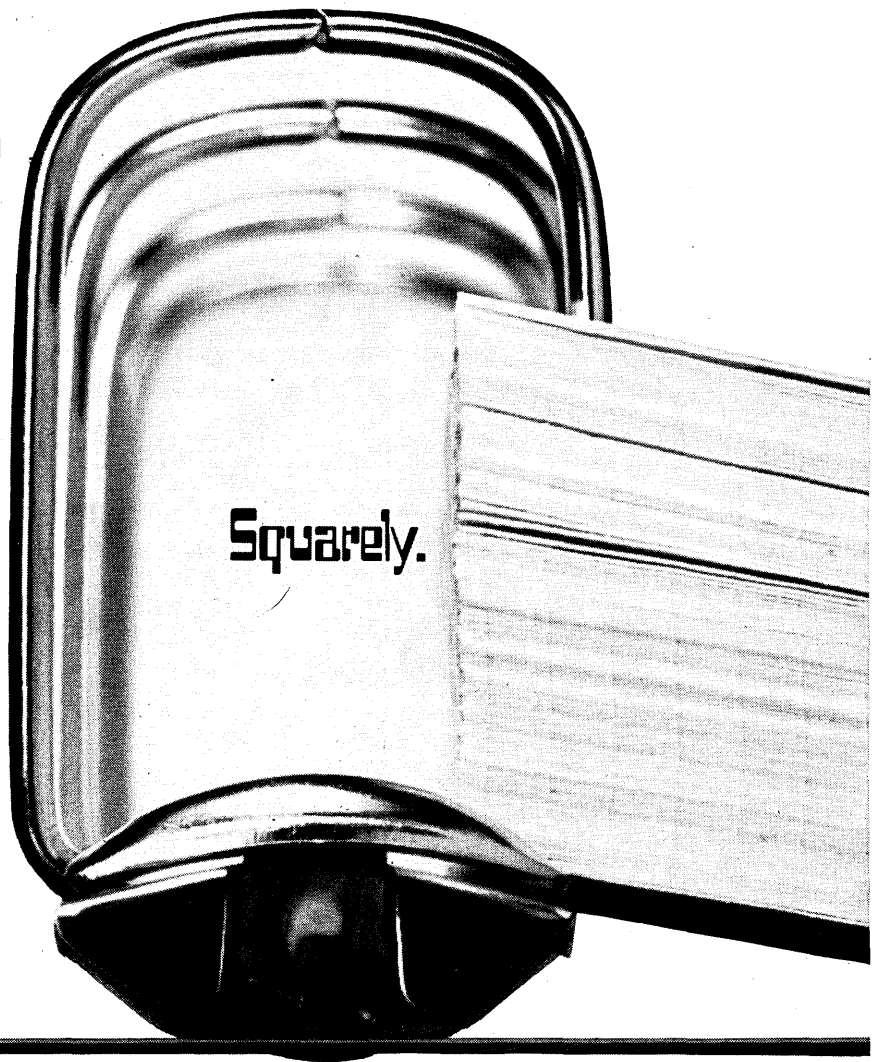
How will you sell against the New Systems? With better performance. With better reliability. With a monolithic memory system from Cogar. Cogar Corporation, Technology Division. All Angels Road, Wappingers Falls, N.Y. 12590 (914) 297-4323

COGAR: The Mind Joggers[®]™

Face the facts.

Fact: Accodata is the *only* square ring EDP binder on the market. Fact: square rings permit sheets to lie absolutely flat. Fact: flat sheets are easier to read. Fact: square rings hold more sheets. Fact: sheets go in and out of square rings much faster. Fact: Accodata Square Ring Binders come in waterproof, scuffproof, tearproof Accohide.* Fact: you'll get more details writing for our 4/color catalog or asking your Acco dealer. All the details, in fact.

* A chemical resin.



ACCO



5150 N. Northwest Highway,
Chicago, Illinois 60630;
New York, Los Angeles, Boston;
Gary International, Chicago, U.S.
Canada/England/Holland/Mexico
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Japan/ Divisions of Gary Industries, Inc.

WE TOLD YOU SO.

We're Data General Corporation.

Two years ago, when we first went into business, we told you we had the world's best mini computer, the Nova.

We were right.

Nova turned the mini computer business on its ear. It was the first small computer built on big computer concepts: medium scale integrated circuits, multiple accumulators, 16-bit word length, read-only memory that is interchangeable with core.

The competition has been Nova-chasing ever since.

Meanwhile we have continued to make outrageous claims and make them come true.

We told you we would stay two steps ahead of the competition.

And we introduced Supernova, the world's fastest mini computer, with add time of 300 nanoseconds from read-only memory, 800 nanoseconds from core.

We told you we would become a major influence in the mini computer business in a hurry by delivering in volume. There are already close to 500 Novas and Supernovas installed, and our production rate is rapidly on its way to making us number 2 in the mini computer business.

We told you we would deliver all kinds of options and peripherals: we're shipping Nova and Supernova in expanded configurations with up to 32K core memory,

read-only memory, industry compatible mag tape units, a variety of discs, a complete line of A/D and D/A conversion equipment, real-time clocks, communications equipment.

Now we want to tell you about software.

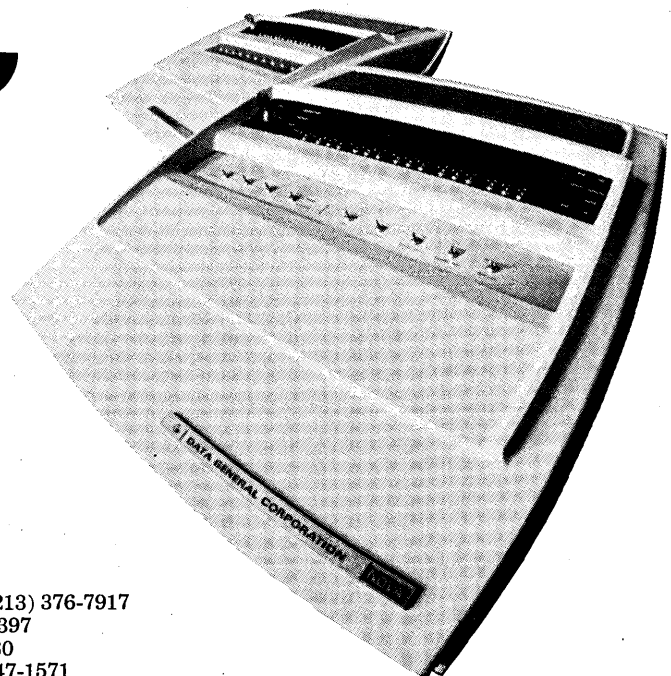
We just introduced the biggest package of mini computer software ever put together in one spot at one time by any mini computer company big or small, old or new. It includes extended ALGOL 60, extended FORTRAN IV, single user and time-sharing BASIC, a Disc Operating System.

This is big computer software, designed specifically for mini computers. It was put together in an integrated effort, not tacked together over several years.

Now it's possible to buy one of the hot computers and get software too.

Believe it. We told you so.

DATA GENERAL



Southboro, Mass. (617) 485-9100
Clark, New Jersey (201) 381-3500
Bryn Mawr, Pa. (215) 527-1630
Orlando, Florida (305) 425-5505
Chicago, Illinois (312) 539-4838
Richardson, Texas (214) 231-4846
Englewood, Colo. (303) 771-0140

Manhattan Beach, Cal. (213) 376-7917
Palo Alto, Cal. (415) 321-9397
Hull, Quebec (819) 770-2030
Montreal, Quebec (514) 747-1571
Toronto, Ontario (416) 447-8000
Vancouver, British Columbia
(604) 731-2711



calendar

DATE	TITLE	LOCATION	SPONSOR/CONTACT
June 22-26	11th Joint Automatic Control Conference	Atlanta, Ga.	ISA, ASME 345 E. 47th St., New York, N. Y. 10017
June 22-24	Spring General Meeting	Seattle, Wash.	DPSA P. O. Box 1333, Stamford, Conn. 06904
June 23-26	Annual DP Conference	Seattle, Wash.	DPMA 505 Busse Highway, Park Ridge, Ill. 60068
July 19-25	Interactive Computer Graphics Conference	Stanford, Calif.	Stanford U/D.A. Thompson Industrial Eng. Stanford U, Calif. 94305
Aug. 10-13	6th Education & Training Conference & Equipment Expo	New York City	AMA 135 W. 50th St., New York, N. Y. 10020
Aug. 11-14	Systems Engineering & Computer Control Symposium	Kyoto, Japan	IFAC, JAACE 14, Kawahara-cho Yoshida, Sakyo-ku Kyoto, Japan
Aug. 24-28	World Conference Computer Education	Amsterdam, Netherlands	IFIP, IAG/A. Veenhuis 6, Stadhouderskade, Amsterdam 13, Neth.
Aug. 25-28	Western Electronic Show & Convention	Los Angeles	WESCON/Don Larson 3600 Wilshire Blvd., Los Angeles, Calif. 90005
Aug. 30- Sept. 2	Computer Electronic & Magnetic Materials Conference	New York City	AIME 345 E. 47th St., New York, N. Y. 10017
Aug. 31	5th Annual Urban Symposium	New York City	ACM/P. R. DeCicco Brooklyn Polytechnic 333 Jay St., New York, N. Y. 11201
Sept. 1-3	25th National Conference	New York City	ACM/Sam Matsa IBM, 410 E. 62 St., New York, N. Y. 10020
Sept. 14-15	2nd Annual Conference	Washington, D. C.	SMIS One First Nat'l Plaza, Chicago, Ill. 60670
Sept. 14-16	Canadian Computer Show	Montreal	GanIPS/ITSC 481 University Ave., Toronto 2, Canada
Oct. 5-9	Computer 70 Int'l Exhibition	London, England	BETA 109 Kingsway, London, W.C.2, England

280	380	580	680	780
285	385	585	685	785

NEW MODEL 280 & 285 DIGITIZERS FOR GRAPHIC DATA INPUT THROUGH DIRECT INTERFACE TO A COMPUTER OR DATA TERMINAL



DIGITIZING IN THE 70's

The Model 280 and Model 285 are the first models of a new family of ten graphic data digitizers to be introduced by CALMA Company in 1970. Each of the new models will be tailored to a specific digitizer application, and will be provided with systems software.

TWO SIZES

Equipped with 32 x 42 inch tracing bed, the Model 280 is designed for fast and accurate input of such graphic data as oscillograms, photographs, and projected film images (with optional projector). The Model 285, illustrated above, is equipped with a 48 x 60 inch tracing bed for digitizing large charts and maps. Both digitizers are designed for direct on-line operation through an electronic interface to your computer or data terminal.



COMPANY

707 Kifer Road • Sunnyvale
Calif. 94086 (408) 245-7522

Compare the IBM 360/20 with the NCR Century 100.

A benchmark study, recently performed by an independent consultant, compares the NCR Century 100 with the IBM 360/20 Models 2 and 4. This study points out that the NCR Century 100's total throughput is faster, more efficient. In fact, it indicates the NCR Century to be 23 per cent to 43 per cent more productive.

We believe our NCR Century 100 offers more performance per dollar than any system on the market. Its memory is in the 800-nanosecond range. Its dual disc unit stores more than 8.3 million characters and accesses data at an average of 43.7 ms. Monolithic integrated circuitry, more reliable than hybrid circuitry, is standard throughout the NCR Century system. Printing speeds range from 450 to 3,000 LPM. The NCR Century offers low-cost on-line capabilities if your needs demand this requirement.

The NCR Century 100 offers three lan-

guages: COBOL, FORTRAN, AND NEAT/3. It has an RPG Translator that easily converts 360/20 RPG source programs to NEAT/3. A full-scale operating system includes complete monitor control, a conditional job control language, a three-year operational calendar for job scheduling, continuous logging of computer operations—and more. And when you step up to the NCR Century, you gain full access to NCR's big library of applied systems.

For its capacity and throughput, we believe our NCR Century 100 is the lowest-priced computer in the industry. On the average, it's 30 per cent lower in cost than the 360/20 Model 2.

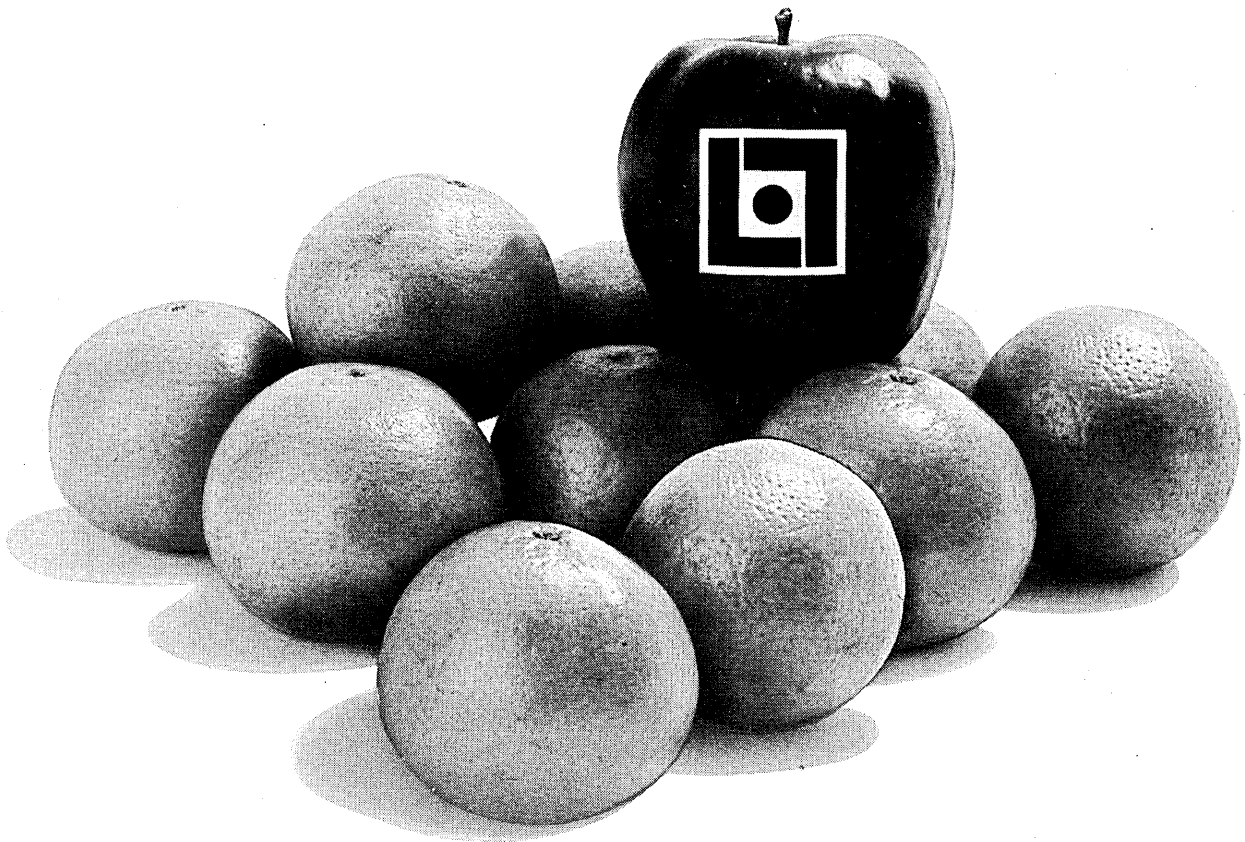
There's more to tell, of course. And we have a factual booklet that describes how much performance you could be getting with the NCR Century 100. For your free copy, write EDP Advertising, NCR, Dayton, Ohio 45409. Or talk to your NCR computer man.



THINK

Think again.

NCR[®]
Computers



Logically speaking... you can't compare apples with oranges.

There is only one "big apple" to be bought in the data input market.

It's Logic's LC-720 KeyDisc Data Input System.

The LC-720 is a "whole" system . . . the most advanced, compatible, flexible and versatile system of its kind.

It has a whole range of applications and performs a broad-spectrum function.

But don't get it mixed up with those limited, basic systems designed for limited, basic use.

However, if you're shopping for a limited, basic system, we'll provide you with one that incorporates many of the advanced features of the LC-720.

Another shopping tip to remember . . . the LC-720 KeyDisc Data Input System

can save you up to 50% of data preparation costs. And *logically* speaking, money saved is money earned.

Lewis Barr at Logic will tell you why the LC-720, *big or small*, is the best in the market. Call him at 609-424-3150.

It's the *logical* thing to do.

LC-720 KeyDisc System



21 Olney Avenue • Cherry Hill Industrial Park • Cherry Hill, N.J. 08034 • (609) 424-3150

What every should know about computer

When we first started making computers, we realized our job wasn't only making computers.

It was also making sure our customers got the most out of them.

The same holds true today.

That's why we make available to you the best possible services.

That means the best possible Systems Engineering Services. Data Processing Education. Computer Programs. And Custom Contract Services.

IBM Systems Engineering Services

Systems engineering is the fine art of figuring out how to get your computer to solve your particular business problems.

It's also a demanding science that takes knowledgeable people who have to know a lot about data processing. And your business.

For IBM, these people happen to be systems engineers.

They are ready to provide you with advice and counsel on any data processing problem.

How the service works.

Let's say you need to correct an out-of-stock situation.

The solution could go like this.

First, a systems engineer works with your people to figure out exactly how fast

your products are moving. Next, they determine what your minimum reorder levels should be.

Then they work out a procedure to have your computer tell you when and what to reorder.

Your out-of-stock situation can become a thing of the past.

Our systems engineers might also show you a more efficient way to send data from one office to another. Or one warehouse to another.

They might help standardize how your programmers write programs. So your programmers can work better as a group.

They might suggest an orderly way to fill orders. Or assist in redesigning your order forms. Or in streamlining your data files.

Who needs Systems Engineering Services?

Those who need the experience of a computer professional, need them.

Those who have to get three things done this year but only have people enough to get two things done, need them.

In short, anyone who needs to get more out of his computer needs IBM Systems Engineering Services.

IBM Data Processing Education

Another way to get more out of your computer is to provide your people with an edu-

computer user IBM services.

cation about computers.

The best place to get this education is at an IBM Education Center.

Right now, we're offering over 100 different courses.

We have courses for beginners. Like Fundamentals of Programming.

We have courses for the advanced. Like Design & Analysis of Data Base Systems.

We would also be happy to teach our courses on your premises or design one especially for your people.

"Hands-on" computer experience.

In all our courses, our emphasis is always on results.

That's why we use the latest educational techniques. Like programmed instruction and video tapes.

Many of our courses give your people the chance to use our computers.

Our courses can help your people become computer professionals.

People who really know how to put your computer through its paces.

IBM

Program Products

We're talking about our computer program products.

Our computer program products can help your computer do a particular job faster. And more efficiently.

In addition to the many basic control programs that support IBM computers, we have developed and announced over 50 new program products since last summer.

Programs designed to help you get the most out of your IBM computer.

IBM Custom

Contract Services

Our Custom Contract Services are for companies who need more comprehensive IBM involvement to solve specific data processing jobs.

We do all the work. From start to finish.

The design, programming and all the other tasks required to get the job done.

And when we're done we turn the whole operation over to you.

Whether it's the installation of a network of computer terminals, or even the development of a payroll system.

Our services are at your service.

Now that we've told you something about our services, we hope you'll put them to work for you.

And your computer.

Remember. A computer can't support itself.

It needs your support.

And our services are always at your service.

IBM®

As far as your computer is concerned, Brenda McGuire is just another figure.



The computer is a modern-day miracle. But you've got to admit that when working with graphics some things are lost in the translation. And some things should never be lost. They won't be when your computer is interfaced with our 410. Our 410 shows you a picture of who—or what—you want to identify. And it's in as much of a hurry as you are.

While your computer is coming up with a current bank record, our 410 is coming up with a signature and a face to go with it.

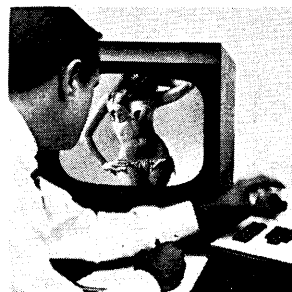
While your computer is processing the necessary

pre-admittance data, our 410 is coming up with the required patient history information.

Our 410 can come up with anything from its files in a matter of seconds. And if you want a copy of what you're looking at, you can have it in a few more seconds. It's all on a TV screen at your desk.

The 410 is a labor-saving device for your computer. And a time-saving, mistake-saving, space-saving device for you. We'll tell you all about it. Write Mosler, Dept. D-6,

Information Systems Division,
Hamilton, Ohio 45012.



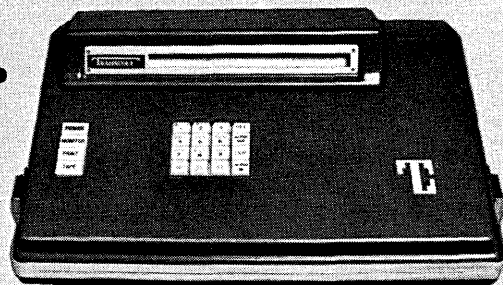
Mosler

An American-Standard Company

Improving systems for security and communications

IBM has a new computer terminal that you can go places with.

We've got a terminal that already is places.



We're not the biggest company. We just make the best low-cost remote computer terminal on the market today. And we were the first to make it.

All good reasons why the TransCom IT-216 is already in places around the country. One of our customers has installed and system-tested over 60 TransCom IT-216 terminals with more on order. And not just because we were first. It's simply that the TransCom family of data input and conversational terminals has transmission capabilities that really count.

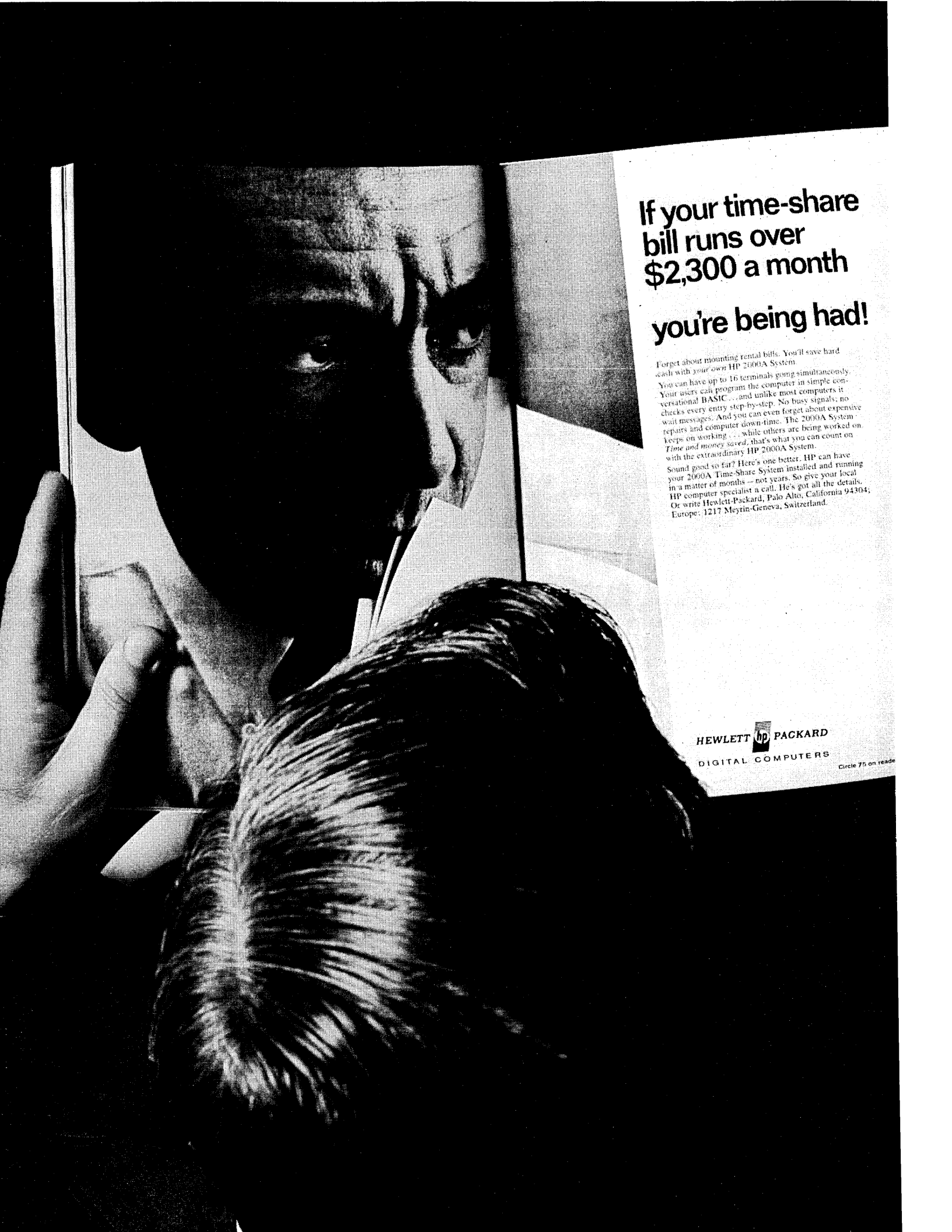
Like a printer for instant visual hard copy verification. And built-in audio capability. Or inexpensive compatibility with any computer and information system. And at under 20 pounds, you can go places with it, too.

But what should count most with you is that we've been delivering for a year now. And we can deliver for you, too, with a right-off-the-shelf shipment. Call or write:

TransCom Incorporated,
12 Tobey Road, Bloomfield, Connecticut 06002. (203) 243-1486

A Subsidiary of Hi-G, Inc.





**If your time-share
bill runs over
\$2,300 a month
you're being had!**

Forget about mounting rental bills. You'll save hard cash with *your own* HP 2000A System. You can have up to 16 terminals going simultaneously. Your users can program the computer in simple conversational BASIC... and unlike most computers it checks every entry step-by-step. No busy signals; no wait messages. And you can even forget about expensive repairs and computer down-time. The 2000A System keeps on working... while others are being worked on. *Time and money saved*, that's what you can count on with the extraordinary HP 2000A System.

Sound good so far? Here's one better. HP can have your 2000A Time-Share System installed and running in a matter of months -- not years. So give your local HP computer specialist a call. He's got all the details. Or write Hewlett-Packard, Palo Alto, California 94304. Europe: 1217 Meyrin-Geneva, Switzerland.

HEWLETT  PACKARD
DIGITAL COMPUTERS

Circle 75 on reader



**Last year this ad offered you
the best time-share buy
on the market.**

**Now we've got an even
better deal. Our new system
handles twice the users
for just \$3117 a month.**

Last year, we had one Time-Share system that made a lot of sense to a lot of people. Now, we've got two! Our new HP 2000B System does an even better job of holding the line on rising time-share costs. It handles 32 users simultaneously. Twice as many as its "little brother" (HP 2000A)—for only a third more cost.

Of course, if you already have a 2000A (or only need a 16-terminal system right now), you can upgrade to 32 terminals any time you're ready. Either way, you'll still have the best time-share buy on the market.

Both systems provide the advantages of HP BASIC, easiest programming language around. More scientists, engineers, educators and businessmen are using it every day. To make the 2000B even more useful, some new language features have been added. Like chaining (where one program calls in another automatically). Common storage for simplified programming. And doubled data file capability, for access to 16 files simultaneously.

Sound good so far? Here's more. Our 2000B, complete with custom software, control teleprinter and all 32 terminal interfaces, costs just \$119,900. Or \$3117 a month on our four-year lease plan. And if you want to start with a minimum investment, our HP 2000A is still only \$92,000. And don't forget what we said about upgrading!

For all the details, contact your nearest HP computer specialist. Or write to Hewlett-Packard, Palo Alto, California 94304; Europe: 1217 Meyrin-Geneva, Switzerland.

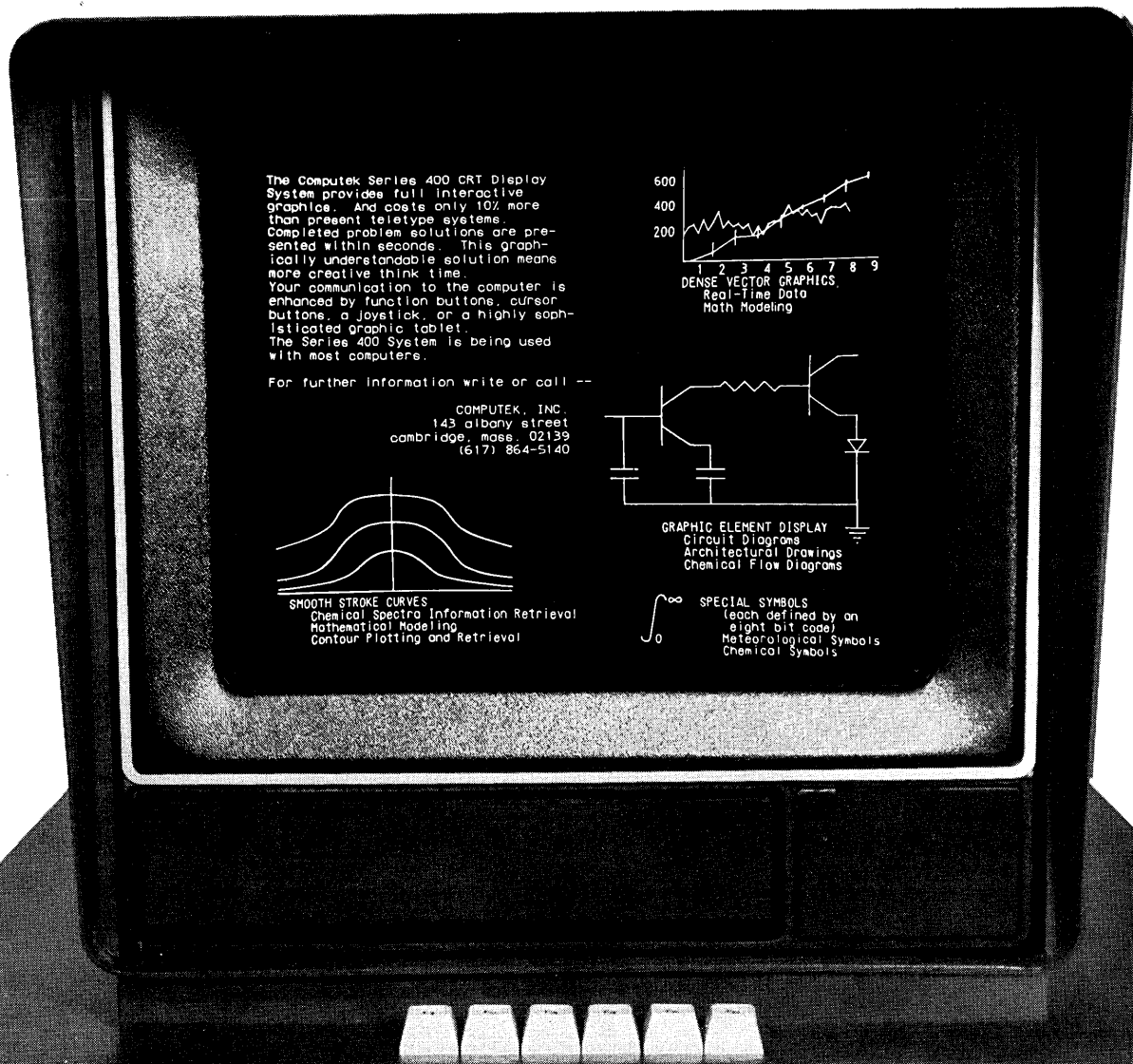
HEWLETT  PACKARD

DIGITAL COMPUTERS

CIRCLE 64 ON READER CARD

22006

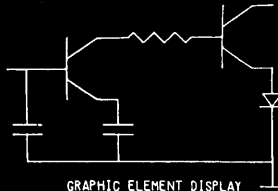
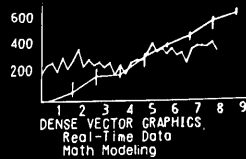
Graphically speaking!



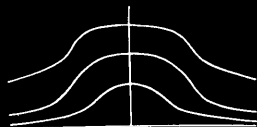
The Computek Series 400 CRT Display System provides full interactive graphics. And costs only 10% more than present teletype systems. Completed problem solutions are presented within seconds. This graphically understandable solution means more creative think time. Your communication to the computer is enhanced by function buttons, cursor buttons, a joystick, or a highly sophisticated graphic tablet. The Series 400 System is being used with most computers.

For further information write or call --

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cambridge, mass. 02139
(617) 864-5140



GRAPHIC ELEMENT DISPLAY
Circuit Diagrams
Architectural Drawings
Chemical Flow Diagrams



SMOOTH STROKE CURVES
Chemical Spectra Information Retrieval
Mathematical Modeling
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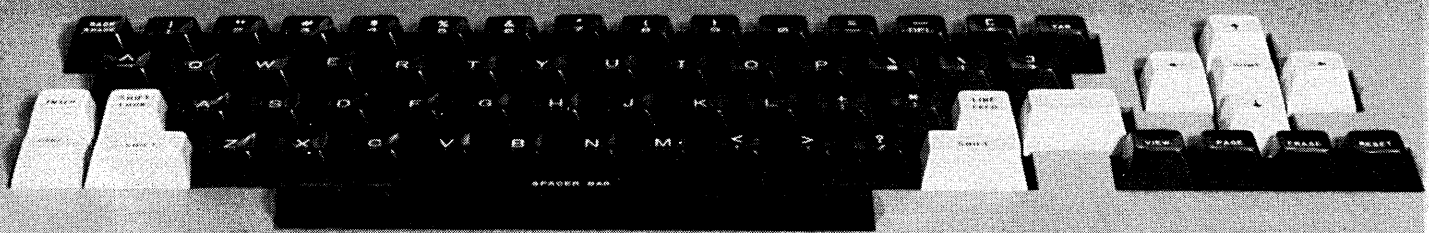
SPECIAL SYMBOLS
(each defined by an eight bit code)
Meteorological Symbols
Chemical Symbols

ON

LINE LOCAL

computek

READY



Moore New Ideas for Data Processing

Speed up expediting with your computer

When materials and purchased sub-assemblies aren't ready on schedule, the production operation grinds expensively to a halt. Moore can provide a computer-controlled expediting system that keeps suppliers on their toes. Preparation of queries is quick and inexpensive. Needed information comes back by return mail. System also provides an effective way to appraise vendors. Ask about Idea #401.

Automated system for rack jobbers

Nobody envies the jobber's routeman all the bookkeeping that goes with his job. And it stands to reason that he could cover a lot more territory if relieved of that chore. Moore has a way to do this. A Moore system, utilizing optical scanning, reduces bookkeeping to drawing lines on a sheet of paper. The system is errorless, widely adaptable, economical. Ask about Idea #402.

Lower the cost of re-issuing identity cards

When identity or credit cards are prepared in a separate operation from preparation of records, both have to be matched and then prepared for mailing. Time-consuming. Costly. Prone to mismatches and other errors. Moore has a new system which eliminates all these disadvantages. One pass through computer prints plastic card and records simultaneously. Ask about Idea #403.

Automate ALL the way

A Moore Interstacker device can double the output of your printer. It can be used separately or in connection with a Moore Imprinter-Detacher machine. Ask for a demonstration.

Moore ideas can make your automation even better

Sometimes a very simple idea can make your ADP setup deliver much more than you thought possible. Moore specialists work closely with the equipment people to get a perfect marriage between paper and hardware. It always pays to call in a Moore man when you talk to equipment people. One Moore idea may be what you need.



MOORE® BUSINESS FORMS, INC.

Over 675 offices and plants, 2618 salesmen in North America

GENERAL ELECTRIC'S

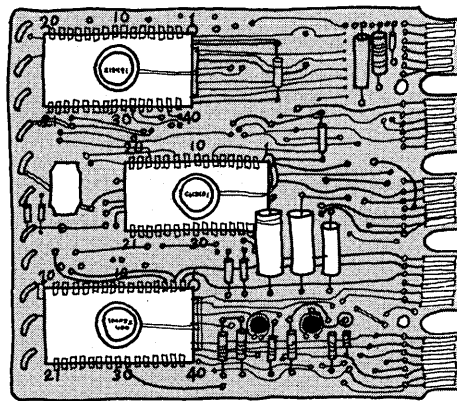
TermiNet

Fast and Quiet



10, 15, or 30 characters per second...more than twice the speed of conventional equipment, so you get the most from today's high-speed data generation and communication equipment. This can mean big savings — in your office, in computer time and in the use of communication lines. This extra quiet impact printer makes less noise than an office typewriter, so it can be where it is needed... where your people are.

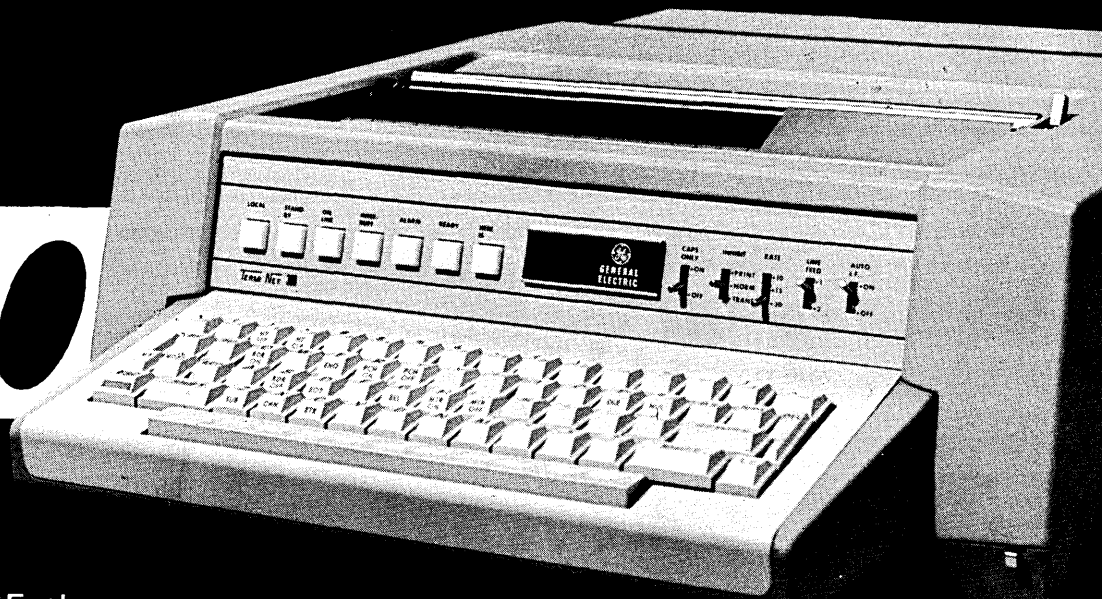
...Highly Reliable



The TermiNet 300 printer is basically an electronic device with a minimum of mechanical parts. There is no moving carriage and the electronic keyboard has a light touch for rapid, accurate typing. You also get high reliability and compactness by the use of large-scale integrated circuitry.

* Trademark of General Electric Company

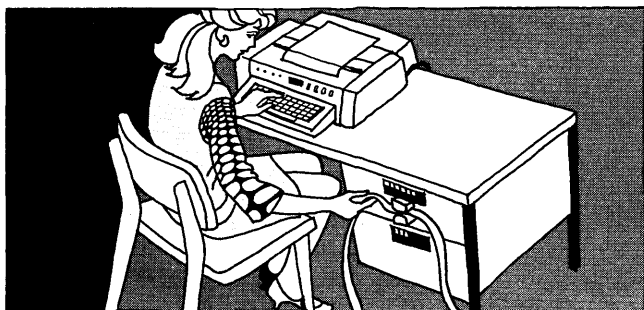
* **300**



For
Time Sharing
Point-to-Point Data Exchange
Management Information Systems

...Versatile

- Time sharing
- Point-to-point data exchange
- Editing and formatting
- Management information systems
- Information retrieval
- Repetitive printing
- Computer input/output



Whatever your application, this highly versatile data communication printer has a lot to offer. Impact printing can give you clear, multiple copies. Fast printout and a full ASCII character set means less time spent on communication lines.

The TermiNet 300 printer's compact, highly portable, "go anywhere" size saves you money, too. Because now you can put it where you want it...when you want it.

...And More

Many options are available to tailor GE's TermiNet 300 printers to your specific requirements.

- **PIN FEED.** For rapid, accurate handling of business forms.
- **PARALLEL INTERFACE.** To accept data in parallel form and utilize associated devices.
- **HORIZONTAL TABULATION.** For quickly setting tabs at every print position. This aid in formatting output data can be done from a remote location, or on the local keyboard.
- **BUILT-IN DATA SET.** Available as a plug-in board. Completely eliminates the need for a separate expensive data set.

That's just a few...there are many more. Even if you don't want or need all of the available options now, most can be added at a later date.

TermiNet 300 data communication printers are now in full-scale production. Want more information? Write Section 794-01, General Electric Co., Schenectady, New York 12305

GENERAL  **ELECTRIC**

put your stake in Florida.

We Have Competitive Advantages You Simply Can't Afford To Overlook

When your surveying team pounds the first stake into the good Florida earth you'll be off and running.

Florida has competitive advantages for you that are bound to find their way into your profit and loss statement.

Our recently passed laws governing revenue bond financing are going to smooth the pathway to new building and improvement.

We have a labor training and motivating program — without cost to you — that takes all the headaches out of recruitment.

The all-round advantages of Florida living make us the **most** attractive state for all kinds of skilled people.

When you start thinking about sites, think about Florida where you get the big competitive edge. Phone (904) 224-1215, or send the coupon.

Florida

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I'm interested in a business or industrial future
in Florida. Please send me more information.


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Title or Position

Company

Street

City State Zip



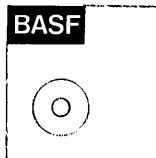
**BASF computer tape reliability helps
Gulf Canada keep deliveries, billings
and payrolls on time...an absolute,
everyday necessity
in the oil business**

As head of Computer Operations in the Toronto headquarters of Gulf Oil Canada Limited, Harry Bongers is among the countless systems managers who depend on BASF tapes. The results of three months of careful testing proved that BASF tapes could deliver the dependable performance required in Gulf Canada's Series 360/Model 40 IBM system (eight 2401 Model II's).

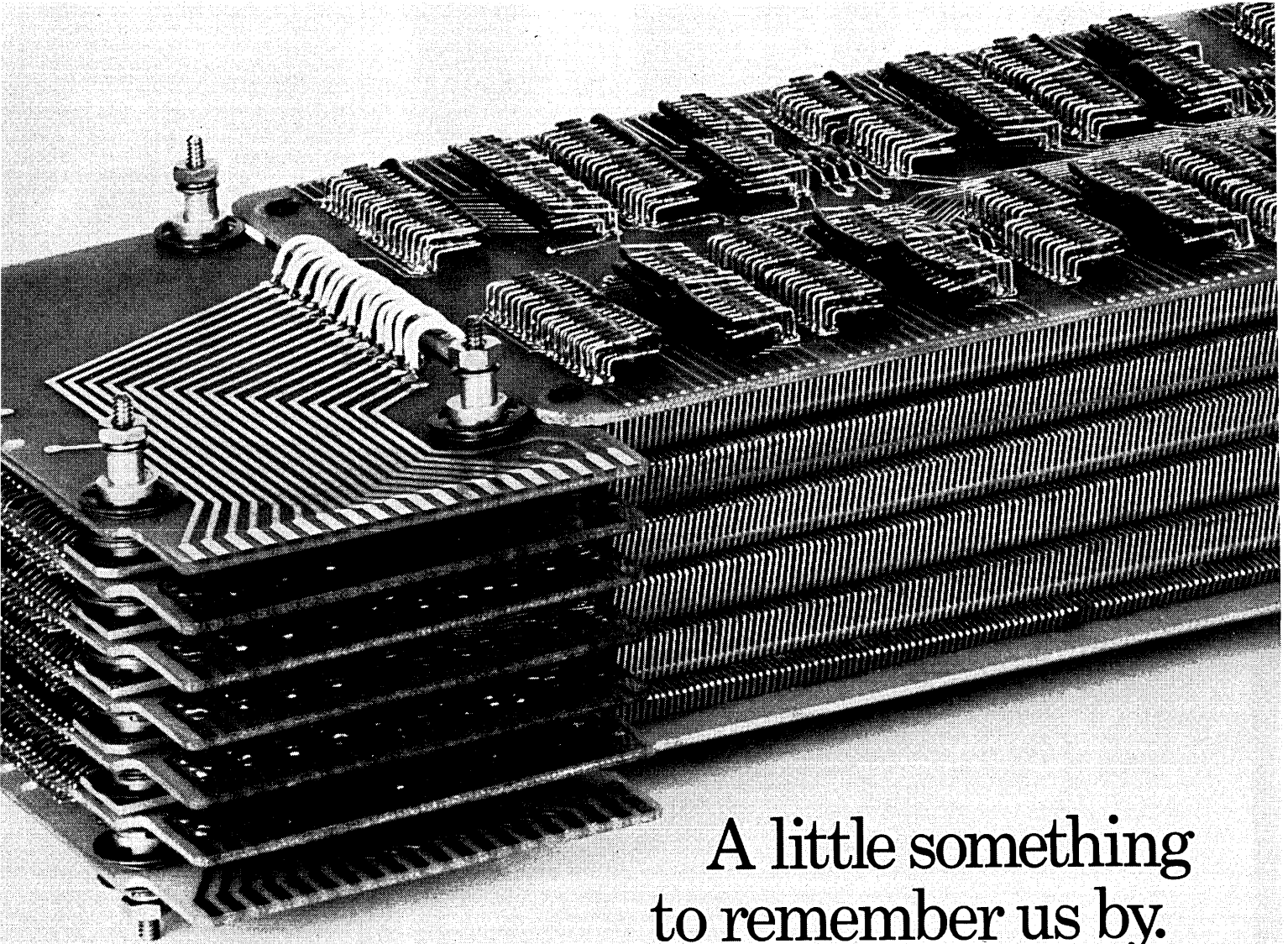
"A broad range of processing activities at a continuous high volume is handled and there is no time for errors," says Mr. Bongers. Payroll, benefits and statistics for the entire 10,000 employees across Canada are processed at the Toronto data centre. In addition, the system handles automatic delivery scheduling and billings for domestic furnace oil customers and service stations. Between 500 and 600 orders a day are processed for customers not on scheduling.

BASF service helped facilitate Gulf Canada's recent successful conversion from 7-track to 9-track tapes. For full details on how high-performance BASF computer tape will give you more reliability, write for free literature and specifications.

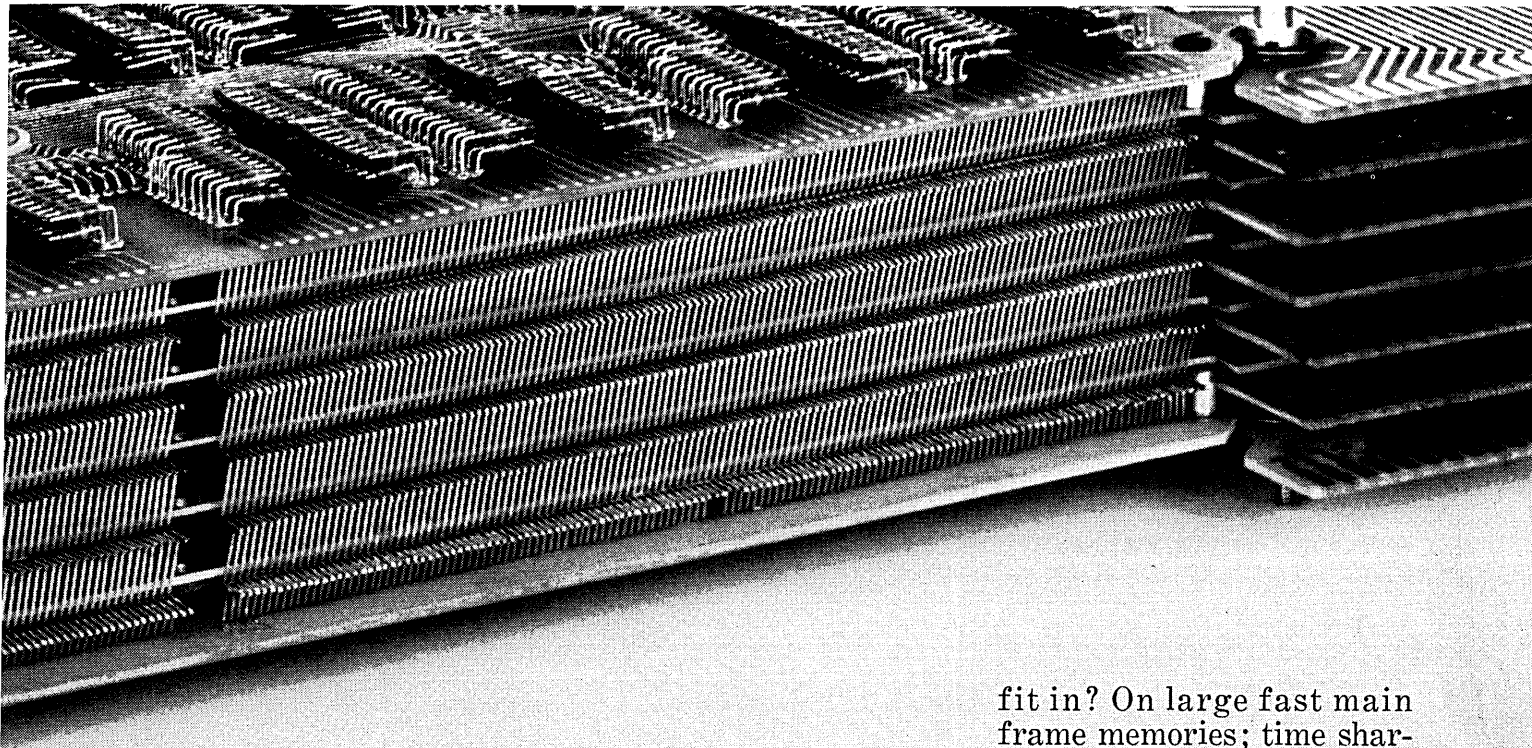
BASF SYSTEMS INC
Crosby Drive, Bedford, Mass. 01730



CIRCLE 8 ON READER CARD



A little something
to remember us by.



You're looking at an actual size photograph of the new Nanostak® NS-3020 commercial memory stack. Proof that big things come in small packages. This stack is so compact its volume is only 25% of competing planar designs.

But we didn't cut corners on performance.

Nanostak is a modular

2½D stack with full cycle times as fast as 700 nanoseconds. Its maximum capacities are 32,768 words by 20 bits, 16,384 words by 40 bits and 8,192 words by 40 bits.

And everything happens so easily.

We've designed Nanostak with printed circuit board edge connectors and mounting jack screws. Which gives you a simple plug-in unit for all NS-3020 configurations.

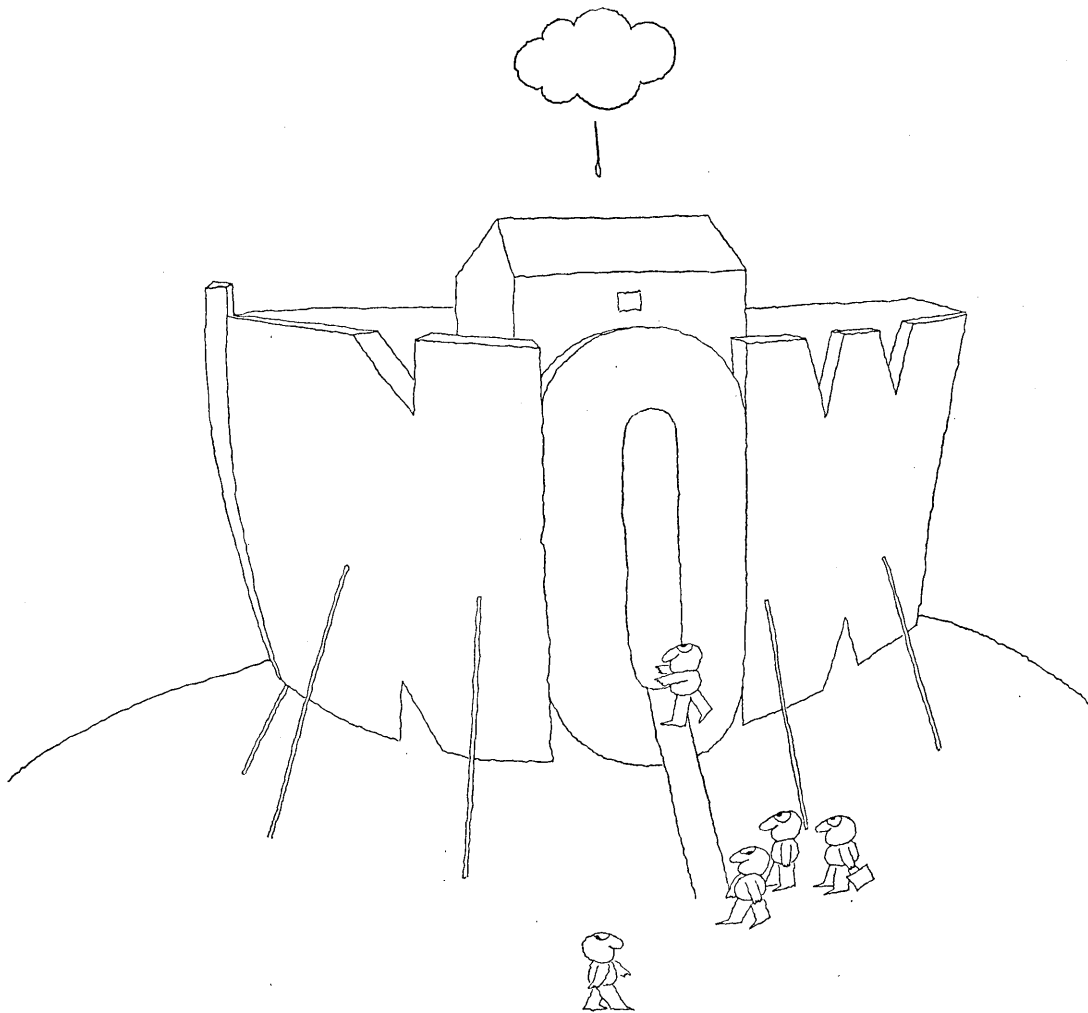
Just where does Nanostak

fit in? On large fast main frame memories; time sharing systems; electronic telephone exchanges and radar signal processors. We've built enough reliability into this stack for process control applications in the most severe industrial environments. Wide temperature range cores are even available as an option.

Nanostak. A little something you might want to talk over with us. Soon.



Electronic Memories. Worth remembering.



Now. Before it's never.

The sea of data needed to run a modern business is at high tide.

The information on which decisions must be based is threatening to engulf the deciders.

In order to shape your course, you have to find out what you need to know, when you need to know it. Which is now.

Univac can help you navigate in the now with on-line, real-time information systems expressly designed to channel a chaotic flood of data.

The UNIVAC® 9000 series systems

offer an unmatched level of data processing power in the low and medium price field.

They are widely used as either central site systems or terminal systems. As terminals they may be upgraded, without reprogramming, in low-cost steps to grow with your processing needs. The UNIVAC 9000 series systems are compatible not only with UNIVAC systems but with most other systems too, and they can operate on a wide variety of line speeds simultaneously

with several central processors.

We can help bring you real-time management for the first time. An end to tidal onslaughts of unorganized data. A beginning to constant command through constant information.

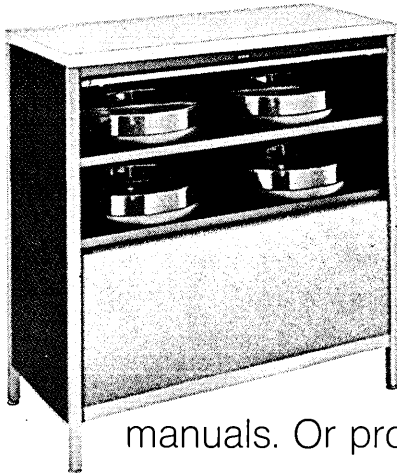
The time to get on board is now. The way is by calling us. We know these waters well.

UNIVAC
FIRST IN REAL-TIME INFORMATION SYSTEMS

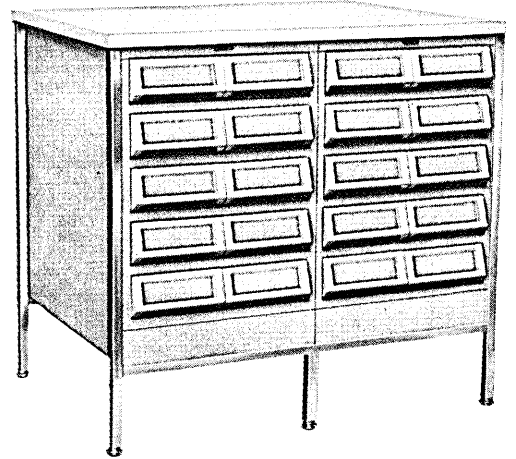
SPERRY RAND

Nothing matches your computer like a Tab Storaway. (Except another Tab Storaway.)

Tab Storaways are as modern as today's third-generation computer. (You can match or harmonize them to your computer in any of



22 colors.) What they can do for you is almost limitless. They can quickly put card files at your fingertips.



Or tape reels. Or data cells and tape reels. Or tape reels and disc packs. Or disc packs and procedure

manuals. Or program decks and tape reels.

Or tape reels, disc packs, and data cells. In fact, our

Storaways are versatile enough to hold whatever

you use in your computer

room. You provide the

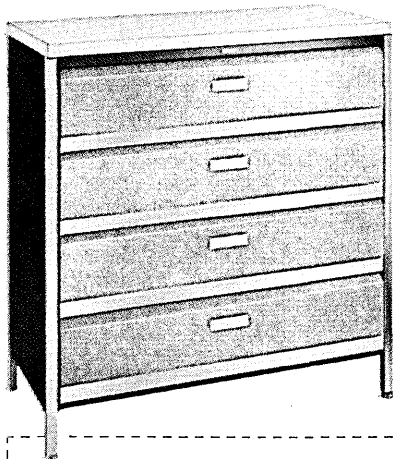
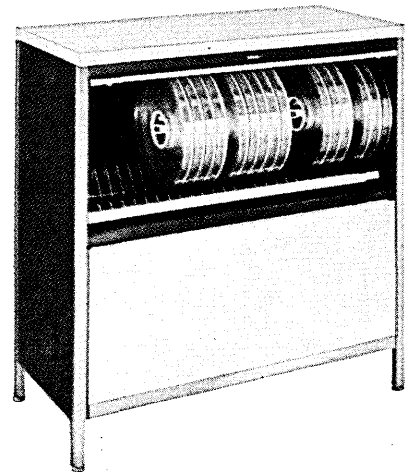
specifications. We'll

provide the Storaways.

So if you're looking for

Storaways to go with your computer, just mail

the coupon to Tab. Ask us for a match.



Gentlemen: I'd like more information on your Storaway cabinets.

Name _____ Title _____

Company _____ Street _____

City _____ State _____ Zip _____

TAB
PRODUCTS CO.

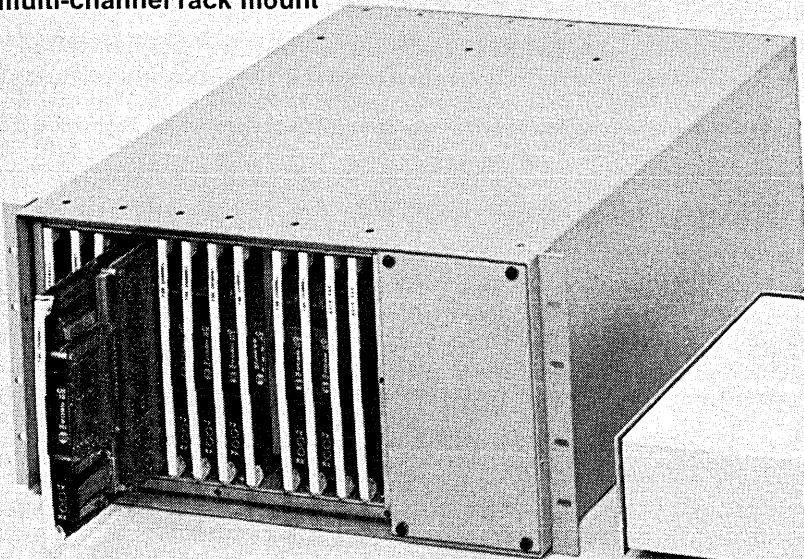
2690 Hanover Street, Palo Alto, California 94304

Booth 225
DPMA Convention
June 23, 24, 25, 26
Seattle, Washington



For OEM or end-user applications

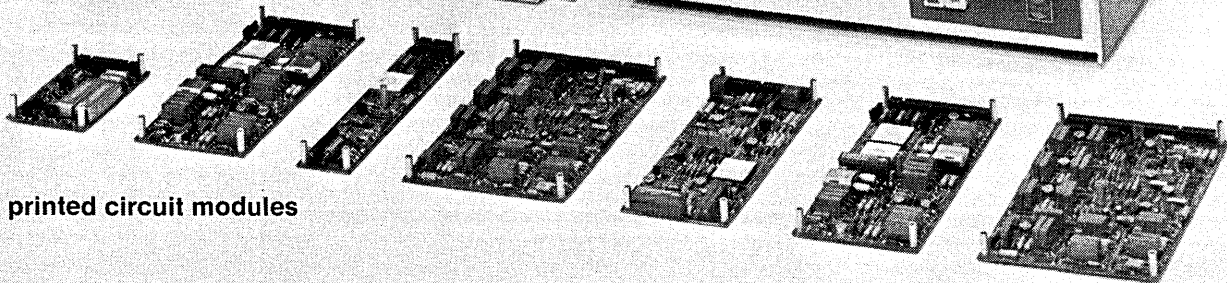
multi-channel rack mount



desk or wall mount



printed circuit modules



3 configurations of Collins TMX-202 data sets

Collins new TMX-202 FSK data sets are available in all three configurations: desk or wall mount, standard multi-channel rack mount, or compact printed circuit modules (transmit, receiver, keyer, test-alarm, and interface).

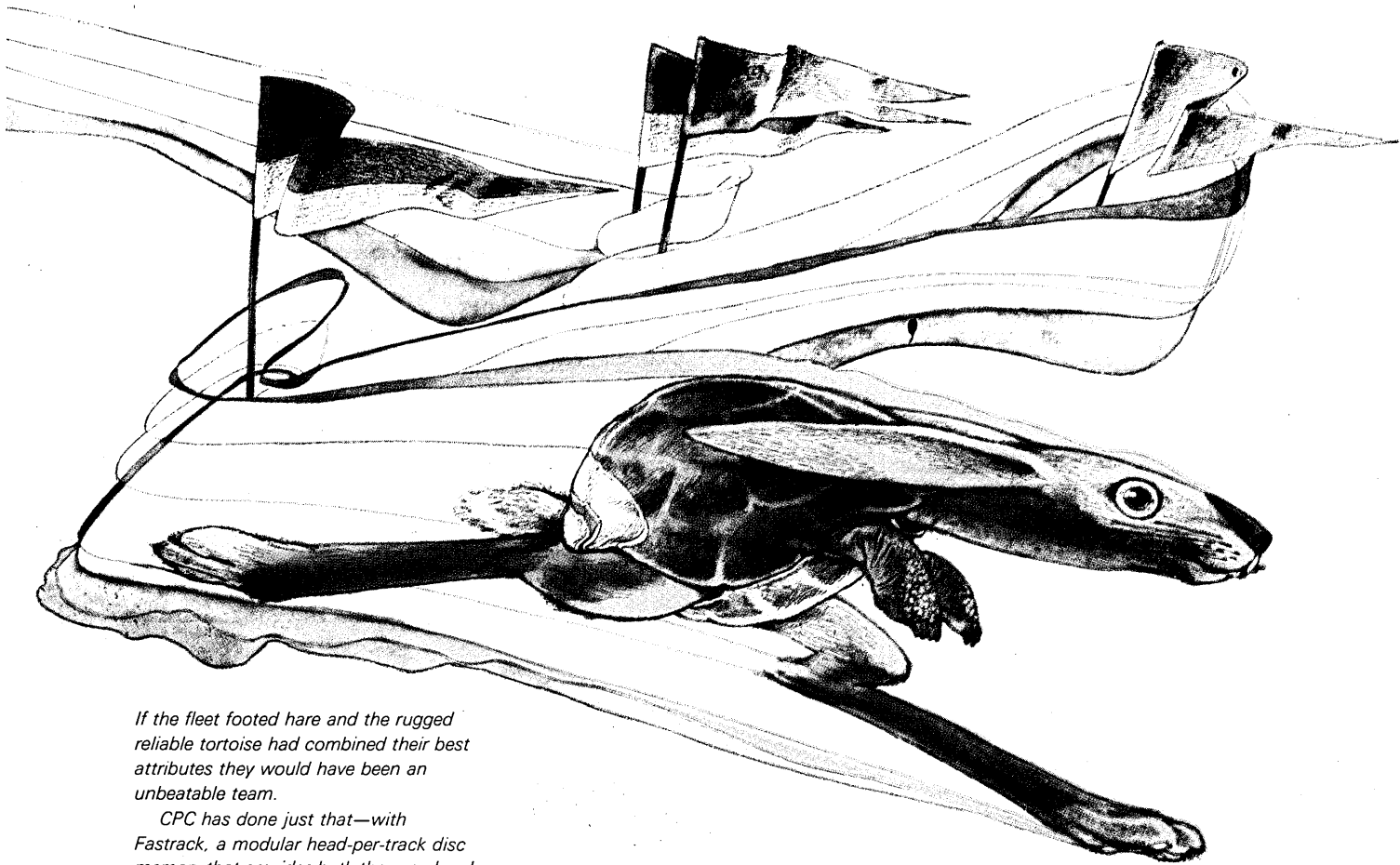
The sets operate at data speeds ranging from 150 to 1800 bps, full- or half-duplex, over unconditioned telephone circuits type 3002 (Tariff FCC 260), or over the dial network with a telephone company data access arrangement. Digital interface meets RS-232B. State-of-the-art design incorporates IC's, hybrid thin film circuits and MOS/LSI arrays to improve performance and reliability.

The TMX-202 family is another example of the engineering and manufacturing excellence achieved at Collins through use of the C-System—a computer-controlled system which integrates design and production, as well as other management control functions, into a single network.

Call or write your Collins engineering sales representative or Collins Radio Company, Data Equipment Marketing, Dept. 600, Newport Beach, California 92663. Phone: (714) 833-0600.



COMMUNICATION/COMPUTATION/CONTROL



If the fleet footed hare and the rugged reliable tortoise had combined their best attributes they would have been an unbeatable team.

CPC has done just that—with Fastrack, a modular head-per-track disc memory that provides both the speed and the data reliability so necessary in this exploding world of program swapping, time sharing, message switching and real time computing.

It's the head arrangement that does it!

IT'S THE HEAD ARRANGEMENT THAT GIVES FASTRACK™ BOTH SPEED AND RELIABILITY

Fastrack Speed vs. the Disc Pack

Too often, Disk Pack Manufacturers define "access time" as the time it takes the moving head to reach the desired track. They conveniently fail to mention the additional time required for the rotating disc to reach the data point.

In reality, the fastest disc pack takes an average of 30 ms to move the arm plus an additional 12 ms to reach the data. That's an average total time of 42 ms. And typically, disc packs take 70 ms or longer.

This slow access time is just not acceptable in most real time computing applications.

On the other hand, CPC's head-per-track modules gain access to data in 16.7 milliseconds average because hundreds of "fail safe" flying heads hover micro-inches above each track. There is no time lost in head motion. No errors caused by positioning. Data transfer is fast, too — 3 MHz bit serial or 6 MHz two-bit parallel. And a single Fastrack disc module can store up to 48 million bits of data.

Fastrack Data Reliability vs. Disc Pack

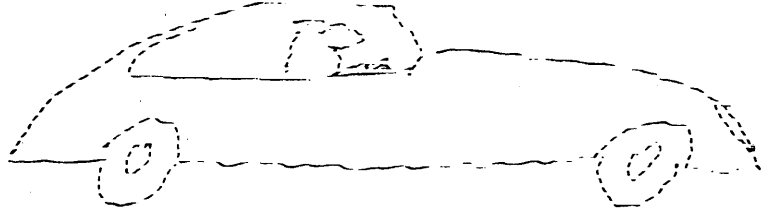
Fastrack has a maximum of one recoverable error in every 10 billion bits of data transferred. Compare this with the one in a million error rate of the typical disc pack. This means that Fastrack's data reliability is ten thousand times better! Disc packs may be OK where errors are easily recognized and can be tolerated — but not when the disc memory is the heart of a real-time system where the drop of a bit could be a disaster.

Fastrack also eliminates the possibility of head avalanche. Each disc is sealed. The precision flying-heads never touch the recording surface and automatically retract if motor speed, internal voltages or air pressure varies. The continuous air filtering system makes it impossible for self-generated contamination to accumulate.

There's a lot more to the Fastrack story — the fast modular disc memory which provides from 24 to 96 million very reliable bits in a compact cabinet. Call us today or write for our brochure.

FASTRACK™ BOTH SPEED AND RELIABILITY

cpc computer peripherals corp.
5037 Ruffner Street
San Diego, Calif. 92111
Telephone (714) 279-7500



PDP-15 is a Jaguar at a soap box derby.

Lots of companies make medium size computers. Too many. But a lot of them are obsolete, and some of them never did have any horsepower. PDP-15 is different. Half the price of some of the competition. But better than that, software proven in 400 field installations, full monitor control, four versions that fit most applications specifically, and all budgets. Write.

digital
COMPUTERS - MODULES

Digital Equipment Corporation
Maynard, Mass. (617) 897-5111



letters

the devil you say

Sir:

Although George Comstock and I are pleased with the accurate reporting done on our "design philosophy," we cannot take credit for developing this philosophy ourselves (April, pp. 218-220). Actually, it has been developed over the years by many contacts with able people, but first credit must be given to Earl Masterson of Honeywell EDP.

We do take credit for both learning and applying these principles effectively, and we believe that we provide some unique capabilities stemming from the application of these principles. They do work and we recommend them to all designers of peripherals for any system, large or small, with enthusiasm based on experience.

DR. ANDREW GABOR
Diablo Systems, Inc.
Hayward, California

to hill with this

Sir:

Mr. Hill writes a good story (Mar, p. 59) though a fundamentally under-researched one. His understanding of franchising is cursory at best and his stresses on the major advantages of franchising are misplaced.

From a franchisor's point of view, let me more clearly explain its concept and comparison.

First, franchising provides the neophyte entrepreneur with top level, highly skilled management advice and supervision. This does allow an individual without a working knowledge of the business he is entering an excellent chance of success. This is the major contribution of franchising.

Mr. Hill mentions a 30% failure rate in new, nonfranchised businesses. His figure, according to SBA, is about 250% low. This, and other sources, report infant mortality more in the realm of 80%. The reasons he chose were accurate, however.

Second, while franchise fees raise a considerable amount of capital, rest assured it hardly covers the development and sales cost. Anywhere from 15% to 35% of the fee goes to the franchise salesman. Another 15% to 20% goes into advertising, literature, travel, etc. From 65% to 80% is used in research, development, systems sup-

port effort. If you have noticed that the total percentage is more than 100%, that was the point.

Any franchisor looking to his franchisor fees for the return of his investment and franchising costs (the whole fee to say nothing of the down payment) is headed for serious financial troubles before the business is even off the ground.

The power of franchising for the franchisor is a rapid, nationwide distribution of sales personnel (or stores) without the overwhelming problems of recruiting employees plus the shared responsibility of financial investment. The power of franchising for the franchisee is the relative ease of business

entry with a shared responsibility of management. Most of the failures in franchising are directly attributable to an approach that differs with either of these powers.

True, as Mr. Hill says, "the dogs have to like what is being franchised;" but, it does take more than a nickel to create a viable franchise. Ask any franchisor that has survived more than two years in this crazy boom-while-bust economy.

BOB NELSON

Mr. Swiss of America, Inc.
Oklahoma City, Oklahoma

Mr. Hill replies: I bow to Mr. Nelson's obviously
(Continued on page 43)

straighten out

Sir:

I hope that I may be allowed to comment on Fred Gruenberger's reply to my letter published in March (p. 226).

I should have been more explicit in my remark that DATAMATION began in 1955. I take his point that the title was used in this form first in 1959, but surely he would agree that this was only a title change of a journal which started in 1955 as *Research and Engineering*.

With regard to abstracting services, we in the computer world are most definitely in trouble. The coverage by abstracting services of the computer literature is very poor.

In order to keep this letter brief I think that the accompanying data will

estimated 5,000 items published in 1966.

With all the money that is spent within the computer industry and the information handling technology that is available, surely we can do better than this.

ALAN PRITCHARD
Manchester, England

Editor Forest replies to Mr. Pritchard: You certainly are allowed to comment on Mr. Gruenberger's reply to your earlier letter, but I guess it's time for me to step into the picture to straighten out some basic facts. First of all, *Datamation* started in 1957 as an offshoot of another publication called *Research & Engineering*, which was started in 1955 by another publishing company, and acquired in 1957 by F. D. Thompson Publications, Inc.

But the change from *Research & Engineering* to *Datamation* (the latter name was played down

Name of journal

Computer Abstracts	3,391	16.8
Computing Reviews	1,718	8.5
Information Processing Journal	3,833	18.9
IEEE Transactions Abstracts	570	2.8
Literature on Automation	2,140	10.5
Data Processing Digest	258	1.27
U.S. Government R & D Reports	2,659	13.1
STAR	2,812	13.9
Referativnyi Zhurnal Vychislitel'naya Tekhnika	4,806	23.7
Referativnyi Zhurnal Kibernetika	4,279	21.2

Number of 1966 published abstracts % coverage.

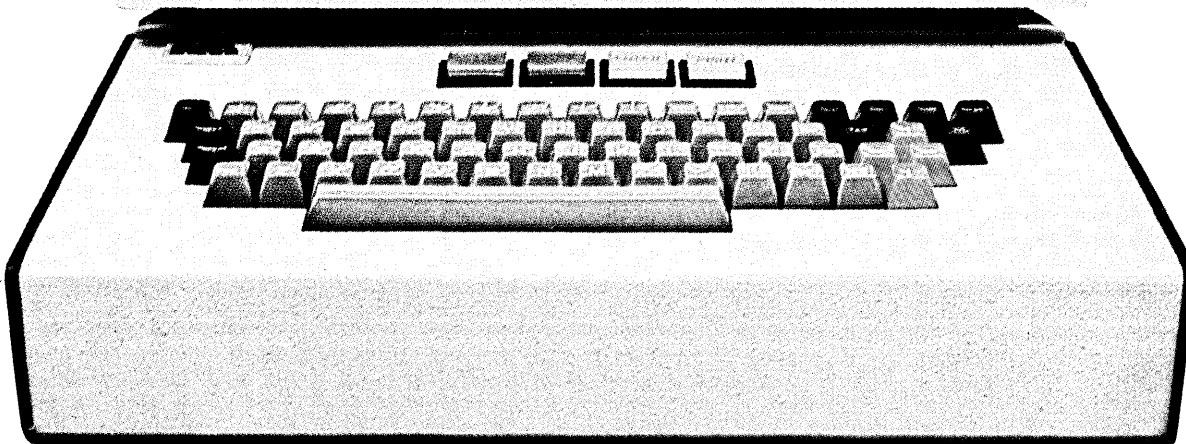
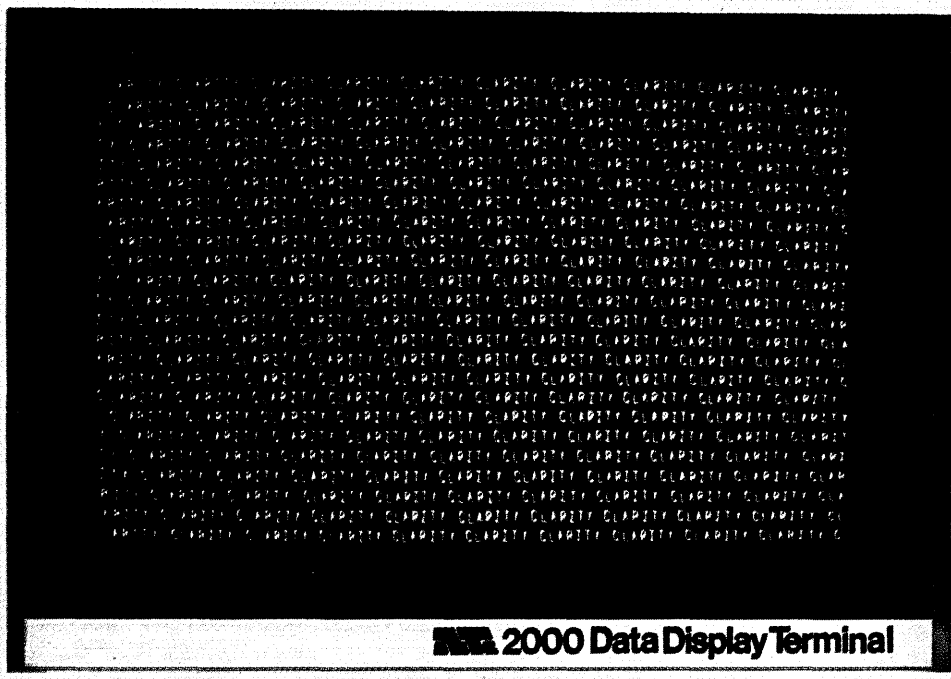
illustrate this point more than a discursive letter (these figures are based upon an, as yet, unpublished final report on a research project carried out at the North Western Polytechnic School of Librarianship, London, and sponsored by the Office for Scientific and Technical Information).

Total number of 1966 published items studied was 20,268. At least 3,000 items were not abstracted at all and my survey did not cover an

on the cover until the January/February, 1958 issue, when "Datamation" took the predominant position on the cover; "Research & Engineering" disappeared from the cover beginning with the May/June, 1959 issue) was much more than one in name.

From the last issue of R&E to the first issue of *Research & Engineering*, the Magazine of *Datamation*, the magazine dropped its previous R&E emphasis . . . and became almost overnight an information processing publication.

I thought that both you and Fred might like to know a bit more precisely some of the facts behind the birth and evolution of our magazine.



we're sorry, Mr. Watson...

For yielding to temptation in a recent advertisement. And comparing your Model 2260 so unfavorably to our ATC 2266. Never again! Since the ATC 2266 Data Display Terminal does sell on its own merits, here goes.

To begin with, the ATC 2266 *puts up 1920 characters*. Clearer, more legible characters, too (our cursive stroke vs. the old dot matrix.)

Undeniably, the ATC 2266 *is* completely compatible with IBM System/360. Plug-to-plug interchangeable with the IBM-2848/2260 display subsystem. Right down to the software. And, what's more, you can

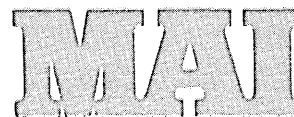
have the ATC 2266 in less than 90 days. Maintenance is available from our network of close to 1,000 service representatives.

Here are some more merits. Program Controls for character addressing, formatting ability, protect mode and auto tab erase. Plus two Operator's Controls: insert key and delete key. Plus optional lower case, limited graphics and hard copy.

ATC also makes three other multi-station display terminals, in 960, 480 and 240 characters. And stand-alones in 1920 and 960. All offering unbeatable cost/performance ratios, buy or lease.

Will you forgive us now, Mr. W.?

The ATC 2266 is sold and serviced through more than 45 MAI offices in the U.S.A.



300 E. 44th St., New York, N. Y. 10017

Manufactured by
Atlantic Technology Corporation
The Display Company

letters ...

superior knowledge of franchising. As for the failure rate of new business, he will have to quarrel with my source, not me. I'm inclined to believe that 80% mortality is more nearly correct than the figure I used. I hope this did not destroy the main point of the piece, though, which was to identify for the prospective franchisee some points of importance to consider before plunking down his money.

t-s to task

Sir:

Mr. Roy's article (Mar. p. 52) reads like a brochure from any of a hundred service bureaus or time-sharing companies—all roses and a bright future for the amazing computer entrepreneurs. In fact, the changing role of the service bureaus is that most of them are in great financial trouble. Like bowling alleys in the mid-sixties, service bureaus are proliferating in number and dissipating in profits. Service bureau salesmen operate almost solely in a replacement-market atmosphere, where pirating away of customers from other companies is the only way to do business. Where 10 service bureaus in a city might make an honest profit, there exist 20 or 30 struggling along.

I say Amen, on the other hand, to Mr. Hammerton's article (same issue) and Mr. Nelson's comments (News Scene). These men speak to the point of *survival*. One can only guess why the president of ADAPSO isn't looking under the table to see how many fingers are crossed when the members talk optimistically about the seventies.
THOMAS H. HOGAN
New York City, New York

let it all hang out

Sir:

News briefs (Mar. p. 161) reported the meeting sponsored by the Science & Astronautics Committee of the House of Representatives on "The Converging Technologies of Communications, Computers and Automation in the Management of Knowledge and Information." The attendees stressed the threat of invasion of privacy. I believe informational privacy to be a false issue.

What should concern us is the potential for injury resulting from the misuse of personal information.

To fight against the increasing transparency of our lives is to fight a losing battle, and to fight it on the side of the furtive, the covert, the clandestine, the surreptitious and the underhanded. I advocate:

(1) laws actively to make public about everyone, information available

about anyone; and

(2) laws for individuals to use to defend themselves against blackmail, discrimination, extortion and similar information-based threats.

As our private masks lose their opacity, I believe we'll find each other not so different from ourselves after all.

RUSSELL J. ABBOTT
Redondo Beach, California

wimmix master

Sir:

In the March Forum, Mr. R. L. Patrick replies to a critic of his earlier article on the WIMMIX procurement. However, he muddies the water by trying to pass off a number of sweeping generalizations as "conventional wisdom."

First off he categorically tells us that all the talented people have migrated away from second generation systems. In fact he claims that the only ones left working in second generation systems

are "youngsters on their way up, trainees, and 'average' programmers who are content to be followers." Incredible!

I've always thought that the complexity of the computer application was more important than the computer generation. The federal agency where I work is presently implementing second generation computer systems for various military commands. While we have lost as well as gained our share of good people, the ones who left specifically in order to work on third generation machines have generally been the "youngsters" who have somehow reached the same conclusion as Mr. Patrick; that experience on the IBM 360, no matter how trivial, is worth more than continuing to solve problems on a second generation machine.

A second point made by Mr. Patrick is about the federal personnel system,
(Continued on page 250)

you don't pay any money but take your choice anyway

Sir:

OCR A VERSUS OCR B AND ON AND ON AND ON.

Why not a contest? Print the two styles, side by side, and let your readers express their opinions.

I personally think that OCR A is true slob-art and OCR B is a quite fine looking font. But, why not put it up to the vote of your pertinent readership.

MICHAEL RADOW
New York City, New York

THIS IS A SAMPLE OF THE USASCSOCR - SIZE A AS PRODUCED
FROM AN IBM SELECTRIC TYPEWRITER - ELEMENT NUMBER 091

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

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The following is an example of the print-out of the B-font element made for Great Britain. This font is highly regarded by the European Computer Manufacturers' Association (ECMA) but domestic users and manufacturers regard it as unnecessary.

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1 2 3 4 5 6 7 8 9 0 = =

Q W E R T Y U I O P [
q w e r t y u i o p]

A S D F G H J K L : "
a s d f g h j k l ; '

Z X C V B N M , . %
z x c v b n m , . %

Dear Computer Development:

Can you tell me how to get
from peripherals to memory
and back again
without bothering my
overworked CPU?
Puzzled



Dear Puzzled:

Take the Universal Bus, like in the cd 200 minicomputer. Direct Memory Access is standard, so any peripheral can talk directly to memory—and vice versa—without going through the processor. And peripherals can even talk directly to each other.

computer development

3001 S. Daimler Street, Santa Ana, Calif. 92705 • (714) 557-9720

The cd 200 □ Eight-bit and 16-bit operations □ 69 instructions □ Universal Bus □ Direct memory access □ Multiple register sets for rapid context switching □ Time-shared cross assembler with simulator □ \$2995 for 4K byte machine in OEM quantities □ The newest idea in minicomputers.

Man does not live by mainframe alone.

Some computer makers give you a mainframe. Period.

Honeywell 316 and 516 computers come with everything from soup to nuts. Like one of the broadest lines of peripherals and subsystems.

These include: Seven-track and nine-track magnetic tape units with vacuum capstans and hardware error correction. Moving head disc stores, including a dual spindle model (performs read or write operations on one spindle while the other is in the seek mode) and a high-capacity model (14.4 million bytes). Buffered line printers with speeds up to 950 lines per minute. Paper

tape and card readers and punches. Data acquisition and control interfaces. Displays. Plenty more, too.

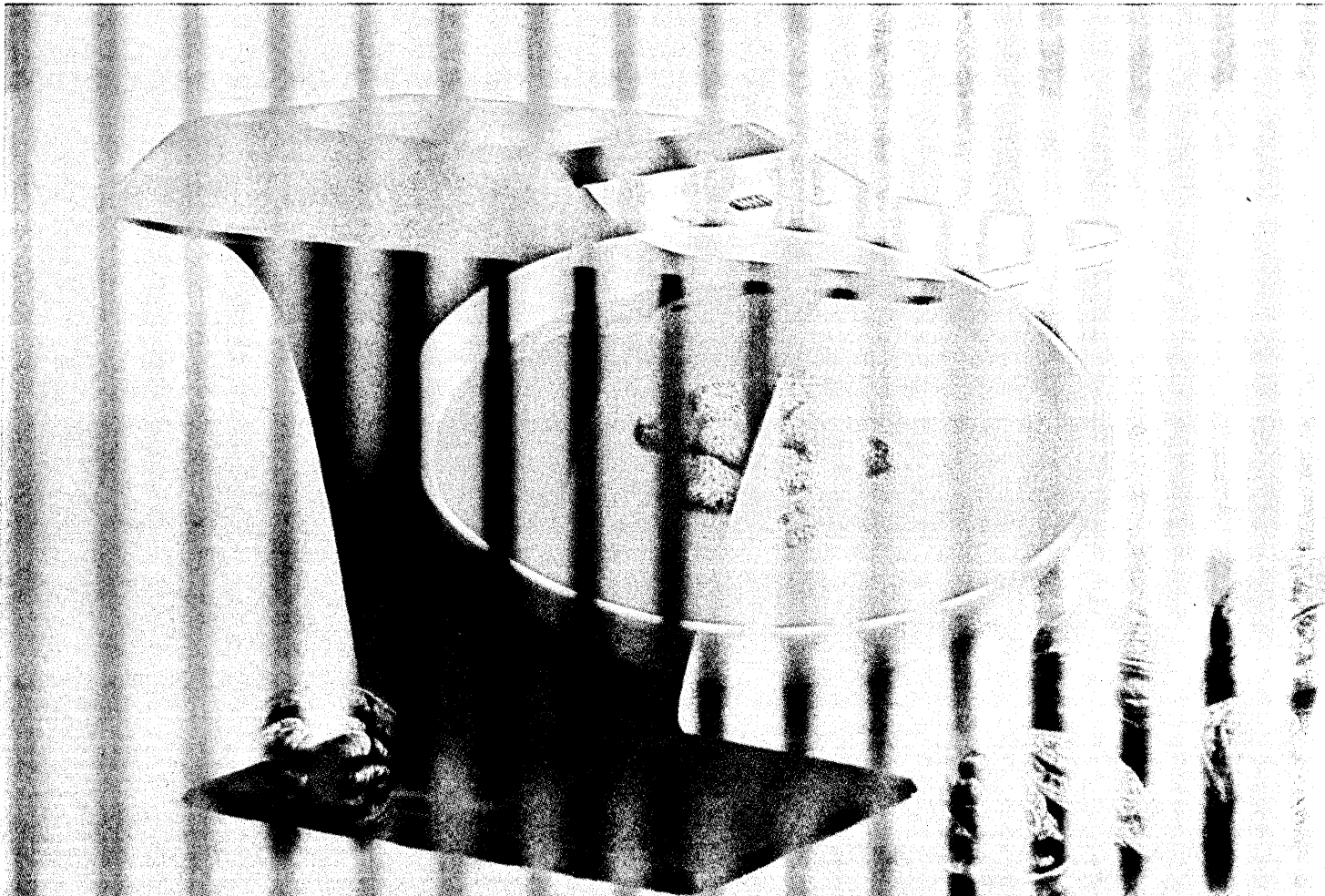
Want to build your own subsystems? There are more than 400 compatible Honeywell logic modules to choose from. Memory systems, too.

Software? More than 500 field-proven programs.

Get more information about the Series 16 family of real-time, on-line computers and options. Write for the 316/516 literature kit. But whatever you do, consider the alternative: Honeywell, Computer Control Division, Framingham, Mass. 01701.

The Other Computer Company: **Honeywell**

HONEYWELL INTERNATIONAL—Sales and Service offices in all principal cities of the world. Manufacturing in Australia, Canada, Finland, France, Germany, Japan, Mexico, Netherlands, Spain, Taiwan, U.K. and U.S.A.



CIRCLE 55 ON READER CARD

**The name
makes a
in disk**



on the label difference packs.



When the name on a disk pack is "Scotch" Brand, it comes from the world's most experienced producer of magnetic computer products.

It's a product of the pioneers who gave the EDP industry its first computer tape.

It's made by the same people who have made virtually every major technological breakthrough in magnetic media.

You can expect "Scotch" Brand Disk Packs today to be unsurpassed in reliability and performance. And when the next advance comes in disk packs, you can expect it to come from 3M.

"SCOTCH" IS A REGISTERED TRADEMARK OF 3M COMPANY.

3M
COMPANY

The barrier breakers.

CIRCLE 142 ON READER CARD



Burroughs closes a communications gap.

Our new Series N Magnetic Tape Encoder brings a number of distinct advantages to the process of recording data for computer input.

First of all, it closes the operator/machine gap by communicating in "plain English". When the operator keys an "A", she can display the "A". On a large, easy-to-read ALPHA-NUMERIC display. This simplifies error identification and spot corrections. The display also reminds her where she is in a program and what she should do next. And even tells her when she has made an operating mistake.

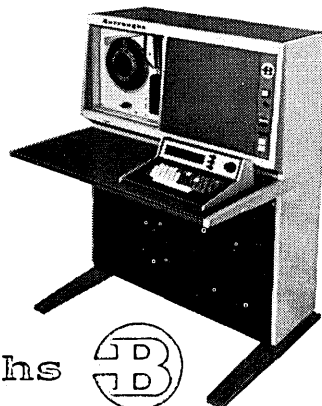
With all this built-in help, she can concentrate on speed and accuracy to prepare more data, faster. And the ability to verify on the same encoder just as fast reduces machine investment and eliminates scheduling problems.

Secondly, Burroughs Encoders can communicate over phone lines, providing economical, high-speed data communications. Other optional capabilities include variable record length, pooling, paper tape and card input and line printer. All this means increased data handling flexibility.

In addition, the Series N improves communications with your computer. Magnetic tape data can be recorded up to 30% faster than punched cards. And your computer accepts it, 50 times faster. The faster you talk to your computer, the more efficient its use, and the sooner it responds with timelier records and reports.

For a brochure call our local office or write us at Detroit, Michigan 48232.

The New
Burroughs
Magnetic Tape
Encoder



Burroughs



look ahead

MINICOMPUTER BOOM INCLUDES BUST FOR SOME MAKERS

The minicomputer business, off to a modest 1967 start of \$25 million, will reach \$90 million in processor sales in 1969, then soar to \$250 million by the end of 1975, with systems sales that year representing a cool \$1¼ billion.

That's the estimate made in the April-May issue of High Technology West, which adds: "A shakeout among manufacturers must come." The publication claims there are 70 hardware minimakers now, plus 10 outfits modifying and marketing others' gear. Their definition of minicomputer includes the System 3, for which they estimate a market of 25,000 units. IBM, they say, has already sold 5K units, and may be readying a mini in Europe for test marketing there.

Finally: "A \$1K processor is expected in 1970."

HONEYWELL EYES NO. 2 SPOT AS IT WOOS GE

Honeywell's agreement to buy GE's computer business, announced late last month, would place the "other computer company" very close to being number 2 and certainly the second strongest overseas. The combined firms, Honeywell with \$1.5 billion in installations at year-end and GE with \$1.3 billion, hold an estimated 8% of the market now. After weeding out conflicting products, they may have 6%.

In the deal, it is said, Honeywell would get strong engineering, good manufacturing facilities and product planning, but poor marketing. GE, which would retain an 18½% interest in the combined companies, is freed from a venture that in 14 years has cost the company an estimated \$400 million, though some estimates go as high as \$1 billion.

Some observers feel GE is making a big mistake, could have made it by waiting a little longer. One source says the company last year lost \$40 million on the operations it is selling and that this was a big improvement over the \$80 million lost in '68. What the move may give GE products, however, is customer confidence that now they have solid management support, a feeling lacking till now.

What will be the new company's marketing stance? At press time, observers felt melding both companies' products wouldn't be an insurmountable problem. The GE 600 series and H-8200 are "so close they could drop one," remarks one watcher, though the 600 is scientific, the 8200 business. The GE 115 also runs head-on into the H-115 and 120.

Future product announcement plans are now out the window. But Honeywell reportedly has two new computers on the boards for announcement this fall: a \$2K/month disc-only system falling between IBM's System/3 and the H-115, and a medium-scale i.c.

(Continued on page 51)

punch

Mylar at 150 cps

punch

Paper at 150 cps

punch

within EIA standard tolerances

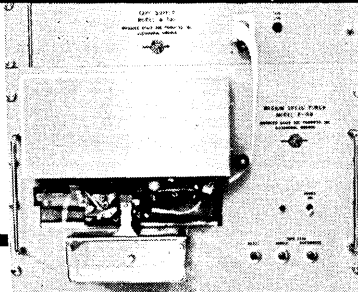
punch

up to 1 billion operations (oiled paper tape)

punch

up to 500 million operations (Mylar in 3.7—4 MILS)

Only one punch guarantees this kind of performance at a competitive price, the new P-150 from Advanced Space Age Products, Inc. It's the latest in a long line of punches, translators and related equipment. For all the facts about the amazing P-150, put this coupon in the mail today. P-150 is \$2,250; with long-life block, \$2,705. Prices include electronics. Delivery 60 days ARO.



Mr. Morris Bowles
Advanced Space Age Products, Inc.
4308 Wheeler Avenue
Alexandria, Virginia 22304 Tel: (703) 751-3320

Tell me more about the P-150 and while you're at it, send me information about the other ASAP products I have checked.

- P-240 Model 180 Master Translator
- P-300 Model 181 Static Translator

Name _____ Title _____

Company _____ Phone _____

Address _____

City _____ State _____ Zip _____

A Subsidiary of Telegraph Equipment Corp.

look ahead

system smaller than the H-3200. A third small-to-medium system is also in design.

At any rate, the Honeywell-GE merger news is merely an agreement in principle, thus still subject to disagreement and discontinuance. Besides, remarked one observer, "What do you get when you add two dwarfs? A midget?"

195 BENCHMARK LOOKS GOOD

Reports are trickling in on user benchmarks of the IBM blockbuster, 360/195. One, testing it on a differential equation problem with "lots of n-core pounding," found that the 195 posted 30 seconds "time-in-time-out" versus three minutes on a CDC 6600 and 5½ minutes on the Univac 1108. "We're favorably impressed," he said, noting that the 195 and CDC 7600 look "pretty much alike." The guess is they will come "within five or 10% of each other, depending on the problem."

NCR'S GOODIES: PRELUDE TO THE 300?

Quiet but bustling NCR is ready to bust loose with some new products. In June, they'll announce a new financial terminal that will read MICR-to-tape for transmission to a central computer, which will send back daily trial balances. Aimed at small corresponding banks or for branches of bigger banks, the system will combine an MICR reader/sorter, a Mohawk key-to-tape unit, and a minicomputer-based controller. It's to handle 2500 documents/day, rent for \$1950/month.

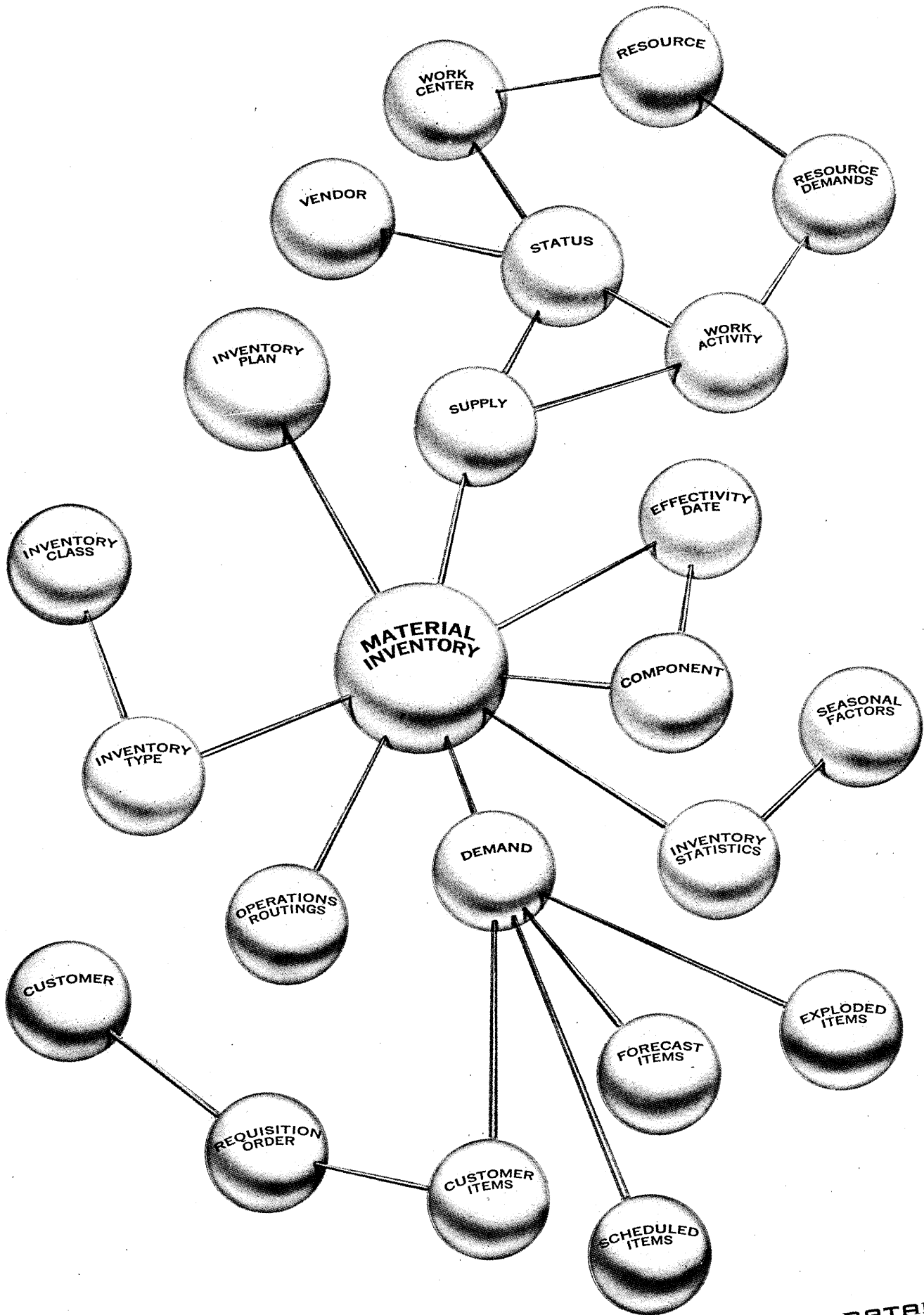
In July, the firm will offer an 11-high oxide-coated disc drive, said to provide almost 50% greater densities than IBM's 2314. Could they be warming up for an even bigger announcement in the fall? The Century 300, which we now hear will dump MOS for core memory, has to come out someday.

IBM UNDERGOES THROES AND WOES

IBM World Trade comes up a hero at IBM since sales abroad are on the upswing. T. J. Watson noted in May that it was taking up slack from the off-quota domestic operation, and reports say that 40's, 50's and 65's are going like PDP-8's in Europe. This seems like the one silver lining at the moment since other IBM edp activities are listing a little. Federal Systems Division is naturally down. Service Bureau Corp. is trimming and cutting everywhere after what rumors say have been three losing years, including a 10 megabuck loss in '69. (SBC's time-sharing group in White Plains was even sharing phone lines with IBM for awhile.) And rumors are that the unbundled services will have to wait longer than expected to meet their profit potential.

Watson said IBM slipped off target in SE contracts beginning in April. One report says that by May IBM had met only 40% of its SE dollar quota; another—53%. (If IBM was on target through March, however, April would have had to be a contract-canceling month.) In mid-May we heard IBM planned to transfer 800-1200 SE's to the sales force. IBM says this was not true prior to that date, but could not comment on plans, and repeated its commitment to the SE business. Speculation says that the economic downtrend and plans to announce new equipment could cause a temporary and large movement to sales. IBM's seldom been known to unload personnel in any down market. The New Series, the first one—NS-2—due this month, should be the shot in the marketing arm. The Mod 50 replacement was due in June, then August, and now June again, we hear.

(Continued on page 265)

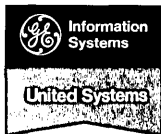


DATAMATION

Compare other data base management systems with General Electric's Integrated Data Store

Use this check list to compare I-D-S with any other data base management system you know:

	GE I-D-S	OTHER		GE I-D-S	OTHER
Creates a variety of data structures according to user definition:			Includes all random organization methods	<input checked="" type="checkbox"/>	<input type="checkbox"/>
• hierarchies	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Dynamically allocates and deallocates data storage space	<input checked="" type="checkbox"/>	<input type="checkbox"/>
• tree structures	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Data base can reside on a mixture of random access devices	<input checked="" type="checkbox"/>	<input type="checkbox"/>
• networks	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Eliminates the need for designed overflow areas	<input checked="" type="checkbox"/>	<input type="checkbox"/>
• unlimited combinations of the above	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Available data storage space is perpetually inventoried	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Eliminates need for redundant data	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Simple, powerful, easy-to-use language	<input checked="" type="checkbox"/>	<input type="checkbox"/>
No user intervention required in maintaining data structure linkages	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Offers nine methods for record retrieval	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Protects against the storage of duplicate data	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Permits movement through the data base in any direction	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Control key modification automatically adjusts data base relationships	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Reduces system implementation time	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Gives ten choices for the physical placement of records	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Proved effective through worldwide use in a variety of businesses	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Provides versatility in ordering a set of records:			Extensive error analysis is provided	<input checked="" type="checkbox"/>	<input type="checkbox"/>
• sorted	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Flexible debug aids	<input checked="" type="checkbox"/>	<input type="checkbox"/>
• first in, first out	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Data base accessible by COBOL or FORTRAN object programs	<input checked="" type="checkbox"/>	<input type="checkbox"/>
• last in, first out	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Supported by extensive utility routines	<input checked="" type="checkbox"/>	<input type="checkbox"/>
• random	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Continuous journalizing of data base for recovery purposes	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Unlimited number of entry points into the data base	<input checked="" type="checkbox"/>	<input type="checkbox"/>	File protection by software	<input checked="" type="checkbox"/>	<input type="checkbox"/>



Regardless of what business you're in, General Electric computers with Integrated Data Store (I-D-S) can revolutionize your data base management capabilities. It can improve your efficiencies at running far more than just production control (as illustrated here); it can upgrade personnel, finance, customer record, and many other functions, as well, in virtually any industry from banking to manufacturing. You tailor your own I-D-S system to the types of retrievals you think are best for your business. Your information is then linked together into networks wherein the prime element in one network may be subordinate to another. Redundancy is eliminated.

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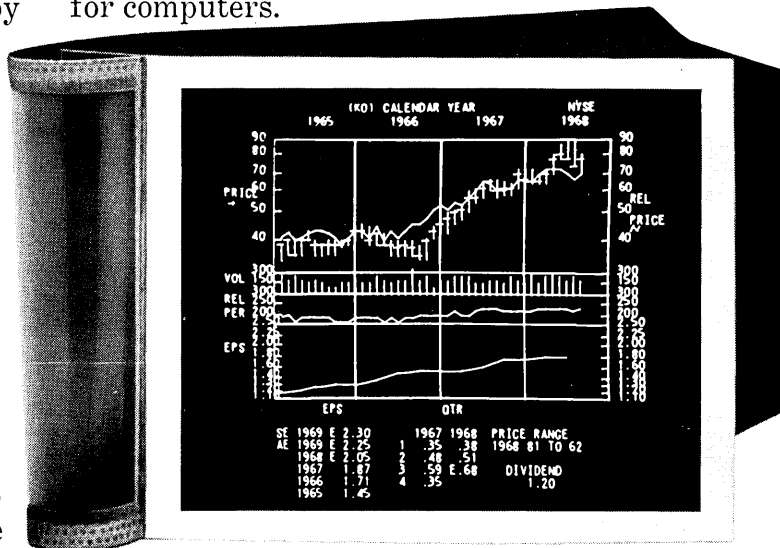
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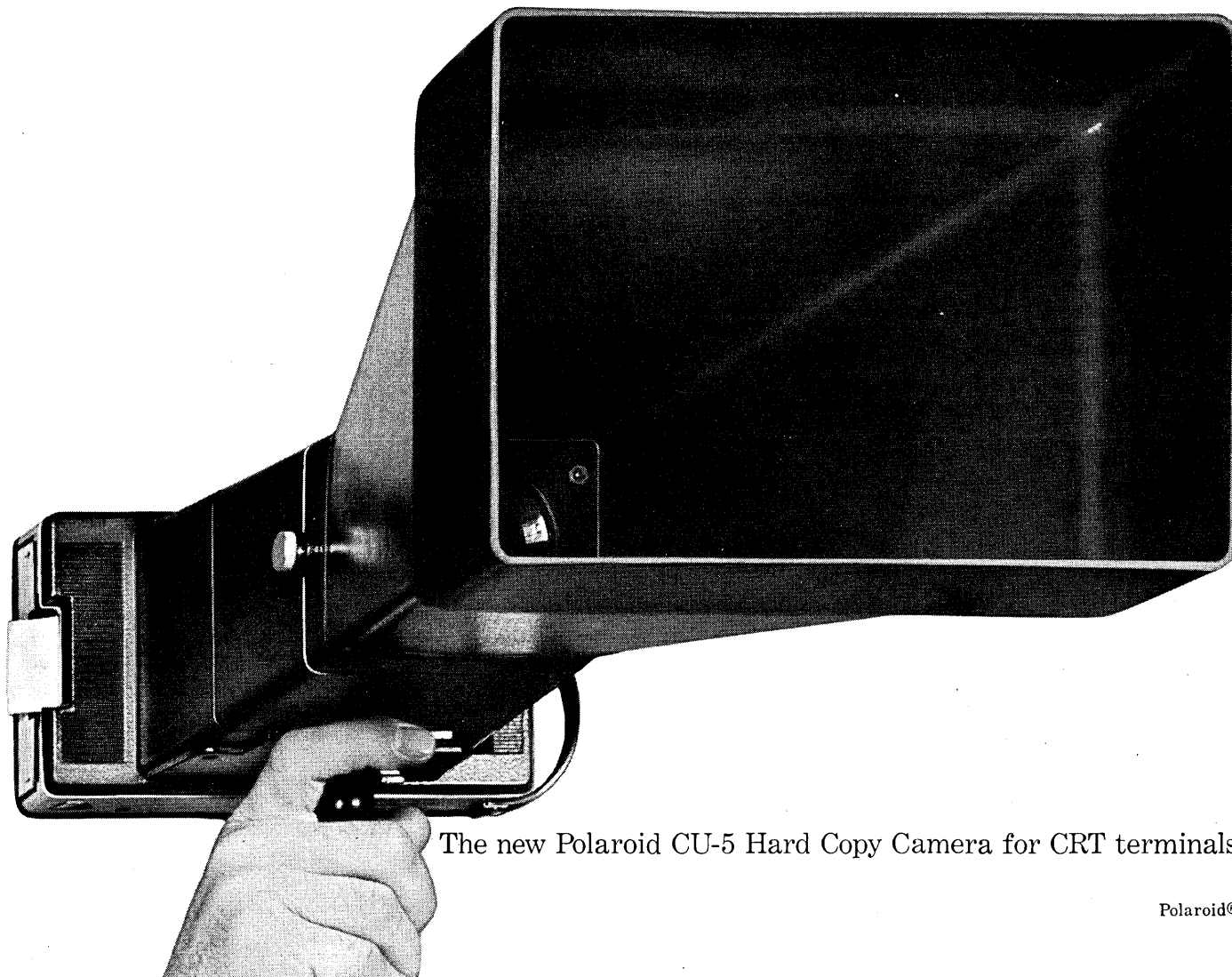
cost of other equipment.

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The new Polaroid CU-5 Hard Copy Camera for CRT terminals.

editor's readout

NOW THAT I HAVE THE MICROPHONE ALL TO MYSELF . . .

Last month at the Spring Joint Computer Conference a panel of five computer experts and one *DATAMATION* editor discussed "Lessons of the Sixties" under the benign if cunning direction of Sheldon B. Weinberg, who is probably the funniest bright man in the industry.

The panel offered, I think, many important insights into successes and failures of the Sixties, their causes and what we might learn from them. But many of the points were made so *well* that it was easy to miss the insights and begin to view the session as a computer version of "Can You Top This?"

I got to laughing so hard that I failed to introduce to the panel and the audience what I think are two key failures of our industry in the Sixties.

One of those is our failure to tell society at large what we're up to. There is among computer folk an almost Messianic belief that computer systems can do anything . . . and do it better than plain old dumb people.

In some ways, it's a healthy enthusiasm that has helped us to tackle problems that might have fended off a more cautious, sensible crew.

On the other hand, it has led society and ourselves to expect too much of our industry and its systems. Even when a system performs better than any sensible person could expect it to, it is a failure when measured against what we dreamed for it. We'd like to see the industry reflect a bit more carefully on what systems can and cannot do, and why it is so difficult to make large and complex systems work . . . then communicate the results of those reflections to the public.

Another failure that needs more attention is our poor record in opening the doors of opportunity to the underprivileged. Some of our major manufacturers and other organizations have initiated sensible and important programs that make jobs available at lower levels. The Urban League, IBM and SDC—to name only three—have cooperated in ambitious programs aimed at finding people with brains and aptitude and giving them the training they need to qualify for positions as programmers.

But then the organizers of these programs have to convince employers to give these people a chance, an obstacle that has not proven insignificant.

The crises on our campuses and in our ghettos is not unrelated to these two failures of our industry.

The young people are saying, in part, that our political and social and educational institutions have failed, that our values are screwed up, and that the systems we have devised to tackle complex social problems have failed. If we can teach them what systems can and cannot do, point out to them realistically where we have succeeded and failed, we might be able to interest them in learning enough about computers to inspire them to turn these marvelously inadequate and promise-laden instruments to more important uses than we have so far managed to do.

The bitterness and rage of the Black, the Mexican-American, the Puerto Rican, American Indian, and poor white is based on an even more stark and discouraging disparity between dream and reality, promise and opportunity. At the current pace of progress, it will take generations of legislation, court reviews and riots before our educational and sociological structures can alter enough to give these people a chance to penetrate the middle class.

Let's not wait for a panel discussion at a 1980 SJCC to make the tragic admission that these two failures—unmentioned at the "Lessons of the Sixties" session—loom as the largest and most significant failure of our industry in the 1970's.

—R.B.F.

THE FUTURE ROLE OF KEYBOARDS IN DATA ENTRY

by Robert C. Stender



This article is intended to present a simple, conceptual framework for thinking about the future role of keyboards in data entry.

Consequently it:

1. Summarizes the historic i/o problem, particularly the data entry problem.
2. Provides a simple explanation of the present position of keyboards in the total data entry field.
3. Summarizes the present status of keyboard entry devices and systems.
4. Predicts, briefly, the major future trends in data entry.
5. Predicts, in some greater detail, the major future trends in keyboard entry devices and systems.

In short, this article is a considered estimate of the future opportunities for users and manufacturers of keyboard entry devices and systems.

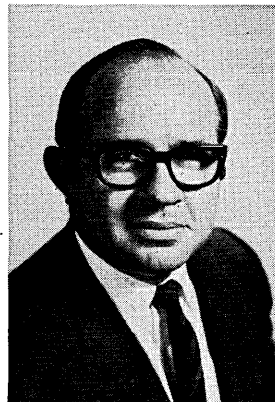
Since the early days of unit record equipment, data processing users and the industry have "lived with the input/output problem" meaning, very simply, that processing equipments operate with shorter time frames and better cost/effectiveness than input and output devices. As we all well know, the rapid evolutions in computer technologies have much magnified this problem.

Main frame computers now operate in the nanosecond time range, and the cost/effectiveness (cost per calculation) of the better main frames has improved by factors of 4 to 10 with each new generation or new line of computers. For example, IBM calculates that the cost of 100,000 multiplications on the IBM 704 was \$1.38 but the same cost on the IBM 7090 was \$0.25. This same cost with the better "third generation" machines is in the range of a few pennies, at most.

These orders of magnitude increases in main frame speed and cost/effectiveness have been the main force in the growth of the computer industry. The number of computers installed in the U.S. has increased from 600 in 1956 to 6,000 in 1960 to 60,000 in 1968. Various industry and financial sources forecast that the present number of com-

puter installations will double or triple by the mid-1970's and that the computer market will continue to sustain its 20% per year expansion in size.

These speed and cost/performance trends in main frames seem destined to continue. The technologies of all four main elements of modern computers—logic circuitry, main memory, file or auxiliary memory and systems organization—continue to advance. For example, Seymour Cray, the inventive large machine genius at Control Data, is reported to be now fully devoted—in his idyllic laboratory near Chippewa Falls, Wisc.—to developing a main frame that will process a billion instructions per second. IBM claims that one dollar, in 1950, bought the processing of 35,000 computer instructions and that, by 1967, one dollar bought the processing of 35,000,000 computer instructions. Seymour Cray apparent-



Mr. Stender is president of Menlo Systems Inc. and was previously president of Data Pathing Inc. His experience has also included positions with Control Data, Itek Corp., and Union Carbide Corp. He has a BS in engineering from the U.S. Military Academy, an MPA in administration from Harvard, and a PhD in economics pending from Harvard.

Data preparation and entry has long been the tightest bottleneck in data processing and now a full-scale assault on this problem has been mounted. In this issue we attempt to define the problem and suggest some solutions by looking at the history, present, and future of data entry techniques. The focus is on the new key/disc/tape systems, currently the strongest contender for the keypunch replacement market.

ly wants to add several more zeros to the number.

While computers have definitely become easier to use and much more widely used, the technologies of the other major elements of computer *systems*—input devices, output devices and programming systems—have clearly not kept pace with the increases in speed and cost/performance of main frames. Hence, we still live with a much magnified “I/O problem” and with the “software and edp people problems.”

While computers have improved in cost/effectiveness by factors of more than 1000 since the first Univac I was delivered in 1951, input and output devices have improved by much smaller factors. The reasons are obvious and basic. Mechanical and electromechanical devices operate in the seconds to microseconds time frame. More important, most input/output devices must “interface” with humans that operate in the minutes to milliseconds time frame.

In general, output devices have shown much more impressive improvements in time frame and in cost/effectiveness than have input devices. For example, printers now operate more reliably at over 1000 lpm than the 150 lpm printers which were astounding but unreliable devices in 1951. This factor of 7 to 8 improvement in speed seems very sluggish compared to the dramatic increases in main frame speeds but the best modern keyboard entry device is only about 50% better in “throughput” time than the original card punch keyboard devices.

To the computer, this roughly 16-fold increase in output device speed over input device speed must make little sense. In both input and output, the main frame communicates to some form of auxiliary, intermediate or file memory where the improvements in speed and cost/effectiveness are, at least, impressive. For example, modern tape units are 30 times faster than the 1951 models.

There are four major practical reasons that output devices have shown more rapid improvement.

First, many output devices seldom, if ever, interface directly and continuously with the sluggish human. High

speed printers pump out reports at fairly impressive cost/effectiveness, but the IBM 029 keyboard and the Teletype ASR35 operate in the 10 to 15 strokes per second range.

Second, by the very nature of much data processing—including the abacus and the adding machine—the volume of data input exceeds the volume of data output.

Third, electronics and sophisticated electromechanical technologies generally are—or have been made—more applicable to output devices than to input devices. For example, crt displays have become impressive output devices, at least in terms of time frame, but the crt light pen input is still slow and expensive.

Fourth, due primarily to the requirements of human interfacing, secondarily to the structure of user need, and thirdly, and consequently, to the product policy of IBM—clearly the dominant factor in I/O as well as main frames—most input devices still run to the slower intermediate memory media while most output devices run from the faster magnetic intermediate memories.

Clearly, the major challenge to the industry is to greatly improve the time frame and cost/effectiveness of data input—the “Beetlebaum” in the computer race.

data entry

The much-used term *data input* generally is restricted to putting data into computer-readable form and recording it on some form of intermediate memory. In this article, we shall use the much broader term *data entry* to cover the entire process or subsystem for feeding computers which may include the following functions:

1. The capture or recording of human- or nonhuman-sensible data at its source or origin.
2. The transmission of this data to a data conversion device.
3. The conversion of the data to machine-sensible form.
4. The transmission of the converted data to some intermediate memory media.

(Continued on page 62)

5. The recording of the machine-sensible data on this intermediate memory.

6. Data error checking, communications error checking, data verification and data validation to insure that valid data is ready for preprocessing.

7. Preprocessing—including editing, reformatting, merging, sorting, collating and further field, batch, hash and applications error checking.

8. The transfer of this preprocessed data to intermediate memory.

This definition of data entry is broad enough to cover the spectrum from the most sophisticated process control or missile tracking system to the most ancient of the Chinese accounting systems.

More important, this definition covers all of the technologies of data capture, data transmission, data conversion, and data input. To summarize, these major technologies are listed in Table 1.

Most important, this framework covers all the known applications of keyboards to data entry.

predominance of the keypunch

In spite of the plethora of technologies applicable to data entry, keypunch equipment has been—and remains—the most standard means of data input.

Some large amount of this predominance rests on the inventive genius of Dr. Herman Hollerith and the marketing and management acumen of Thomas J. Watson, Sr. But the fantastic success of the keypunch rested on solid economic grounds. The Hollerith code and the keypunch equipment and unit record processors were the first successful and economical solution to the rapidly growing data input and data processing workload that grew out of the

heavy industrialization of the U.S. from 1880 to 1950.

The now standard keypunch equipments were developed in the 1920's and 1930's as the most feasible means of preparing unit record data for processing on accounting machinery. During the 1930's and 1940's, accounting machinery firms, predominantly IBM, very successfully exploited the rapidly expanding market for electronic accounting machinery, and keypunch equipment rapidly became very widely used.

With the advent of electronic computers in the 1950's, the keypunch, being the only established and reliable data entry device, experienced a massive boom. IBM, which in the late 1930's and 1940's had gained a predominant position in the unit record and electronic accounting equipment market, was the main beneficiary.

By the mid-1960's, IBM had about half a million keypunch units installed, producing about \$400 million in annual revenues.

The benefits of the punched card system are still real. By nature, the punched card is a turnaround document. It is a discrete unit record that has use in both operational and data processing environments. Properly used, it is both human and machine readable.

But with the dramatic increases in cost/effectiveness of computers, the impressive improvements in intermediate memory devices, and the respectable improvements in output devices, the weaknesses of the keypunch have become increasingly apparent and bemoaned. Card input to computers with tape or disc output requires extra processing. Card input requires expensive preprocessing (edit, validate, reformat, sort, merge, collate, etc.) on expensive main frames. Input costs increase rather linearly with data input volume. Keypunch direct costs (operator wages and

DATA CAPTURE	DATA TRANSMISSION	DATA CONVERSION	DATA INPUT
Audio Recording	RF, UF, VHF, UHF, Microwave	Audio/Digital	Keypunch Devices
Video Recording	Telephone & Telegraph	Video/Digital	Keyboard-to-Tape Devices
Instrument Recording	Private lines & cables	Mechanical/Digital	Keyboard Entry Systems
<ul style="list-style-type: none"> • Mechanical • Electro-mechanical • Analog • Digital 	Pneumatic conveyers	Analog/Digital	Mark Sense Readers
Manual Recording	Mechanical conveyers	Manual	Card Readers
<ul style="list-style-type: none"> • Writing • Marking • Mark sense • Punching 	Postal Service	Data converters	Optical Character Readers
Manually operated Recorders	Delivery Services		MICR
<ul style="list-style-type: none"> • Typewriters • Time clocks • Portable punches 	Messengers		Paper Tape Readers
Automatically operated Recorders			Microfilm Readers
<ul style="list-style-type: none"> • Modern factory data collection terminals • Modern point of sale recorders 			

Table 1—Major data entry technologies

equipment costs) have almost doubled during the two decades of the computer age. Keypunches are limited to preparation for data input, and verification costs are high. Input speeds are low compared even to other keyboard devices. Cards are expensive, bulky and not usually reusable.

The major message is, of course, that the keypunch is purely a data input device while data entry is a complex and costly system of many steps.

There have been eight major attacks—some frontal, some flanking and some very tangential—on the large, profitable and still expanding keypunch market. The *five* earliest of these attacks were focused largely on the keypunch as a data input device rather than a data entry system. In very recent years, *three* additional attacks—one frontal, one flanking and one very tangential—have been made on the keypunch as a data entry system.

The five early attacks with devices were:

Paper Tape. Paper tape technology has few functional and economic advantages over punched card technology. Paper tape was never really “sanctioned” by IBM and thus never became a major volume factor in the industry. Paper tape did, of course, find a small niche where variable length records and low costs were paramount.

Magnetic Ink Character Reading (MICR). Developed for—and partly by—the commercial banking industry largely to replace the keypunching of check transactions, MICR did impact the keypunch market a few percent in this one application area, but has found few other volume applications. (But observe, below, that magnetic techniques may have a larger role in point of sale and credit card data entry systems.)

Mark Sense Reading (MSR). These equipments have found fairly wide use in the educational community but have only tangentially impacted the keypunch market. However, note that Dr. Hollerith developed the punched card primarily to process the 1890 United States Census but the 1970 census form was designed for mark sense reading. MSR definitely does have a place in the market but it appears limited to simple, slow moving, turnaround applications.

Optical Character Recognition (OCR). Optical character recognition was certainly one of the truly exciting technical developments in data input during the late 1950's and 1960's and became the first product that made any significant dent in the keypunch market. But development has been painfully slow, and the volume build-up has been consistently well below the forecasts of the OCR prophets.

The first commercial OCR data input equipment was delivered in January, 1956, when there were roughly 600 computers installed in the U.S. During the late 1950's and early 1960's, particularly as the “third generation” main frames appeared, OCR was rapidly increasing its flexibility, and the costs of keypunching kept climbing at about 5% to 10% per year. There was great enthusiasm about OCR capturing the bulk of the keypunch market. However, there are now only about 1500 OCR installations and some 80,000 computer installations in the U.S.

The two major reasons for this slow growth are obvious and real. First, OCR is still, economically, limited to reading simple, marked preprinted forms or highly stylized fonts although flexibility of input fonts has increased and will continue to increase. Second, OCR was originally developed as a data input device and not as a data entry system. The pioneers in using OCR did some monumental reprogramming jobs. In recent years, OCR suppliers have added a preprocessing controller or computer so that the newer units

are data entry subsystems.

Most OCR users and suppliers no longer view it as a frontal attack on the keypunch market or as a direct replacement for all or most keypunches. Rather, the economics of OCR are most impressive where the front end of the data entry system employs OCR-compatible forms and documents in relatively large volumes, where the forms are typed or filled out at the source or at remote collection points for collection, transmission (by mail, courier, etc.) for volume data input on an OCR installation with impressive preprocessing (edit, reformat, merge, sort, collate, etc.) capabilities. In this mode, it seems virtually certain that OCR has a good future. OCR may also find wide use as the “front end” for typesetting and photocompositions in the graphic arts.

In the past five years, two forms of keyboard-to-magnetic-tape devices have been developed for data input. The first and, to date, very successful form is primarily a direct unit-for-unit replacement for keypunch equipment employing a keypunch type keyboard entry of data, bypassing the mechanical punching of cards, and recording the keyed-in data electronically on magnetic tape. The second form, which is more of an adjunct to keypunch entry than a replacement for keypunch equipment, employs a typewriter keyboard for the recording of data, usually textual data, on magnetic tape in cartridges or cassettes. Mohawk Data Sciences led the way in 1965 in introducing keyboard-to-tape replacements for keypunch equipment. IBM led the way in 1968 in introducing keyboard-to-tape cartridge devices for textual data entry.

The idea of using a keystroke to record information electronically on magnetic tape was not new in 1965. Such devices had been developed in the late 1950's and early 1960's. The keyboard-to-tape units introduced in the late 1960's proved successful basically because the reduced costs of keyboards, of integrated circuits, and of tape units combined to bring the price close to keypunch equipment.

Mohawk's first units were delivered in 1966 and, after some early introduction problems, sales and backlog grew dramatically. For over two years, Mohawk had the only practical alternative. In 1968, Honeywell announced its Keytape line and Sangamo Electric announced its Data Stations. Since then, the “copying” and “elaboration” phenomena so typical of successful computer products have occurred, and a large number of new keyboard-to-tape replacements for keypunches have been announced.

These products cost somewhat more than standard keypunch equipment. In successful installations, this increased cost is offset by increased operation efficiency, reduced computer input time, and reduced supplies costs.

Suppliers claim up to 1/3 to 1/2 improvement in operator efficiency due primarily to somewhat quicker set-up, somewhat simpler verification, and quieter operation. Computer input times are reduced, particularly if a number of recorder tapes are pooled onto a master tape for computer input. In volume operations, magnetic tape costs are somewhat lower than card costs.

Otherwise, these keyboard-to-tape units have the same economic and operational limitations as keypunch equipment. Keyboard-to-tape units are data input devices and provide no significantly increased capability in error checking. The accuracy of data input is not appreciably improved over keypunch input. Hence, the cost to the user of bad data entered into the computer system remains high. Further, while computer input times are reduced, the larger costs of computer run times for editing, reformatting, sorting, collating, merging, matching and printing out errors

and exceptions are unchanged. The manual set-up, error and exception handling, and verification routines used are basically identical to the keypunch routines.

However, the astounding market acceptance of keyboard-to-tape devices as replacements for keypunches—possessing only modest economic and operational advantages over keypunches—has shown clearly that the keypunch market is ripe for penetration and conversion. Since May, 1966, over 35,000 units have been delivered, mostly by Mohawk and Honeywell. In short, about $\frac{1}{6}$ of the keypunch market has been captured in four years and, perhaps more important, that market has been conditioned to look seriously at data input approaches that bypass card punching.

IBM has very carefully avoided any product offering that is a direct replacement for keypunch equipment in major computer installations. The basic reason for this restraint is obvious. Nearly all of the more than 500,000 keypunch units in the U.S. are IBM equipment. The majority of these are still owned by IBM and rented directly to the user. IBM depreciates this equipment, no doubt quite profitably, on a four-year schedule. The revenue life of keypunch equipment has exceeded eight years. By my estimates, IBM's annual revenue from the sale and rental of keypunch equipment must still exceed \$400 million. The bulk of this revenue is from equipment rentals. Much of the IBM rental revenue runs through directly to net profit. Thus IBM has been careful to prolong the use of keypunch equipment.

However, IBM has led the way in marketing keyboard-to-magnetic-tape cassette and cartridge devices. These devices, which are inherently more expensive for data entry than keypunch and keyboard-to-tape devices, have found increasing use in the entry, retrieval and updating of textual data and other "exception" data not normally or economically handled on keypunch equipment.

In 1968, IBM did sanctify the keyboard-to-magnetic-memory approach to data input by announcing companion units that enable a keyboard operator to capture information on magnetic tape and then enter it automatically into a computer.

The IBM offering consists of two units—a Model 50 Magnetic Data Inscrber and a Model 2495 Tape Cartridge Reader. The Model 50 Inscrber is basically a Magnetic Tape Selectric Typewriter recording on noncomputer-compatible 16mm magnetic tape contained in a cartridge. It rents at \$175/month and lists at \$9,605, about the same price as a keyboard-to-tape device. However, since the 16mm tape is not computer compatible, a tape reader is required to feed the inscribed data into a computer.

The 2495 Reader reads up to 12 cartridges from Model 50's (or MT/ST) into the multiplexer channel of a System/360 Model 25, 30, 40 or 50 at 900 characters per second. The 2495 rents for \$340/month and lists at \$18,670. Tape cartridges hold 23,000 characters and cost \$12 to \$20 each depending on order quantity.

The MT/ST has a typewriter style keyboard. The Model 50 Inscrber has the keypunch style keyboard. As Patrick McGovern, editor of EDP Industry Report, observed in 1968: "IBM's entry, obviously, puts direct keyboard-to-tape into the major leagues. No longer will it be necessary for prophets such as Mohawk to preach the benefits of conversion to direct-to-tape recording. IBM's direct and well-planned (albeit limited) move into this field has now notified the world that its single-minded commitment to the punched card is on its way out; and that the industry leader is moving, with beautiful restraint, into the domain of keyboard to computer input . . . At the same time it is entering the keyboard-to-tape field, IBM is also reserving as

much of a hold as possible on its existing business with punched cards and card equipment. (The new units work only with the 360's)."

The Model 50 Inscrber and the Model 2495 Reader are clearly intended *not* to compete with keypunch units.

The keyboard-to-cartridge approach is technically similar to keyboard-to-tape units with the cartridge or cassette being an intermediate between the keyboard and the computer-compatible input. This intermediate step adds considerably to the cost. In practice, this offering is economically justified in many applications involving formatted text editing and update where the tape is used for format presentation and the operator enters the record data into that format.

Other keyboard-to-cartridge products similar to the IBM MT/ST and the Model 50 Inscrber have been offered by Dartex, Communitype, Systronics and Data Action.

As an aside, IBM has since very cleverly impacted the use of Hollerith cards in unit record systems. Much of the IBM card equipment in the roughly 40,000 unit record installations in the U.S. had been purchased by users, purchased by third party leasing companies, particularly MAI, or rather fully depreciated by IBM. In July, 1969, IBM announced its System/3. It is communications compatible with the 360 but the two systems are otherwise incompatible. Basically, the System/3 is targeted on the unit record market and the very small or "would be" computer user. Very cleverly, it can be used for remote input by major computer users but cannot directly replace their keypunch equipment.

The three data entry systems attacks on the keypunch market (not counting OCR, which is now evolving into a data entry system) have been, of course, source data entry systems, remote access immediate response systems, and keyboard entry systems. Clearly, in the 1970's we will see the appearance of a plethora of data entry systems.

source data entry systems

Included in this category are factory data collection—where source data entry systems are now quite impressive; point-of-sale recording—where further progress on data capture and systems performance is needed; and credit card transaction recording, which is a special case of point-of-sale recording, and other forms of order entry. The following discussion is largely limited to factory data collection, the most mature of source data entry systems.

In large industrial firms, frequently from 20% to 40% of the data processed is generated within, controlled by, and used within the firm and frequently largely within one complex or plant. The balance of the data processed is prepared by or for higher management, customers, vendors, employees, governmental units, unions, shareholders, etc. Much of this "in-house" data relates to the accounting function but much also relates to the logistics of plant operations. It is, of course, a truism that timely, accurate logistics information is required for efficient plant operations. In recent years, to improve the accuracy and to speed the flow of this data, two forms of source data entry in industrial plants have been developed and found significant market acceptance.

In the more continuous process industries, closed loop process control of the production processes has been highly developed. In these systems, source data is frequently recorded in real time by analog instruments, converted to digital form and automatically entered into the computer based process control system. This form of source data entry is outside the area of interest of this article and will not be further discussed.

In the fabrication and assembly and batch process industries, closed loop process control techniques are being approached by employing source data entry by employees into special purpose terminals for recording such data. Factory data collection is of interest in this article for two reasons. First, to the extent that "floor data" is entered at the source and automatically recorded on computer sensible media, the keypunch load in the plant is reduced by a significant but modest amount. Second, and more important, the systems techniques developed in successful factory data collection systems offerings are instructive in defining a successful systems approach to the keypunch market. Hence, the evolution of factory data collection is summarized briefly below.

Prior to the mid-1950's, factory "floor data" (such as clocking in and out, job completions, inventory transactions, labor distribution, etc.) were recorded manually by employees, collected manually and delivered to central points where the data was checked, coded and batched. In small plants the data was processed manually and the results were distributed manually and/or verbally. In larger plants, the data was keypunched and processed on unit record equipment or computers. In these manual data collection systems, data errors were frequent and data flows were very slow. In large plants, particularly in frenetic fabrication and assembly operations such as aerospace, electronics and broad product line durable goods manufacturers, the costs of bad data or slow data were frequently very high.

Consequently, in the late 1950's and early 1960's, four firms developed product offerings that consisted of employee-operable data input terminals and card or paper tape punching equipment. Some number of terminals were cabled through a very simple communications net to a card or paper tape punch. These developments were pioneered by a small company which developed the "Transactor" line, later acquired by Control Data which, itself, developed the 180 and 8010 data collection products. IBM's announcement quickly followed and the IBM 1030 line, running to punched cards, of course, became the industry standard. RCA developed the EDCE (Electronic Data Gathering) products but gained little volume. Friden developed the "Collectada."

The terminals in these offerings were able to read employee identification badges (for attendance recording and identification of the employee making other transaction entries), to read punched cards (containing the fixed data relating to the transaction being recorded) and to permit the entry of variable transaction data by the employee recording the transaction. The output was punched cards or paper tape ready for computer preprocessing.

These early offerings did somewhat reduce data errors and did somewhat speed up the flow of data. But, like the keypunch and the keyboard-to-tape devices, these factory data collection terminals were almost purely input devices connected by simple communications to a nonintelligent auxiliary memory. Similarly, these early offerings speeded the flow of data to a central punching station but the punched data still had to be collected and processed.

However, these early offerings did establish—at least in "good" installations—the economic and operational feasibility of automated factory data input. They also made graphic the user demand for a data entry system with greater speeds of data flow and much greater data error detection and correction.

The way to satisfy these needs was well defined by the late 1950's. Put a small computer at the center of an improved communications net, make the computer police

the terminal operation for data accuracy, and output the data onto magnetic tape, preferably already edited and formatted. The problems in satisfying these needs in the early 1960's were almost entirely economic. The costs of discrete electronic components, core memories, and communications devices made the costs of electronic terminals much more expensive than the electromechanical terminals and punches, especially when each terminal was allocated its share of the overhead costs of the communications net and computer. Further, these early systems offerings were based on a single computer of a particular size, and the systems were "monolithic" in terms of maximum numbers of terminals served and of programming competence.

Still, RCA, Control Data, General Electric and some users—notably Lockheed, Burbank—pursued these systems solutions and, initially, confirmed their diseconomies in the early 1960's, except in very large, relatively compact systems where the cost of one processor could be spread over many dozens of terminals. This large systems break-even size made marketing extremely difficult and product profitability virtually impossible. Consequently, only a few dozen of these early systems were ever delivered.

By the mid-1960's the costs of logic elements had dropped significantly due largely to integrated circuits. Core memory costs had decreased. Thus the introduction of an economical electronic factory data collection system was possible. As is frequently the case in the computer industry, the pioneering of the economics of a new product for a known demand was done by a new venture company, Data Pathing Inc., which benefitted considerably by hiring some of the best technical and marketing people who had struggled prematurely with the pertinent problems at Friden, RCA, GE, Control Data, and in user organizations. Data Pathing made its first delivery in June, 1967. This offering was economical at 15 terminals/processor and was designed with modular hardware and software so that systems could be readily expanded in size economically and could be made sensibly "fail safe." (Continued on page 66)



While these newer systems do bypass card punching in the entry of floor data, and, consequently, reduce somewhat the keypunch load in these firms, the concentration of keypunches is still increasing in medium and large industrial firms.

The five data input devices and source data entry systems discussed above are limited to data entry. The flow of data is unidirectional from the operator to a computer sensible recording medium. The only "feedback" to the operator is limited control and format information, and little processing other than error checking is performed on the data before it is recorded. (Modern source data collection systems and OCR equipment may do preprocessing tasks including error checking, edit, reformat, sort, merge, match, exception coding and error and exception capture and printout which, of course, reduces computer run times and increases data accuracy.)

In recent years, numerous developments have been pursued to enable human beings and computer systems to communicate with each other. Other developments have been pursued to enable computers to communicate with each other. These many developments, which are very exciting technically, travel under a confusing array of buzz words and acronyms including "time-sharing," "conversational time-sharing," "on-line computing," "real-time processing," "multiple-access computing," "remote computing," "reactive systems," "interactive systems," "real-time data communications," "machine-aided cognition" and the like.

For our purposes, we shall use the term "remote access immediate response" (RAIR) processing for those developments which allow humans and computers to communicate with ease. Also, we shall use the term "remote batch processing," for those developments which allow computers to communicate with each other.

In a RAIR system, there are bidirectional flows of data between human operators and computer memory. The basic components of such a system are:

1. A digital computer (which may also be used in batch or remote batch processing).
2. A communications net, usually including controllers, concentrators, multiplexers and terminal modems.
3. Human operable terminals, usually a keyboard for inquiry and a typewriter or a crt display device for response.

RAIR terminals are now used in more than 700 specific applications, but these fall into five categories.

In the simplest category, RAIR processing performs data input with computer acknowledgement. For example, in some "on-line order entry" systems, the operator at a remote site enters the order data, the computer receives, processes, and records this data and replies that the order is acknowledged. In these simple applications, the main function of the computer is to store data in a file and to acknowledge that the task is done.

At the next level of complexity and cost, RAIR processing performs a variety of inquiry and response tasks. For example, in order entry the computer may give a response including order number, scheduled shipping date, items back ordered, etc. At present, the three most common applications of "in-house" RAIR processing—order status, inventory status and credit status—are in this category. In these applications, the main function of the computer is to conduct a file search and to respond with the requested file data.

At the third level of complexity, RAIR processing is used for simple problem solving. Much of the in-house scientific

and technical RAIR processing (the fourth most frequent in-house use of RAIR) and most of the service bureau RAIR processing is in this category. In these applications, the operator presents a specific problem (e.g., the solution to a design equation, the determination of monthly payments of principal and interest on a proposed mortgage, etc.), the computer calculates the answer to the problem and responds. In these applications, the main function of the computer is arithmetic.

At the fourth level of complexity, RAIR processing produces structured reports such as summary sales analyses, reports on parts under expedite including perhaps inventory status, production units affected, orders affected, scheduled cure dates, vendor status, etc., or summary accounting reports. In these applications, the inquiry causes the computer to do file search, arithmetic processing, and report generation. Few firms have yet reached this level of sophistication in RAIR processing. In the service bureau area, Keydata has led the way with a packaged accounting service for small and medium sized distributors.

At the highest level of complexity, RAIR processing is used for complex problem solving, gaming and modeling. In these applications, both the operator and the computer make inquiries and responses and carry on a rather prolonged conversation. These applications—such as "computer-aided design," "machine-aided cognition," "computer-aided decision making" and "computerized associative learning"—attempt to exploit the great computational speed and large memory capacity of modern large scale computers coupled with the ability of the operator to aid the computer by altering programming, processing routines, and/or supplying new file data. This form of RAIR processing is still largely experimental in universities and very large governmental electronic and aerospace development organizations.

In applications, remote batch processing parallels RAIR processing. In this form of processing, however, the operator enters the data into a local processor and it processes the data and/or communicates with a larger central computer which responds to the local processor which outputs the processed response (e.g., a computer driven printer).

The great technical enthusiasm and glamour of "time-sharing," "data communications," "on-line real-time systems" and the like, as well as the increasingly well established utility and economics of RAIR and remote batch processing in critical inquiry and problem solving applications, has caused most computer users and virtually all established computer hardware manufacturers to move, albeit at widely varying speeds, toward the use of, or product offerings in, the areas of RAIR and remote batch processing. In addition, a veritable horde of new venture companies have been formed to exploit the apparently very large market opportunities in RAIR and remote batch processing. For example:

1. Over 100 new service bureau firms have been established offering various forms of RAIR processing but predominantly scientific problem solving. Four of these (Call-a-Computer, Tymshare, Com-Share and Allen-Babcock) have achieved significant market penetration (3% to 7%). But the bulk of these firms are still unprofitable. Several dozen have folded and the average time to break-even now appears to be in excess of three years.

2. Over 30 new firms have been founded to develop time-sharing computers or data communications computers for "front ending" other scientific or business processors. None of these firms have yet achieved significant market penetration although several are profitable and show good volume

growth.

3. Over 60 new firms have been founded to develop RAIR terminals or remote batch processors. Some have already folded and few are profitable. Viatron undoubtedly is the most interesting new venture in this area, having promised a "full system" line of terminals, peripherals, communications devices and small processors at very attractive rental prices for virtually all applications of RAIR and remote batch processing or "dispersed computing." (As an aside, Viatron seems to be a four-way gamble—on the rapidly decreasing cost of MOS; on the rapid and continued development of RAIR processing; on a novel approach to computer industry marketing and field services; and on competing with IBM for major volume more on cost than on quality.)

The potential utility of, and market for, RAIR and remote batch processing is extremely attractive. The best available data and forecasts on this market are summarized in Table 2.

Many conclusions can—and have—been drawn from these and similar data. Obviously, RAIR and remote batch computing are here to stay. Their utility in critical inquiry and problem solving applications, where the computational power and memory capacity of large computer systems are readily available to professional operators (e.g., scientists, programmers, production control supervisors, credit managers, etc.), is becoming well established.

Note in Table 2 that, in 1972, about 60% of the computer value delivered in the United States during that year will have some RAIR and remote batch processing capability. Note also, however, that at the end of 1972 only about 40% of the computer value installed in the U.S. will have that capability.

For the purpose of this article, RAIR processing presents three obvious questions.

the developing market

First, what share of the RAIR and remote batch processing capability will be used in those fashions rather than in classical batch processing where keyed input of data is well entrenched?

Second, what will the split be between RAIR processing (where classical keyed input is largely obviated) and remote batch processing (where classical keyed input is frequently used, albeit on a decentralized basis)?

Third, how much of RAIR processing will be used for volume data input substantially displacing keyed input.

At this time, few facts and no answers are in on these three questions. But some facts are significant.

First, IBM is very heavily committed to RAIR processing for at least two very sound economic reasons.

1. RAIR processing has minimum impact on keypunch equipment.

2. RAIR processing uses large amounts of main frame time, main memory, and file or auxiliary memory, especially discs, products on which IBM has excellent profit margins.

Second, in the next few years, the capabilities for RAIR and remote batch processing in general-purpose computers installed will grow much more rapidly than the use of such processing, presuming users realize the high cost of RAIR processing. The RAIR terminal and remote batch processor market is not now large and is dominated by IBM and Teletype with Viatron running hard to get a major position. At the end of 1968, there were about 100,000 RAIR terminals and remote batch processors in use. By the end of 1969, this number had expanded to about 170,000 but these terminals and processors were at approximately 40,000 sites. The median concentration of RAIR terminals per site (factory, office building, laboratory) was about six by the end of 1969. The average customer now spends about \$1000 per month on terminal equipment (rental or purchase and maintenance). Late in 1969, less than half of established computer users were using or experimenting with RAIR processing and 30% had not used RAIR and had no plans to do so. Consequently, at the end of 1969, the \$5.5 billion worth of general purpose computers capable of RAIR processing was supporting 170,000 terminals—a computer overhead value of \$32,500 per terminal where the average value is about \$6,000 per terminal. Obviously, the installed processors are still used predominantly for batch processing. In fact, at the end of 1969, the average RAIR terminal was used less than one shift per day (average connect time about six hours) and less than one sixth of the RAIR terminals were connected on a full-time basis.

By 1972, the number of RAIR terminals and remote batch processors will expand to over 400,000. The number of computer users employing or experimenting with RAIR will increase by about 50%, from less than half of present computer users to about 70% of present computer users. The number of remote sites will increase to over 60,000. So the terminal concentration per site will increase only modestly to about seven. More startling, at the end of 1972, the

YEAR	TOTAL ANNUAL VALUE OF EQUIPMENT AND SERVICES DELIVERED BY U.S. FIRMS	CUMULATIVE NET VALUE, GENERAL PURPOSE DIGITAL COMPUTER SYSTEMS INSTALLED BY U.S. COMPUTER MANUFACTURER (year end)	TOTAL VALUE, GENERAL PURPOSE DIGITAL COMPUTERS DELIVERED BY U.S. FIRMS	CUMULATIVE NET VALUE, GENERAL PURPOSE DIGITAL COMPUTER SYSTEMS INSTALLED IN U.S. (year end)	TOTAL VALUE, GENERAL PURPOSE DIGITAL COMPUTERS INSTALLED IN U.S.	TOTAL VALUE, GENERAL PURPOSE DIGITAL COMPUTERS INSTALLED IN U.S. SENSIBLY USEABLE IN RAIR SYSTEMS	CUMULATIVE NET VALUE, GENERAL PURPOSE DIGITAL COMPUTER SYSTEMS INSTALLED IN U.S. SENSIBLY USEABLE IN RAIR SYSTEMS	TOTAL VALUE, REMOTE TERMINAL AND DATA COMMUNICATION DEVICES USEABLE IN RAIR SYSTEMS IN U.S.	TOTAL REVENUE, DATA PROCESSING SERVICES U.S.	TOTAL REVENUE, RAIR SERVICES IN U.S.
1967	9,360	18,900	5,900	13,600	3,900	1,000	2,000	235	400	50
1968	11,300	24,500	7,200	17,350	4,800	1,600	3,500	335	570	100
1969	13,150	31,000	8,300	21,400	5,320	2,200	5,500	450	775	180
1970	15,000	38,250	9,300	25,700	5,775	2,800	8,000	590	1,025	300
1971	17,050	46,300	10,500	30,800	6,500	3,500	11,100	800	1,350	500
1972	20,000	56,500	13,200	37,600	7,400	4,200	14,800	1,100	1,850	900

Table 2—Summary data on "RAIR" processing (in millions of dollars).

\$14.8 billion worth of general-purpose computers capable of RAIR processing will be supporting 400,000 terminals—a computer overhead value of \$37,000 per terminal while the average value of a terminal will be around \$5,000. Clearly, for the next several years, most general-purpose computers will continue to be used predominantly in batch processing employing classical keyed entry of data.

However, there is a small but rapidly expanding coherent market developing for RAIR equipment. At the end of 1968, there were about 150 computer sites employing 60 or more RAIR terminals. By 1972, this population will be about 400. The bulk of these large users are predominantly large technical organizations. Over 70% of these users employ IBM computers. While over 300 different RAIR terminal models are already available, the bulk of the terminals in these large using sites are IBM 1050's, 2740/1's, Teletype ASR 33's and ASR 35's, and the IBM 2260 crt terminal. The great bulk of additional planned usage is in critical inquiry (order status, inventory status, credit status) and in specific problem solving, especially scientific and technical.

The costs of RAIR processing are high. The on-demand communication costs from remote terminals are significant. The costs of programming, program overhead, interrupt, and file search in large computers are considerable. At the present time, few experienced large users of RAIR processing are known to plan the use of RAIR for volume data entry. But these basic economies of RAIR have started a perceptible trend toward remote batch processing and, consequently, some decentralization of the classical keyed data entry operations.

On the other hand, RAIR and remote batch processing depend critically on the existence of very timely and highly accurate data files. To the extent a customer uses these new inquiry and response, problem solving, and data communications techniques, the demand for more timely and more accurate entry of data to files is increased. In short, RAIR processing does not significantly replace keypunching but it does, logically, demand a more expeditious and more accurate solution to the problems of data entry.

During the past year, a number of keyboard data entry systems have been announced, and a few dozen of these systems have now been delivered.

The main elements in these announced offerings are an "029" or typewriter-like keyboard station for data input (keypunch replacement), a controller or standard core memory minicomputer for control and some degree of pre-processing, and a disc drive, disc pack drive and/or one or more tape units for output.

As with the early factory data collection systems, these offerings appear to be—or should be—technically sound. (The major characteristics of most of these controller-based or core-memory-computer-based keyboard data entry systems are summarized in the survey article by John Alrich in this issue.)

While these offerings are a major step forward in that they all attempt to address the data entry problem on a systems basis, there are obvious limitations or shortcomings in these early offerings, largely still economic problems.

The controller-based offerings have the following general limitations:

1. They can handle a limited number of input stations (4 to 16 usually).
2. They are not economically competitive with key-to-tape units for installations with less than 7 or 8 stations.
3. They have limited control capabilities.
4. They have limited preprocessing capabilities.

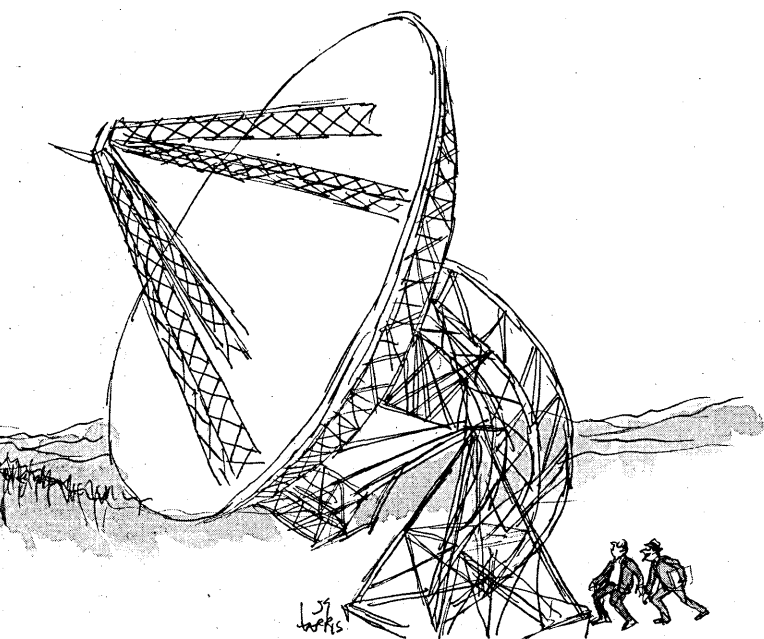
The computer-based offerings have the following general limitations:

1. They cannot economically handle a small number of input stations. The cost of the computer produces high per-station costs except in large systems, generally 16 to 64 input stations.
2. The systems are monolithic in that they depend on a single core-memory computer which makes the entire system subject to catastrophic failure.
3. Most of the core-memory computer power is devoted to data input and control. Preprocessing competence is limited or expensive.

In preparing this article, I checked with a representative sample of major users of keypunch and keyboard-to-tape units. All were aware of many of these early systems announcements. All seemed pleased with the development toward keyboard data entry systems. The gist of the most frequent responses were:

1. Most of the announcements are still "paper tigers."
2. The "entry price" (e.g., first order value) of the offerings which promise real systems advantages (e.g., the computer-based offerings with preprocessing capability) is too high (e.g., the loaded terminal cost is too high except in large systems). (This may be an extremely critical point in understanding the structure of the keypunch market. Traditionally, keypunch units have been added in small quantities. Orders for quantities of 20 or more are rare. Deliveries of quantities of 10 or more at one time are unusual. This "gradual expansion psychology" carries over to consideration of replacement equipment and is reinforced considerably since, in most installations, the keypunch operation is frequently the critical bottleneck where mistakes in selecting or converting the replacement equipment cannot or will not be tolerated.)
3. Automated pooling is attractive but this approach (e.g., the controller-based system) increases equipment costs without much reducing operator costs, error rates or computer overhead.

The first of these early commercial keyboard data entry systems was delivered in June 1969 by Computer Machinery Corp. The rash of product announcements since



Boo!

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that time indicate to me that major users and suppliers have acknowledged that keyboard data entry systems are possible and desired.

Estimates on the total data entry market in the U.S. vary considerably. Estimates on the segments of this market vary even more widely. The numbers used in this article, while based on many sources, are my own, and I have attempted to be moderately conservative.

In 1969, U.S. firms delivered over \$7.5 billion of equipment and another \$2.5 billion of data processing supplies and services. In-house costs are generally estimated to exceed industry revenue. Hence, we talk of our \$20 billion industry. Estimates of the portion of this staggering total that apply to data entry vary from \$6.5 billion to \$11 billion.

It is generally agreed that peripheral equipment sales as a percentage of total computer equipment sales has increased from 19% in 1955 to 51% in 1965 to nearly 60% in 1969. Hence, peripheral equipment sales in 1969 were

about \$4.5 billion, but these gross figures include all nine categories of data input devices and data entry systems as well as discs, tapes, displays, and data transmission devices. While solid figures are sparse, it seems safe to assume that the 1969 sales of data input equipment and data entry systems was over \$1 billion but under \$2 billion.

A useful general overview of the U.S. data entry equipment market is presented in Table 3. This is based largely on the August 6, 1969, issue (Volume 4, No. 22) of *EDP Industry Report*. Their figures were for March, 1967, since those were the latest data available from the U.S. government on employment by taxpaying unit. The data does not include government or foreign units or computer installations.

The same overview is provided in Table 4, which shows estimated distribution of keypunch and key verifier devices in the U.S. in 1969. These data are based on the Creative Strategies Incorporated study, "Optical Character Recognition Industry 1968-1973," published in January, 1970.

(Continued on page 70)

Size of Unit (Number of Employees)	No. of Units (Tax Report- ing Units)	No. of Units with Computers	% of Units with Computers	Comment Concerning Data Entry
0-19	3,011,934	829	0.03	Generally manual entry, processing and output.
20-99	314,773	3,289	1.04	
100-249	44,577	3,154	7.08	Mostly still manual but target area for System/3, RAIR terminals, and service bureaus.
250-499	14,246	2,637	18.51	
500-999	6,111	2,905	47.54	Unit record and computer users. Target area for System/3 data input devices and smaller data entry systems.
1000-2499	2,799	2,513	89.78	
2500-4999	714	714	100.00	The main computer market and the target area for data entry systems including OCR.
5000 & over	321	321	100.00	
TOTAL	<u>3,395,475</u>	<u>16,360</u>	<u>0.48</u>	

*Source: County Business Patterns U.S. Department of Commerce, 1967; Computer Installation Data File, International Data Corporation, 1967.

Table 3—Basic structure of the U.S. data entry market* (by number of tax reporting units and number of employees).

Number of Machines Per Installation	Number of Installations	Total Number of Devices	Comments
1-5	30,000	90,000	Logical keypunch users.
6-12	10,000	90,000	Logical keypunch, keyboard-to-tape and controller based systems users.
13-25	4,000	76,000	The primary market for data entry systems including OCR, computer based keyboard entry systems and "in house" RAIR and Remote Batch processing systems.
26-50	2,500	95,000	
51-100	1,200	90,000	
Over 100	500	100,000	

*Source: Diversification Planning Service; Optical Character Recognition Industry 1968-1973, Creative Strategies Incorporated.

Table 4—Estimated distribution and number of keypunch and key verifier devices in use in U.S., 1969*.

In Table 5 is my best—and, hopefully, conservative—estimate of the 1969 sales by U.S. manufacturers of data input devices and data entry systems.

It's a propitious time to do some forecasting for a portion of the computer industry, since just months ago the industry soothsayers all had their "go" at the turn of the decade. There was surprising unanimity in predictions for the 1970's. The major prognoses included:

1. The gradual evolutionary appearance of a "fourth generation" of main frames with:
 - a. Cost/effectiveness improvements of 10 to 100.
 - b. Increasing use of LSI for memory and logic.
 - c. Rapidly increasing use of microprogramming or firmware, including readily alterable firmware (read-only

DEVICE OR SYSTEM	SALES
Keypunch & Related Equipment	500
Paper Tape Equipment	20
Mark Sense Equipment	10
MICR Equipment	20
OCR Equipment	250
Keyboard-to-Tape Equipment	150
Source Data Entry Systems	70
RAIR & Remote Batch Systems	60
Keyboard Entry Systems	5
TOTAL U.S. SALES	1,085

Table 5—Estimated 1969 sales by U.S. manufacturers of data entry equipment (in millions of dollars).

memories that are easily field changeable or changeable under computer control).

- d. Rapid exploitation of high speed cache (fast buffer) memories.
- e. Increasing construction of multitiered, multiprocessor and multisite systems.

2. Continued evolution of hardware and software toward "computer utilities" employing the above "fourth-generation" techniques but combining remote access immediate response, remote batch, and classical batch processing.

3. A trend toward file centralization with some degree of file duplication at the lower tiers in the system (but this centralization and decentralization argument still rages).

4. Greatly increased attention by users and suppliers to systems reliability including "fail safe" multiprocessor tiers with redundant equipments, separate power supplies, self-failure detection and correction capabilities (e.g., systems diagnostics, automatic switchover and backup and improved "soft failure" and "fast recovery" techniques).

The probable trends in data entry seem obvious.

Data entry devices will peak out and decline in percentage of industry volume. This certainly seems true for paper tape, MICR and mark sense equipment. I feel it finally will be true of card equipment. Note that IBM has moved or is moving production of the 029 keypunch and other unit record and Hollerith card equipments to Canada and overseas partially, apparently, to free up production capability for the amazingly successful System/3 but probably also in recognition that data input systems—including OCR, RAIR, remote batch and keyboard entry systems—are finally replacing the foundation on which IBM's fantastic growth and profitability were based. Note also that IBM is already heavily committed to OCR, where they have over a third of the current market, and to RAIR and remote batch processing where they now have the bulk of the industry volume.

Further, note also that IBM has recently raised the prices on their old card equipments *and* maintenance. It seems clear that IBM is in the process of riding down the Hollerith card equipment—no doubt, very profitably. The interesting strategic question is: how hard will IBM push in OCR, source data entry and RAIR and remote batch processing, and, as a corollary, will IBM ever introduce a keyboard data entry system that directly impacts the keypunch in major computer installations?

The volume growth of peripheral equipment—including data entry systems—will increase dramatically. Many industry and investment predictions forecast that by the mid-1970's, two-thirds to three-fourths of installed value will be in peripheral equipment.

The volume increase in data entry systems will be particularly dramatic. This increase will be shared by OCR, source data entry, RAIR and remote batch processing and keyboard entry systems. The forecasts of the advocates of these four forms of data entry are staggering. The sum of the four are unbelievable.

Rational friends in the OCR business predict that OCR in the 1970's will increase by more than a factor of 10 in number of installations and value of installed equipment. They buttress their claims with plausible arguments about increased font capability, lowered unit costs, facsimile transmission, remote scanning devices, great flexibility for handling both in-house and turnaround documents, and rapid expansion of OCR techniques in printing and the graphic arts. On these bases, OCR shipments in 1980 would be over \$2.5 billion.

Equally rational friends in the RAIR terminal and remote batch (e.g., time-sharing, computer utility and such buffs) predict even more startling growth. The Arthur D. Little, Inc., study on *Markets For Computer Peripherals and Terminal Devices*, published in October, 1969, contained the summary shown in Table 6.

the terminals

There certainly is no shortage of RAIR terminal offerings. Well over 300 different models are now available. The bulk of the present volume is going to IBM and to Teletype Corp.

Viatron originally predicted it would ship 5,000 to 6,000 terminals per month by mid-1970. Even their current estimates of 1000 terminals/month by mid-1970 is impressive. Much has been written about Viatron's volume gambles on MOS, volume build-up "mail order" sales, "replacement maintenance," and profit margins. While these are very legitimate concerns, I feel the future of Viatron and the rate of growth of RAIR processing depend predominantly on other factors, particularly:

1. What will be IBM's product strategy in this area?
2. How fast and how well can users and computer manufacturers solve the communications-oriented software and communications "front end" problems? (In short, how fast can the main frame or tiered systems handle crt terminals at 300 cps rather than 10-15 cps?)

3. How many users and applications can really justify, economically, remote access immediate response in view of the considerable costs of data transmission, computer interrupt, and file search, however performed?

There's little doubt that RAIR and remote batch processing will expand considerably in the 1970's—perhaps even dramatically. But few facts on IBM strategy, user need, and user economics are yet in.

Hard facts on data entry are even more scarce. Elegant factory data collection systems are already avail-

able. But the major markets—point-of-sale recording, credit transaction recording and order entry—are still up for grabs. Technically, a wide variety of magnetic, optical and other techniques are being pursued. Undoubtedly, the problems of item identification (tags), source entry (clerical reading with a magnetic or optical “wand”) and systems processing (credit check, exception transactions, etc.) will be substantially hammered out during the 1970’s. No doubt source data entry in these applications will be “old hat” in 1980. But the rate of progress in these areas depends on a few inventions, much clever engineering, and very effective marketing. At this point, I have great faith in tailored source data collection systems but no conviction on the share of the market they’ll capture by 1980.

In any case, the American Management Association has caught the theme of the 1970’s. Their recent 16th Annual EDP Conference was devoted to “EDP Management in the Decade of Terminal Oriented Systems.” OCR requires some form of terminal for initial preparation. Source data collection requires at least a numeric and control terminal. RAIR processing, economically, now demands a keyboard terminal for inquiry.

But I think the exciting opportunity and challenge—at least for the next few years—is in keyboard data entry systems as relatively direct replacements for keypunches and typewriters.

trends in keyboard data entry systems

A major role for keyboards in data entry seems assured throughout the 1970’s.

1. *Keyboards will continue dominant in data input devices.* Ancient as the technology is, the keypunch population in the U.S. is still expanding. The keypunch still has a significantly long useful life. Keypunches will continue to be used—no doubt, at some point, in diminishing numbers—as a useful data input device in many data processing establishments.

Similarly, the keyboard-to-tape device population in the U.S. is still expanding. They will continue to be used as keypunch replacements—no doubt, at some point, in diminishing numbers. Their population, while relatively small, is still increasing. They may well, like the keypunch and paper tape equipments, continue to have a role in many

data processing installations, particularly small or remote installations.

While keyboard-to-paper-tape devices are already obsolete, they may well continue to have a minor role in some small business and scientific systems. MICR, which makes little use of keyboards, has plateaued and is largely locked in on banking applications. MICR may find use in other applications (transfer of stock certificates, processing of preprinted credit and order forms, etc.), but some OCR buffs predict the complete demise of MICR and mark sense readers.

2. *The strong trend toward data entry systems will continue and grow stronger.* The four data entry systems that seem certain to expand rapidly during the 1970’s are: OCR; source data entry; RAIR processing; and keyboard entry systems.

While many consider these four entries to be directly competitive, each has its own peculiar strengths and weaknesses. No doubt, these four entries are in a horse race, but technical developments and a mammoth market need for cheaper, faster, more accurate data entry will probably make all four entries winners.

OCR. By the early 1970’s, it seems quite certain that highly reliable OCR equipment will be available capable of handling handprinted and many-font documents, pages and journal tapes. Where the cost of data communications can be justified, OCR (now really a data entry subsystem lacking a front end) can be fed by remote buffered keyboard terminals, remote scanning terminals, or facsimile transmitters. OCR will capture much of the very high volume, highly standardized data entry. As a requirement and fallout, the business forms industry will be upgraded in quality, price and volume. The main constraints on the use of OCR will continue to be:

1. High fixed equipment cost.
 2. Still-limited font capability.
 3. User costs of systems redesign and reprogramming.
 4. Lack of any economical means of automating input to OCR’s.
 5. Slow turnaround.
 6. Complexities and costs of error checking.
 7. Higher cost and bulk of input forms.
- I personally expect OCR sales volume to expand nearly

Category	1969		1974	
	Population	Annual Shipment Value (MM\$)	Population	Annual Shipment Value (MM\$)
CRT	40,000	100-140	150,000-200,000	180-250
TTY	100,000	60-100	250,000-300,000	80-150
Data Recorder				
Key-Tape	20,000	135	75,000-100,000	140-160
Key-Disc	10	12	4,000- 6,000	100-120
Key-Cassette	500	20	75,000-100,000	80-140
OCR	1,000	210	5,000- 7,000	750
COM	300	45	2,000- 4,000	60-80
Audio Response	300-500	5-10	5,000- 10,000	20-30
Graphics CRT	500	50	5,000- 8,000	70-90
Plotter	5,000	25	10,000	30-40

Source: Arthur D. Little, Inc., estimates.

Table 6—Market for selected peripheral equipment and terminal devices, 1969-1974.

twice as fast as total industry volume during the 1970's.

Source data entry systems. To date, the only source data entry systems that have achieved any significant market volume and profitability are factory data collection systems. However, in spite of recent failures of certain early point-of-sale systems and the dominance of NCR in the cash register business, increasingly competent electronic "cash registers" are appearing. Effective source data entry systems for large retail (high volume) operations seem certain to become economical and reliable during the 1970's. With improvements in remote batch processing and decreased data communications costs, source data entry systems with only a few input devices/site could become economical.

Much of the market success of source data entry systems depends on technical developments, particularly of inexpensive and reliable optical or magnetic readers, and on the rate of market penetration against the entrenched cash register and credit card devices. However, I have faith in rapid—though not untroubled—growth of source data entry systems, but I have no percentage or dollar forecasts on volume.

It should be noted that virtually all source data entry terminals employ a keyboard, at least for entering numeric and/or control information.

RAIR processing systems. Time-sharing with remote access immediate response terminals is the current major fad in the industry. For critical inquiry and response functions (e.g., for very perishable inventory such as a seat on an airliner or very important management information such as financial and order status) the costs of remote RAIR terminals, data communications "in," computer interrupt, file search, computer processing and set-up, and data communications "out" frequently may be justified. I personally expect remote batch processing to develop more rapidly than RAIR processing (once the fad wears off) and that RAIR terminals will grow in use rapidly but will be serviced generally by local computers.

Again much of the market success of RAIR and remote batch processing depends on future technical developments, data communications cost and the marketing and product strategy of IBM. However, I have faith in rapid—though probably very confused—growth in volume in RAIR and remote batch processing but, again, I have no percentage or dollar forecasts on volume.

It should be noted that virtually all of the RAIR terminals employ keyboards for inquiry and printers and/or displays for response.

Keyboard data entry systems. There is no doubt that the keypunch market and a very germinal keyboard data entry systems market are ripe for the appearance of an economical and reliable keyboard data entry system.

Use of the early systems, designed in 1967 and 1968, and marketed since mid-1969, have clearly defined the improvements which users and potential users demand or desire. These major requirements or desires are:

1. The system needs enough *processing power* to do the entire data input, control, verification, validation, editing, reformatting, merging, sorting and collating so that the output tapes or disc packs are ready for main frame processing.

2. The *direct costs* of equipment and operator time must be competitive with keypunch and keyboard-to-tape devices in small or "starter" systems (say 4 to 8 input stations).

3. The system must be designed so that it is "*fail safe*."

4. The system must be—or nearly be—*turnkey* so that costs of systems redesign and reprogramming are minimal.

5. The system must be *modular* so that expansion and change are easy and economical (up to hundreds of data entry applications and many dozens of input stations).

6. The system must be designed to be adaptable to "*fourth-generation*" technologies and to remote batch, multitiered, multiple processor data processing systems.

7. The input stations must be *acceptable to, and preferably "upgrade,"* the keypunch operator.

8. The systems control methods must be readily *acceptable to keypunch supervisors.*

All of the technology to meet all eight of these user demands or desires now exists. Consequently, possibly within months, certainly by 1971, I expect to see the announcement of a truly impressive and economical keyboard data entry system.

The key technology in the successful entries will be microprogramming, since this technique will provide power for input, control and full preprocessing at very acceptable prices (Demands 1 and 2).

systems significance of microprogramming

Successful keyboard data entry systems will rather fully exploit microprogramming because keyboard entry necessarily involves frequent repetition of the same processing steps in many sequences. In this sense, microprogramming is not new, but a modern creative imitation of the old wired plugboards.

The second wave of keyboard data entry systems will have markedly reduced costs because microprogramming elements are now as inexpensive as normal electronics circuitry and as inexpensive as core memory . . . and 5 to 10 times faster.

Microprogramming involves the very rapid assembly and use of complex control or processing routines by chaining together strings of subroutines from a library of such subroutines . . . frequently stored in a fast, read-only memory.

That microprogramming is a wave of the future can be seen from what is already in use today. IBM System/360's and RCA Spectra 70's use microprogramming—but for extremely simple tasks (largely emulations). I'm convinced that the first commercial systems application of microprogramming will be to the dedicated task of keyboard entry.

Successful keyboard data entry systems will be able to employ multiple processors, probably in tiers, in order to insure "fail safe" operation (Demand 3) and ease and economy of expansion (Demand 5).

Successful keyboard data entry systems will be designed with a large standard library of software and firmware routines to enable the manufacturer to deliver turnkey systems to minimize user systems design and programming costs (Demand 4).

Microprogrammed computers for keyboard entry systems are, by their nature, modern communications oriented processors and fit extremely well with "fourth generation" and remote batch developments (Demand 6).

Much has been learned in recent years about all aspects of terminal and input station design, including increasingly the human factors. With proper design, operator acceptance (Demand 7) should be readily met. Similarly, the technology for providing the supervisor with a highly usable and acceptable control station (Demand 8) should, also, be readily met.

To date, data input devices—particularly keyboard-to-tape units and OCR—have slowed down the growth of the keypunch market. I fully expect that the death blows to the keypunch will be quickly and neatly delivered by such modern keyboard data entry systems. ■

A HISTORY OF KEYED DATA ENTRY

by Robert F. Carey



In keyboard data entry, we are witnessing the transformation of an innovation into a commodity. Webster's Seventh gives the reader his choice of interpretation of the word "innovation": something new or a change; or a novelty. To some, in 1965, the introduction of my company's keyed Data-Recorder was looked upon as a novelty; to others, it was a new idea, a new method, a new device—as was Mr. Boole's automated loom in the mid-1800's, Dr. Hollerith's punched card in the 1890's, and let us not forget Mr. Babbage's Analytical Engine.

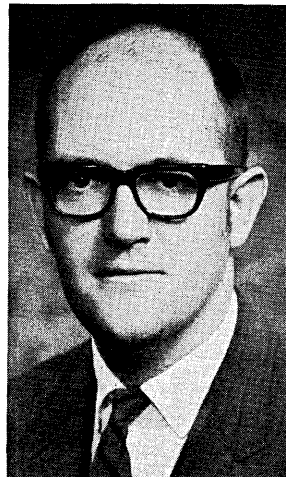
Necessity has, in fact, been the mother of invention in our industry. Boole's automated loom was the result of his failing company's efforts to increase production and decrease overhead. His wooden blocks, with precisely punched holes, actually controlled the color selection of textiles weaved by his loom. Could he not be called the father of numerical control?

Dr. Herman Hollerith was far more fortunate. His success in "automating" the 1890 census with the first "punched card" again proved that man is seldom satisfied with the way things are and sets out to make them better.

The 1890 census was finally completed in 1897. With his cards, his punches, and "readers" he was able to finish the 1890 census in late 1892. And we talk about improvements in throughput and turnaround times today!

Dr. Hollerith was astute enough to patent his ideas and later founded the Tabulating Machine Co. The company became the Computing-Tabulating-Recording Co. in 1911. In 1914, Thomas J. Watson, Sr., joined the company, and the rest is history. The punch card had arrived, and prospered.

In the post World War II period, the use of automatic data processing blossomed. Processing of data became more and more automated and, therefore, faster. Human labor was decreased in the data processing room, but, by the mid-50's, the keypunch rooms, adequate for the 30's and 40's, were in a constant state of expansion. Then came high-speed computers to replace the relatively slow adp equip-



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ment of the past two decades, further compounding the problem.

In progressive firms of the 1950's, the old "tab" room was known as the computer room and for good reason. Card-read speeds had increased measurably, as had punch and print speeds, not to mention the tremendous internal computational speeds. Processing was now a function of electronic rather than electromechanical technology. Human labor was, of course, decreased, but only in regard to the processing of data . . . not inputting it.

During the 50's, the keypunch had evolved to the stage of printing while punching, and the Sperry-Rand unityper was born.

The Univac Division of the Sperry-Rand Corp. realized that a definite need existed for a device capable of faster input speeds and thus liberated from the restrictions of the punch card. Indeed, Univac had already produced a 90-column "round hole" keypunch for use with its tabulating equipment.

The Unityper was a most interesting device. If the reader can recall seeing (or having heard of) the metal tape used with the Univac I, he will understand the principle of the Unityper.

The device inscribed directly from a semistandard typewriter onto Univac-compatible metal tape. The Unityper inscribed at 50 characters per inch on the metal tape in blocks of 120 characters, separated by an inter-record gap of 1.25 inches. The inscribing was incremental, as was the keypunch of then and today. That is, with each keystroke, the character keyed was "written" onto the metal tape. Although development problems, both major and minor, somewhat hindered the acceptance of the device, some were placed into productive use in the U.S. and abroad. The Unityper is thought by some to be the forerunner of today's keyboard-to-tape devices. There can be no doubt that the equipment offered to the Univac computer user the first alternative to the punch card for entry of mass information into the cpu.

For that reason, it has earned its place in the museum. In 1957, there were two developments yet to occur in the evolution of keyboard data entry devices, and the dp community would have to wait some seven years for them.

By 1958, first deliveries of the second-generation systems had started. The new systems were capable of processing information at millisecond speeds. As the 60's dawned, it was becoming obvious to many users that a speed gap existed between the cpu's ability to process information and the traditional method of capturing input. The computer systems of the early 1960's lowered the cost per unit of throughput, whereas the cost per unit of input rose steadily as keypunch operator salaries steadily climbed.

In 1964, the new third-generation computer systems with nanosecond internal speeds were introduced. The advantages of this generation of systems resulted primarily from the great reduction in cost per item of throughput achieved through multiprocessing. The increased speeds of input and output devices contributed little to the saving. They were mechanical and, in most cases, only slightly faster (though much more reliable) than their first-generation ancestors.

The result was inevitable. Most systems became I/O bound simply because the input and output state of the art had failed to keep pace with cpu development. Especially neglected was the input area, since both the keypunch and punch card had been in use for 30 years before the first computer generation without any major improvement.

In August of 1964, a group of eight men—specialists in data processing, production, engineering, finance, and mar-

keting—met at a dining-room table in the small town of Herkimer in the Mohawk Valley in upstate New York. Each believed that it was time to find a better way to capture the data from the source document for the computer. They were convinced that most keypunch operators could not be replaced by automatic "readers" for many, many years to come, so they set out to develop a device to make maximum use of the operator's skill. The result was Mohawk Data Sciences Corp.'s keyed Data-Recorder, first delivered in April, 1965. Necessity again mothered invention.

The device was unique in three ways. It encouraged the immediate correction of "sensed" key errors. Since an entire record (usually 80 columns, or optionally higher) was keyed into an intermediate storage device, or buffer, the operator had the capability of correction by merely striking over the incorrect character or field with the correct character(s). This resulted in fewer errors to be corrected during verification. The user was not required to make any alteration of his existing "card" formats. The microsecond duping and skipping alone resulted in significant increases in productivity. The recorder's only mechanical action took place in reading and writing tape.

The second unique feature was in the tape medium of transcription. Magnetic tape, by 1964, was a widely accepted vehicle for high-speed storage and retrieval. The Data-Recorder was designed to write from the keyboard buffer directly to computer-compatible magnetic tape.

Thirdly, the capability to read the tape into the keyboard buffer allowed the same machine to function as a verifier. The "verify" operator, using the keyboard (which was the same as the IBM keypunch except for seven additional keys), operated the unit exactly as she formerly did on her verify machine. If an error was found, she merely touched the correction key and erased the incorrect character by the depression of the correct one.

Since fewer errors found their way to verification, and those that did were corrected immediately on the same machine, some installations reported amazingly high production rates and vastly "cleaner" input to the computer.

Of course, the magnetic tape was reusable. Those installations making a complete conversion to tape input were freed from the high costs of purchase, usage, and storage of punch cards. The keypunch supervisor was relieved of the task of scheduling work based on the mix of punch machines and verify machines. With the new machines, every unit could be scheduled with great flexibility, since each was a dual-use machine. Every recorder could operate as a "punch" or "verifier," in any mix needed. This usually resulted in fewer units being needed, since it was no longer necessary to provide extra punches or verifiers for peak period use.

A third operating mode, called search, was incorporated into the Data-Recorder. This mode allowed a particular record to be located on the tape for correction, deletion, or display.

In most installations of early 1966, user acceptance of the concept thrived. The correctable buffer helped encourage the immediate correction of sensed errors, in addition to being faster—the main purpose of the design. Analysis revealed that 85%-90% of keying errors were immediately sensed by the operator. After two keystrokes, she had corrected the error and had resumed recording the remaining information from the source document. Early users reported production increases on a scale from 20% to 40%. A few, with all-numeric applications and few keystrokes per record, attested to 50%-75% improvements.

One might wonder why the industry did not flock to the

innovation and make it an overnight success. It was noted above that Webster's Seventh applied the meaning "novelty" to the word innovation. Based upon the early reports of cost reduction and productivity increases, some firms prematurely rushed into the installation of the devices. The Data-Recorder meant change, and change means adjustment. Management, excited by the hope of diminishing a long-neglected profit drain, looked at the new machines as the panacea for computer input. Alas, in many cases, this was not to be.

The way of life in dp departments was instantly changed; heard in the keypunch room was "I can't see what I'm doing!"—in the computer room, "There's no control with tape!" and in the programmer's office, "I need cards!" Mohawk realized that the installation of keyed Data-Recorders had a different impact on each segment of the data processing community.

The keypunch operator was not interested in cost reduction, the computer operator cared little about the quietness of the device, and it mattered little to the programmer that the unit functioned both as a punch and verifier. Thus, in some cases, the introduction of the innovation was an exercise in futility. It was quickly learned, after some unsuccessful installations, that it was not good enough to "build a better mousetrap" . . . someone had to make it work.

By mid-1966, about 1,500 Data-Recorders were in operation, and the concept of key entry direct to magnetic tape was changing from novelty to acceptance; in spite of the fact that over 500,000 keypunches were then in use. Only two drawbacks remained. First, no major manufacturer of data processing equipment had introduced, or even announced, plans to develop a keyboard-to-tape device, which would have blessed the concept. Secondly, although committed to a national sales and service organization, MDS could not possibly hope to cover every user point in the U.S. for many years to come.

For the above reasons, MDS, in the fall of 1966, entered into a five-year agreement with the National Cash Register Co. to manufacture and sell to NCR a minimum of 1,000 units per year. NCR and MDS then jointly marketed the Data-Recorder in the spirit of friendly, although sometimes meaningless, competition. As 1966 drew to a close, over 2,000 Data-Recorders were in use.

Throughout 1967, the industry buzzed with rumors of impending new product releases by the "giants." Yet none came. The most significant developments in key entry de-

vices came with the first deliveries of a System 360-compatible Data-Recorder (the MDS 6401), and the shipments of Data-Recorders which, in addition to operating as key-to-tape devices for input, also functioned as off-line card or paper tape-to-magnetic tape converters, transmitter-receivers, and printers.

By January of 1968, some 6,300 units were installed. Still, this represented only about 1% of the number of keypunches installed at the time. The innovation, now considerably refined in operation and appearance, was still an orphan.

Finally, in the spring of 1968, the concept was once and for all removed from the novelty status. Honeywell announced their version, called Keytape. The concept fostered in 1965 had finally gained acceptance by a major computer manufacturer. The MDS keyed Data-Recorder, from the spring of 1968 on, was no longer an innovation.

It was surprising to most, and amazing to some, that IBM made no attempt to develop a key-to-tape device during this period, for, by mid-1968, MDS and NCR had approximately 9,000 units in operation.

Thus, by mid-1968, just prior to the first delivery of the Honeywell Keytape, MDS and NCR had achieved a foothold of nearly 2% of the previously keypunch-dominated keyboard-input market.

By now, keypunch operators were rapidly being trained in the new key-to-tape operation. The vendors of the equipment had, of necessity, treated their installations with gentle care and rapt attention. Computer operators learned that the magnetic tape which they had been handling for the past nine years was just as reliable when received from the keypunch room as it had always been within the computer room. Programmers realized that the new input medium gave them relief from the restrictions of the 80-character unit record, and formatless (no program) recording was being attempted with good success.

The key-to-tape device had become a way of life in nearly 5,000 installations by mid-1968.

By now, the Community Corp. had introduced its Model 90 Data Jotter, which represented a departure from the MDS and Honeywell devices. The Jotter featured input via typewriter to a non-computer-compatible magnetic tape cartridge.

Thus, anything typed on an ordinary electric typewriter could be captured, via a conversion unit, on magnetic tape. Moreover, the use, on some models, of the program and

CHRONOLOGY OF KEY TO TAPE EQUIPMENT							
KEYBOARD TO MAGNETIC TAPE (COMPATIBLE)	SPERRY-RAND "UNITYPER"	MDS 1100			MDS 6400 HONEYWELL K700 FACIT 6000 SANGAMO DG 7100 SANGAMO DG 9100 HONEYWELL K900	VANGUARD KB600 KEYMATIC 1000 POTTER KDR HAI 100 BURROUGHS N	FRIDEN 4300
KEYBOARD TO CASSETTE/CARTRIDGE (NON COMPATIBLE)					COMMUNITYTYPE 90	IBM 50 SYCOR 300 CYBERCOM MK2 TY-CORE 7500 VIATRON 21 DATA ACTION 150 DICOM 344 DATA INSTRUMENT CO. - Dataplex	
"CLUSTERS" (*WITH MINICOMPUTER)						*LOGIC LC-720 *CMC 9 *REALTRONICS RI *SANDERS 6000 *COMPUTER CONSOLES *COMPUTER ENTRY 6000 *GENERAL COMPUTER 2100 *CONSOLIDATED COMPUTER	MDS 9000 *INFOREX I.K.E.S. *PENTA KeyLogic *SYSTEMS ENG. KEYTRAN *VIATRON 2140 MDS 9200 *TEC, Inc.
	1955 ←	→ 1965	1966	1967	1968	1969	1970

data (pad) memory unit made it possible to store up to 80,000 characters of fixed information for repetitive use, for such applications as inventory control, billing, and retail accounting.

The Sangamo Electric Co., at nearly the same time, announced its version of a keyboard-to-tape device, similar to those of MDS and Honeywell. The ds7100 and 9100 were similar in many respects to their forerunners but offered a digital buffer display in addition to the many options then available on the first "stand-alone" units of Honeywell and MDS.

So, as the year 1968 drew to a close, some 15,000 key-to-tape units had been delivered. Three per cent of computer entry units were now direct-to-tape devices. The growth of this new market was very promising. In an industry dominated for 40 years by one manufacturer, an infant sub-industry had grown at the average rate of 120% per year. That year was a turning point for the key-to-tape industry.

and finally, ibm

1968 truly can be called the year that the industry looked within itself and realized that there was, indeed, a need and a place for innovation in the data-capture and computer-entry phase of data processing; for in mid-year, IBM made its long-awaited announcement of the Model 50 Data Inscriber. With the birth of its new product came the tacit acknowledgement that a new wind would shortly sweep through its customers' data entry rooms. This truly signaled the birth of an industry . . . the transition from an innovation to a commodity.

The IBM 50 magnetic tape Inscriber was as different in operation from the above keyboard-to-tape devices as they were different from the keypunch. The entry of the Model 50 into the field raised many eyebrows for one major reason. Recorded input from its keypunch keyboard was written on a non-compatible 16-millimeter magnetic tape, at a density of 20 characters per inch. The recording was incremental, that is, it was written directly onto the sprocket-fed magnetic tape cartridge. The capacity of each cartridge was equivalent to some 275 punch cards, and each cartridge was compatible with IBM's well-known magnetic tape Selectric typewriter (MT/ST). Each small plastic cartridge-enclosed tape provided input to the IBM Model 2495 reader, which fed the recorded information into the System 360 at 900 characters per second.

The IBM announcement was closely followed by new keyboard-to-compatible-magnetic-tape devices, similar to those of MDS and Honeywell—from Vanguard Data Systems and the Potter Instrument Co.; and, by the end of 1969, no less than seven variations of the IBM 50 had appeared on the scene or had been reported. Others quickly announced their efforts. The most significant was by Viatron Computer Systems. The System 21 offered the user a choice of keyboard configurations (typewriter or keypunch), utilized a small cassette, featured a crt display, and had a very low price per station.

The marriage of the crt and cassette was not new. Sycor, Inc. unveiled its Model 301 key-cassette terminal in mid-1968. The most unusual feature of the Viatron announcement, the one which stirred the most interest, was the price.

It is most interesting to note that by mid-1969, a true industry had been born—the keyboard data entry industry. Branches were beginning to appear. The innovation of bypassing the punched card for computer input by now had evolved into three distinct machine types:

1. Keyboard entry to compatible tape.

2. Keyboard entry to non-compatible tape.
3. Multi-station keyboard entry to shared processor.

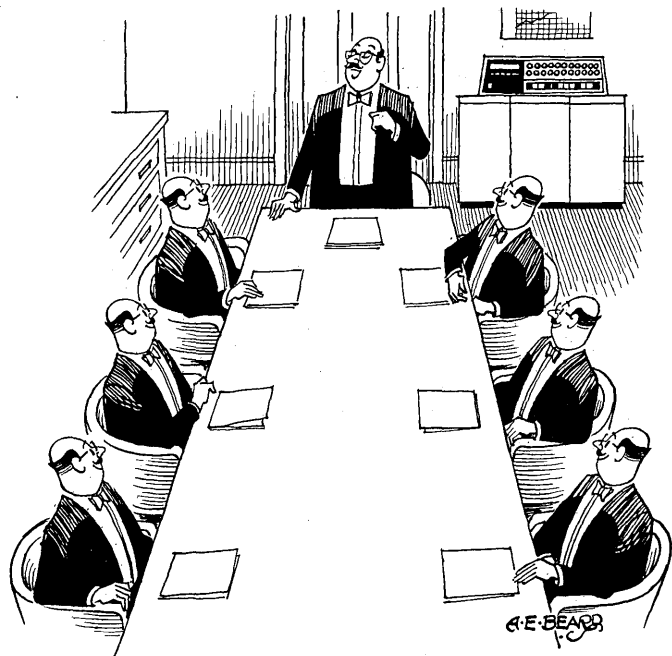
In mid-1969, first deliveries of multi-keyboard devices began. Both Logic Corp., with the Key Disc system, and Computer Machinery Corp. with the Model 9, took different approaches, but were first to introduce the concept of multi-station input called "clusters." In Logic Corp.'s 720 system, all data entered into the time-shared keyboards is processed and stored on a magnetic disc in the central processor. Each record is then verified against the disc and corrected, if necessary, in the conventional manner. Sixty keyboard stations can be controlled by the central processor.

The CMC entry may be configured with up to 32 keystations; again, each time-shared. This system's heart is a PDP-8 computer containing magnetic disc intermediate storage. After verification, batches are transferred onto compatible magnetic tape. A teleprinter serves as the supervisory work station. Both systems utilize a keypunch style keyboard.

Thus, by mid-1969, the shared processor concept was also moving from innovation to commodity. No less than 13 firms now are attempting to create and share the market.

By the end of 1969, nearly 50,000 keyboard-to-tape units of all types were in operation. Some 30 firms, and more to follow, most of them small one- or two-product companies, and some of them giants, are vying for the computer user's business. If you believe you can utilize their products, examine your computer input costs carefully. There may, indeed, be significant savings with the introduction of the new technology and methods in the previously taken-for-granted keypunch room.

It is amazing that the emergence of this industry has all taken place in five years. It is more amazing that nothing took place until then. It is even more amazing to speculate on where the state of the art of keyboard entry would be today if those eight men had held their meeting in Herkimer, New York, 10 years sooner.



"Well, gentlemen, I'm sure we all agree that my computer programmed management selection scheme has proved highly successful."

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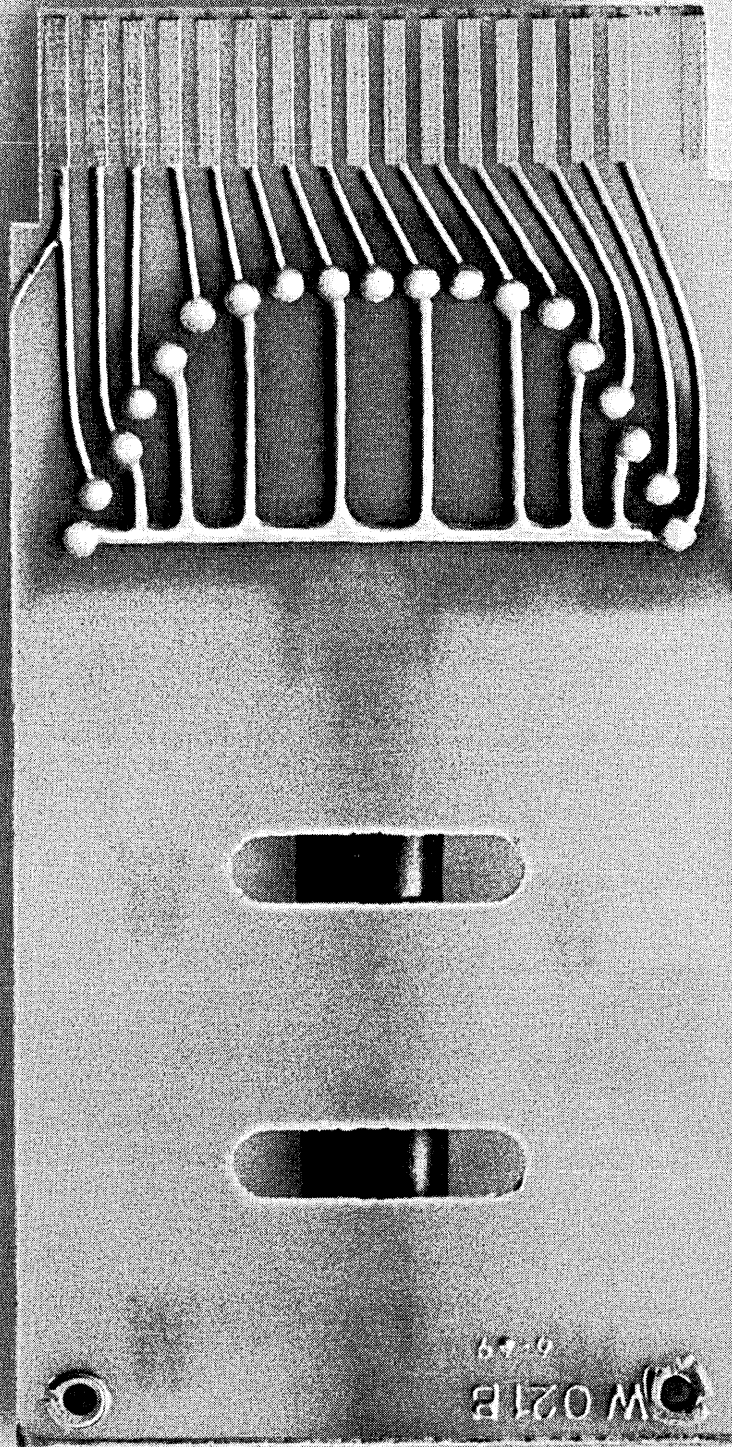
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CIRCLE 15 ON READER CARD

Lockheed Electronics

Data Products Division, A Division of Lockheed Aircraft Corporation

KEYPUNCH REPLACEMENT EQUIPMENT

by John C. Alrich

More efficient ways are rapidly becoming available to produce machine-readable storage and entry media from source document data. One of the means, keyboard to magnetic tape converters, is the subject of this survey and represents very significant competition to card equipment, wherever a turn-around document is not required.

The ubiquitous electromechanical keypunch has been and remains the primary means for producing machine-readable data and serves as the standard by which competing systems are compared. It is estimated that approximately one million keypunch operators are diligently reading, keying, skipping, duplicating, and verifying on some 600,000 keypunches and 300,000 verifiers. A skilled operator can outpace the mechanical punch response; separate verification is required; data packing efficiency is abysmal; card readers are cumbersome and slow. Hence, the emerging interest in more efficient methods of data input preparation.

survey questionnaire

To accumulate data for the table, questionnaires were sent by DATAMATION to all known manufacturers. After 30 days, the nonresponders were contacted and reminded of the deadline. Sales and technical literature were collected and three earlier surveys were perused. Wherever the tabular data were derived from information not supplied by a questionnaire, an asterisk appears after the name of the manufacturer. Note that a number of the systems listed have not as yet been delivered so their characteristics and costs may not be firm.

Terminals which are highly specialized or which are primarily data transmission terminals are not included in the survey. Finally, *enhanced* keypunches have not been listed. These systems buffer a full record, thereby permitting the operator to backspace and make character or field changes prior to card punching. After releasing the card, the operator can immediately begin keying in the new data while the previous record is being punched. Furthermore, verification can be done on the same machine. Both Burroughs and Univac make this equipment and CalComp makes an attachment which permits this type of operation with IBM keypunches.

the tables

In our Summary of Characteristics tables, we divide the systems into two groups: Stand Alone (pgs. 80-83) and Shared Processor (pgs. 84-88). The former grouping can be further subdivided into computer-compatible tape terminals and those using cassettes, cartridges, and special tape deck designs. Generally, in either case, a small buffer, capable of holding one record of alphanumeric characters, is associated with each keyboard. When the unit record is completed, the block of data is transferred to tape. Then the handler reverses to the beginning of the record and reads it back for a

character-by-character check against the buffer memory contents prior to entry of the next record.

Those systems employing a shared processor use as intermediate bulk storage a disc (usually) of either fixed-head or movable-head design. In this approach a number of keyboards, typically 8 to 64, are time-shared by a minicomputer onto a disc file. The computer stores, formats, edits and processes the data. Under control from a supervisory console, the disc contents are periodically batch-transferred to a computer-compatible magnetic tape.

In each of the two tables—after the manufacturer's name, the equipment name and model number—are four columns relating to the characteristics of recorded data on the magnetic tape. Units permitting recording of only a single character per record use an incremental tape handler in the stand-alone systems; others record a block at a time. Maximum record lengths often can be increased optionally by adding buffer storage and are indicated with and without options.

Standard formats can be selected by the operator in all systems noted but may be only a limited set locally if a supervisory console is employed. The number shown is the maximum available in combination where applicable.

All systems using a record buffer permit on-line editing before release; those tape handlers designed to do record backspace can usually edit after recording a record. Editing on nonbuffered keyboards is done by the software operating system otherwise.

The term "IBM 029 compatible" refers to keyboard layout that is similar to the 029 although extra keys and functions are generally present. The function keys enable all the spe-

(Continued on page 83)



Mr. Alrich is manager of engineering at Compata, Inc. He has been active in the design and development of digital systems since 1951, working for Burroughs, Consolidated Systems, Bunker-Ramo, and Hughes Aircraft. He has a BS in engineering from the University of California at Berkeley.

STAND ALONE PROCESSORS

MANUFACTURER	NAME MODEL / NUMBER	CHARACTERISTICS OF RECORDED DATA				number of standard formats	EDITING	
		minimum record (characters)	maximum record (characters)	maximum characters per field	maximum fields per record		before release	after recording
BURROUGHS CORP.	Magnetic Tape Encoder N7200 (7 track) N7500 (7 track) N9800 (9 track)		80-160				Yes	Yes
CALIFORNIA COMPUTER PRODUCTS, INC.	Punchmaster 2029 and 2059	80	1760	80	330	22	Yes	
COMMUNITYTYPE CORP.	Communitytype Data Input System Model 80	1	160	160	2	2	Yes	Yes
CYBERCOM CORP.	Mark 1	80	120 ²	No limit	No limit	2	Yes	Yes
DATA ACTION	Magnetic Data Inscrber Model 150	1	720	720	48	8	No	Yes
DATA INSTRUMENTS CO. ¹	Dataplex Series 100	1	Limited by cassette	Limited by cassette	Limited by cassette			
DIGITAL INFORMATION DEVICES, INC.	Data Transcriber	12	100-200	100-200	Variable	3-up	Yes	Yes
HONEYWELL, DATA PRODUCTS DIV.	Keytape 700 (7 track) 900 (9 track)	80	400 ³	400	400	2	Yes	Yes
IBM CORP. ¹	Magnetic Data Inscrber Model 50	1	1-720	720	720	8	Yes ⁴	Yes
INTERNATIONAL COMPUTER PRODUCTS, INC.	KeyCette Model 1000	96	96				Yes	Yes
KEYMATIC DATA SYSTEMS CORP. ¹	Keymatic Encoder Series K-1000		9,999				Yes	
MAI EQUIPMENT CORP.	MAI 100 See entry under Digital Information Devices, Inc.							
MOHAWK DATA SCIENCES CORP.	1100 Series 6400 Series	10	180	180	180	2	Yes	Yes
MOTOROLA INSTRU- MENTATION AND CONTROL INC.	Datascribe KB600 (7 track)/KB800 (9 track) See entry under Vanguard Data Systems							
THE NATIONAL CASH REGISTER CO.	Magnetic Tape Encoder 736 Series See entry under Mohawk Data Sciences Corp.							
PERIPHERAL BUSINESS EQUIPMENT, INC.	Magnetic Data Recording System Model 4301	20	80 (standard) 200 (optional)	200	200	Unlimited from master tape	Yes	Yes
POTTER INSTRUMENT CO., INC.	Keyed Data Recorder KDR-3100 (7 track) KDR-4100 (9 track)	20	160	160	160	2	Yes	Yes
SANGAMO ELECTRIC CO.	Data Station 7100 (7 track) 9100 (9 track)	80	120	No limit	No limit	3	Yes	Yes
SYCOR, INC.	Sycor Key Cassette Model 301 or 302	1	216	216	216	15	Yes	Yes
UNIVERSAL DATA ACQUISITION CO. ⁹	Portable Alpha/Numeric Recorder Model 5021	1	Variable	Variable	Variable	None	Yes	Yes
VANGUARD DATA SYSTEMS	Datascribe™ KB600 (7 track) KB800 (9 track)	80	100 (with optional 200)	Unlimited	Unlimited	2	Yes	Yes
VIATRON COMPUTER SYSTEMS CORP.	System 21 Model 2111	1	160	160	160	400	Yes	Yes

NOTE: An empty space means that no information was available at the time chart was produced.

¹ Questionnaire not received for survey.

² Multiples of 120 characters, optional.

³ Plus increments of 10 characters,
optional.

⁴ Unit lacks buffer so special dup
and skip codes provided by
System/360 Utility program.

⁵ Using the pooler, converts to 7 track
at 800 bpi or 9 track at 1600 bpi.

⁶ 5% discount

GENERAL CONSIDERATIONS

KEYBOARD		DISPLAY			OPERATOR AIDS				PROCESSOR	
IBM 029 compatible	type	form	simultaneous display	field position	control function	error	audible alarm	backspace	programmable	operator change
Yes		Alphanumeric	1	Yes	Yes	Yes	No	Yes	Yes	
Yes		Alphanumeric Special	80	Yes	Yes	Yes	No	Yes	Card programmable	Yes
Yes	Solid-state	Alphanumeric	1	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Yes		Alphanumeric	1	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Yes	Solid-state	Alphanumeric	1	Yes	Yes	Yes	No	Yes	Yes	Yes
IBM Selectric		84-character set	Hard copy	Not applicable	Yes	No	No	Yes	Yes	Console switches
Yes	Solid-state	Alphanumeric	18	Yes	Yes	Yes	No	No	Yes	Yes
Yes	Magnetic read	Alphanumeric	1	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Yes		Alphanumeric	1	Yes	Yes	Yes	No	Yes	No	
Interface to customer keyboard as required		Hard copy from customer input device	Variable	Variable	No	No	No	Yes	No	No
IBM Selectric		Alphanumeric	1							
Yes		Binary	1	Yes	No	Yes	No	Yes	Yes	Yes
	Solid-state Contact								Yes	Yes
Yes	Solid-state	Alphanumeric	1	Yes	Yes	Yes	Yes	Yes		
Similar plus additional	Reed relay	Special (standard) Alpha (optional)	1 (standard) 80 (optional)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Yes		Alphanumeric	1	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Type-writer	Contact	Alphanumeric	1-320	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No	Micro-switch	Alphanumeric	18	Yes	Yes	Yes	No	No		
Yes	Contact	Alphanumeric	1	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Yes	Light	Alphanumeric	320	Yes	Yes	Yes	Yes	Yes	Yes	Yes

⁷ An 8% increase announced after May 1, 1970.
⁸ Available 4th Qtr.

⁹ Unit designed primarily for source data collection.

GENERAL CONSIDERATIONS									
MANUFACTURER	OUTPUT MEDIA							SPECIAL FEATURES	first installation
	computer format	number of tracks	reel size (inches)	density BPI	IBM compatible	options	pooler required		
BURROUGHS CORP.	Compatible to all major mag. tape systems	7 9	5 7/8 8 1/2 10 1/2	200 556 800	Yes		Yes		December 1968
CALIFORNIA COMPUTER PRODUCTS, INC.	Card				Yes			Fixed data insertion Self checking Batch total Left zero insert	May 1967
COMMUNITYTYPE CORP.	Character Serial ASCII EBCDIC	7 9	7	200 556 800	Yes	None		Record counter Aero balance Self check digits. Auto pooler List I/O accumulator	October 1970
CYBERCOM CORP.	Cartridge		Special: 6 3/8 x 3 3/16	200 800	After pooling	None	Yes		December 1969
DATA ACTION	Tape Cartridge ⁵ EBCDIC	9	IBM standard cartridge	20	No	None	Yes	Cartridges are compatible to IBM 2495 cartridge reader. Pools to 7- or 9-channel tape; up to 1600 BPI.	January 1970
DATA INSTRUMENTS CO. ¹			Tape cassette	20	No		Yes	Model T-30 terminal transfers messages via telephone to remote cassette recorder.	Early 1970
DIGITAL INFORMATION DEVICES, INC.	Character Serial ASCII EBCDIC	7 9	8 1/2	200 556 800	Yes	None	Yes	Communications on-line 360/30 or itself	August 1969
HONEYWELL, DATA PRODUCTS DIV.	ASCII EBCDIC	7 9	10 1/2	200 556 800	Yes	Card punch Paper tape	Yes K-712		July 1968
IBM CORP. ¹	EBCDIC MT/ST	9		20	No	None	No	IBM 2495 tape cartridge reader needed for direct input.	1968
INTERNATIONAL COMPUTER PRODUCTS INC.			Cassette		No	None	Yes	Requires ICP DigiVerter to convert cassette to 7- or 9-track tape.	May 1970
KEYMATIC DATA SYSTEMS CORP. ¹	EBCDIC	7 9	Mini to 8 1/2	556 800	Yes		Yes	Expanded keyboard functions.	
MAI EQUIPMENT CORP.									
MOHAWK DATA SCIENCES CORP.	Character Serial ASCII EBCDIC	7 9	5-10 1/2	200 800	Yes	Card punch Paper tape	Pools up to 3 tapes		April 1965
MOTOROLA INSTRUMENTATION AND CONTROL INC.									November 1969
THE NATIONAL CASH REGISTER CO.	Character Serial Bit Parallel	9	10 1/2	800					
PERIPHERAL BUSINESS EQUIPMENT, INC.	Character Serial ASCII EBCDIC	7 9	7 10 1/2	200 556 800	Yes	Card punch Paper tape	Yes	Unique multi-station operation w/o cpu	April 1970
POTTER INSTRUMENT CO., INC.	Character Serial ASCII EBCDIC Other	7 9	up to 10 1/2	200 800	Yes	None	Yes		June 1969
SANGAMO ELECTRIC CO.	Character Serial BCD EBCDIC	7 9	7	200 556 800	Yes	None	Yes		March 1969
SYCOR, INC.			Cassette		No	None	Yes	Cassette pooled to 800 BPI, 9-track IBM compatible tape.	February 1969
UNIVERSAL DATA ACQUISITION CO. ⁹			Cassette	64		Paper tape	Yes	Requires UDAC 5600 converter for IBM 7- or 9-track compatible tape.	August 1969
VANGUARD DATA SYSTEMS	ASCII EBCDIC	7	10 1/2	200 800	Yes	Paper tape Card punch	Yes	Interfaces with 200 data set MOR-2000 Document Readers (Motorola)	August 1969
VIATRON COMPUTER SYSTEMS CORP.			Cassette		Yes	Card punch	Yes	Cassette pooled to 556- or 80-BPI 7- or 9-track IBM compatible tape, 6" reel.	October 1969

NOTE: An empty space means that no information was available at the time chart was produced.

¹ Questionnaire not received for survey.

⁵ Using the pooler, converts to 7 track at 800 BPI or 9 track at 1600 BPI.

⁶ 5% discount

⁷ 9% discount

^{7a} An 8% increase announced after May 1, 1970.

⁸ Available 4th Qtr.

⁹ Unit designed primarily for source data collection.

MARKETING CONSIDERATIONS

how is unit/system sold	order lead-time	system maintenance	purchase price (basic)	maintenance rate per month	lease rental per month	lease term
Direct			\$8,790 (N7200) \$9,090 (N7500) \$9,290 (N9800)	Included in lease rate	\$170 \$178 \$185	1 yr.
Direct	2 mos.	Seller	\$4,750	\$30		3 mos.
Direct	3 mos.	Sub-contractor	\$7,000	\$50	\$160	4 yr.
Direct	2 mos.	Seller	\$8,300 (Key Encoder)	\$20	\$155	1 yr.
Direct	2-3 mos.	Seller Reps OEM	\$6,900	\$20	\$155	1 yr.
			\$24,950	\$100	\$695	1 yr.
by MAI	3 mos.	by MAI	\$5,800	\$15	\$145	1 yr.
Direct	70 days	Seller	\$7,750 (700) \$7,500 (900)	\$21	\$152 \$177	1 yr. 3 yr. 5 yr.7
Direct	6-9 mos.		\$9,605	\$66	\$175	
Direct	2 mos.	Seller	\$2,490			
	2 mos.		\$7,900 (7 track) \$8,750 (9 track)	\$28 \$30	\$150.10 \$166.25	1 yr.
Direct	8 wks.	Seller	7,200 ^a (1101) \$8,000 (6401)	\$20 \$24	\$120 \$145	1 yr.
Direct	1-2 mos.	Seller	\$7,500 (7 track) \$8,500 (9 track)	\$50		1 yr.
Direct	3 mos.	Seller	\$7,000	\$18	\$133	1 yr.
Direct Reps OEM	4-5 mos.	Seller	\$7,250 (7 track) \$8,100 (9 track)	\$20 (7 track) \$25 (9 track)	\$140 \$165	1-3 yrs.
Direct	1-2 mos.	Seller	\$7,640 (7100) \$8,200 (9100)	\$18 (7100) \$22 (9100)	\$140 \$155	1 yr.
Direct	1-2 mos.	Seller	\$7,000	\$30	\$150	1 yr.
Direct Reps	3 mos.	Seller RCA Honeywell Fed Electric	\$1,485	\$30		
Direct Reps Distributor	1 mo.	Seller Reps Distributor	\$7,500 (KB600) \$8,500 (KB800)	\$15	\$143 \$163	1 yr.
Distributor	6-9 mos.	Seller	\$2,640	1/2 of 1% of purchase price	\$55	3 mos.

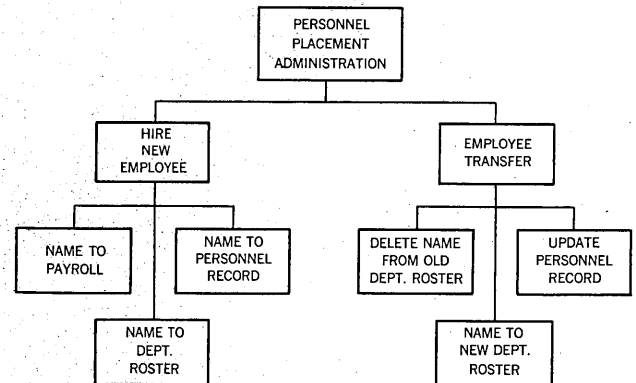
KEYPUNCH REPLACEMENT EQUIPMENT . . .

cial operations that are common to the keypunch—error release, duplicate, skip, left zero, fill, etc.—and functions unique to tape equipment, such as memory backspace, field backspace, end of tape mark, etc. The mechanism for performing the entry is seldom a simple open-contact closure as in the keypunch but instead includes sealed reed or mercury switches, Hall-effect integrated circuits, photoelectric diodes, and proximity transducers. Some keyboards are so quiet mechanically they simulate an adjustable key click as an aid to the operator. Options may include multiple-key interlocks or two-key rollover that allows only one key to be read out at a time if several keys are depressed simultaneously. The last key released is the last key read out.

Most other keyboards use a standard typewriter layout and although this design is not, strictly speaking, a keypunch replacement device it is close enough to justify inclusion.

display and control panel

All the key stations make provision for local display to show the operator the current mode: write, read, verify and program select or program verify (in units with internal storage), and current status and error conditions. In addition, a digital display shows the character position in the record and the last character keyed in the write and verify modes or the character stored in the current position in the



read mode. Single characters may be indicated by rear illumination, projection, or character-forming gaseous discharge tubes.

Several designs feature a CRT which permits a display of a complete record. In the Sanders 6000, for example, a replica of the source document form is displayed and the operator fills in the character locations in sequence as indicated by a cursor.

In the stand-alone units, the processor column might better be thought of as a "controller" since present costs prevent the use of a computer with high speed storage and full arithmetic capabilities at each station. However these units are far from unsophisticated. The now almost classical approach, pioneered by Mohawk Data Sciences, implements high speed skip, duplication, formatting, error detection and correction, data and program display, and variable record length recording.

With the cost of minicomputers dropping dramatically over the last few years, multiplexing a number of key stations onto a disc by means of a shared processor would seem to be an obvious extension of the concept, particularly where more than 10 or 12 stations can operate in a cluster. An added consideration is that *much* more sophisticated supervision of the operation of the key stations takes place.

(Continued on page 89)

SHARED PROCESSORS

MANUFACTURER	NAME MODEL / NUMBER	CHARACTERISTICS OF RECORDED DATA				number of standard formats	EDITING	
		minimum record (characters)	maximum record (characters)	maximum per field characters	maximum fields per record		before release	after recording
ADDRESSOGRAPH MULTIGRAPH CORP.	AM Series 600 Data Entry System (manufactured by Computer Entry Systems Corp.)	20	496	Record size	Record size	12	Yes	Yes
COMPUTER MACHINERY CORP.	Keyprocessing System Model 9	1	240	64	32	300 ¹⁰	Yes	Yes
CONSOLIDATED COMPUTER	Key-Edit Series 100	20	80-240	Record size	Record size	63	Yes	Yes
DATA SYNETICS CORP.	Magnescrifer M-1	1	400-1000	400	400	1000	Yes	Yes
ENTREX, INC.	Series 480	1	Any	Any	Any	1024	Yes	Yes
GENERAL COMPUTER SYSTEMS, INC.	Data/Tape 2100		200	50		none	Yes	Yes
HONEYWELL DATA PRODUCTS DIV. ⁵	Keyplex	1	400	400	400	400	Yes	Yes
INFOREX, INC.	Informex Key Entry System 2901 (Keystation) 1301 (Control Unit)	16	125	125	125	4	Yes	Yes
LOGIC CORP.	LC-720 KeyDisc System	1	160 or optional	Record size	Record size	1,000	Yes	Yes
MOHAWK DATA SCIENCES CORP. ⁷	9000 Series		80					
PENTA COMPUTER ASSOCIATES, INC.	KeyLogic	14	200-400	32-200	57	200 ⁸	Yes	Yes
PERIPHERAL BUSINESS EQUIPMENT, INC.	Magnetic Data Recording System Models 4302, 4303, 4304	20	80-200	80-200	80-200	Unlimited ⁹	Yes	Yes
REALTRONICS, INC.	R1 Controlled Data Entry System	1	192	192	192	191 ¹⁰	Yes	No ¹¹
SANDERS ASSOCIATES, INC.	System 6000 Display Data Recorder	1	1,024	1,021	340	Unlimited	Yes	No
THE SINGER CO., FRIDEN DIVISION	Magnetic Data Recording System Models 4302, 4303, 4304 (See entry under Peripheral Business Equip. Inc.)							
SYSTEMS ENGINEERING LABORATORIES	Keytran	1	398	128	32	1000	Yes	Yes

NOTE: An empty space indicates no information was available at the time this chart was produced.

⁵ Preliminary information only.

⁷ Questionnaire not received for survey.

⁸ Up to 1000 from tape.

⁹ Accessed from master tape program.

¹⁰ Operator can use 2 formats
with options up to 7.

GENERAL CONSIDERATIONS

KEYBOARD		DISPLAY			OPERATOR AIDS				PROCESSOR	
IBM 029 compatible	type	form	simul-taneous display	field position	control function	error	audible alarm	backspace	program-mable	operator change
Yes	Reed relay	Alpha-numeric	1	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Yes	Solid-state	Alpha-numeric	1	Yes	Yes	Yes	Yes	Yes	Yes	No
Yes	Solid-state	Alpha-numeric	1	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Yes	Contact	Alpha-numeric	1 (alpha) 9 (decimal)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Yes	Reed relay	Alpha-numeric	480 (crt) with roll up/down	Yes	Yes	Yes	Yes	Yes	Yes	Yes, limited
Yes		Strip printer	Variable	Yes						
Yes		Alpha-numeric	1-4	Yes	Yes	Yes	Yes	Yes	Yes	
Yes	Solid-state	Alpha-numeric	125	Yes	Yes	Yes	No	Yes	No	No
Yes	Electronic	Alpha-numeric	1 Optional, 240-char. crt	Yes	Yes	Yes	Yes	Yes	Yes	Supervisor only
Yes	IBM-029	Alpha-numeric	1	Yes	Yes	Yes	Yes	Yes	Yes	No
Yes	Solid-state	Alpha-numeric	1	Yes	Yes	Yes	Yes	Yes	No	
Yes	Light	Alpha-numeric	1	Yes	Yes	Yes	No	Yes	Yes	No
Typewriter (standard) 029 (optional)		Alpha-numeric crt	All		Yes	Yes	No	Yes	No ¹³	No
Yes	Solid-state	Alpha-numeric	1 (standard) 3 (optional)	Yes ¹²	Yes	Yes	Yes	Yes	Yes	Yes

¹¹ Can edit after recording on disc.

¹² Field name display optional.

¹³ Factory modification of controller.

GENERAL CONSIDERATIONS									MARKETING				
MANUFACTURER	OUTPUT MEDIA							SPECIAL FEATURES	first installation	how is unit/system sold	order lead-time	system maintenance	
	computer format	number of tracks	reel size (inches)	density BPI	IBM compatible	options	pooler required						
ADDRESSOGRAPH MULTIGRAPH CORP.	Character Serial ASCII EBCDIC	9	10½	800	Yes	Line printer typewriter	Optional	System/360 Interface is standard. Any tape switched to any operator.	February 1970	Direct	3 mos.	Seller	
COMPUTER MACHINERY CORP.	Character Serial ASCII EBCDIC	7	10½	556 800	Yes		Inherent		July 1969	Direct	3-6 mos.	Seller	
CONSOLIDATED COMPUTER	Character Serial ASCII EBCDIC	7 9	10½	556 800	Yes	Card punch Line printer			November 1969	Direct	2-3 mos.	Seller	
DATA SYNETICS CORP.	Character Serial ASCII EBCDIC	7 9	8 and 10½	200 556 800	Yes	Paper tape Card punch	Inherent	Separate recording on journal tape to insure against loss.	July 1970	Direct	4-6 mos.	Seller	
ENTREX, INC.	Character Serial ASCII EBCDIC BCD	7 9	up to 10½	556 800 1,600	Yes	Card punch Paper tape	Inherent		June 1970	Direct	3 mos.	OEM	
GENERAL COMPUTER SYSTEMS, INC.	Character Serial	7 9	10½	200 556 800 1,600	Yes		Inherent						
HONEYWELL DATA PRODUCTS DIV. ⁵	Character Serial EBCDIC BCD	7 9		800 556	Yes		Inherent		January 1971				
INFOREX, INC.	Character Serial ASCII EBCDIC	7 9	8½	556 800	Yes		Inherent		January 1970	Direct	6-9 mos.	Seller	
LOGIC CORP.	Character Serial EBCDIC ESCII	7 9	10½	200 556 800 1,600	Yes	Paper tape Card punch	Inherent	Output media either IBM 1316 disc pack or compatible mag. tape.	March 1969	Direct	4 mos.	Seller	
MOHAWK DATA SCIENCES CORP. ⁷													
PENTA COMPUTER ASSOCIATES, INC.	Character Serial EBCDIC ASCII	7 9	Mini to 10½	556 800	Yes	Card punch Paper tape	Inherent		January 1970	Direct	3 mos.	Seller	
PERIPHERAL BUSINESS EQUIPMENT, INC.	EBCDIC	7 9	7 and 10½	200 556 800	Yes	Card punch Paper tape	Uses 4303 or 4304	No disc for intermediate storage. Can pool on-line.	April 1970	Direct	3 mos.	Seller	
REALTRONICS, INC.	Character Serial EBCDIC BCD	7 9	8½ and 10½	200 556 800	Yes	None	Inherent	Tape may be written on/off line.	January 1970	Direct Reps	3-4 mos.	Seller OEM Reps	
SANDERS ASSOCIATES, INC.	Character Serial EBCDIC BCD	7 9	7	800	Yes		Inherent		December 1969	Direct	3 mos.	Seller	
THE SINGER CO., FRIDEN DIVISION	(See entry under Peripheral Business Equip. Inc.)												
SYSTEMS ENGINEERING LABORATORIES	Character Serial ASCII BCD	7 9	10½	200 556 800	Yes	Card punch Paper tape	Inherent		April 1970	Direct	3 mos.	Seller	

NOTE: An empty space indicates no information was available at the time this chart was produced.

² 15% discount.

³ 5% discount.

⁴ 10% discount.

⁵ Preliminary information only.

⁶ One year—\$3,490; 2-yr.—\$3,100;

3-yr.—\$2,730.

⁷ Questionnaire not received for survey.

⁸ Up to 1000 from tape.

⁹ Accessed from master program tape.

¹⁰ Operators can use 2 formats with options up to 7.

¹¹ Can edit after recording on disc.

CONSIDERATIONS				MULTIPLE-INPUT SYSTEMS									
purchase price (basic)	maintenance rate per month	lease rental per month	lease term	NUMBER KEYSTATIONS		MONITOR STATION					INTERMEDIATE STORAGE		
				basic	maximum	device	entry monitoring	monitor software	supervisory functions	optional functions	storage capacity		
\$16,200 Approx.		\$360 Approx.	12-15 mos.	2	6	Any keyboard	No					4M char.	
\$98,000 (for 10 key stations)	\$336	\$2,225	1 yr. 5 yr. ²	10	32	Console switches Lamp display ASR-33	No	No	Batch output Record format Load from tape	Format printout Tape labeling	Operator analysis On-line batch Transfer	7.25M char.	
\$87,000 (LEVEL I) \$131,700 (LEVEL IV)	\$400 (LEVEL I) \$630 LEVEL IV	\$1,660 \$2,510	1 yr. ³ 3 yr. ⁴ 5 yr.	8	32	ASR-33	No	Yes	Place format program into memory. List current batches being entered or verified. Transfer data from drum to tape. Erase.		Multiple field Batch totals Alphanumeric Checking range Limit check Arithmetic check	.7M-5.6M char.	
\$123,800 (for 8 terminals)	\$309.50	\$3,095	1 yr.	8	31	Any of the terminals ASR-33	Yes	Yes	Perpetual activity logs. Operator statistics Batch status reports Record format printouts System diagnostic tests Control totals Output tape writing			600,000 char. on disk plus addressable storage tapes	
	\$230 Basic			8	64	CRT and I/O typewriter	Yes	Yes	Entry to storagee Delete or charge Delete or change Assign programs to key stations Initiate pool merge			1.4-5.5M char.	
\$155,000		\$4,250	1 yr.	19	31	Std. GCS keyboard & printer terminal						850K char.	
\$150,000		25 KB \$2,800- \$3,800		8	64	ASR-33	Yes	Yes	Control and monitor			3.5M char.	
\$25,500 (control unit) \$1,200 (key station)	\$50 (control unit) \$4 (key station)	\$560 \$ 50	1 yr.	8	8	All key-stations have monitors (crt)	Yes	Yes	Record counts Verify error Count Balancing Job status		On-line communications	688K char.	
\$150,000	\$510 (for 14 stations)	\$2,500 ⁴	5 yr.	12	64	ASR-33	Yes	Yes	Reordering of records Operator performance			7.25M char. or 29M char.	
				16	32	Controller/Multiplexer	No		Up to 40 programs (any 4 called to keystations)		Accumulators	2,400 ft. std. tape reel	
\$110,000	\$375	\$3,000	1 yr.	8	64	IBM Selectric	No		Format table generation System monitoring File output control			2M char.	
\$7,000- \$530,000	\$18-\$1200	\$133- \$10,000	1-3 yr.	1	64	None required						700-2,400 ft. mag. tape	
\$102,900	\$286	\$2,060	1 yr. ¹³ 3 yr. 5 yr. ¹⁴	8	32	ASR-33	No		Control and monitor		Suspend task Resume task Move task	3M char.	
\$16,616	\$90	\$464	1 yr.	1	11	None required						1,024 char.	
\$117,500 (with 16 terminals)	\$596	\$3,435	1 yr. 4 yr. ¹⁵	Variable	48	IBM Selectric	Yes	Yes	Assign Reassign Erase Delete List Date	String Load EOJ Suspend Dump Format	Type Status Tape Alert Save	Bid on special request	2.6-5M char.

¹² Field name display optional.

¹³ 10% discount.

¹⁴ 13% discount.

¹⁵ 15% discount.

MULTIPLE-INPUT SYSTEMS

MANUFACTURER	INTERMEDIATE STORAGE		PROCESSOR			MARKETING CONSIDERATIONS		
	number input records	device description	storage capacity	optional software	options incl'd in basic system	incremental cost/KB	incremental lease per mo.	incremental maintenance per month/KB
ADDRESSOGRAPH MULTIGRAPH CORP.	60,000	Small mag. tape reel	Not required					
COMPUTER MACHINERY CORP.	56,099	Disc 12.5ms avg. latency 80ms sek time	12K 12 bit words	Operator analysis Automatic batch transfer Check digit control		\$3,150	\$85	\$13
CONSOLIDATED COMPUTER	8,820-70,560	Drum 17ms avg. access time	8K-32K bytes 12 bit/bytes	See monitor options		\$4,500 (9-16KB) \$3,700 (18-32KB)	\$85 \$70	\$20
DATA SYNTHETICS CORP.	Variable and unlimited with tapes	Fixed-head disc DEC RS08 Dectape transport	8K 12 bit words	Comprehensive	PDP-8/I RSO8 disc DEC tape transports 7/9 track incremental tape transport	\$3,600	\$90	\$9
ENTREX, INC.		Disc 8ms avg. access time 105ms max. Fixed and removable disc cartridge	16K bytes 8 bit/bytes, up to 64K bytes	Check digit Sort Auto batch transfer Batch total Intra-record arithmetic Operator performance		\$2,990	\$65	\$10
GENERAL COMPUTER SYSTEMS, INC.		Fixed-head disc	12K bytes @ 16 bit/bytes					
HONEYWELL DATA PRODUCTS DIV. ⁵		Disc	16K/core 16 bit words					
INFOREX, INC.	5,500 records 125 char. long	Disc	ROM - 4K bytes R/W - 4K bytes 8 bit/bytes	On-line tape-to-disc communications		\$1,200	\$50	\$4
LOGIC CORP.	40,000 or 160,000	IBM 2311	Varian 620/i 8K bytes 16 bit/bytes			\$2,500	\$46	\$8.50
MOHAWK DATA SCIENCES CORP. ⁷	Up to 38,400	Up to 7 tape drives 14 max. with dual processor				\$3,900	\$60	\$5
PENTA COMPUTER ASSOCIATES, INC.	106,000	Fixed-head disc 17ms. avg. access time	32K bytes 8 bit/bytes	none required		\$4,200	\$100	\$12
PERIPHERAL BUSINESS EQUIPMENT, INC.	Variable					\$4,500	\$84.75	\$12
REALTRONICS, INC	54,502	Fixed-head disc 17ms avg. access time 15,360 char./track	32K-64K 6 bit/bytes	Batch balancing Sort/merge, Range testing Automat format switching Generalized editing Table look up Record insert, List		\$5,520	\$115	\$5
SANDERS ASSOCIATES, INC.	1	Magnetic core	None (Controller multiplexes up to 12KB to 4 tape handlers.)			\$4,522	\$140	\$35
THE SINGER CO., FRIDEN DIVISION	(See entry under Peripheral Business Equip. Inc.)							
SYSTEMS ENGINEERING LABORATORIES	2.65-5.5M char.	Movable-head disc 25ms max latency 30ms to 145ms access time	8K-16K 16 bit words		Standard SEL 8108	\$2,700	\$80	\$14

NOTE: An empty space means that no information was available at the time chart was produced.

⁵ Preliminary information only.

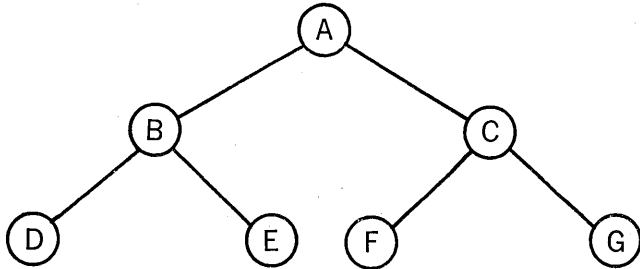
⁷ Questionnaire not received for survey.

**KEYPUNCH
REPLACEMENT EQUIPMENT . . .**

The supervisor often defines specific jobs, assigns the operator who will transcribe the data, receives reports on the operator performance (i.e., keystrokes per hour) and of job status and disposition. The intermediate storage medium is generally a fixed or movable-head disc (Consolidated Computer uses a drum). Where a disc pack is used, no final disc-to-tape transfer need be implemented.

In the case of the shared-processor systems, output media refers to IBM 729 or 2400 Series compatible tape units; the stand-alone units may, of course, also utilize this class of tape handler.

The use of a cassette or cartridge (in this context, the word "cassette" refers to a commercial quality "Philips-type"



cassette of 0.150-inch-wide magnetic tape, typically 300 feet long; "cartridge" refers to all other types) represents a recent innovation in the stand-alone group and differs from the previous class fundamentally in that a tape pooler is required (the others may use it optionally) to convert cassette or cartridge data into properly formatted computer

tape. Except for its reduced bulk and cost per station, this latter technique is similar operationally to the earlier key-to-tape systems. Record buffering is generally employed with this approach as well, with several exceptions—including the IBM Model 50 and Data Instruments Dataplex Series 100. Although both these systems generate special tapes without a shared processor, both require a computer and extensive software to reformat and edit the data.

The various columns of information under "Marketing Considerations" are self-explanatory but special attention might be paid to the date shown under "First Installation." Examples where delivery had not been made prior to this survey (the data, hopefully, is current up to April) allows the reader to apply a figure of merit to the rest of the associated information by that manufacturer.

some final comments

Finally, a word of caution to those readers who want something more than a panoramic view of this dynamically changing equipment. All of the systems noted are much more than a keypunch replacement in that their *total* operations permits considerably more sophistication than simply increasing keystroke speed. Procedures such as methods of entering and changing record formats, corrections of procedural errors and engineering design decisions influencing system reliability and maintainability, are all vitally significant in the selection of a system and yet are not simply reducible to parameters that can be listed in a table. It is hoped the table will serve as a starter for those who may finally want this level of detail and allow them to focus on systems that warrant a detailed examination. □

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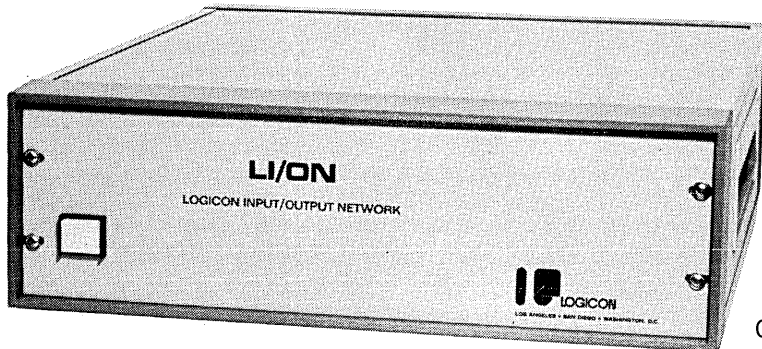


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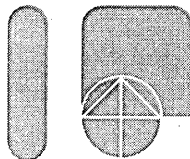


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DATA PREPARATION AT BLUE CROSS

a happy user.

by John R. Landon

Data preparation costs at Blue Cross of Southern California have grown to the point where today they are a significant part of the over-all data processing budget. Although the cost of computer processing has actually decreased during the last decade, the cost of preparing data has increased substantially because of higher labor costs.

It has also been increasingly difficult to fill our needs for operators to handle the present workload, let alone future requirements. Thus we have been interested in new data preparation equipment that might be more efficient.

For several years we used keypunches, and they were satisfactory for the volume of general claims being processed, but with the advent of Medicare and Medicaid the scope of data preparation increased considerably.

Prior to our expansion, our data preparation section consisted of 40 keypunches and verifiers, and approximately the same number of operators working one shift. As the workload increased, it was apparent we needed a more efficient data entry system. After researching the market in 1967, we selected the key-to-tape encoder (NCR 735, manufactured by Mohawk Data Sciences).

Generally, data preparation and input rates increased considerably; prior to tape input, a card reader was used as an input device resulting in an extremely slow process of getting data into the computer. There were some cases where using tape was a compromise because a number of our routines had been designed to read and audit cards as they were being brought into the system; however, revisions were made to our computer programs to read card images on tape and then later perform the audits on the input data.

Another advantage was the fact that the encoders could be used for both keying and verification of data, solving the problem of balancing the numbers of card punches and verifiers. We had some problems with the key-to-tape units, however. We process many different types of claim forms and transactions, all resulting in a lot of minireels on a daily basis. All these small reels had to be pooled and merged on either a 1200 or 2400 foot reel for computer processing. Poolers are costly, averaging approximately \$180 a month each. For our volumes, it was necessary to have two sets and a third set could easily have been justified. One operator was assigned at each set of poolers to mount and unmount minireels, control, and monitor the pooling activity. Since there were three shifts, there were five operators involved in the pooling at a monthly cost of \$2,500 in salaries, over and above the cost of the poolers themselves.

Training for the key-to-tape system presented another drawback. We found it took several weeks before an experienced keypunch operator could work with any degree of efficiency. In some ways, a key-to-tape unit is relatively

simple to operate; in other ways, it's rather complicated. An operator has to be able to interpret each problem that arises, analyze it and then correct it. Although key-to-tape proved better than keypunches, it was not the ultimate answer.

In the summer of 1968, we investigated Computer Machinery Corp.'s new KeyProcessing System.

The system is controlled by a small computer, and it includes intermediate disc storage where each individual keystation's output can be held until verified and, on command transferred in correct sequence to tape.

We knew this concept was new, untried, and unproven; however, we felt it had enough potential advantages over other methods to justify our investment in a feasibility study. We undertook a twelve-week feasibility study to determine productivity, operator training requirements, reliability, pooling versus no pooling, quality and performance, data control and personnel acceptance. The bulk of the work to be processed was "live data" and was input directly into our daily systems. As a result, we decided to go ahead and the first KeyProcessing System was installed in July of 1969. Six months later, our entire data entry operation was converted and we are now using three CMC-9 Systems and a total of 60 keystations.

It was the capability of limited verification that made the CMC equipment attractive to us at the beginning. Using a number of 80 character records for one document and being limited by program control, selective verification is impossible. Therefore, we are designing large records up to 480 characters for the KeyProcessing System, as an exam-



Mr. Landon has been with Blue Cross of Southern California for four years as manager of data processing. Before that he held various positions with Allstate Insurance Co. He is active in the development of educational programs for the nontechnical manager and a member of DPMA. He has a BA in business from Bradley University.

ple, to verify any one field without being restricted with program control.

During our three-month evaluation study, additional tests were made in our general claims department utilizing the variable length record under programmed control rather than multiples of 80 character records which often require "free punching." When a "free punching" condition exists, automatic functions such as auto skip, duplication and the like are limited. The results of this additional testing in our claims processing showed that productivity increased as much as 15% to 20% over key-to-tape units.

Our study showed that the keying speed of a data preparation operator is basically the same with CMC equipment as it was with the key-to-tape unit. However, additional productivity was realized due to tape handling, operator involvement being eliminated completely. All format programs are stored in the system and program loading is simple.

The KeyProcessing System is basically software-oriented. For example, we can automatically transfer completed batches, upon supervisory command, in any desired sequence, from the disc onto a single reel of tape. Our preliminary testing has shown that the elimination of poolers resulted in savings of \$2,500 a month.

Savings also have been realized on hardware costs. Aside from the poolers themselves, we have eliminated approximately 10% of other related equipment. We believe it is possible to operate at top efficiency in our present environment with the KeyProcessing System with five less operators than with previous methods. As our workload increases, we anticipate proportional labor savings due to the fact that fewer operators will be needed to process additional workloads. Since the system basically supervises itself, we also anticipate having to use less supervisory personnel as our workload increases. Other savings may result from the fact that we can measure operator efficiency on a daily basis. Without making the operator feel that she is being "checked on" or on display, we will have daily information as to the total number of records processed, total number of keystrokes, total minutes of write and verify time, and total errors corrected in verification.

operator training and acceptance

It was anticipated that operator training would be simpler for the KeyProcessing System. When we converted from keypunch to key-to-tape, it took an average two and one-half weeks before a girl began to approach her keypunch efficiency on the encoder. When we converted to KeyProcessing, we found that an encoder operator is adequately trained in one day. After learning the concept, the operators needed from one and one-half to two days before they regained their original level of proficiency. One operator, for example, with five years' keypunch experience and two years' encoder experience, averaged 10,823 keystrokes per hour during the twelve-week study period. (A rate of 8,000 keystrokes per hour is used to estimate workloads, according to various industry sources. This rate is usually attained when working from legible, well-designed source documents and well-designed formats applicable to the particular type of data preparation equipment in use.) Another operator with only ten months' experience on the encoder was able to average 9,583 keystrokes per hour and another girl with ten months' keypunch experience and one year on the encoder averaged 9,809 keystrokes per hour.

The most convincing figure was for an operator with only a typing background—no keypunch or encoder experience. After two days she was able to average 6,871 keystrokes

per hour. We think that now we will be able to draw largely from typing talent and, in two days, train a competent operator.

The study also showed that when 80-character records were used, operator performance was about the same as with key-to-tape equipment. However, when longer records were used, the average keystrokes per hour increased more than 10%. We think that most competent operators will continue to average 8,000 or 9,000 keystrokes per hour. We do have girls at Blue Cross who can key, for a sustained period, at rates of 12,000, 14,000 and 20,000 keystrokes per hour on CMC equipment, and it is anticipated to establish 10,000 keystrokes per hour as a measurement of the mean for the proficiency standards of the operators.

When we first converted to key-to-tape, we found some operators reluctant to make the change. With cards, they could see what they were doing and handle the cards. With key-to-tape systems, there was a certain amount of tape handling, but the feeling of keying into "nothingness" did present some problems.

Even when training operators with keypunch experience only, we have found that retraining on the KeyProcessing System is comparatively easier. The display panel, for example, helps negate the feeling of working with an intangible, and the column counter lets them know where they are. When we first started working with this equipment, we let the girls try the system and gave them the opportunity to critique it. Some minor keyboard modifications made by CMC, such as lowering it and relocating several of the keys, were a result of this.

cards vs. tape

In our history of data preparation, we have gone from cards to minireels to what might be termed maxireels. Cards are expensive and there are storage costs, and with cards, you are always faced with the possibility of the cards getting warped, wet, mutilated, or dropping a deck and putting the entire run out of sequence.

Minireels of tape are also relatively expensive, costing approximately \$4. However, tape costs are not nearly as high as card costs and tape can be reused repeatedly. Tape can have drawbacks—a reel can be cracked, the tape can be defective or dirty and, at times, there is the problem of isolating a bad tape. But, with our present method of data preparation, most of these pitfalls have been bypassed.

reliability


During our evaluation period, the reliability of the hardware also was tested and we found that uptime of the disc, computer, and control console was 98.3%. However, to insure complete back-up, the three KeyProcessing Systems are operated with 20 keystations through a triplexor. The total system has the flexibility of switching keystations from any one system and moving up to 12 keystations to each of the other KeyProcessors. Since data preparation activities here at Blue Cross are based on three shifts, five days per week, we had a requirement of complete back-up. Another advantage of this configuration is that it allows the opportunity for the vendor to perform preventive maintenance on prime shift.

With our data processing operation at Blue Cross growing steadily and rapidly, it was almost predetermined that we make use of the latest equipment for data entry to keep pace with our main computer facilities. We must get the data to the computer as quickly and as efficiently as technology will permit. Installation of the KeyProcessing System is helping us realize that goal. ■

EVALUATION OF KEYBOARD DATA ENTRY SYSTEMS

pick one

by George R. Trimble, Jr., and Anthony J. Penta

 The punched card has been the primary means of preparing information for entry into data processing equipment since its invention in the 1890's. Recent years have seen the development of other media including magnetic tape, magnetic tape cartridges or cassettes, and magnetic cards. Even more recently, data entry systems based on small computers have been developed, providing flexibility and editing capabilities which are not available with the simpler, stand-alone systems.

Several criteria must be used to evaluate the various data entry systems. The speed with which the data can be prepared is one of the prime concerns since very large volumes of data must be keyboarded. Cost is obviously another major consideration. In any system, errors are unavoidable, and features to ensure the accuracy of the data prepared and the means used to detect and correct these errors are significant.

Speed, in itself, is not an adequate measure of the effectiveness of a system—the important factor is the total elapsed time from the beginning of the keyboarding of the source data until a clean file has been prepared for input to the applications processing program. There are many ways in which the total elapsed time can be reduced.

Human factors are another major concern in the evaluation of these systems. Since the primary input to the system is through a human operator working at a keyboard, the system must provide facilities to assure that the operator can work accurately, comfortably, and without undue fatigue. The system must also be reliable and provide backup in one form or another.

Since many new data entry systems are being developed and marketed today, the problem of conversion from existing systems to more advanced systems is another factor which must be considered. It is necessary to retrain or reorient operators to utilize the newer systems. This retraining may be relatively minor if the changes in the system and procedures are slight, or it could involve extensive retraining if the procedures are significantly different from those

currently in use.

The objective of this paper is to examine the data entry problem and to define the features and facilities which are or should be available in data entry systems.

functions of a data entry system

The first function to be examined is keyboarding the data. Human factors are obviously one of the most important concerns at this interface with the system. The success of the system depends on the ability of the operator to communicate to the system and be communicated to by the system. This is particularly important since the quality of keypunch operators has been continuously lowered during the past few years due to the increase in demand. The system must communicate information back to the operator at the keyboard, and the clarity of the system status and



Mr. Trimble is vice president of research and development for Penta Computer Associates. He has been in the dp field since 1949 when he started programming the ENIAC at Aberdeen Proving Ground. At PCA he is responsible for the design and development of application-oriented systems. The Key Logic data entry system was conceived and designed by him.

error indications is one of the primary factors.

Verification. After the data has been keyboarded into the system, it is necessary to verify that the data have been correctly entered. There are two basic ways in which verification can be performed. The fastest and most accurate is to have a different operator rekey those data which are particularly critical and compare the rekeyed data with that keyed during the initial keyboarding. Any mis-compare indicates an error either in the initial keying or in the rekeying. The second form of verification is by visual means in which an operator looks at a display of the data which was originally keyboarded and compares it with the source document. This form of verification is very slow and relatively inaccurate, since it depends on visual comparison, character by character.

Validation. Data validation is becoming more significant as a data entry function due to the ability of hardware to perform a limited amount of processing on the data as it is entered. There are many forms of validation, such as check digits, range-checking numeric fields, and checking that characters are within a well-defined subset of acceptable characters for a field. The use of small computers to control the keyboards greatly expands the capability of data validation. Stand-alone systems generally have no validation capabilities.

Data formatting. This is another function which can be performed by the data entry system. Simple formatting includes such things as inserting constants in the record being keyed, duplicating fields from one record to the next, and skipping over fields which are not to be keyed during data entry. The use of small computers to control keyboards greatly extends data formatting capability. The applications programs are much more effective and efficient if the data has been appropriately formatted.

Typically, the first run on a large computer, before processing by the applications programs, is an edit program which performs the validation and formatting functions. As a result of the editing, errors are detected in the input data and this data must be recycled through the data entry system in order to have it corrected. The more of these validation and formatting functions that are performed by the data entry system, the less these functions are required in the editing programs on the main computer. In some cases it may be possible to completely eliminate editing on

the main computer if the data entry system is capable of performing all of the required editing functions. Thus, the validation and formatting functions of the data entry system are extremely important in reducing the turnaround time or the total elapsed input data preparation time.

Output. The ultimate output of a data entry system must be in a form which is readable by the main computing system. Although punched cards are the most frequently used media for this purpose, they are usually converted to magnetic tape before input. The output of a data entry system may be punched cards, magnetic tape, disc packs, or perhaps direct communications with the main computer. Obviously, the degree of compatibility with the computer is of prime concern in selecting the machine-readable media for communication with the main computer.

Control functions. In any system, and data entry systems are no exception, it is necessary to maintain control over the functions performed. Control may be entirely manual and performed by a supervisor, or it may be automated. Control functions include such simple things as assigning tasks to operators, segregating files of data and identifying them, and keeping statistics for accounting purposes so that the originating departments can be charged for the service performed.

Errors. Errors will occur in any data entry system, and procedures for detecting and correcting these errors must be incorporated into the system. The facility with which errors can be corrected varies greatly from system to system. In a punched card system, the card in error can be removed and a correct one put in its place. In magnetic tape systems, if a record is in error, it may be necessary to create another tape and merge these two tapes to create an updated, corrected tape.

All of the functions described above are elements of the various data entry systems, and the facility with which they are implemented varies greatly from system to system. To evaluate a system, it is necessary that these functions be considered. The following paragraphs define some of the desired functions available in various types of systems, and provide a basis for comparing and evaluating these systems.

types of validation

Whereas verification assures that the operator has keyed the data from the source document correctly, validation checks that the information on the source document is itself valid according to various editing rules. Several types of validation checks are incorporated into edit programs.

The most common form of validation is character subset validation. In specific fields only restricted subsets of the total character set are permitted. For example, in numbers fields only the digits 0 through 9 should be keyed into the field. A variation on numeric fields permits + and - signs to be keyed, usually as the first or the last character of the field. Similarly in an alphabetic field all of the characters must be from the subset A through Z. The blank or space character may be handled as a special case and may be permitted in some alphabetic fields while being invalid in others. Obviously, there may also be fields in which the character set is unrestricted, and any of the characters can be entered in the field.

Special character subsets may also be applicable in certain cases. For example, in some installations only the COBOL subset of 48 characters may be valid. Hexadecimal characters are another special case and are particularly important when 8-bit bytes must be entered into the system. The usual character set is a 64-character set as indicated on the 029 keyboard. There are not enough charac-



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ters to define all 256 possible characters in an 8-bit byte, and the use of hexadecimal characters is one means of entering any 8-bit combination into a byte position. For a hexadecimal field, the valid characters are 0-9 and A-F.

The character subsets mentioned above are the most frequently occurring character subsets in editing routines. However, a particular application may have an even more restrictive character subset, so it would be useful to have a way for the user to define his own character subset which would be valid for a particular field.

The next level of validation is specifying values or ranges of values valid within the field. For example, a 3-digit numbers field may only permit values in the range 147 to 262 and 385 to 978. Anything outside of these ranges would be invalid.

non-numeric fields

In non-numbers fields, the field may be restricted to a subset of specific values which are valid for that field. For example, in a retailing application an account type might be *bu* for budget, *rc* for regular, and *rv* for revolving. Thus, only these three values would be accepted within this 2-character field. This concept could be extended to account numbers, or part numbers, or some other large set of values. Validation in these latter cases would obviously require very large tables and might require a significant amount of time.

Fields used as an identification may include a check digit as a part of the field. This is very common in credit applications in which an account number has a check digit. Thus, another form of validation is a calculation of the check digit for such a field to check the account number. The common check digit calculations are mod 10 or mod 11 with mod 7 and mod 9 check digits being used less frequently.

One of the most effective means of validating inputs is by generating totals for numbers fields. By this means, the system can compare this calculated total with an externally calculated total entered by the operator. If these two totals do not match, there is obviously an error somewhere.

Validation can be extended to cross-field dependencies in cases where values in a specific field are dependent upon the values in another field. In this case, the system must modify the validation rules for a specific field based on the particular values which have been entered in another field. For example, if the type in one field is *bu*, the numeric range in an amount field might be 0 to 250; whereas if the type field is *rc*, the value in the amount field might be 0 to 450. The cross-field dependencies which are checked in editing programs can become quite complex. However, the more of this type of validation that is possible in the data entry system, the greater will be the chance that the edit run on the main computer can be eliminated completely.

record formatting

One of the major functions of an edit program is to reformat the data which has been entered for convenient and efficient processing. Formatting includes such functions as rearranging the fields within the record and inserting characters automatically so that the operator does not have to insert them.

The data on a source document is not necessarily arranged in the order most convenient for processing. For example, sort routines work more efficiently if the sort keys are at the high order end of the record and are all contiguous. The source document may not have this information in the beginning of the document; it may be scattered

throughout the document. Thus the operator must either key the data in the order in which it occurs on the source document and then have an edit program rearrange the fields within the record, or key the fields in the order in which the applications routine expects them. A data entry system that can handle this has accomplished another function of the editing routines.

The length of a field needed may not be the same as the length of the field keyed. For example, a processing routine may expect a 20-character field in which the data entry operator would key a maximum of 10 characters. The remaining 10 characters are "field filler" and must be provided by the edit program or by the data entry system. Similarly, the record length needed may not coincide with the record length keyed, and "record filler" characters must be provided. A special case of field filler is when variable-length fields may be keyed and the system automatically left- or right-justifies the field and fills the positions not keyed with a filler character. In this case the operator might key 5 characters, then skip to the end of the field. The system should fill the remaining 5 characters of the maximum of 10, in addition to filling with the 10 filler characters which must be provided by the data entry system or edit routine.

Numeric fields are a special case in which the field is right-justified and filled with zeroes on the left when the entire field is not keyed. The left-zero fill function is a fairly common feature of data entry systems.

Many times a constant value should be inserted in one or more fields of a record. The ability to automatically insert constant values is also useful. Two forms of automatically inserted values are used. In one case the values are always inserted in a field for a particular format and do not vary from file to file. The other case is a field in which a constant value is inserted for one batch or file and a different constant inserted for another batch or file. The auto-skip feature of the IBM 029 keypunch is an example of an automatically inserted value in which the value inserted is restricted to being a field of blanks. The ability to insert a value other than blank is desirable.

Decimal information keyed into a system normally requires one byte for each decimal character. In 8-bit bytes, it is possible to pack two decimal digits into a single byte. The data entry system may provide the packing of decimal information.

other editing functions

Reading tape records is more efficient if short records are blocked into larger ones. The data entry system should do this, thus providing another edit routine function.

Two character codes are used by most dp systems today—EBCDIC and ASCII. The data entry system should provide code conversion so that the output to the applications program will be in the proper character code.

In a relatively small number of applications, decimal information should be converted to binary information for processing by the applications routine. In business applications, the processing is usually done within the cpu with decimal arithmetic. In some applications, however, primarily scientific work, the decimal information should be converted to binary to facilitate processing. This is another service which data entry systems can and should provide where appropriate.

A facility which is carried over from the days of tab equipment is cross-footing. New fields can be defined by arithmetic operations on other fields within the record. For example, field C might be defined as the sum of fields A and

EVALUATION OF DATA ENTRY SYSTEMS . . .

B. The generation of internal fields through the cross-footing operations of addition, subtraction, multiplication, and division is another desirable feature. Any generated fields should also pass the various types of validation checks before they are accepted as valid.

The facilities provided at the operator station must be oriented towards operator comfort, convenience, and efficiency. In terms of the effort expended in human factors design, the 029 keyboard developed by IBM probably represents the ultimate, or as close to it as can be reasonably achieved, for a data entry keyboard. In a sense, it might be considered as a standard.

The 029 keyboard was designed to facilitate mass data entry, and does not reflect capabilities required for other types of data entry. For example, there are a large number of girls trained to use typewriters on which the character set and keyboard arrangement is different from the 029. These two keyboards really represent two different areas of data entry. The second area is, as yet, largely untapped by the computer industry. At the present time, however, we must consider that there are two standards to be used, and the evaluation must be performed on the basis of which type of data is to be entered through the system.

In addition to the physical specifications, there are func-

tional considerations which must be evaluated. Some of the formatting functions mentioned above really apply as an operator consideration, in that they ease the burden of the keyboard operator. For example, the generation of filler characters for fields and records and the left-zero fill function help her, since she does not have to key these; as does the ability to rearrange fields within a record so that she can key from the source document in a straightforward manner; and the ability to insert constants in output record automatically.

Often a value for a particular field must be repeated for a series of records. The ability to automatically duplicate a value from one record to the next within the same field means that the operator keys the value only once and then the system automatically inserts or copies the value from the previous record to the current record. This is the auto-dup key function of the 029 keypunch. Similarly, a value which occurs frequently within a file or batch of records, but not in contiguous records, can be placed in an output record through the use of the auxiliary duplicate function. The common value is recorded in some intermediary storage; when it is required, the aux-dup key is depressed and the value is read from auxiliary storage and copied into the field of the current output record. Thus, the operator can

SUMMARY OF

KEYBOARD OPERATOR FACILITIES

Keyboard
029 Arrangement
Typewriter

Data Display
Character
English Graphic
BCD coded
Other coded
Field
Record
Formatted
Unformatted

Position Indicator
Field
Name
Number
Column within field
Column within record

Position Control
Backspace
Character
Field
Record
Forward Space
Character
Field
Record

Critical Controls
Toggle Switches
Keys on Keyboard

Temporary Termination
Only at end of Batch or File

Only at end of a Record
Any time

Number of Formats Available On-Line

VALIDATION FEATURES

Character Subsets
Numbers
Sign Control
Alphabetic
Blank Control
Alphameric
Hexadecimal
COBOL Subset
User-Defined Subset
Other

Value Set Validation
Number of Fields
Number of Values (Length of Value Table)
Field Size

Numbers Range Checking
Number of Fields
Number of Ranges per Field
Maximum Field Size

Check Digits
Mod 7
Mod 9
Mod 10
Mod 11
Other

Field Totals
Number of Fields
Length of Fields
Offset Value

Cross Field Dependencies
Sequence Checking
Record Count

FORMATTING FEATURES

Field Positioning within Record
Field Filler
Record Filler
Field Length
Packed Decimal
EBCDIC/USASCII Conversion
Other Conversion
Record Blocking
Numbers Sign Positioning
Over Units Position
Over High Order Position

Cross Footed Fields
Add
Subtract
Multiply
Divide

Validation of Generated Fields
Totals of Generated Fields
Length of Generated Fields
Maximum Number of Generated Fields

Decimal to Binary Conversion
Record Length
Maximum
Fixed
Variable

Alternate Formats
Number of Alternates
Method of Selection of Alternates

cause an entire field to be inserted through the depression of a single key.

One of the most important functions, from a human factors viewpoint, is the clear indication to the operator of the status of the functions she is performing. If the operator makes an error, and the system will not accept the requested data or functions she has requested, it should clearly and specifically indicate exactly what is in error. A single red light which indicates an error but does not tell her exactly what she did is confusing. In a keypunch, since there are no validation functions performed, a single error indication is adequate. In data entry systems based on a computer, however, the various types of validation will require different types of correction procedures, and the operator must know, for example, whether she has an invalid character, or an out-of-range value, or some other specific problem.

Closely related to error indication is the problem of error correction. Once an error has been specifically identified, the operator must correct that error. A mispunched column on a card requires that the card be removed and all of the correct columns up to the column in error be duplicated or repunched as well as the column in error. Computer-based systems permit the operator to repunch only the particular character or field in error. Between these two extremes

there are many variations: some errors can be corrected fairly easily while others require the generation of correction tapes and additional merge and update routines on the large computer.

A very desirable characteristic is the ability to correct errors in the verification process. When the verification operator has discovered that a character or field is in error, she should be able to correct the error immediately, rather than requiring that the entire record be rekeyed.

error-handling facilities

Several types of error-handling features should be available. For those cases in which the system detects that the current character is in error, the system should reject the character, indicate the nature of the error, and permit the operator to correct that specific character without any further manipulation on her part. If the operator determines that a previous character, or the entire field, is in error, she should be able to backspace over a character or an entire field.

Part of the operating procedure for some installations is to reject all of a record when any part of it is in error and the error cannot be corrected by the operator. In this case, the system must be capable of having the entire record

CHARACTERISTICS

Toggle Switch
Key Selection

Auto-Dup
Aux-Dup
Auto-Skip
Auto-Insert
Left-Zero Fill
Automatic Justification
Left
Right

Manual Skip
Manual Duplication
Character
Field

Maximum Number of Fields
Maximum Field Length

ERROR HANDLING

Error Indication
General
Specific
Keyboard Locking
Aural

Immediate Error Correction
Re-key Character
Backspace/Re-key Field

Uncorrectable Errors
Bypass Field
Log Bypassed Field
Reject Record
Deferred Correction

Verification
Re-key
Visual

Immediate Correction/Substitution
Validation During Substitution

Record Deletion
Record Insertion
In Middle of Batch/File
At End of Batch/File

SYSTEM CONTROL FUNCTIONS

System Start-Up
System Shut-Down
System Status Reports
Terminal Status
File Status

File Output Control
Output to Tape
Old Tape
New Tape
Current Tape
Output to Disc
Labelling
Merge Batches
Multi-File Reels
Multi-Reel Files
Erase File
Checkpoint Disc
Restore Disc

FORMAT (PROGRAM) PROCESSING

Generation
At Supervisor's Station
At Data Entry Station
Off-Line on other CPU

Library Storage

Magnetic Disc
Number of Formats Standard
Number of Formats Optional
Method of Selection
By Operator
Assigned by Supervisor
Magnetic Tape
Number of Formats
Available On-Line
Normally
Emergency Only
Selective Group Loading
Selective Table Loading

Library Update
Add to Disc
Delete from Disc
Replace
Add to Tape
Delete from Tape
Temporary Override
By Supervisor
By Operator

AUXILIARY SUPPORT FUNCTIONS

Sorting
Batches
Files
On-Line/Off-Line

Merge
By Batch Number
Batch Merge
File Merge
File Explosion
Batch/File Listing
Report Generation

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removed. With punched cards, it is a simple matter to remove the card. But with a more advanced data entry system, it must be possible to remove from the system that portion of the record which has been keyed, by eliminating it from the buffer or tape file being generated.

Some types of errors cannot be corrected by the operator because there is an error in the source document. Thus the system must permit the operator to bypass that field, identify, and automatically log the error which has been bypassed. With punched cards, the operator must circle the item in error on the source document and expect the correction procedure to be initiated on this basis. A preferable technique is to generate a listing of all errors bypassed because the operator cannot correct them, and use this log as a complete and accurate basis for going back to the source of the document and correcting the errors. Having obtained the corrections, the system must have facilities to permit those records which are partially complete or are known to be in error to be corrected on the basis of the error log.

A frequent error is the operator keying the same record into the system twice, or not keying a record at all. These extra or missing records can be detected by the "batch total" feature, or they can be detected on the verification pass. In either case, it must be possible to delete the extra record from the file or to insert a missing record or group of records in the file. With punched cards, this deletion or insertion is relatively simple. But some computer-based systems do not provide this capability at all, while others provide complete facilities for deleting and inserting records in the file. In some cases, record insertion may be performed by adding records to the existing file and then sorting that file so that the records passed to the main processor will be in the correct source sequence.

operator performance evaluation

The supervisor of a keypunch or data input section knows which operators are better and which poorer, largely by subjective evaluation. One of the primary advantages of the computer-based data entry system is that it is possible to gather objective statistics to help evaluate operators.

In a keypunch installation, one way to measure operator performance is simply to weigh her card wastebasket. This, however, does not indicate the number of errors which have been passed on to the computer, and these statistics cannot be gathered until the edit run on the computer has been made and the number of rejects indicated in the error listing. By this time it is frequently difficult, if not impossible, to correlate the batch of data with the operator who keyed it.

Care should be exercised in evaluating the statistics gathered by the data entry system, however, because operator performance also depends on factors not derivable by the system itself—for example, the quality of the source document. A typed document, obviously, is more readable than a handwritten one, and a smaller number of errors can be expected.

These are the basic evaluation statistics which computer-based data entry systems can gather:

1. Operator identification
2. Batch and/or file identification
3. Operator start time
4. Operator stop time
5. Number of records keyed
6. Number of source document errors which the operator had to bypass
7. Number of operator keystrokes

8. Mode of operation, that is, data entry, verify, update, etc.

9. Operator errors

The last item can be misleading because it is difficult to define. A system can keep track of the number of times an error indication is displayed, or the number of times the operator backspaces a character or field, or rejects the entire record. However, these may not be her errors but a result of the quality of the source document.

The number of errors which must be corrected during a verify run is another means of indicating operator performance. Again, however, it may be that the verify operator misinterprets the source document.

The basic data entry system must provide features to facilitate the accurate and rapid recording of data on a machine-readable medium. There are, however, many auxiliary functions that lessen the requirements on an edit program and reduce or eliminate some of the later processing runs. As an example, a common function performed prior to processing is input data sorting. If the data has been keyed in the correct order, sorting is not required. But this is not always practical. Thus, sort or merge routines that can be executed by the data entry system are very useful.

Many systems have been designed on the basis of the input data being in 80-column card image format. This means that when a source document containing more than 80 characters of information is input, multiple cards must be prepared from the source document. This results in duplication of much of the information on the additional cards and increases the burden on the keyboard operator.

The key-to-tape and computer-based data entry systems are not restricted to an 80-character record. However, to take advantage of this capability, the applications programs must be rewritten so that the inputs expected are in the expanded format. This is not a simple job; hundreds or perhaps thousands of man-hours might be required. As a result, many people are preparing data in 80-column card image format for processing by the applications programs and not taking advantage of the increased capability of computer-based data entry systems.

One solution is to make one pass over the source document and keyboard all of the information as a single record. Of course, the record length limitations vary from system to system and this must be taken into account. Once the source data has been captured, however, and each item of information has been keyed only once, the data entry system can explode this record to prepare an output file to be processed. For example, a record which would require 4 punched cards or 320 characters might be compressed to 150 characters if all of the redundant information is removed. Then the records could be keyed as 150-character records. The output programs would not write the file as a single 150-character record, but could generate 4 output files, each of which is a card image duplicate of what the applications programs would expect. By this process, the applications programs do not have to be rewritten, yet advantage is taken of the data entry system to reduce the keyboard requirements. The 350- to 150-character reduction is not an exaggerated example but is representative of very large keyboarding reductions which can be obtained if the record explosion capability is part of the data entry system. Thus, this feature is a very significant factor in evaluating the data entry system.

Computer-based data entry systems can use standard computer peripherals, so many additional functions are potentially available. For example, a simple function such as listing a file is a very desirable capability. Simple report

generation capabilities will permit the data entry system to perform limited processing and report preparation from the basic files which have been keyboarded, without requiring the main computer, and thus reduces the processing load.

Any system requires some degree of control. The supervisor of a keypunch installation normally provides most of the control. There are several things which she must do that can be automated and will therefore increase her efficiency.

When a file of data is to be keyboarded, it must be controlled by a format which specifies the characteristics of the data to be keyed. In a keypunch installation, there is a file of 029 drum cards which the supervisor will give to an operator when a job is assigned. This file is, in a very real sense, a data format library whose formats must be generated, maintained, modified, and at times overridden for the job to be performed. This is relatively simple with the 029 drum card, since these can be generated on a keypunch; the maintenance consists of simply removing those which are obsolete and inserting new ones in the file. Modifications to an existing drum card can be made by simply punching a new card.

Computer-based data entry systems maintain the library of data formats or programs on a disc file which is an integral part of the system. The same functions of format generation, maintenance, modification, and override must be available to the system even though these formats are stored on a magnetic disc or drum.

The data formats can be generated through an operator's terminal or through the supervisor's terminal. In some cases the data formats can be prepared externally on another computer and the formats loaded into the data entry system through a magnetic tape drive. It is essential that the supervisor be able to prepare and enter formats into the system through her terminal.

The computer-based system must also permit deletion of a format from the library, the addition of a new format to the library, or the modification of an existing format. It should also allow the supervisor to enter a temporary override to a format for a particular job so that it is not necessary to create an entire new format for that job.

The assignment of a format to a keypunch operator is done by the supervisor giving her the format card. In the data entry system, two ways are available. In one approach, the supervisor assigns a format to a particular terminal, and the operator then must go to that terminal. This is not quite as flexible since it restricts the use of the terminals, and the operator has the problem of assigning specific terminals to jobs. The other way is to have the supervisor identify the format to be used by a symbolic name or number and then have the operator enter this identification at the terminal which she happens to select. The system will then use that format table to control the selected terminal.

The supervisor must know the status of the system at all times so that she can assign tasks to operators as required. In a keypunch installation, this is done manually, and the supervisor must keep her own record defining which jobs have been assigned to which operators. The supervisor must also manipulate the decks of cards produced and pass them on to the next function in the system, mainly verification or card-to-tape conversion.

helping the supervisor

In a computer-based system many of the control functions required can be automated. Since the system knows what job is being worked on at each terminal and by each operator, the supervisor can simply request that the system type out a "status log" which identifies the jobs currently in progress, whether they are active or complete, whether they

are data entry or verification, and any other significant information.

One of the major functions of the supervisor is control of the completed jobs. She forwards the cards to the computer center for the next step in processing, if the data entry system is a keypunch installation. For key-to-tape installations using stand-alone units, it is necessary that the supervisor pool tapes (when different parts of a file have been keyboarded by different operators) so that a single tape is transmitted to the computing center for processing. In a computer-based system, this function is performed by the supervisor requesting that the completed files be moved from the disc to the tape. Since a disc is used as the intermediary storage in this type of system, pooling is eliminated.

One of the primary means of controlling information in a computer center is the use of labels written on the tape or disc drive containing a file of information. The system should be able to place labels on the tape or disc for more effective control of completed output files. Any labels so generated should obviously be compatible with the labels required by the larger dp system on which the applications programs are run.

For purposes of backup, the supervisor may wish to generate multiple copies of the output files. Thus, when a file is written on tape, it should not be erased from the disc until the supervisor has so directed. Similarly, if for some reason a file is no longer required, the supervisor should be able to erase the file from the disc without generating a tape or disc pack from it.

Many types of data are collected on a daily basis but are not processed until the end of the week or the end of the month. This means that the data must be maintained somewhere until it is processed. If the data entry system has enough internal storage to maintain this amount of information, then auxiliary file manipulation procedures are not required. Since, however, internal storage is usually limited, it is desirable to output the data from a day's keyboarding operation to a temporary tape and then add information, which is to be included in this output file, to that tape without requiring pooling of the tapes. This simply means that the previous day's tape should be mounted, and the supervisor should be able to write a file at the end of that tape.

system evaluation

Since the requirements for an individual installation will vary depending on the nature of the data being processed and the characteristics of the main computing system, the buyer must establish the criteria by which he will evaluate the data entry system. For example, if his main computer has only disc packs as inputs and no magnetic tape, then the data entry system must generate its outputs on a disc pack. If the data to be prepared consists of a large percentage of records containing account numbers with check digits and a few numeric fields for which batch totals are available, then the check digit and batch total features of the data entry system would be very important.

The user must weigh the various factors and do a cost-effectiveness evaluation on the basis of his specific needs. The variety of available data entry systems makes the task of evaluation a fairly complex one. It is hoped that the features described in this article will assist potential users of data entry systems in determining what their data entry requirements are and which features are important for them, so that they can evaluate their needs and select the system which is most appropriate. ■



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SHARED PROCESSOR KEYBOARD DATA ENTRY

the software side

by A. H. Rosbury

Shared processor keyboard data entry systems may be about to work a revolution. Still in the fledgling stage with only about 60 systems in use, this burgeoning new application of the mini/midi computer promises to transform the chatter of the keypunch into the near silent click of the electronic keyboard.

At the end of 1969, more than 60,000 computer systems were operating in the U.S. alone, demanding input data that cost over \$700 million to prepare. Today, 30% to 50% of installation expense is for data preparation. These costs are rising at an annual rate of approximately 20%, and most users are hard put to supply the necessary volume of prepared data using the standard keypunch or newer key-to-tape equipment. Shared processor data entry systems, built around the general-purpose computer, shift the emphasis of the solution from single-purpose "black box" hardware to the stored program concept, with software playing the leading role in a new approach to the user's oldest problem: getting the data in!

the software system

Because the nucleus of a shared processor system is a general-purpose computer, the software used to control and direct the various data preparation activities is of paramount importance. Every major function in the process, handled previously by hardware, must now be performed by software, and all functions must be coordinated.

The design of such a software system involves the solution of many problems, but the three major areas of concern are:

1. Control of the system as a whole.
2. Communicating with the data entry stations and processing the data received.
3. Outputting the data in the desired form for subsequent processing on other systems.

A typical shared processor system, Systems KeyTran

(Fig. 1)—with Systems 810B processor, up to 48 keyboard entry stations, supervisor's console, moving-head disc, and magnetic tape—will be used as an example in examining these major areas and their basic problems more closely.

Maintaining control over all the elements of a typical shared processor system is a complex problem. At any given moment during normal operation, widely varying individual functions will have to be directed to proper completion. Examples include: the keyboard operator, entry or verification of data, supervisory messages to or from the supervisor's console, error conditions on any device in the system that needs attention, and final output of data from disc to tape. In order to allow such concurrent operation and provide the flexibility to direct a wide range of functions, the method used to control the system must itself be asyn-



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**PROCESSOR KEYBOARD
DATA ENTRY . . .**

chronous, immediately responsive, and expandable to allow for the addition of control functions.

KeyTran uses a system of asynchronously operating software modules and overlays under the control of a small executive. As shown in Fig. 2, the executive is a simple task selection scanning routine which checks a set of indicators associated with particular functions to determine which functions, if any, require action. This scanning process takes place as a background operation.

Both the scanning and the processes it activates are interrupted by routines for data input/output. When requests for processing are indicated, they are honored on a first come, first served basis, the appropriate overlay is

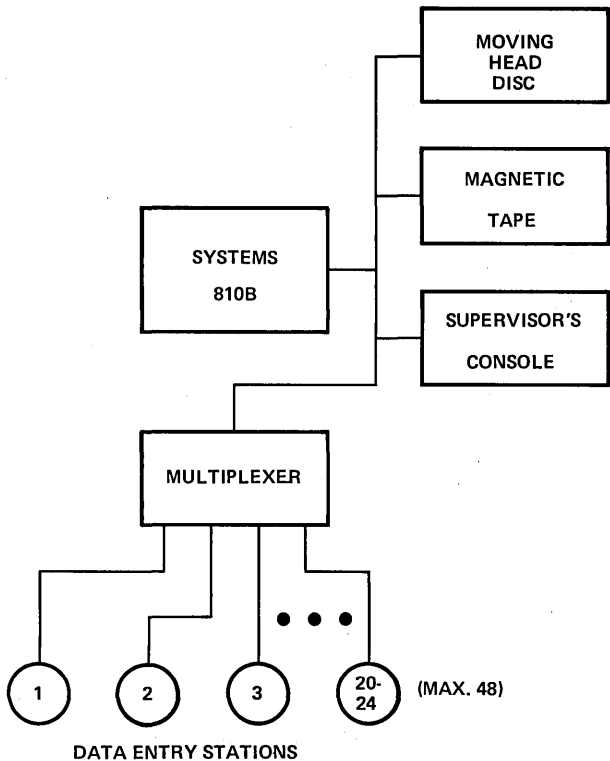


Fig. 1 KeyTran data entry system.

brought into memory from the disc library and allowed (with interruptions) to execute. When the processing is complete, control returns to the executive, and the scanning continues.

Typically, approximately one millisecond is required to complete a task selection scan. However, an interrupted scan takes only about 100 microseconds, while a scan accompanied by a full load of peripheral, supervisor, and keyboard interruptions can require a maximum of 50 milliseconds.

Expanding or modifying any of the control function processors requires only an overlay of the processor and a small modification to the executive.

the multistation—keyboard input

Before data can be accepted from an entry station it must be distinguished from the other stations. This identification is the first problem in attempting to communicate with multiple stations, and the method used must also provide for the addition and deletion of stations without requiring extensive change within the system. Other software problems include getting all the current data from all the stations, validity checking and updating the buffers of data being separately constructed, displaying the data at the

station with control and/or error signals, and transferring filled buffers to mass storage.

Typically, a varying number of stations will be in operation for varying periods of time. Each operator will enter data at a unique rate, punctuated by a characteristic series of pauses and breaks. As buffers are completed, provision must be made for keying to continue without pause while the data is transferred to disc. Display of the data at the station should be as immune as possible from such unpredictable as station or system power failure.

Initially, for KeyTran, it was proposed that individual unit numbers be assigned for each data entry station, and that all stations be connected to the processor with a shared i/o bus. The problems associated with applying this method, however, were significant. Such a system uses relatively costly and bulky cabling techniques and requires complex circuitry for synchronization of signals, identification of units, etc. The physical separation of any data entry station from the processor is limited to about 100 feet, which would force a rather dense floor plan arrangement for larger systems and exclude remote stations. Also, certain failures

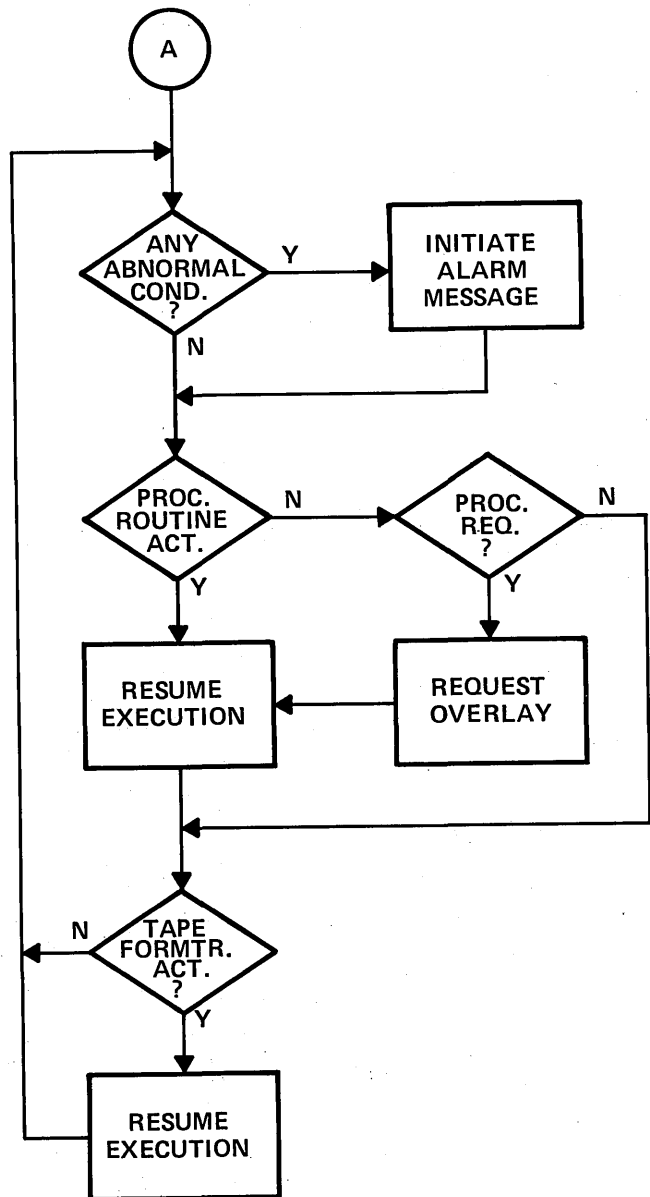


Fig. 2 Executive task selection routine.

in an individual data entry station could disable the entire system.

The use of a recently developed high-speed parallel/serial multiplexer offered a relief from most of the problems associated with a bus system. Because each data entry station would be on its own "private line," costly "share" circuitry was unnecessary, and, depending on the quality of line, physical separations of over 500 feet were possible. Also, the addition of units to the system would be very simple and straightforward. However, serialization is a time-consuming process, and some means of increasing its effective speed would have to be found or the multiplexer solution could not be used.

A resolution of this problem was achieved with the system shown in Figs. 3 and 4. On input, the data transfer begins when a key is struck at the data entry station. This initializes an automatic serialization and transfer of the data into an 8-bit register in the multiplexer reserved for that data entry station. The software may unload this register on command.

For output the software sends a series of words, four per data entry station. Each four words causes a switch to the next station until all stations are serviced. If no new data is to be sent to any particular station, the four words are zero, and no serialization takes place. Input from and output to any data entry station may be simultaneous. This arrangement creates what appears to the processor to be a single unit or "multistation." The software periodically sends dis-

play data to all stations. The multiplexer, therefore, is treated as a virgin unit for each exchange of information. Besides simplifying the exchange of data, this "fresh update" adds to the integrity of the system by preventing the loss of data due to momentary power failure.

The "smoothing" of the uncoordinated keystation operation is done by controlling the data collection/display cycle with a clock interrupt. When the interrupt transfers control to the processor routine, a request for data from the multiplexer is made. The new data is analyzed and used to update the buffers after the appropriate validity checking is done. When all updating is completed, the input data and appropriate control information is transmitted to the multiplexer for display on the entry stations. This approach allows the use of a small, simple handler with only the "multistation" to be serviced. It in turn services the separate data entry stations.

intermediate storage

Intermediate mass storage for the collection of data from the entry stations is required in a data entry system to reduce costs. For KeyTran, it was originally planned that a fixed-head disc would be used because of its rapid access speed, reliability, and associated ease of programming. As the system was developed, however, the relatively low volume of storage available and corresponding high cost per stored word resulted in the selection of a movable-head disc instead. The access penalty of a movable-head disc was

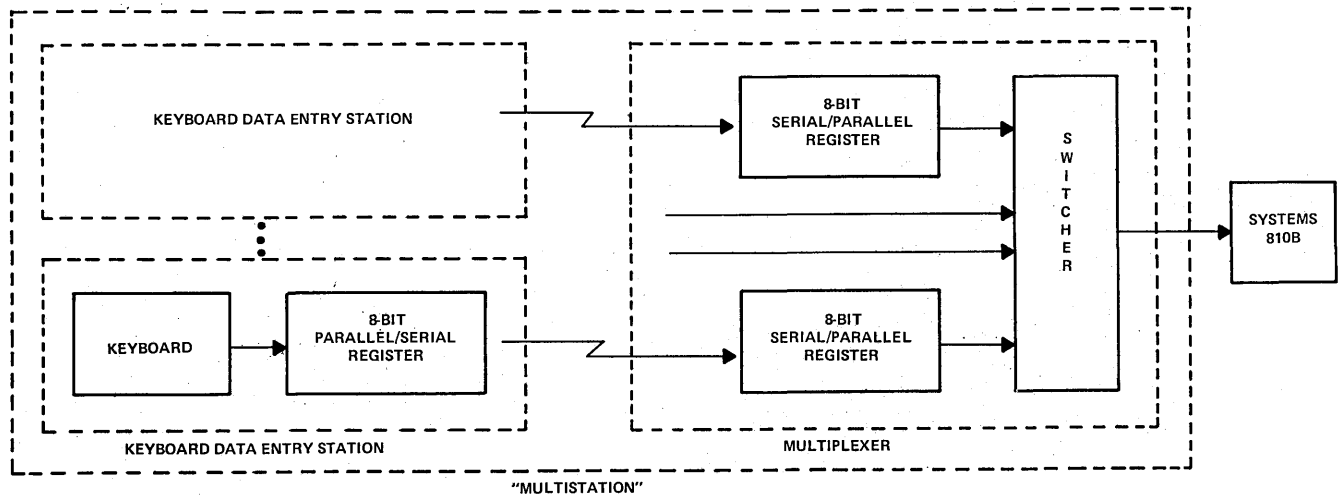


Fig. 3 Data input from keyboard entry stations.

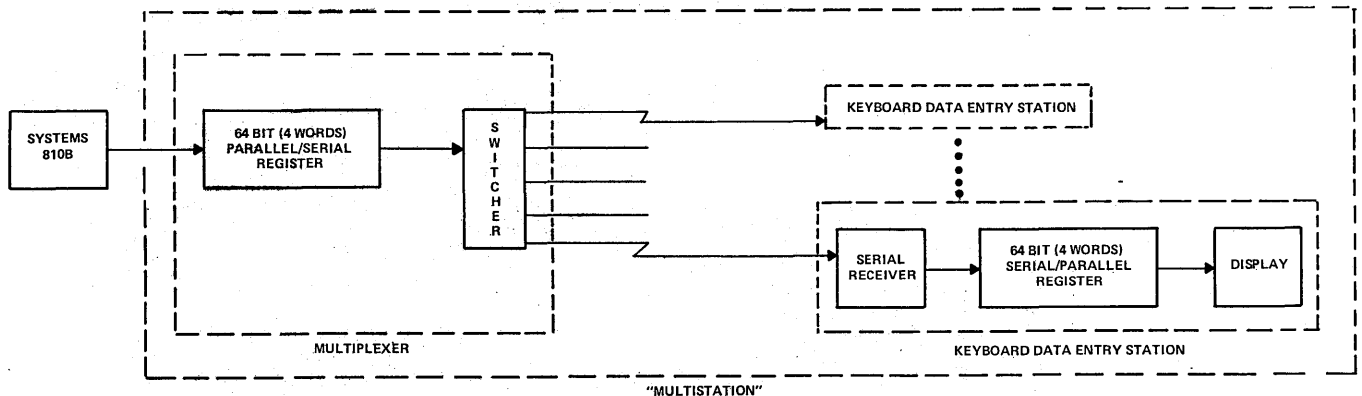


Fig. 4 Display data output to keyboard stations.

PROCESSOR KEYBOARD DATA ENTRY . . .

offset by the use of a "linked sector" allocation philosophy, in which sectors are allocated dynamically as needed, and connected to one another logically by pointers within each sector. This approach virtually eliminates disc access seek delays—since sectors are assigned continuously for all jobs.

Along with the choice of type of storage, a selection of the technique for buffering the data through memory as it was collected had to be made. After a buffer in memory is filled, keying must be allowed to continue uninterrupted while a transfer to disc is made, and the buffer becomes "available" again.

To allow for such "overflow," a sector-sized, 96-word buffer plus an extra 40 characters was originally allotted in memory for each data entry station. Keying after the first 96 words would be stored in the extra 40 characters until the

require data for several computers with different character sets. Also, the process of outputting the data to the tape should not interfere with normal data entry operations.

Transcription of the accumulated data from disc to tape is handled as a background function (Fig. 5). Using an output record format previously defined by the operator, data is collected from the disc into an appropriately sized memory buffer of up to 398 characters. All field positioning, generation of blank or skip fields, left zero filling, etc. is done as the record is constructed. A master record containing standard or other constant fields unique to the job being processed may also have been defined, and appropriate copying of information from the master (auxiliary duplication) is accomplished at this time. Duplication of any fields from the previous record is also handled during the output

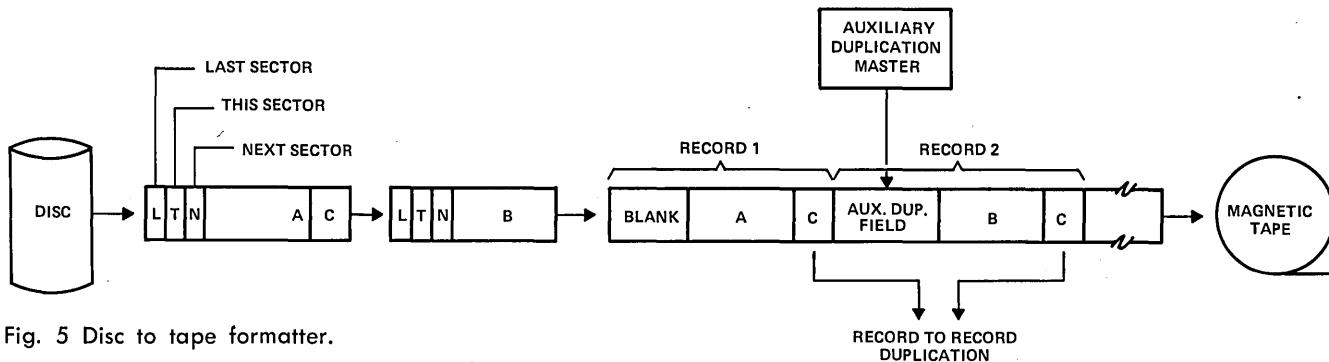


Fig. 5 Disc to tape formatter.

transfer was complete, then moved into the regular buffer and continued as usual. This approach was soon found to be inadequate, both because of its memory requirements and because of other restrictions. For instance, one of the design goals was to allow continuous forward and backward scanning in recorded data. For backscanning the "overflow" technique was cumbersome when sector boundaries were crossed, since the first data desired was at the wrong end of the buffer. Also, as features were added to the system during its development, memory requirements became severe.

Concurrent design of the handling of program format definition showed that the data defining a program format of up to 32 fields could be stored in 48 words. Using this as the key, the disc unit was modified from 96-word sectors to 48-word sectors, and double buffering in memory was used, thus eliminating the problems of keying overflow and simplifying disc storage handling. This solution introduced another serious problem, however. The change from a disc track containing sixteen 96-word sectors to a disc track containing thirty-two 48-word sectors decreased the time available for processing between sectors and made it impossible for software to accomplish sequential, multisector transfer for control program overlays. This meant at least one revolution between sectors, a prohibitive delay in program response.

Consequently, further changes were made to allow the disc controller to perform automatic sequential sector and head addressing. This made it possible for multisector data transfers of up to one full cylinder to be performed without the necessity for sequential sector addressing by the software.

The last stage of data preparation is to provide the collected and verified data in a form appropriate for further processing, usually on tape. Formatting and code conversion is necessary since the data preparation system may not use the same character set as the computer, or the user may

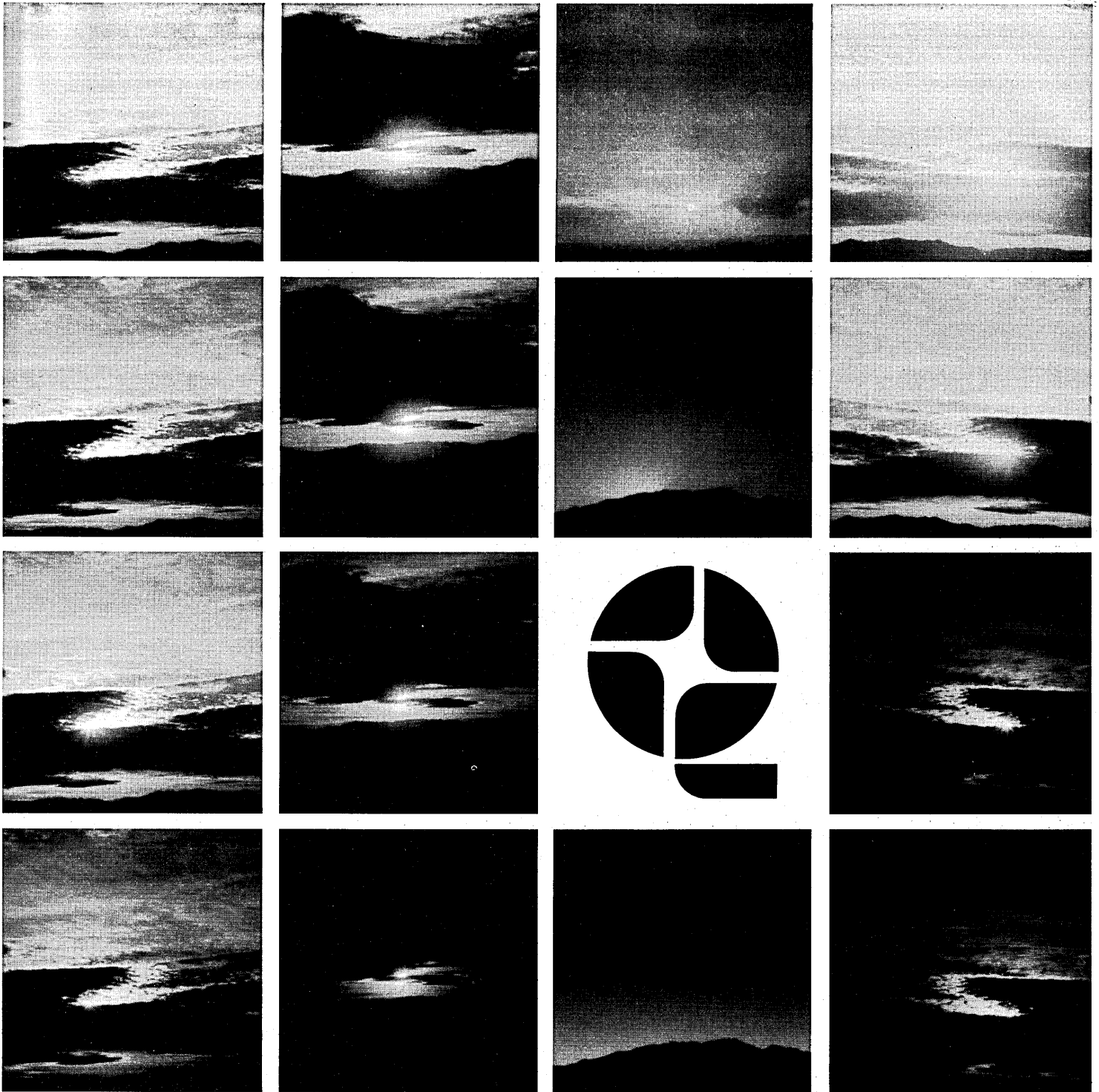
formatting. Code conversion to EBCDIC or USASCII is provided for 9-track tape, and to BCD (IBM or Honeywell) for 7-track tape. Records are unblocked.

The operation of I/O handlers is governed by hardware interrupts. After transfer of the first record or character of a block is initiated by the handler, control is returned to the task selection scan routine. When each subsequent record or character becomes ready for transfer, a hardware interrupt occurs, returning control to the handler which transfers the data and again relinquishes control. All interrupts are recognized and control is transferred within 2.25 microseconds. When the entire requested transfer of data is complete, the handler sets the appropriate software indicator to cause the executive to initiate further processing.

today's system vs. tomorrow's problems

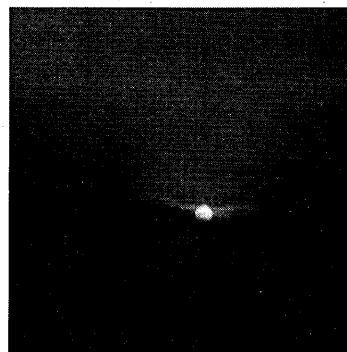
The basic functions described are present in all shared processor keyboard data entry systems. The sophistication of the control and operation, physical design, price, etc. vary from manufacturer to manufacturer, and some features, such as zero balancing, check digit verification, and the use of additional peripherals, may be standard, optional, or not available, depending on the software provided. A few likely areas for future development are background batch processing, remote data collection, communications and batch job entry, direct data entry and on-line MIS.

Currently, an estimated 600,000 keypunches and verifiers are installed in the U.S., with approximately 80% of these units in clusters of 14 or more. Such large-scale input facilities accentuate the need for total data entry systems, rather than individual units. Shared processor systems satisfy today's requirements, and through continuing software development will meet tomorrow's needs as well—indicating the input function is beginning to come of age. ■



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A LARGE-SCALE DATA ENTRY SYSTEM FOR THE IRS

cardless

by C. Frank Hix, Jr., and John E. Magsam

Large-scale data entry systems can be defined as those requiring in excess of 200 data entry terminals to handle the application. Such a system was designed and developed by the General Electric Co. for the Internal Revenue Service (IRS). At the present time, three systems are installed—one in the southwest region (Austin, Texas) with 384 keystation terminals; one in the southeast region (Chamblee, Georgia) with 384 keystation terminals; and a larger one recently installed in the western region (Ogden, Utah) with 560 terminals. Austin and Chamblee anticipate processing 120,000 documents per day and Ogden approximately 180,000 documents per day during the peak period of this tax processing year.

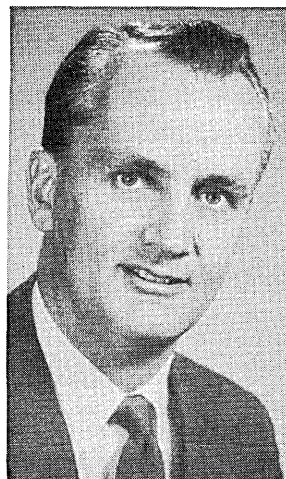
With this solid, successful experience, GE is interested in marketing large-scale data entry systems on a custom basis; i.e., GE will supply the required hardware, the operational software, and, at the customer's discretion, an application software package.

Virtually any computer information systems manager knows the frustration of coping with the problems generated by punched cards. The initial keypunching of the cards, the verification and validation of these cards, the accounting controls of the cards through various stages of processing, and the repeated handling of the cards are all costly, time-consuming, error-prone operations. In addition, the physical facilities required to house keypunches and verifiers and to store vast quantities of blank and punched cards add to the cost and inconvenience involved.

In the IRS this problem becomes horrendous when you consider the number of items to be processed. In noting the advantages of the direct entry system, the Congressional Record, 1968, states, "Upon installation of the Direct Data Entry System in all seven IRS centers, the punching and processing of some 400 million cards per year will be eliminated. Reduction in key verification and error resolution requirements should produce savings of several million dollars per year to the Service."

Features and capabilities incorporated into the direct data entry system are as follows:

1. Provides increased rates of data entry into the system. The electronic keyboard accepts information approximately 7% faster than a key punch—roughly equivalent to the time saved in the transition from a manual to electric typewriter.
2. Provides validation checks of the entered data before the verification process.
3. Reduces the necessity for key verification of the entire entered message.
4. Provides operator capability for correcting transcription errors on line.
5. Provides the capability for sorts, merges, and edits within the system.



Mr. Hix has been with GE since 1949 and has managed systems engineering activities since 1959. He is currently responsible for the system configuration, staging, and installation of special systems involving both special and standard edp components for the Information Systems Equipment Div. He has long been associated with digital processors in aerospace, satellites, and commercial systems. He has BSEE and BSMS degrees from the University of Colorado.

6. Provides accurate, quick, and simple control of processes to be used for handling various types of documents and their requirements for processing.

Large-scale data entry operations have many of the same functional requirements as an on-line computer system for process control. The significant characteristics applying to



The IRS Service Center in Ogden, Utah.

both applications involve the volume of data input in a variety of forms, the random nature of data entry into the computer, the need for queueing systems, many internally stored process programs, the use of priority sequences in controlling operations, extensive coordination and control of program and memory resources, and an elaborate "interrupt system" to maintain i/o and processing activities at their most efficient levels (Fig. 1).

The GE/PAC 4020 process control computer has the necessary features to meet these requirements. In addition, it can utilize large amounts of bulk storage, in the form of disc and tape subsystems, to contain input data. Large data entry systems also require significant amounts of working core and also some form of rapid access bulk storage, such as a drum that can be used as an extension of working core.

A slightly modified DATANET-760 keystation terminal device provides the operator input. A specially designed keyboard was utilized to obtain optimum operator perfor-

mance.

The DATANET-760 consists of up to 32 keystation terminals, each having a CRT for display of data. The CRT displays up to 184 characters (four lines) of information that is keyed into the keystation terminal prior to transmission to the processor. An entry marker is utilized over a character in the text to indicate position and permit the operator to change specific characters as required. The entire information displayed on the CRT is transmitted to the processor when the release key on the keyboard is actuated. The DATANET-760 is connected to the system via a serial communication data channel. Data transfer to the processor occurs asynchronously at a data transfer rate of 3520 baud. Transmission between the DATANET-760 and the processor conforms with ASCII and EIR-RS 232B industry

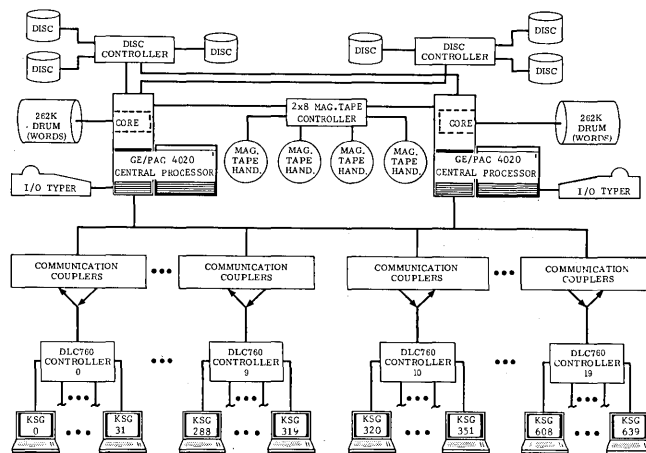


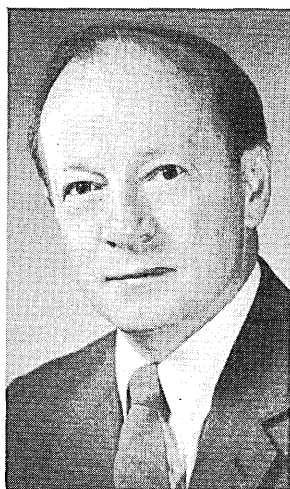
Fig. 1 Direct data entry transcription system.

standards, thus facilitating the use of data sets and communication phone lines in remote terminal applications.

Input/output processing activities are accomplished concurrently through the use of automatic program interrupts.

As illustrated in Fig. 2, program instructions are executed at a rate much faster than data input/output transfers can take place. Since both the program instructions and i/o transfers occur at their maximum rates, i/o activity is concurrent with process activity. The steps taken in this process are:

1. The monitor program makes decisions and gives control to the appropriate process program.
2. Process program receives control of the computer.
3. Instructions of the process program are executed in sequence.
4. Interrupt occurs.
5. Control is transferred to the instruction related to the device causing the interrupt.
6. Instruction is executed.
7. Control is returned to the interrupted process program.
8. Process program instructions are executed in sequence.
9. An interrupt occurs.
10. Control is transferred to device-related location.
11. Instruction is executed—it is transfer of control instruction.
12. Control is transferred to service program.
13. The reference area and monitor information areas are interrupted.
14. Control is returned to the process program.
15. Process program instructions continue to be executed



Mr. Magsam has been with GE since 1956 and since 1968 has been manager of the IRS project which includes the planning, directing, and implementing of GE direct data entry systems at designated IRS sites. He is responsible for quality control, scheduling, installation, and customer acceptance of all IRS systems. He holds a BS in physics from St. Joseph's College.

DATA ENTRY FOR IRS...

in sequence.

The operating system performs three major functions: it coordinates all i/o operations; it coordinates and controls the system resources such as service programs and routines, memory allocation, queues, error detection and recovery procedures, and priority and status tables; it coordinates

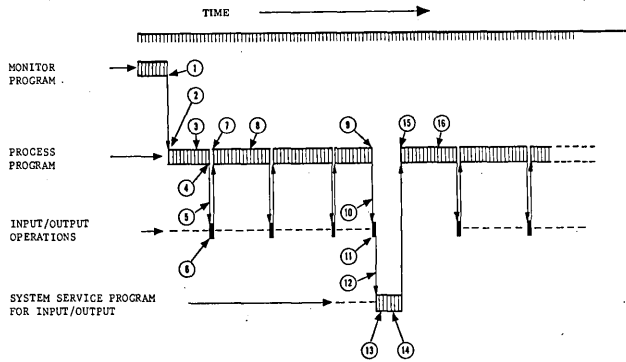


Fig. 2 Concurrent processing and I/O activities.

and controls the application program assignments in order to maintain efficient flow of data through the system.

The primary application program tasks are original entry, validation, and verification.

Original Entry. The oe function is accomplished as follows:

1. The oe operator selects work for input.
2. The operator then enters data from document (work reflected on CRT screen).
3. When document is complete or when the screen is filled, she releases data to drum for temporary storage by striking the release key.

Validation. The validation function is accomplished in the following steps:

1. When the oe data is entered on drum, the operating system initiates a request for execution of the validation program.
2. The validation program removes data from the drum, performs mathematical balance checks, format checks, etc. and sets indicators to specify which portions of the drum require verification.
3. The validated data with its indicators flows to a working disc for temporary storage.

Verification. The verification program is accomplished as follows:

1. The kv operator selects oe'd block from work batch.
2. kv operator recalls data to the working segment of the drum for verification.
3. The operator accomplishes verification of block and corrects errors if applicable.
4. The operating system releases data from the drum to a working disc for temporary storage. In background mode processing, the data is transferred to disc and tape for permanent storage.

The kst operator works in a real-time environment. The response time as she transcribes the document data to the CRT screen is immediate. When releasing information to the computer system, the average response time for a group of 320 operators entering various types of documents in the original entry mode was measured at 0.4 seconds (Fig. 3). This measurement was made with 320 operators entering data in the oe mode. The graph indicates that 80%, or 256 of the total 320 operators, received a response from the computer in less than 0.5 sec. Another 13%, or 42 more, received their responses between 0.5 and 1.0 sec., thus a total of 93%, or 298 operators, received responses in less

than one second. The remainder of the operators received responses in less than 2.0 sec. This particular measurement, conducted with a load simulator processing typical IRS documents, involved 12,306 responses. This order of response time is typical of the system and has been demonstrated on the production work at the IRS service centers.

if trouble occurs

Although the two central processor systems normally operate independently, with the DATANET keystation terminal load approximately equally divided, system redundancy has been provided to minimize interruption time to individual keystation operators in the event of a hardware failure in the computer/peripheral complex. Redundant peripheral i/o devices have been provided for access to tape, disc, and keystation subsystems. Each processor system contains the necessary drum and core capacity to process data from more than 600 keystation terminals. In the IRS application, if a processor failure should occur, all keystation terminals can be switched to the remaining processor and all keystation operators can continue to process data, with some retardation of throughput.

The operating system also contains the functions necessary for initialization, restart, and end-of-shift operations.

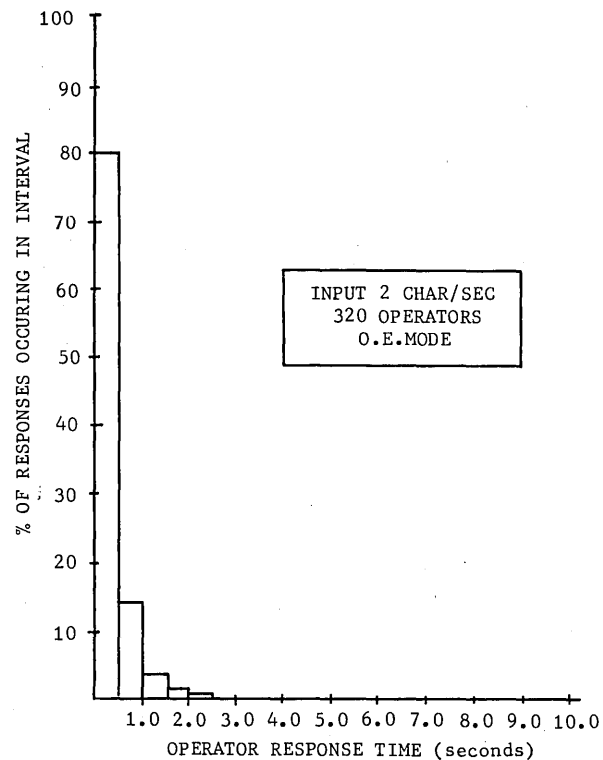


Fig. 3 Operator response time.

The keystation operator in the data entry system has an expanded role over her counterpart in the keypunch operation. As indicated earlier, the operator is a decision-maker in the processing of information, and she carries on an intelligent dialogue within the system.

The total system concept of processing data has greatly pleased the keystation operators and the management people in the IRS. Ervin B. Osborn, director of the Southwest Service Center in Austin, Texas, stated, "Of particular interest is the enthusiasm for the Data Entry System shown by our personnel and the ease with which we have trained our employees in its use." Other benefits cited by Mr.

Osborn are:

1. The employee turnover rate has been reduced.
2. The noise level has decreased tremendously, contributing significantly to employee comfort and efficiency.
3. Many of the problems associated with hiring and training personnel have been minimized."

Cardpunching is eliminated in the direct data entry system; therefore, the "80-column barrier" is broken. With the data entry terminal, practically any amount of data can be entered directly into the system as a logical record. Files in a direct data entry system can be formatted as desired. The file organization shown in Fig. 4 is for the IRS processing format.

Up to 100 documents can be organized into a block and prefaced with a block header document. Each document is

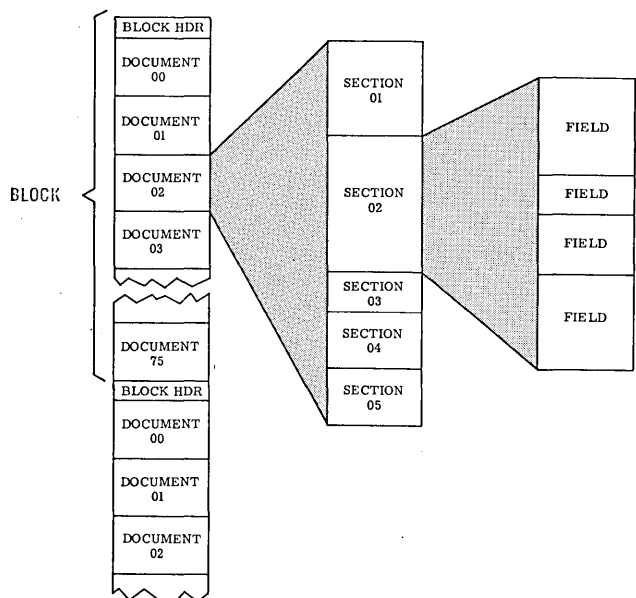


Fig. 4 Typical data format.

divided into sections which can be variable in length and quantity within a document. Each section of a document is divided further into fields which can be variable in length and quantity within a section.

summary

The direct data entry system specified by the IRS demonstrates the advantages of utilizing a total system concept in the processing of a large volume of data through a transcription area. There are many additional features not described in this article which provide further enhancement to this system. The system proved its feasibility after stringent full-load testing at the IRS Southwest Service Center in Austin, Texas. During 1969, the direct data entry system there processed the entire transcription workload associated with 1968 returns, in excess of 9 million documents. Having the experience of a full year's operation at Austin, Texas, and the additional systems installed and accepted in Ogden, Utah, and Chamblee, Georgia, the service is looking forward to increased efficiency and significant cost savings during 1970. Service centers at Kansas City, Missouri; Covington, Kentucky; Philadelphia, Pennsylvania, and Andover, Massachusetts, will be equipped with the data entry system. The General Electric Co. is extremely proud of the system performance and is presently investigating other applications for this type of large-scale data entry system. ■

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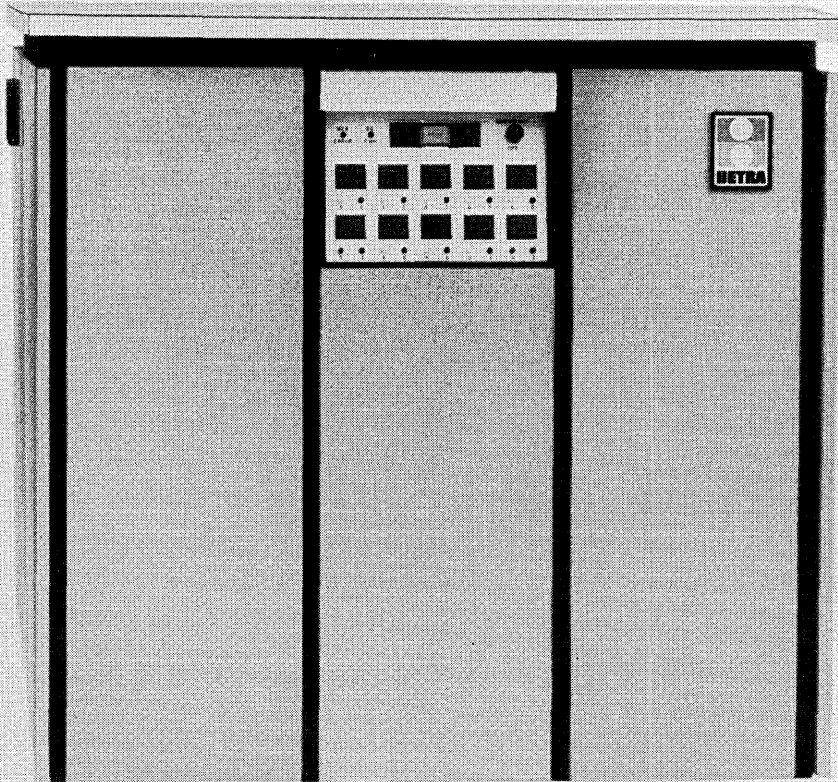
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DPMA 1970 INTERNATIONAL DATA PROCESSING CONFERENCE AND BUSINESS EXPOSITION

june 23-26

Seattle is the site of the Data Processing Management Association's 19th annual International Conference and Business Exposition—a generally well-run conference whose program stresses the more practical aspects of information processing. In honor of the occasion, Washington Governor Daniel J. Evans has officially proclaimed the week of June 22 to be "Data Processing Week." The convention will be held at the 74-acre Seattle Center, the home of the now-famous 605-foot Space Needle. Approximately 3500 people are expected to attend the 12 three-part short courses and the 10 general interest seminars. More than 20,000 will view the displays of some 100 exhibitors.

short course seminars

The exhibits will open Tuesday, the 23rd; but the seminar program does not start till Wednesday afternoon so that there won't be any conflict if you want to cover both. Each short course consists of three seminars, which will be held Wednesday afternoon and all day Thursday.

thursday:

Systems Analysis and Design
Control Considerations in Systems Operation
Real Time
Operations Management

Education and Training
Management Information Systems
Dealing with Consulting Firms in Data Processing
Documentation Requirements for Management
Computer Programming and Software Systems
Computing Equipment—Today and



Tomorrow

Topics in General Management
Technical Discussions in Computer and Information Science

general interest seminars

Ten concurrent seminars will be held Friday morning, followed by the conference farewell luncheon. A session on *Documentation and Debugging*, two tasks candidly billed as "unpleasant but necessary," will be chaired by Robert L. Brass, of Auer-

bach. Bob Bemer, of General Electric, a prime mover in "computer year" activities, will chair the seminar on *Standardization—What, Why, and How?* *Optical Character Recognition* will examine the reasons for the increased interest in ocr and its potential applications. Session chairman, appropriately enough, is Recognition Equipment's president, Herman Philipson.

The application of behavioral science in the information processing industry will be discussed in *The Human Element in the Information Processing Community*, to be chaired by William J. Horne, assistant vp for MIS at USM Corp. *Management—or Mis-Management*, which will be a discussion of effective management of computer installations, will be chaired by Gopal K. Kapur, senior systems analyst at San Jose State College. P. E. Culbertson, director of NASA's Advanced Manned Missions Programs, will head the seminar on *The Space Program—What Effect on the Computer User?* This session will discuss some new techniques developed which may apply to the computer user in a business environment. Dr. John W. Coughlan, CPA, will chair *Linear Programming*, an attempt to introduce top and middle management to the fundamentals of using linear programming to optimize solutions to common management programs. *Information Storage and Retrieval* will be a state-of-the-art re-

view. *Plotters and Their Applications and Applications of Microfilm Technology in Data Processing Systems* round out the technical program.

ladies program

Ladies activities begin Wednesday with a boat trip to Blake Island in Puget Sound and a luncheon at an Indian restaurant that includes interpretive dancing by North Coast Indians. Breakfast at the Space Needle and a trip to a shopping center are also planned. Of course, the ladies are invited to the banquet Thursday evening. Registration fee is \$45. Plan to take this opportunity for a short vacation. Since the conference ends on a Friday, you might want to enjoy a weekend in this beautiful country before returning to your respective rat-races.

tours

While Seattle can't exactly be called a hub of edp activity, there are five tours of computer installations there that should be of interest. The Boeing tour features a walk-through of a full-size 747 mock-up; and if you must, they'll probably let you see their 360/65, two 360/40's, three 360/30's, and a plotter. The Weyerhaeuser installation, based on four GE-635's, includes a nationwide teleprocessing system linking all the company's plants and facilities. Seattle-First National Bank also is a GE installation, where as many as one million transactions have been processed in a single day. Pacific Northwest Bell Telephone's computer installation processes business for the state of Washington and part of Idaho. Multi-processing, teleprocessing with Kansas City, and a microfiche system are included in the tour. The FAA runs one of its 20 air traffic control centers near Seattle. This particular installation takes care of all non-military aircraft in the Pacific Northwest. Three 360's are presently in use there. One tour is included in the full conference registration fee.

registration

The Olympic and Washington Plaza Hotels are co-headquarters. Registration will be held at the Olympic on Sunday, Monday, and Tuesday, and at the Seattle Center starting Tuesday morning. Full registration is \$90 for DPMA members and \$105 for non-members, \$15 of which can be refunded if you want to apply it toward membership dues. (DPMA currently has almost 30,000 members in 260 chapters in the U.S. and Canada and has one chapter each in Japan, the Philippines, and South Vietnam.)

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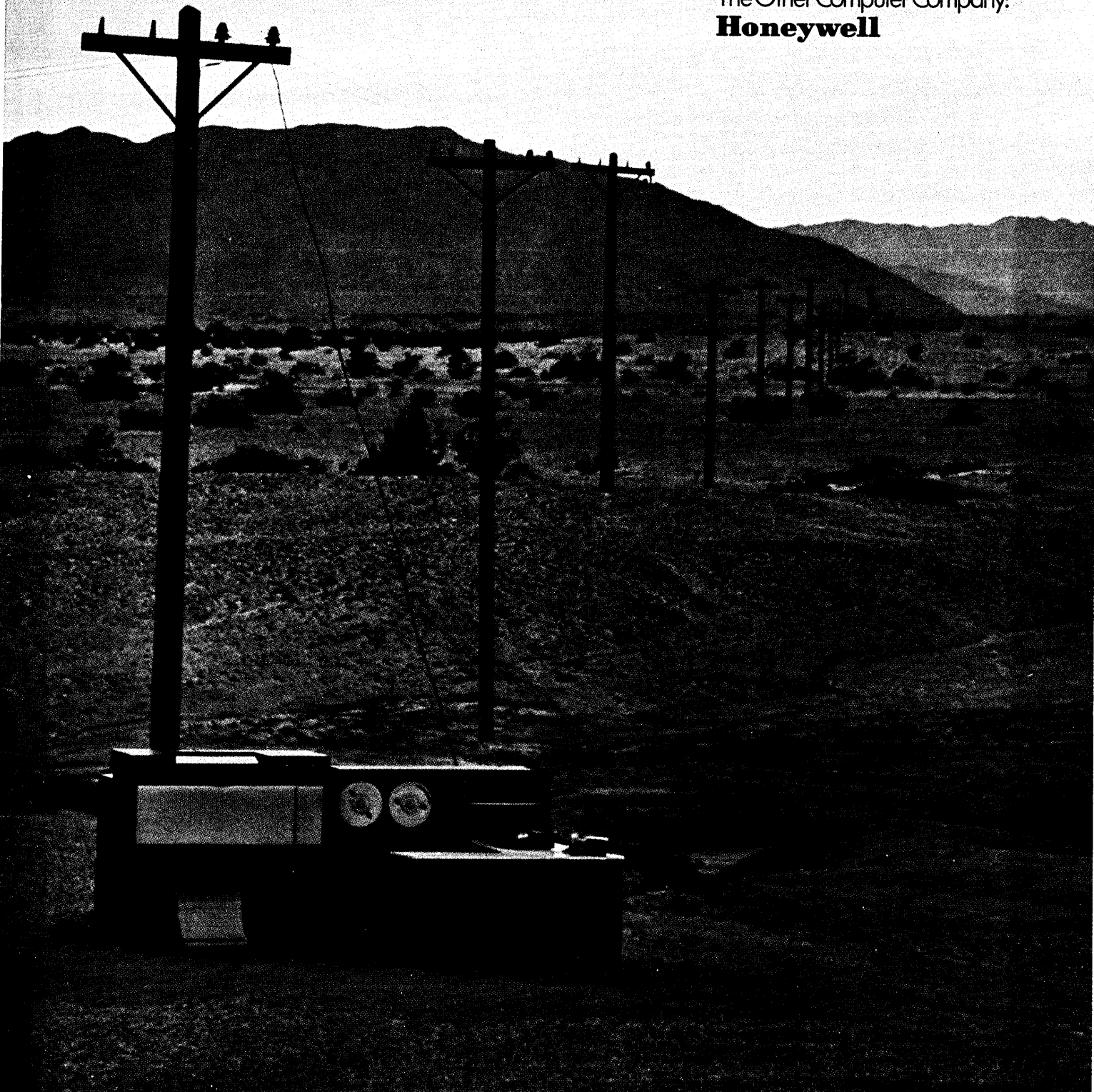
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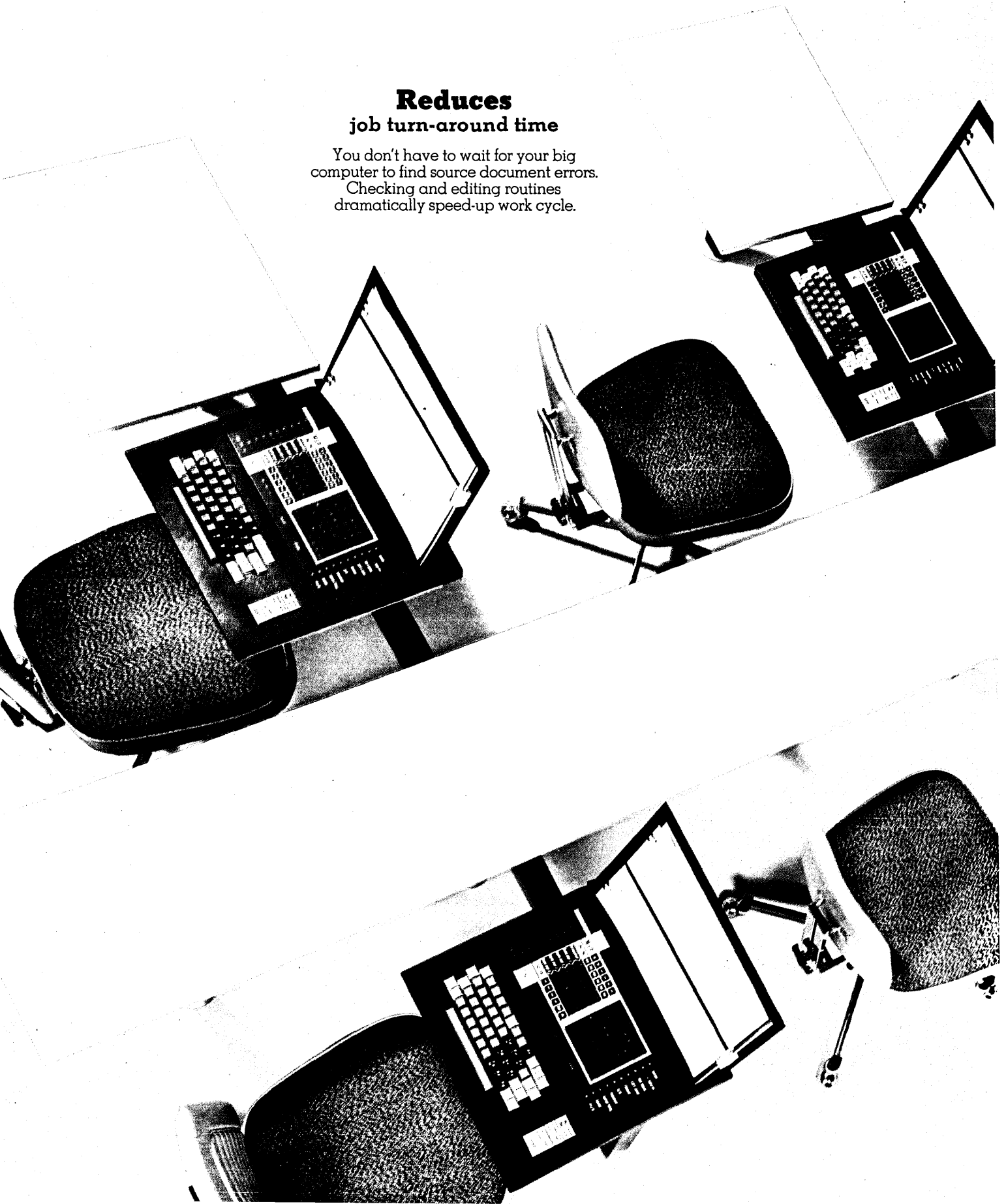
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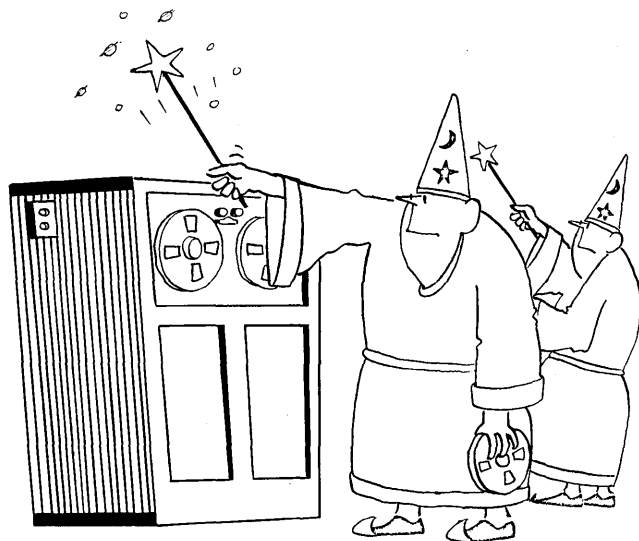
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ALSO SPRACH VON NEUMANN

CHAPTER FOUR
by Eric Blodax

with illustrations
by
Stew Burgess

 **THE PRECEDING EVENTS:** The author, having been firmly launched in a career in the computative arts by his presence at the Airship Foundry during times of great change, goes on to inhabit, for a time, the chrome-plated halls of



the monolithic tower that is the Intelligible Assurance Society. Wearying of life amidst the claims and underwritings, the author returns to the Airship Foundry to broaden his career in design of a computer-based system for the giant Stratobarn. After much travail, the Stratobarn flies, and the system limps into halting action.

Ere long we were processing data regularly from flights of the Stratobarn models assigned to test. Even the government inspectors got so they were willing to look at the truckloads of lists and channel plots which came nightly off the high-speed printer. Things began to settle into a relatively smooth routine, though the smoothness was sometimes disrupted.

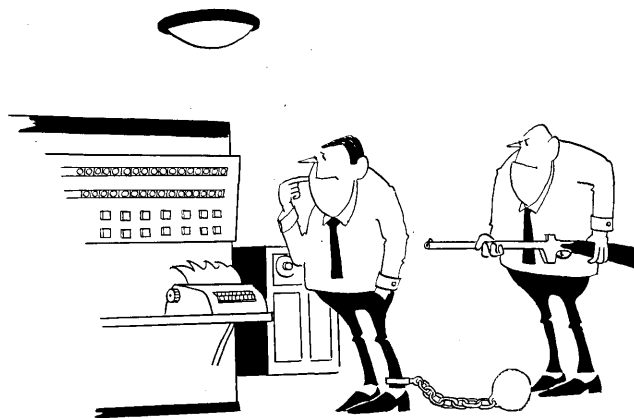
We had advanced so far in our software work on the 1103A that we actually had built an operating system, though we were not sophisticated enough to call it that, since the name had not yet been invented. We worked with a master tape which contained all the scaling and editing functions for flight data, plus all the calculation routines to produce engineering information from raw data. There were programs for airship performance, power plant performance, electrical system performance, and so on through 30 or so programs. The master tape also included the operating system which educated the computer for its night's work. Since we continually worked on improving our software, there were constant updated versions of the

master, and one had to, or at least should, use the latest at any given time.

Updating of the master tape was a cabalistic ritual attended by only a select few. There was John Swanhofer, the night programmer, and Paul Fiemo, the lead system programmer, usually aided and abetted by Betty Campylos, the lead data clerk who kept track of everybody's marbles. This trio would disappear into the computer room behind locked doors. They took with them one copy of the current master tape, a monumental pile of cards, a giant reel of punched paper tape written in dual-binary, and a prayer book with which to invoke the Bull punch not to make any false starts.

After half an hour or so, if all went well, they would emerge with three copies of the new master tape version. These had write lock rings installed, and one copy was locked in the computer room, another was locked in Paul Fiemo's desk, and the third was locked in the flight hangar, in case the computing laboratory should burn down.

Starting a data run was reduced to a fairly simple process which John Swanhofer did every night. He took the master tape, the tape file of instruments installed on all test airships, the card deck of daily data requests, and placed them all in position to be loaded. The card deck was then loaded, and the education run of the computer was ready to start. This was done with three cards colored, respectively, pink, manila, and green. The three cards were also plainly marked 1, 2, and 3, on their faces with black felt pen in case anyone should forget the magic sequence of pink, manila, and green. After this control card load, all hell broke loose on the machine. The master tape read in, the instrument list tape read in, the instrument calibration curves read in, after a brief pause, from the same latter tape. The computer went into mull mode with its green scope flashing up a storm. The scratch tapes began to write and read back like mad, and finally the console typewriter went into action, writing the instructions for the first data run to the machine operator. From this point on, one could remove the master tape and the instrument tape and the machine continued to tell the operator what to do for the balance of the night.



As fate would have it, John Swanhofer went on vacation. Someone had to take his place on the night shift, and the only available candidate was Cal Hepply, fondly known as "Old Cement-Head" to his fellow programmers. Cal was an unlikely candidate at best, but the computer education run was so simple it seemed most probable that even Cal could not honk it up.

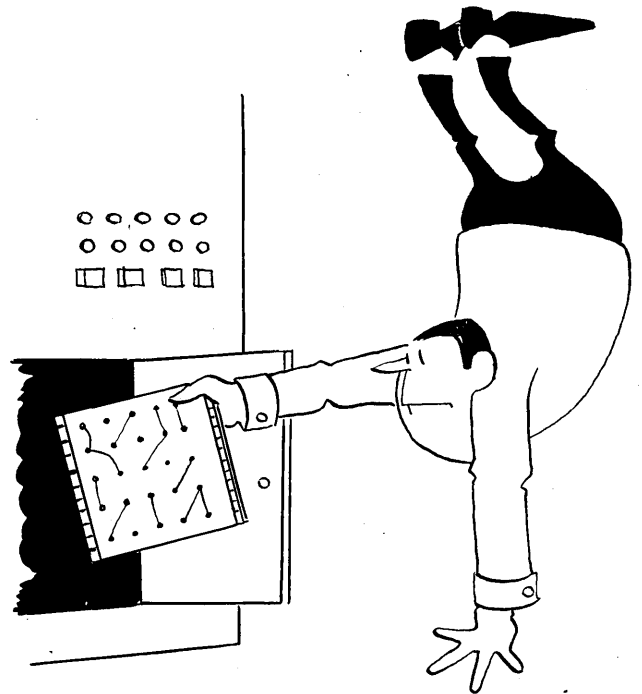
As reported later by sundry incompetent observers, Cal was in quite a sweat over his great and newfound responsibility when the first night of Swanhofer's vacation came on

a Friday. He got sufficiently muddled so that he carefully stacked the control cards: green, manila, and pink. Then he loaded them dutifully into the reader. Tapes began to spin in every direction, and the Bull punch laced a positive stream of cards filled with gibberish.

Poor Cal became absolutely unglued. He began to push buttons all over the console, and with each push more tilt lights came on. In desperation, Cal decided that something was wrong with the tape servos. He removed the write lock rings from all the tapes, and once again loaded green, manila, and pink. The master tape was half erased before Cal caught it and shut it off.

Cal spent the next two-and-a-half hours trying frantically to read the erased front half of the tape. Then he remembered the two spare tapes in safe storage.

As luck would have it, Paul Fiemo had gone skiing for the week end. Long distance calls to the bar of every ski



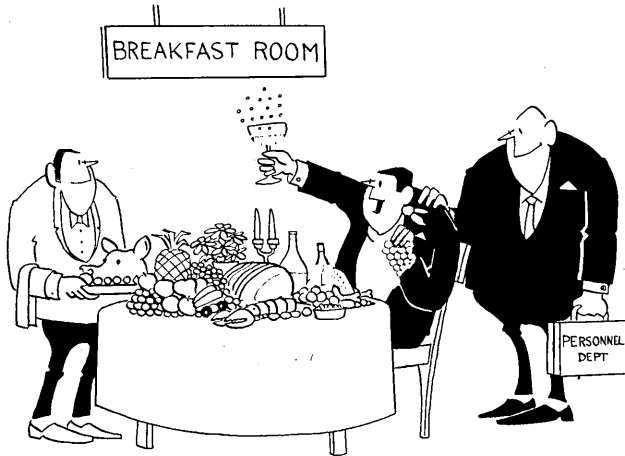
lodge within 300 miles failed to turn him up. Exercising remarkable fortitude and perseverance, Cal crowbarred the whole front off Paul Fiemo's desk, got master tape number two, put it on the machine, and erased all of it.

Fortunately, Cal did not have the combination to the storage in the flight hangar. Next morning we were able to repair the damage. Cal was permanently banished from the machine room, and it took only a week to make up the lost 17 hours of machine time.

There were other people who had to be banished from the machine room, or at least, carefully watched and escorted. One example was the great scientist from Dynamic Analysis Staff, Dr. Yepetevsky. He was promoting a mysterious analytical study of the pressure fluctuations in the helium tanks of the Stratobarn, and liked to work closely with his own data, particularly piles of cards. We soon discovered that Yepetevsky invariably installed reproducer boards upside down, apparently in some forgotten imitative memory pattern related to the design of Russian tab machinery. Since each such installation required a minimum 12 hours of customer engineering time to repair the reproducer and replace board pins, we talked Yepetevsky into letting Betty Campylos take care of his cards and other

needs.

Another person bearing close watching was the noted aerodynamicist, Dr. Grolach, who loved to design wind tunnels which worked blowing in either direction. Grolach was famous for submitting long problems full of parameters and using lots of data for input. These problems frequently



had long-winded sums as coefficients and the sums were made up of terms like $A \sin n \pi$, so that six hours of machine time would produce monumental piles of printouts full of results, all of which were zero.

But, all in all, the times of running Stratobarn data were halcyon days, after the system began to work, and I was able to devote more and more time to goofing off and other intellectual pursuits.

leisure time activities

The computing field was growing by leaps and bounds around us. By now at least two of the initial starters in building computing machines had gone down the tubes, and several more had been acquired and merged, never to be heard from again. There were more and bigger computer conferences, and conference attending became the thing to do.

In order to attend a conference, it was only necessary to concoct a reasonable-sounding story as to why such a trip was essential to the furtherance of one's professional integrity, and, hence, by obvious osmosis, a great technological leap forward for his company. Actual conference attending was quite another matter. Anyone with his head screwed on right soon learned how insufferably boring, trivial, and content-free was the average paper presented at the average conference. It was possible to learn a good deal more sitting in the bar and talking to the right people than by attending scheduled sessions.

Also, for the initiated, there were monumental fringe benefits associated with a conference. While there were customarily "official" notices and pronouncements that recruiting was taboo at conferences, it was possible for the clever man to have every conference breakfast, lunch, and dinner provided by the virtuous hospitality of some eager recruiting team. As it has been since the dawn of the digital age, the situation was ever that people are in shorter supply than machines, and skills are in shorter supply than arm-waving. One could thus gain weight on excellent food for the simple price of looking relatively alert and polite while listening to ridiculous drivel.

The free meal circuit was particularly nice for low-ranking employees of such corporations as the Airship Foundry, whose travel policy consisted of a license to live

off the land. In the instance in which the employee was offered a paltry *per diem* instead of actual expenses, he could actually make a small profit by clever conference attending.

Attendance in the exhibit halls was also to be preferred to attendance at formal presentations of papers. The wise exhibit attender soon learned to dress well and adopt a "big customer" look as he strolled about. It was often well to mention casually the giant installation now in the planning stages back at the home shop. Only the novice would collect the great stacks of literature available in the exhibits. These poor souls, staggering from the hall with their great shopping bags full of lithographed tripe, were immediately marked as junior programmers by the watchful exhibitors.

Since the exhibitors really paid most of the conference expenses, it was not surprising that they came prepared to spend money. One could obtain friendly invitations to innumerable cocktail parties and "hospitality suites," as well as tickets to the best show in town, or invitations to the friendly, local night club.

Sometimes these promotional arrangements went awry. At a conference in Philadelphia the Financial Mother Corporation sent Joe Desmid to operate the hospitality suite which occupied about a third of one floor of the Sheraton. Joe was typical of the incompetent marketing department of the Financial Mother Corporation. Those who observed him at work in New York knew that he customarily came in about ten, had a two-hour lunch with four martinis, and went home about three to avoid the rush. His base salary was about 45 K, plus fringes, and he had come through the ranks of adding machine salesmen, and hence could not be fired nor retired.

Joe Desmid arrived early and began to fortify himself with the customer booze with which he had decorated the



suite liberally. By the time the first customers arrived, Joe had become a bit churlish. He greeted us with something like, "C'mon in, you jerks. What the hell can I sell you today?"

When the Operations Vice President of Financial Mother found him two days later, and sent him home to recover, Joe was asleep in the middle of the floor, surrounded by happy customers.

The higher ranks of the conference-staging associations tended to be dominated by academic-minded people. That is not to say that they were all associated with institutions of higher learning (to coin a cliché) nor did they all possess

advanced degrees, but they tended to think in an academic fashion as opposed to mundane, pragmatic, and ordinary ways of thinking, if there be such. This may have been due in part to the observable fact that, in those days, the colleges and universities, by and large, did nothing novel, inventive, spectacular, or even useful with computers, and the academicians seemed to love to travel, speak, and see their names in print.

The tendency of the academicians to dominate the deliberative and decision-making boards and committees of associations produced some outputs that were ectoplasmic indeed. Some of the high-level pronouncements would have been funny, had they not been so hilarious.

One memorable event of the time occurred when Dr. Jonas Eldritch accepted an invitation to be the keynote speaker at a national conference. Eldritch was academia personified, and he loved to give presentations on such topics as "The Future Impact of Machine Organization and Design Logic Upon the Methods of Probable Computer Interaction in a Truly-Integrated System." Eldritch was also a trifle disorganized. He had a set of black-and-white projection slides which he had carried around since the Boer War. The glass was cracked in the mountings of some of them, and the art work on each resembled the wiring diagram of a complete Polaris submarine.

Apparently Eldritch had no budget for new slides, or could not think of any more. He wrote every speech around the permutations and combinations of the art work he had. He reorganized the slides on the airplane on his way to the conference.

On the morning of the great keynote speech, Eldritch was a bit late in arriving. On entering the hall, Eldritch tripped slightly, jostling his slide box, but he recovered quickly, and strode confidently up the aisle. On the way he handed his slides to Ben Fussie, Administrative Assistant to Joe Desmid, who had been assigned to the slide projector.

Eldritch launched into his presentation, and, at the appointed time, the first slide appeared on the screen upside down and backwards. There was a minor flurry of stifled guffaws in the audience. This unnerved Eldritch slightly, because he couldn't think of anything funny he had said. Ben quickly adjusted the slide.

The second slide appeared reversed left to right. The audience guffaws were less stifled.

And so it went, slide after slide. Ben Fussie assumed the demeanor of Laurel and Hardy, trying desperately to move a piano. Eldritch became more and more nervous, as did Jim Fidge who was chairing the session. On slide number 75, Ben Fussie made his installation so that the image appeared right side up and properly-oriented on the first try. There was a three-minute standing ovation. Eldritch was so upset that he repeated the page he had just finished, getting halfway through it before realizing his mistake.

When he finally concluded, Eldritch sat down, his face purple with embarrassment. The audience cheered madly, stomping feet here and there.

Jim Fidge was so embarrassed for Jonas Eldritch, and so appalled that such an event could occur during his session, that he stood up shakily, wringing his hands. It was manifest that Jim felt he must say something to gloss things over and make everyone feel better.

Jim smiled weakly as he approached the microphone. "Well," he said, "I'm sure that was not as bad as it sounded."

social problems

The computing community was, at least, in its higher levels, disturbed by a kind of self-introspection and worry in those days. There were committee deliberations and reports on things like "The Social Responsibilities of Computer People." It was obvious that there would be development of long-range ballistic missiles, and that they would actually carry atomic warheads, and that computers would guide them, since people never could. There was some doubt about whether computer programmers ought to write code that guided weapons and things like that.

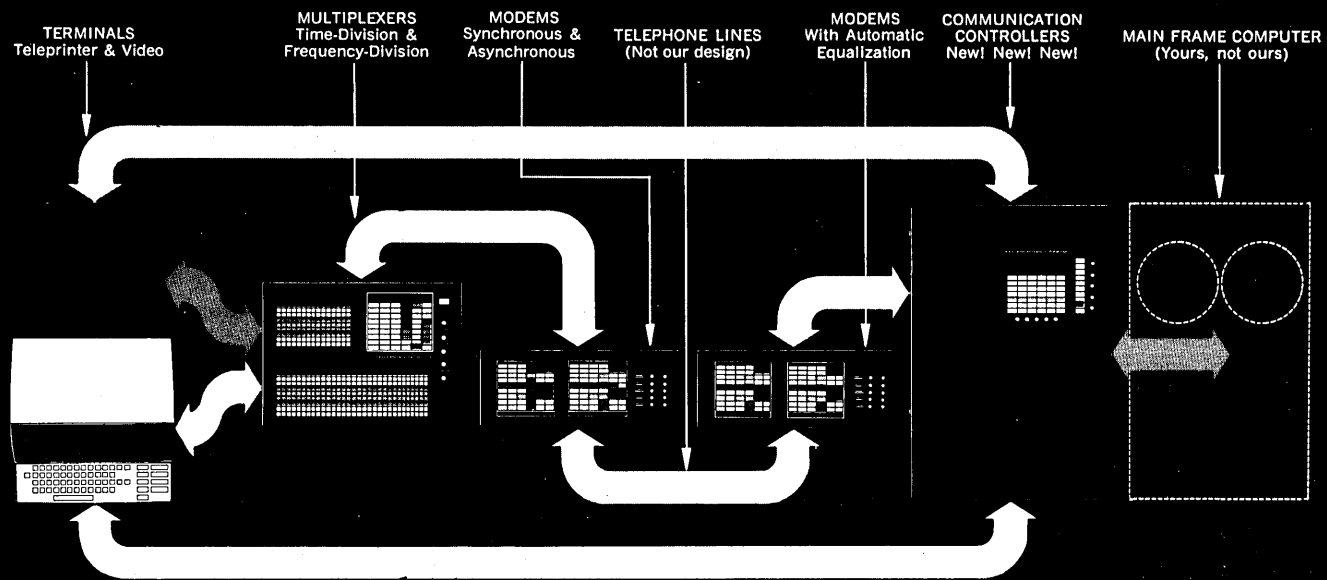
And so the soul-searching went on in committee, and the learned papers were published, and the world little noted and has not long remembered.

And while I was enjoying my balmy days of conference attending and management of the smooth-running Strato-barn system, my career took another sudden trend.

Word came from Jed Mote. I has been asked to transfer to a special, high-level group, specially structured to write a gigantic proposal. The Airship Foundry had decided to bid on a contract for a ballistic missile system. I was to supply the data processing expertise to the proposal effort. ■

(Chapter 5 will appear eventually.)





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DBL: A LANGUAGE FOR CONVERTING DATA BASES

by Marvin Schaefer



It is often desirable to transfer large bodies of data originally prepared for one data management system to some other data management system. Such data are rarely in a format acceptable to the second system, and often they would be more useful if they were structured in some hierarchical manner distinct from the original organization.

It is axiomatic that much of the data in any large data base is in error, or "dirty." Dirty data includes instances where data is absent or appears in incorrect order. The latter results in much of the difficulty in converting data bases, since it is necessary to identify the fact that data are missing or in the wrong order, and then to recognize the resumption of valid data and resume correct processing.

Thus error detection and error recovery are necessary capabilities for the solution of the general problem. Our experience suggested that since we were actually interested in the syntax of the data, and since compilers have long been faced with error detection and recovery, that the use of a syntax-directed compiler would not be unreasonable.

In 1965/66, a series of data base reformatters were written at SDC in the META5 language. In most cases, the input was in fixed format and the desired output in free format. At the time, the data bases had rather simple structures and the conversion process was almost straight transliteration, although error detection was necessary. The META5 language was primarily intended to process free-format data, yet conversion programs were short and quickly written.

As word spread about this new reformatting capability, usage increased sharply at SDC. As new data bases were presented with some hierarchical structure, it became evident that META5 was being somewhat overextended; for though it was never shown that META5 was incapable of reformatting a given data base, the code required for the problem was becoming difficult to read and at times most cumbersome.

As a result of several extensions and modifications, not all compatible with the original META5, the META6 language and system were produced. META6 was specifically aimed at solving the data conversion problem. The new language was heavily oriented toward character strings: providing many generators for scanning variable- or fixed-length strings of specific character types (digits, alphanumerics, etc.); indicating how many successful cases were encountered; concatenating such strings automatically rather than explicitly; and sensitive to the input column setting. One other major modification was the ability to move backwards on the input string rather than merely forward, so as to permit rescanning while retaining the primary structure as a syntax-directed, one-pass, top-to-bottom compiler with backup.

This facility greatly simplified the problem of converting data, at least for those programmers familiar with the META6 language. To those not familiar with the language, it

was relatively simple to explain a given conversion program, but it was found—due to the richness of the language—that the writing of programs was a difficult task. Typically, those who are concerned with converting data bases are generally not aware of the workings of a truth-functional, syntax-directed system, and are constantly plagued with problems associated with backup and the nonrecognition of a given data type.

As a result, a new language (known as DBL—Data Base Language) was designed and developed at SDC to permit unsophisticated users¹ to reformat their own data bases. Plans were made to produce a family of compilers that would generate output for each of the major data management systems in use at SDC, to wit, LUCID/QUUP, TDMS, and DSI (Data System 1—an experimental data management system for small computers). Development of DBL was based on the assumption that while a user may be familiar with his own data base structure, he is not familiar with the format requirements of the system to which he is converting. With DBL, the user has the ability to explicitly generate output, should he so desire; but in the general case, output is automatically produced.

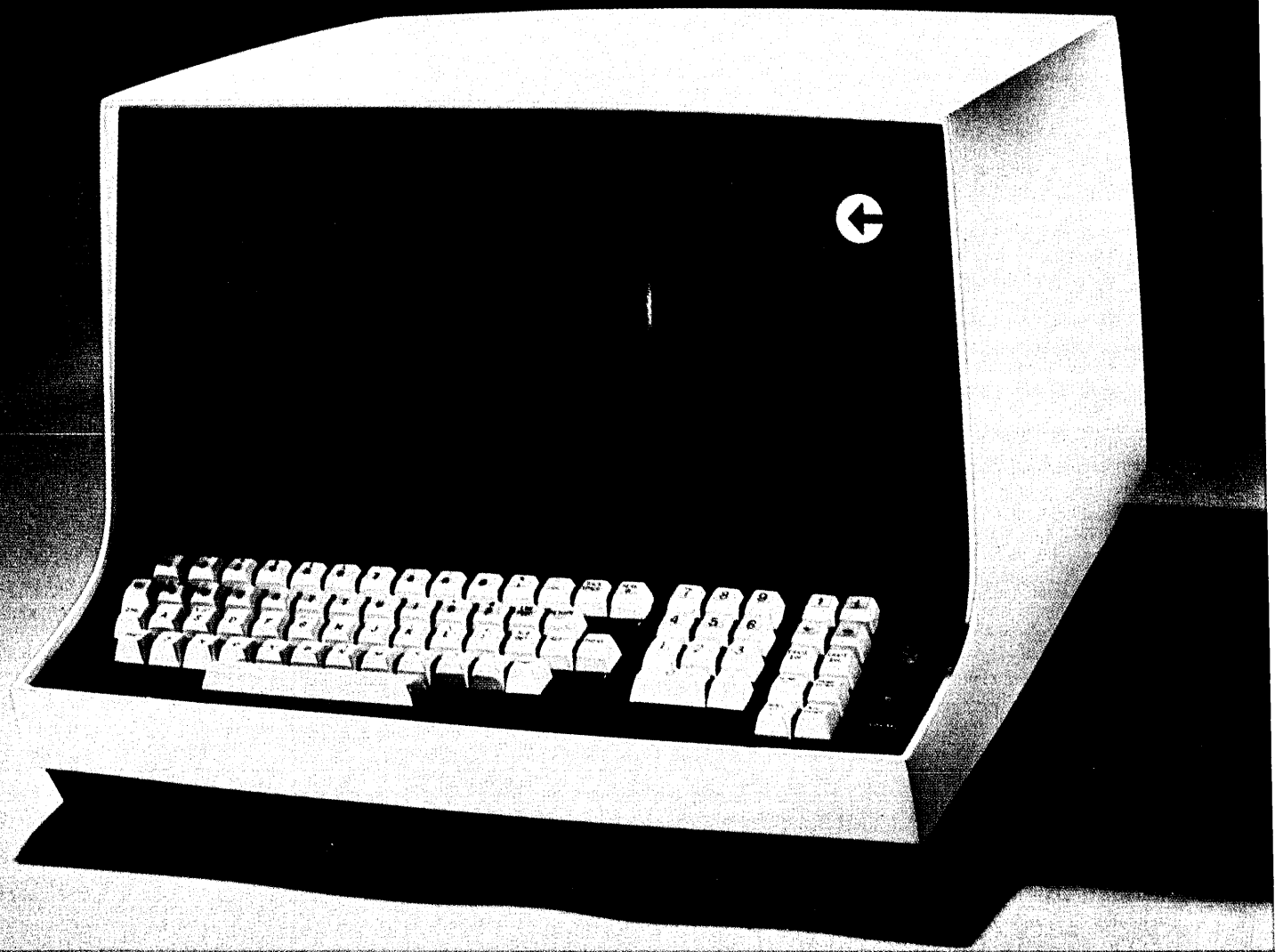
The development of DBL was based on the principle that special-purpose languages should be developed for special-purpose jobs. Although general-purpose languages are capable of performing a variety of tasks, the code they require often obscures the task one wishes to perform. As in higher mathematics and physics, a good notation is essential for grasping certain concepts which might well be unattainable otherwise. And if a notation is simple enough to state a given problem concisely, then, as in the present case, debugging a program in that notation should be that much more straightforward.

(Continued on p. 125)



Mr. Schaefer is a senior computer programming analyst at SDC where his responsibilities include mechanical translation of procedure-oriented languages, program optimization, and program reformatting. He has an MS in mathematics from San Fernando Valley State College.

¹ An unsophisticated user is someone who fits the French definition of a dilettante: *quelqu'un qui connaît, mais ne sait rien.*



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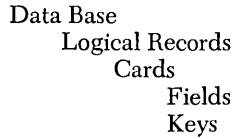
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The remainder of this paper, then, has three main purposes: (1) to describe the DBL language and system; (2) to discuss how the system was implemented and extended; and (3) to use DBL as an illustration of the advantages and disadvantages of special-purpose languages for special-purpose tasks.

description of the dbl language

Data bases, regardless of their format, often have hierarchical structures. In general, this structure is:



A data base is a set of logical records. Logical records are complete classes of related information. Examples are the work history of an individual, accounting information on research projects, etc. Logical records are said to be composed of cards.

A card is an arbitrary unit on which information appears. The standard model of a card is the 80-column IBM card; but cards may be considered to be of any length, the term being used as a descriptor rather than as a constraint. The concept of cards also serves as a convenient way of referring to a set of fields in a given format. In fixed-field data bases, cards are used to make meaningful the terms "column" and "character-number"; i.e., a field might start on card 10, column 25, and run for 15 characters.

A field is the smallest meaningful "container" of information in a data base. It describes how to interpret the information contained in the field. The information contained in the field is called an entry. Examples of fields are generally such things as the name of an employee, the number of children he has, a project number, a code name, an indicator telling whether or not a process is currently in operation. Thus, SMITH is an entry for the field "name-of-employee"; 17 is an entry for "number-of-children," etc.

Fixed fields are of several types. In all cases a fixed field has a length attribute, i.e., the maximum number of characters to be associated with that piece of information. In the case where fewer characters than this maximum are needed to represent the data, the difference is made up with blanks or some other filler characters. In some fixed-field data bases, fields always start (and end) in specific columns. In others, fields might be of variable length (due, for example, to the listing of children's names or other variable data), but these always start in specific position relative to a previous field. Variable-length data bases generally have substructures called repeating fields or nested fields.

A repeating field is a field with a variable or fixed number of entries, each of the same type, such as a list of a person's children. Nested fields are fields contained within the body of given larger fields. Such nested fields might, in turn, contain other fields which can themselves be nested or repeating fields. Examples here include data structures of the form:

```

school attended
  class taken  grade received
  
```

where, for a given school, a number of classes might have been taken and a number of grades (not necessarily the same) received in each. A typical entry in a record of such data might (logically) appear:

```

Harvard
  Math 1      A
  English 4   C
  
```

```

Physics 2      D
                A
Yale
  Russian 3    B
  Math 2      B
  
```

Note that this is a "logical picture" of the input which might actually appear as:

```

5 HARVARD MATH 1 A ENGLISH 4 C PHYSICS 2 D A
5 YALE RUSSIAN 3 B MATH 2 B
  
```

A key is simply another field. However, entries in this field refer to the data base itself, providing descriptive information about the record, card, or fields of the data base. A key is used to give the processor information about the data base. It might be a punch in a given column of a card indicating the format of the card—as in the above example where the 5 indicates educational data on the card-type pictured—or it might be an indicator of the number of entries in a repeating field. A key might also serve as data, as for example an indicator showing the number of children a person has, followed by a list of their names.

program structure

Programs in DBL are written so that the structure of the object data base is most apparent. The user starts with a description of his fields, then a description of their position on cards, and finally a method describing the identification of different logical record types (if such exist).

The user's program is written as a series of declarations, which serve to declare—as well as describe—data structures and their processing. (If one were to consider DBL as a procedural language, these declarations would be analogous to syntax equations in META6.)

The user views his data through an input scanner which moves linearly along the stream of characters comprising the data base. He has control of the position of the input scanner; he can control what it looks at. He is able to tabulate forward (or backward) on the same logical card, or over many logical cards, as necessary.

In processing fields, he can make legality checks on those fields. For example, he might insist that a given field contain numeric data, or have data that are in accord with some list of acceptable data. The actions taken in the event a field of data fails such a test can be specified by the user, or, in the default case, the field will be processed, but with no data output to the target data base.

Physical cards are assumed to be 80-column card images of which the first 72 columns are significant (and constitute logical card images). The user may override these assumptions and instruct the processor to expect input of a given width. Physical and logical card lengths must remain constant throughout the data base, but record length is immaterial to the processor.

In general, input and output are transparent to the user, in that the input scanner is always positioned to the next character on the input stream and the output is automatically generated by the specific DBL compiler invoked. The user does have the ability to modify this convention at will.

language forms

Character set operations. DBL provides the user with the ability to talk about several classes of character types, such as LETTER, DIGIT, etc. The user may also define character sets of consequence to his own purposes, such as VOWEL, HEXADECIMALDIGIT, etc., or the universal character set CHAR, which recognizes any bit configuration fitting into a byte as an element. Then, by using these terms as primi-



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tives, he may specify certain criteria that data must meet in order to be considered legal.

For example, should the user insist that the data field he has named FIELD 13 must consist of precisely 7 digits, he would write the declaration: FIELD 13: 7 DIGIT. The input scanner would move over 7 character positions in processing this field. If there are precisely 7 digits in these 7 positions, the requirement will be met and the gathered data will be output in the correct form as a value of field 13. Otherwise (in this simple case), the data will be scanned, the input scanner will be positioned to consider the character immediately following the seventh character, and nothing will be output for field 13.

Suppose the conditions are less stringent; indeed, that any number between 5 and 7 digits will satisfy the criterion for good data. Then one would write: FIELD 13: 5-7 DIGIT. Then 7 character positions will be examined and—provided that at least 5 of them are digits—the criterion will be met. All those digits (and only those digits) encountered will be gathered and output. It is not necessary that they be consecutive. The input scanner will be positioned after the seventh position scanned. If this criterion is not met, nothing will be output, and the input scanner will be positioned after the field.

More complicated criteria are indicated simply by listing each and separating them with commas. For example, the declaration FIELD 11: 3 DIGIT, 1-5 ALPHUM, LETTER scans 9 columns and outputs only that data which satisfies the criteria. Hence, if the input contains 12AB1C1A then the data gathered will be AB1C1A since the test for 3 digits fails. The more stringent test (to wit, that there must occur precisely 3 digits followed by 1 to 5 alphanumeric characters followed by a letter in the ninth position) would be written as a Boolean expression in conjunction with an IF-statement. (This is described below.) Hence, the user is provided with varying degrees of legality checking.

Positioning on the input string. Several techniques and operators exist in the language to position the input scanner. These include the SKIP operator, which skips a designated number of columns; the TAB (tabulate) operator, which advances the input scanner to a designated column; and the BACKSPACE operator, which backspaces the input scanner to a specified column. Finally, there is a NEXT CARD operator, which may be used to position the input scanner to the start of the next physical card on the input string.

These are the only operators in the language that explicitly reference inputting of data. Input is normally implicit in the language. Hence, one uses the NEXT CARD operator only when it is necessary to skip over one or more columns of data to reach the start of the next card; if the last column read was the last (defined) column of a card, the input scanner is already positioned to the first column of the following card. In this latter case, use of the NEXT CARD operator would cause the skipping of an entire card. Similar rules apply to the TAB and BACKSPACE operators.

These operators may be interspersed as desired with the character set operators described above. As an example of their use, assume it is desired to convert a date of the form YY/MM/DD or YY-MM-DD to a date of the form MMDDYY where YY corresponds to two digits representing the year, MM the month, and DD the day. Assuming the field starts in column 17 of a card, one would write

```
FIELD 17: TAB TO 20, 2 DIGIT, SKIP, 2 DIGIT, BACKSPACE TO 17, 2 DIGIT, SKIP 6
```

DBL provides the user with several means of storing and manipulating stored data. He may store data in symbolic or integral variables, or in pushdown stacks. He may also use

conversion lists for the encoding or decoding of data. DBL also provides access to the numerous data structures of META6.

The user can manipulate these data structures with the standard arithmetic operations, the STORE operator, or the relational operators. Many of these permit expressions as arguments. For example, if the user had a variable named VAL1, he could write such expressions as

```
STORE 'ABC' IN VAL1
STORE 12+VAL1*2 IN VAL1
STORE 3 LETTER, 2 DIGIT IN VAL1
```

In the latter case, the concatenation of 3 letters and 2 digits (if found on the input) is placed in VAL1. (If neither 3 letters nor 2 digits appeared on the input, an error message would be generated and VAL1 would remain unchanged.)

A particularly strong and useful feature of the language is the conversion list, which may be used to either code or decode information as well as legality check its contents. For example, a data base could use two-digit codes to represent the names of states, while the user might prefer to replace these codes with the actual state names where possible, and to detect any codes which appear to be in error. This could be done in the following manner:

```
LIST STCODE: '00' '01' '02' '03' . . .
LIST STNAME: 'ALABAMA' 'ALASKA' 'CALIF' 'COLORADO' . . .
FIELD 113: CONVERT 2 DIGIT TO STNAME VIA STCODE
```

In the event the two digits picked up do not match any of the codes in the list STCODE, an error message will be output and the offending characters left as they were. Should the user wish instead to replace them with the string UNKNOWN, he could write:

```
FIELD 113: CONVERT 2 DIGIT TO STNAME VIA STCODE
OR ELSE REPLACE WITH 'UNKNOWN' END
```

The user could also cause the error message to be output if he felt it desirable.

Dynamic program flow. DBL provides the user with several means of controlling the flow of his program, based on indicators or other conditions. There is a conditional statement which offers the user reasonable flexibility in expressing himself. The conditional is comprised of an IF clause, followed by an optional sequence of ELSE IF clauses, followed by an optional ELSE clause, and concluded with a mandatory END. All of the standard Boolean and relational operators are available, plus an implicit notation for interrogating the contents of the actual input string. For example:

```
IF 'ABC' THEN CARD 1, CARD 2
ELSE IF ('B' OR 'C') AND 2 LETTER THEN CARD 3
ELSE IF ABLE > 15 OR X+Y ≤ Z THEN CARD 4, CARD 2
ELSE CARD 5 END
```

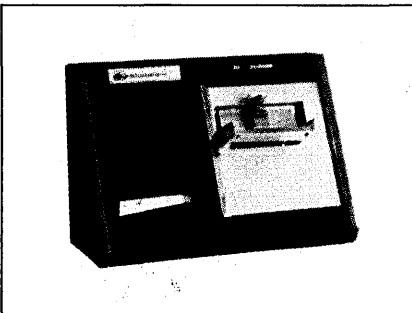
Here, the IF clause asks if the next 3 characters on the input string are the letters ABC, in which case CARD 1 and CARD 2 are executed. The first ELSE IF clause checks for the presence of either a B or a C followed by two letters; the second ELSE IF clause insists that either the contents of the variable ABLE exceed 15 or that the sum of X and Y is bounded by Z. If none of these conditions is satisfied, then the ELSE clause (viz., CARD 5) will be executed. After a clause is executed, control is transferred immediately past the END of the conditional.

Several forms of looping (i.e., iteration) control are provided in the language. These are of the form

(Continued on p. 129)



If the mountain won't go to Mohammed Let Mohammed go to the mountain



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```
REPEAT WHILE Boolean:expression: expression END
REPEAT UNTIL Boolean:expression: expression END
REPEAT FOR numeric:expression: expression END
```

In the first two REPEAT statements, the expression following is executed as long as the Boolean expression is true or false, respectively. In the third case, a number is computed and the loop is executed that number of times.

Typical REPEAT statements are, for example,

```
REPEAT WHILE COL 73-80 = MATCH : CARD I END
REPEAT UNTIL COL 73-80 ≠ MATCH : NEXT CARD, ERROR
END
REPEAT FOR 3 DIGIT: FIELD 8, FIELD 9 END
```

Miscellaneous language features. Various other data-manipulating or data-recognizing features are provided in DBL, all of which are—due to their specialized applications—beyond the scope of this general description. These language forms are intended to aid the user, but it is realized that no special-purpose language can satisfy all possible user application requirements.

More knowledgeable users may elect to perform certain specialized work in the META6 language. META6 has been embedded in DBL primarily so that DBL would provide the user all of the power of META6, yet permit his making use of the more concise and readable notation of a higher level language where desired. Full interface between DBL and META6 is provided.

implementation and extensions

Most of the time spent implementing the original version of DBL was concerned with designing its syntax and specifying its semantics. Indeed, it only required a half-day to write the initial DBL compiler in META6.

The process used was quite simple. The initial DBL compilers translated DBL into symbolic META6, so that the output of the compilations was readable for easy debugging. (The DBL compiler's output was, of course, sent to the META6 compiler for eventual use.)

As a user community grew, the DBL language was found to be lacking in some respects; and of course the DBL compiler did have early bugs that had to be found. But by specifying the compiler in META6, it was trivial to make changes to the syntax or semantics of DBL as needed. New language forms were generally added within an hour, and as a result of the ease with which the language could be modified, DBL changed form rapidly.

When the language finally stabilized, the META6 compiler was modified to compile the DBL compiler's output statements. These were analyzed, code was made more efficient, approximate labels were generated, and a DBL compiler that produced META6 pseudo-machine language directly was produced in two days. This required about a week of checkout and modification before reaching the "95% checked-out stage."

The above time periods are normalized to man-units, as only the author was involved in the work. Most of the debugging time involved was spent correcting keypunching errors.

Because DBL compilers are written in a BNF (Backus-Naur Form) language, it is quite simple to modify the syntax and semantics of the language. The process of extending the language is essentially accomplished in two stages.

First it is necessary to specify the syntactic changes to the compiler and visualize the semantic equivalent in some other higher level language, for instance, META6. Then it is

only necessary to compile this semantic equivalent into assembly language, optimize the code produced (by hand), and finally replace the output statements for the new compiler. This procedure is in practice quite simple, particularly since BNF specifications of languages are transparent to the compiler writer. A specification of DBL in META6 is given in the appendix.

DBL was designed to run interpretively under the META6 system and hence has all the built-in deficiencies normally inherent in interpretive systems. This has not yet been too severe a handicap, because most data base conversions are "one-shot" runs, not production runs. The advantage of being able to compile a program rapidly, and run immediately, outweighs the advantages of running in machine language until the conversion program has been debugged. Normally, DBL users want to try numerous test cases before converting large data bases.

Ideally, two versions of DBL would be available: an interpretive version (which could be quickly implemented for an existing interpreter and would tend to be machine transferable), and a hard-core version for production work. The latter implementation takes time to build, as there is little that one can build onto. It would be relatively simple to modify a DBL compiler to produce assembly language calls on routines in a support package which had been coded in machine language. This could be done after the rapid implementation of an interpretive DBL compiler.

DBL has been implemented in both forms at SDC. The interpretive versions operate on the AN/FSQ-32 time-sharing system and under ADEPT and TS/DMS on IBM 360 computers. The production version operates under OS/360 on a 360/50H.

conclusion

DBL is a special-purpose language designed for reformatting symbolic data files to certain specified formats. The approach taken was to force the user to describe his data base in terms of defined structures, rather than by procedural means, in a manner accessible to the unsophisticated user.

It has been argued that the reformatting problem can be solved by coding in META6, COMIT, or SNOBOL. Indeed, SNOBOL has some pattern-matching forms more powerful than those of DBL (or META6). Using SNOBOL, however, it is necessary to explicitly reference both input and output tapes, and many of the legality checks a user might want to effect must be made by indirect conventions. For example, to determine that at least five of seven characters are digits requires an iteration process in which the input string is constantly being matched against a string of single digits. The user is forced to code something which does not explicitly suggest that five to seven digits are to be recognized and output in a specified form, if present, and otherwise to be scanned over. This introduces a degree of procedurality into the program that impairs both the writing process and the debugging process (since the code may be overly cryptic).

In any case, it is not the author's intention to criticize SNOBOL or any other language. SNOBOL is itself a special-purpose language (in a more global context), which happens to be capable of reformatting a symbolic data base. It is also capable, however, of serving as a vehicle with which to implement special-purpose languages (perhaps like DBL) for resolving special-purpose problems.

With the tools presently at the compiler-writer's disposal, it is not at all difficult to implement special-purpose languages. The process is sufficiently simple to allow rapid redefinition of the given language as undesirable features

manifest themselves, saving final specification and freezing of the language until such time as a number of users have commented on it and its flaws have been removed.

A further advantage of special-purpose languages is that initially it is not necessary that compiled programs in that language run extremely fast; only that they run with reasonable efficiency and that the coding process for the user be as simple as possible. This allows the implementer freedom to experiment with language forms (while being minimally

concerned with machine language details) until he is satisfied that his language is sufficiently stable as to warrant an optimization process.

Finally, this writer's experience with DBL indicates the value of special-purpose languages for special-purpose tasks. Thus, when a means exists for implementing such languages rapidly (as is the case with compiler-compilers), perhaps programming languages should be forced to fit the problem, rather than vice versa. ■

APPENDIX: METALINGUISTIC SPECIFICATION OF DBL

We list below a specification of the syntax of DBL in the META6 language. META6 is a BNF-like language with the following notational differences:

1. Nonterminal symbols appear as upper case Latin letters and are not surrounded by angle brackets.
2. The defining symbol ::= is replaced by either .. or = depending on whether blanks are significant or not.
3. The alternation symbol | is replaced by the slash/.
4. Terminal symbols denoted by PL/I strings, e.g., 'IF', ''' (= the character prime), etc.
5. Alternatives may be bracketed by parentheses.
6. A sequence of zero or more iterations of a syntactic element is denoted by the dollar sign \$.
7. Primitive terms of the language are preceded by a period, e.g., . LETTER is defined as any of the 26 upper case Latin letters, . STRING as the PL/I string, etc.
8. <empty> is replaced by . EMPTY.

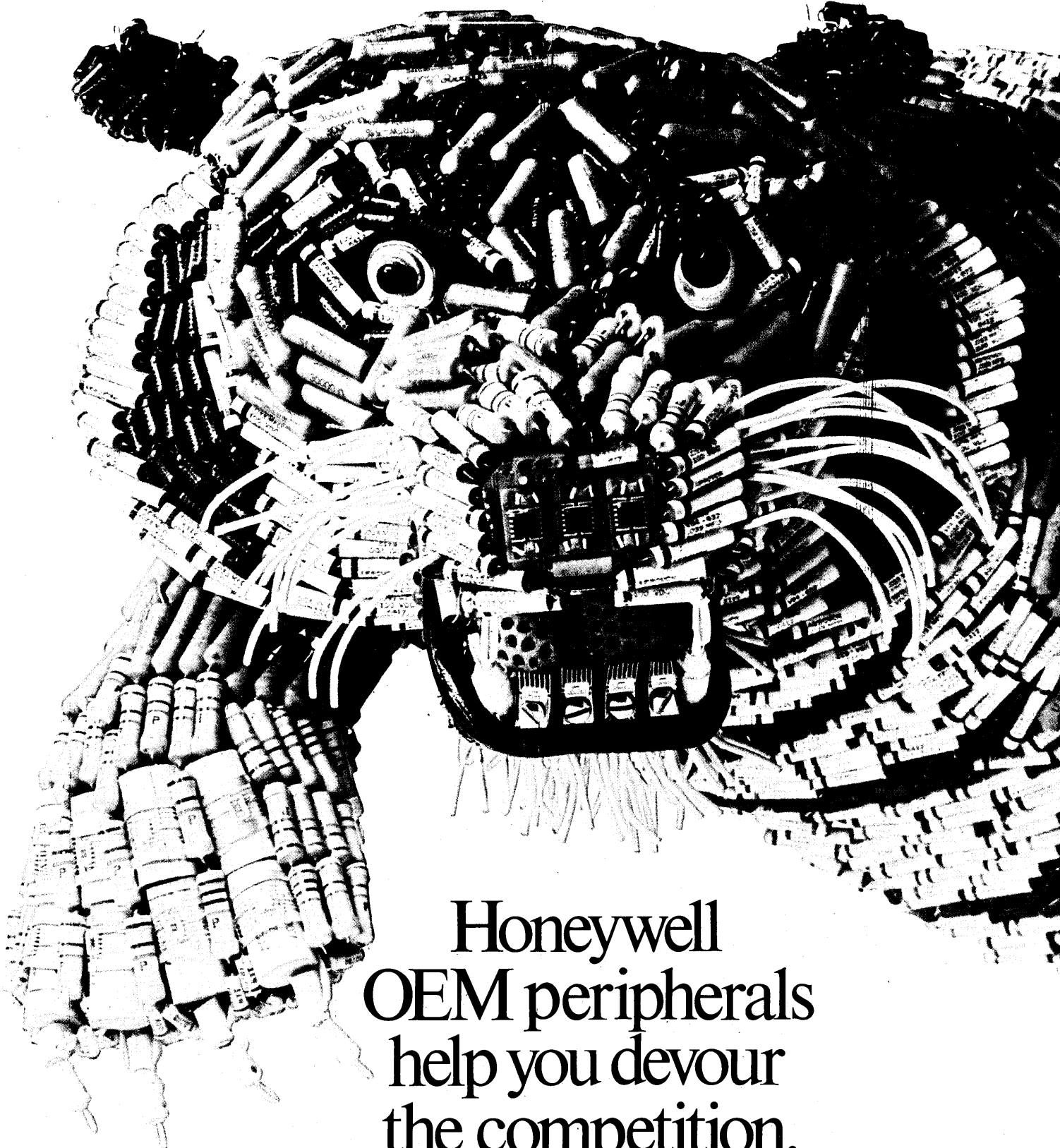
In the specification below, SYNTAX is the equation defining the syntax of DBL programs.

```

ID      .. .LETTER $( .LETTER/.DIGIT)
        /-'''''''';
NUMBER  .. 1$.DIGIT ;
ARITHEXP .. ATERM $( ('+'/'-' ) ATERM ) ;
ATEM    .. AFACTOR $( ('*'/'/' ) AFACTOR ) ;
AFACTOR .. ID /NUMBER / ('+'/'-' ) AFACTOR
        / (' ARITHEXP ' ) ;
CALL    .. ('CARD'/'C' ) NUMBER
        / ('RECORD'/'R' ) NUMBER
        / PATCAL ;
CARD    .. ('CARD'/'C' ) NUMBER ':' EXP ';'
        COMMENT ;
CHARACTERSET = 'CHARSET' ID ':' ('-'/.EMPTY)
              ('"' .CHAR $( '-' .CHAR ) "" /
              .EMPTY ) $.ID ';' COMMENT ;
COLOP   .. 'COL' NUMBER ('-'
              NUMBER/.EMPTY) ;
COMMENT = $(''''' $( '-' .CHAR ) '''' );
CONTRL  .. 'END' 'CARD' NUMBER ';' ;
CONVERT .. 'CONVERT' EXP 'TO' ID 'VIA' ID
          ('OR' 'ELSE' EXP 'END' /.EMPTY) ;
DATABASE .. 'DATA' 'BASE' ':' EXP ';' ;
DECLARATION .. ('VARIABLES'/'VARIABLE'/'VALUE' )
              ID $( ';' ID ) ';' /CHARACTERSET
              /LIST /STACK /ENTTRM /CONTRL)
              COMMENT ;
DESCR   .. NUMBER ('-' NUMBER /.EMPTY)
          DESCLIST /COLOP ;
DESCLIST .. 'CHAR' / 'TEXT' / 'LETTER' / 'DIGIT'
           / 'ALPNUM' / 'SPEC' / 'B'
           / 'NONBLNK' / ID ;
ENTTRM  .. 'ENTRY' 'TERM' .STRING ';' ;
EXP     .. EXPL $( ';' EXPL ) ;
EXPL    .. COMMENT TERM COMMENT ;
FCALL   .. ('FIELD'/'F' ) NUMBER ;
FIELD   .. ('FIELD'/'F' ) NUMBER ':' EXP ';' ;
    
```

```

COMMENT ;
IFSTAT  .. 'IF' RELEX 'THEN' EXP
          $( 'ELSE' 'IF' RELEX 'THEN' EXP )
          'END' ;
INSPAR  = .STRING /ID ;
LIST    .. 'LIST' ID ':' $.STRING ';' ;
MANIP   .. 'REPLACE' 'WITH' EXP /'NO'
          'OUTPUT' /'REMOVE' /'STORE'/'POP'
          ID /'INSERT' ((' INSPAR
          $( ';' INSPAR ) ) /INSPAR)
          /'OUTPUT' OUT / 'ERROR' ;
OUT     .. (' (.STRING/ID) $( ';' (.STRING/ID) )
          ' ) ;
PATCAL  .. ('PATTERN'/'P' ) NUMBER ;
PATTERN .. ('PATTERN'/'P' ) NUMBER ':' EXP ';'
          COMMENT ;
POSITION .. 'TAB' 'TO' NUMBER
           /'BACK' 'SPACE' 'TO' NUMBER
           /'NEXT' 'CARD'
           /'SKIP' (NUMBER /.EMPTY) ;
PROLOG  .. ('PROLOGUE'/'PROLOG' ) ':' EXP ';'
          COMMENT /.EMPTY ;
RECORD  .. ('RECORD'/'R' ) NUMBER ':' EXP ';'
          COMMENT ;
RELAT   = EXP (RELOP EXP /.EMPTY) ;
RELEXP  .. RETERM $( ('OR' RETERM ) ;
RETERM  .. REFACTOR $( ('AND' REFACTOR ) ;
REFACTOR .. 'EOF' / ID 'EXISTS' / .STRING
           / '~' REFACTOR / (' RELEXP ' ) /
           RELAT ;
RELOP   .. '=' / '≠' / '≤' / '<' / '≥'
           / '>' ;
REPEAT  .. 'REPEAT' ('UNTIL' / 'WHILE' /
           / 'FOR' ) RELEX ':' EXP 'END'
           /SEQOP ;
SEQOP   .. (NUMBER/.EMPTY) '$' (NUMBER/
           .EMPTY)
           ((' EXP ' ) / TERM) ;
STANDARD .. 'CF' NUMBER ((' NUMBER ' )
           /.EMPTY)
           / 'TF' NUMBER ((' NUMBER ' ) ;
STACK   .. 'STACK' STK $( ';' STK ) ';' ;
STK     .. ID (NUMBER/.EMPTY) ;
STORE   .. 'STORE' EXP 'IN' ID ;
SYNTAX  .. COMMENT 'DBL' ID ((' 'CARD'/'C' /
           'RECORD'/'R' ) NUMBER
           / 'DATA' 'BASE' ) (';/.EMPTY)
           COMMENT DECLARATION PROLOG
           COMMENT
           $( (FIELD/CARD/RECORD/PATTERN
           DATABASE)
           COMMENT
           'END' ) ;
TERM    .. POSITION / STANDARD / FCALL
          /MANIP / CALL / IFST / .STRING
          /'FALSE'/'TRUE'/'OK' /REPEAT
          /DESCR / ARITHEXP ;
    
```



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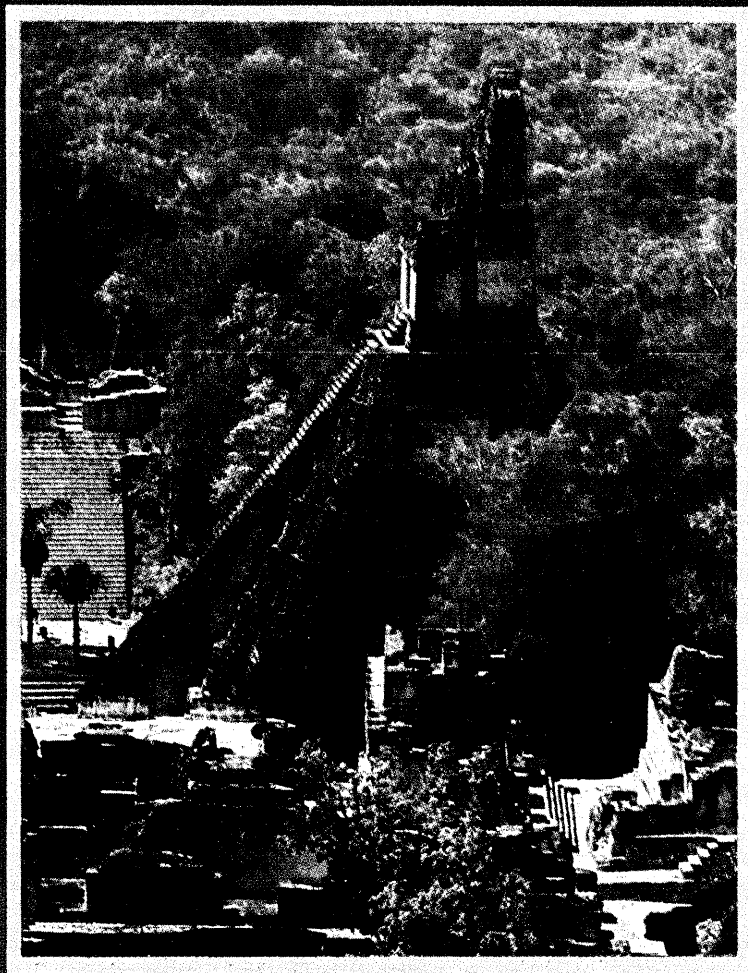
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eliminates your costly computer personnel turnover problem. KATUN eliminates your re-education problems. KATUN eliminates your computer quality-control problems. The result? Vastly improved computer utilization (and customer satisfaction) at less cost. And the end of the talent drain computers place on your executives. For details on our total resource capabilities write to KATUN, 680 Beach St., San Francisco, Calif. 94109 or phone (415) 771-9444. □ *Photo Above: At Tikal, the oldest and largest center of the ancient Maya civilization, in Peten, Guatemala, Temple I towers 15 stories tall over the surrounding jungle. It was built by hand, of limestone about 700 A.D. It was in ceremonial centers such as this that the Mayas developed a time counting system — from which the name KATUN derives — that was more accurate than the calendar we use today.*



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THE THOMIS MEDICAL INFORMATION SYSTEM

by Robert Geisler

 The State University Hospital of Downstate Medical Center has had its activities controlled by an on-line computer system since its opening in 1966.

The computer system, dubbed THOMIS (Total Hospital Operating and Medical Information System), operated on an IBM 1410/1440 system from that date until November, 1968, when operations were transferred to an IBM 360 computer.

THOMIS handles patient information from the point of pre-admission up to and including the time records are transmitted to the medical records department after discharge.

The THOMIS system operates on an IBM System/360 Model 40 computer with 256K of core storage. Its peripheral devices include the following:

1. 2314 disc drive.
2. 1403 printer.
3. 2540 card reader-punch.
4. Six 2401 tape drives (4 9-track, 2 7-track).
5. 2703 transmission-control unit.
6. 2711 line-adaptor unit.

The IBM 1050 data communication system is the mechanism by which all messages are transmitted to the computer, and from the computer to the various terminals located throughout the State University Hospital. The following devices are in use:

1. 1052 printer keyboard combination.
2. 1053 printer.
3. 1092 programmed keyboard.
4. 1092/93 programmed keyboard.

All nursing stations and outpatient clinics have terminals capable of input and output. Depending on the nature of their operations the service areas will only have output devices (e.g., EKG) or both input and output (e.g. pharmacy).

Nursing stations all have 1092/1053 combinations. All nursing station input is via the 1092 terminal.

All outpatient clinics have 1092/1052 configurations. Ordering input is via 1092, as in the inpatient area. The purposes to which the 1052 input terminals are put will be detailed later.

The THOMIS System, while servicing the entire State University Hospital, may actually be considered as two computer systems. Separate files are maintained for inpatients and for outpatients; and to some degree a separate series of programs exists for each. It is the intention of this paper to discuss both the inpatient and outpatient components of THOMIS. Those areas common to both inpatients and outpatients will be discussed in a third section.

Teleprocessing operations. When a patient is admitted to the State University Hospital, he is in one of two categories; pre-admitted or not pre-admitted.

1. The histories of pre-admitted patients have already been stored on disc. The admissions office has a listing of all pre-admitted patients, and using a 1052 terminal enters the

pre-assigned patient number, his medical record number (social security number, if not already known), his date and time of arrival. The computer will automatically assign a bed for the patient (based upon proximity to the nursing station, bed closest to the window) and will only assign him to a room containing a patient of like sex.

2. If the patient has not been pre-admitted, the admissions office transmits, again via the 1052 terminal, his name, date and arrival time, medical record number, admitting physician's code, and a six-digit code that identifies sex and describes his diagnosis. As in the case of the pre-admitted patient, the computer will assign a bed. The history of a patient who has not been pre-admitted is entered into the system that night.

Concurrent with the entry of admit data into the 1052, several operations occur. Via 1053, the nursing station to which the patient has been assigned is advised of the patient's arrival, and the telephone office (CENTREX) receives a notice that the telephone in that room has been assigned to the patient.

After the patient has been escorted to his bed, the physician will examine him and determine what treatment is required. The physician enters all orders, pharmaceuticals, blood tests, etc. into a patient order book manually. The ward clerk using a 1092 terminal transmits the order to the appropriate service area.

Ordering procedures will be discussed later since they are identical for both inpatients and outpatients.

During the patient's stay in the hospital, the nurse in charge may determine that she would like to transfer the patient to a bed other than that assigned by the computer.

(Continued on p. 134)



Mr. Geisler is presently director of the computing center of the State University of New York's Downstate Medical Center. Before starting there as a senior programmer analyst, he worked for CEIR and SDC.

The ward clerk enters the bed transfer into the 1092 terminal at the nursing station. This will cause the patient record to be updated, and will generate messages in both the CENTREX and admissions offices.

At some point during the patient's stay in the hospital, he may be sent home on pass for some period of time (but not discharged). The patient is escorted to the admitting office where an entry is made into the 1052 terminal to the effect that he has left the hospital on pass. On returning, he again stops at the admitting office where an entry indicating his return from pass is entered into the system via the same terminal. As a result of this action, the patient is not charged for days when he is not actually resident in the hospital. Further, his absence has been reported out on a daily basis to the admissions, business, and CENTREX offices. When the patient is discharged from the hospital for whatever reason (voluntary, doctor's order, death, etc.), this information is also entered into the 1092 terminal. At that time, a summary bill containing the totals of the various major categories of the hospital operation (e.g., daily care, radiology, clinical laboratories) is produced on a 1053 terminal in the business office. Simultaneously, the admissions office is advised that the patient has been discharged, and the CENTREX office is notified that the telephone has now been freed for use by another patient.

An inquiry bill, identical in format to the discharge bill, may be requested via 1092 terminal by the business office. As is the case of the discharge bill, it will print on the 1053 terminal.

After physicians' rounds, the patient's condition is entered into the patient's record via the 1092 terminal. This information is then printed on a 1403 high-speed printer in the computing center and distributed to the admitting office so that this information is available if and when friends or relatives call to find out the condition of a patient.

non-teleprocessing operations

During non-teleprocessing hours (midnight through 8 a.m.), the system generates many reports (as detailed below) for the hospital management, which are compiled as a result of the various teleprocessing transmissions throughout the day's operations.

Each day the admissions office receives a list of all patients due on that day. They also receive listings of expected future arrivals. Another report analyzes the expected arrivals by service area.

Each service area receives schedules of all procedures to be performed that day. In the case of the laboratories, specimen pickup lists (ordered by nursing station) are provided to enable the technicians to better plan their agenda.

Among the multitude of other reports provided to facilitate hospital operations are census reports in various formats:

1. By religion—for the chaplain's office.
2. Alphabetical listing of all patients.
3. Patient listing ordered by nursing station.
4. Bed availability reports.
5. Statistical analysis of patient census, by service and subservice.

Certain of our statistical programs produce analyses of the procedures performed on the previous day, for each of the hospital services. This same series of programs may be used selectively to analyze activity for a given service area for any range of time specified.

As a result of terminal links with the telephone company, any telephone calls made during a patient's stay cause a

record to be located in the computing center. This tape is converted to a standard 80-column card by use of an IBM 2671 paper-tape reader linked to an IBM 360/44, also situated in the computing center. After feeding this data into THOMIS, the telephone call becomes a billable item.

Most hospitals, upon admission, stamp an addressograph plate to be used for labelling patients' forms. THOMIS supplies the admitting office with preprinted self-adhering labels for patients. Labels are printed in two sizes. One size contains all data normally found on the standard addressograph, while the other contains only patient name, patient number, and medical record number. The larger label is used on patient forms, while the smaller may be appended to specimen tags. When the patient is escorted to the nursing station his assorted labels are brought along. The clerk may request an additional supply via the 1092 keyboard at her station when her supply runs low. The various label requests are accumulated within THOMIS, and are printed on the 1403 high-speed printer in the computing center.

THOMIS processes results of many of the quantitative tests run on patient specimens in the clinical laboratories. (Ordering procedures for this area will be found elsewhere in this paper.)

Results of tests on any specimen are stored within the system. Each night laboratory profiles are printed for all patients for whom results were reported that day. The profile consists of a listing of all tests performed since the patient's admission to the State University Hospital. Tests are grouped by type, and within type are ordered by date performed. By studying this profile, the physician can easily note all changes in patient condition. (The profile becomes a part of the patient's chart.) When a new profile is printed the previous one is destroyed by the clerk.

Following patient discharge, a detailed final bill is produced on the 1403 high-speed printer in the computing center. The final bill serves as the input to the accounts receivable system. As of this writing, the accounts receivable system has been programmed but is not yet operational.

outpatient processing

Processing of outpatients and inpatients is markedly different in that inpatients are admitted, treated for a period of time, and released. Further, there is a maximum limit to the number (350) of inpatients that may be treated at any time. As a result, our inpatient files have been designed to store, ready for immediate access, that entire number.

Outpatients once admitted are never discharged. They visit the hospital periodically for treatment. Sometimes they have an appointment, sometimes they appear for treatment unscheduled. Volume makes it quite impossible, within the range of devices available to us, to store all outpatient records on the direct-access device.

We have three basic categories of outpatients:

1. Patients due today.
2. Active patients (those with activity in the past three months).
3. Inactive patients (those with no activity for three months, and no reappointments scheduled).

Teleprocessing Operations. Outpatients are admitted to the hospital, and to the THOMIS system, via a 1052 terminal. Upon arrival, the patient is interviewed by a clerk who manually fills out an admission form. Following this, the patient's name, medical record number (social security number), clinic, time, and date are entered into the 1052.

The response from the system is a message containing a patient number which has been assigned by the computer. The admission form is keypunched in the computing center and introduced into the system that night.

All procedures and/or items may be ordered for any patients who fall into category 1, patients scheduled for today. A patient is scheduled for a given date as a result of a clerk's entering a specific reappointment date into the system. The resultant printout on the 1052 terminal in the clinic is given to the patient, thus relieving the clerk of having to prepare a manual appointment notice.

Patients who were not scheduled to visit the hospital on a given date may be processed by entry through the NS program. If the patient is an active patient, his record is given TODAY status and all normal operations may be processed.

If the patient is inactive, his record is not available to the teleprocessing system. The system, instead, creates a dummy patient record using certain basic information, entered for the patient by the clerk, and required by the NS program. This data is typed into THOMIS via the 1052 typewriter. Normal ordering is then possible for the patient. At the end of the clinic's day, the files are reorganized, and any patients who were NS'd during the day are moved to the disc from tape.

Non-teleprocessing operations. After the patient has been admitted and assigned a patient number by the system, his admission form is sent to the computing center where it is keypunched and entered into the system. This data is input to which to build the patient's personal history record.

After admission, labels (as described under inpatient processing) are printed on the high-speed printer in the computing center for use in the treatment of the patient.

Analysis of the patient files each day produces many reports which lighten the burden of the clerical staff, some of which are detailed below.

1. Reappointments—a listing of all patients scheduled to visit the clinic is printed and distributed to each clinic.

2. Missed appointments—the administration of the outpatient department receives a listing of all patients who fail to keep their appointments.

3. Non-scheduled arrivals—outpatient department administration also receives a listing of all patients who arrive for treatment unscheduled.

4. New admissions—each day a report of all new admissions from the previous day is submitted to the outpatient administration, medical records department, and the business office.

5. Medical record notification—five days prior to a scheduled patient visit, a report is produced for the medical records department to notify them of the patient's impending visit. As a result of receiving this report, the patient's chart is available when he arrives at the clinic.

At the end of each month, outpatient bills are produced on the 1403 high-speed printer in the computing center. These bills are drawn off the data compiled during that month. In order to lessen the computer burden caused by the many end-of-month reports required, the billing system has been designed to run at any time after end-of-month. The computer operator simply types in the last day to be billed. Thus, if pressure on the computer requires billing on the fifth of the following month, no problem will exist. This design has also made possible the ability to produce outpatient bills on a weekly, semi-monthly, etc. basis, if, for any reason, the business office should determine this would better suit its purposes.

The billing run serves the additional function of clearing

the patient files of the patient-ordering data.

Ordering procedures are identical for both inpatients and outpatients. Therefore, it was felt that little reference should be made to this subject when discussing those areas to avoid duplication.

After the physician examines the patient, he enters his orders for treatment into the patient's record. This, in turn, is examined by a clerk who looks up the procedure or item specified by the physician in the appropriate catalog (e.g. radiology, pharmacy, clinical laboratory), and determines the procedure or item number. Using that number in conjunction with the patient number, date of service, and quantity (if an item), she enters the order. All patient ordering is done via 1092 terminal. Inpatient ordering uses the 1092 in combination with a 1053; while outpatient ordering uses a 1092/1052 combination. The use of the 1052 is necessitated by the NS procedures referenced above in the description of outpatient processing.

Ordering may be done for today or for the future. When a TODAY order is placed, a copy of it prints out on the terminal in the service area (e.g. radiology), thus informing that department of a procedure to be performed that day.

For a future order, however, while the normal validation prints out for the ordering clerk on her own terminal, it is not repeated in the service area. Instead, a record is made on the 2314 disc. On the day the service is to be performed, the service area is notified, via a listing generated on the high-speed printer in the computing center, of the pre-planned activity for that day.

The above described ordering procedures are standard for the following service areas:

1. Radiology
2. Specialty clinics
 - Physiology
 - Rehabilitation medicine
 - Physical therapy
 - Occupational therapy
 - Neurology
 - Orthopedics
 - Plastic surgery
 - Inhalation therapy
 - Psychiatry
 - Ophthalmology
 - Operating room

As a direct result of the keying in of the order through the 1092 terminal, the patient is billed for the service ordered.

There are certain areas on which our ordering procedures differ in some manner from that described above. These are detailed below.

pharmacy

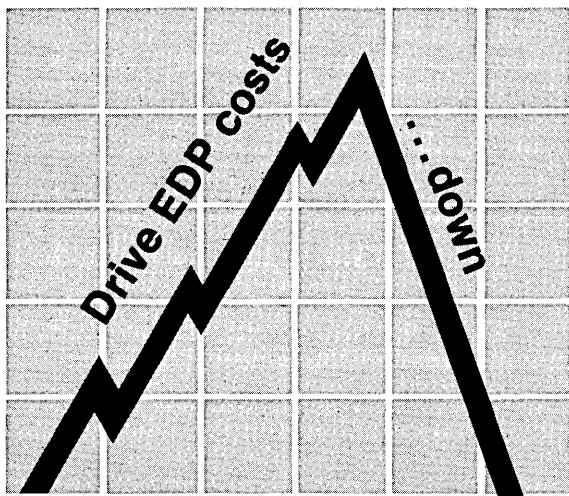
Ordering in this area does much more than simply notify the service area that a service is to be performed. The ordering of a pharmaceutical triggers many operations. At the same time that the validation is printing out on the ordering terminal, a prescription label is printing out in the pharmacy containing all data that such a form must legally contain. This is carbonized, and the duplicate serves as a file copy for the pharmacy. As the label prints on the 1053 terminal, the stock inventory of that item is reduced by the appropriate amount. If an order causes inventory to fall below a specified level, the pharmacy is sent a notification of reorder via 1053.

As in the case of all other ordering, the patient record is, of course, updated so that he will be billed for this item.

The pharmacy maintains stocks of certain items at each of the nursing stations and clinics in the State University

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CIRCLE 91 ON READER CARD

THOMIS MEDICAL INFORMATION SYSTEM . . .

Hospital. When floor stock is required by a nursing station or clinic, the pharmacy clerk orders it through a 1092/1052 combination. This decrements the item inventory. When the floor stock is used for a particular patient, the procedure is similar, but not identical, to normal ordering procedures. The ward clerk enters the order exactly as usual, but also depresses a button labelled "charge only." This will cause the patient's record to be affected, and thus, generate a charge for the patient. However, since the item has already been dispensed and the inventory decremented, neither of these operations takes place.

When the pharmacy receives a shipment from one of its suppliers, the receipt of same is entered through the 1092/1052 terminal to increment the inventory.

Twice a week the pharmacy receives the following reports:

1. Re-order report—list all drugs which have fallen below preplanned re-order levels of inventory.
2. Inventory status report—current inventory in terms of quantity and dollar value.

clinical laboratories

Laboratory ordering is identical to all other ordering. Differences are found in the post-ordering phase of the operations. THOMIS handles the reporting of quantitative laboratory results in the areas of clinical chemistry, coagulation, hematology, special hematology, serology, and clinical isotopes.

Results are entered into THOMIS by a clerk using a 1092/93/53 combination. After the results are entered via the 1092/93, a proof list is printed on the 1053. If correct, they are accepted and stored in the system. Simultaneously with their acceptance by the clerk, they are transmitted to the appropriate nursing station for the use of the physician. Outpatient laboratory results are not transmitted to the clinic since, as a rule, neither the patient nor his medical record will be available. Outpatient results are summarized nightly and sent to the Medical Records Department the following morning for filling in on the patient's chart.

Sterile supply ordering is similar to pharmacy, though with a much smaller degree of ordering on a per patient basis. The vast bulk of sterile supply items are ordered on a mass basis. They do, however, receive all of the standard inventory and re-order reports that the pharmacy does.

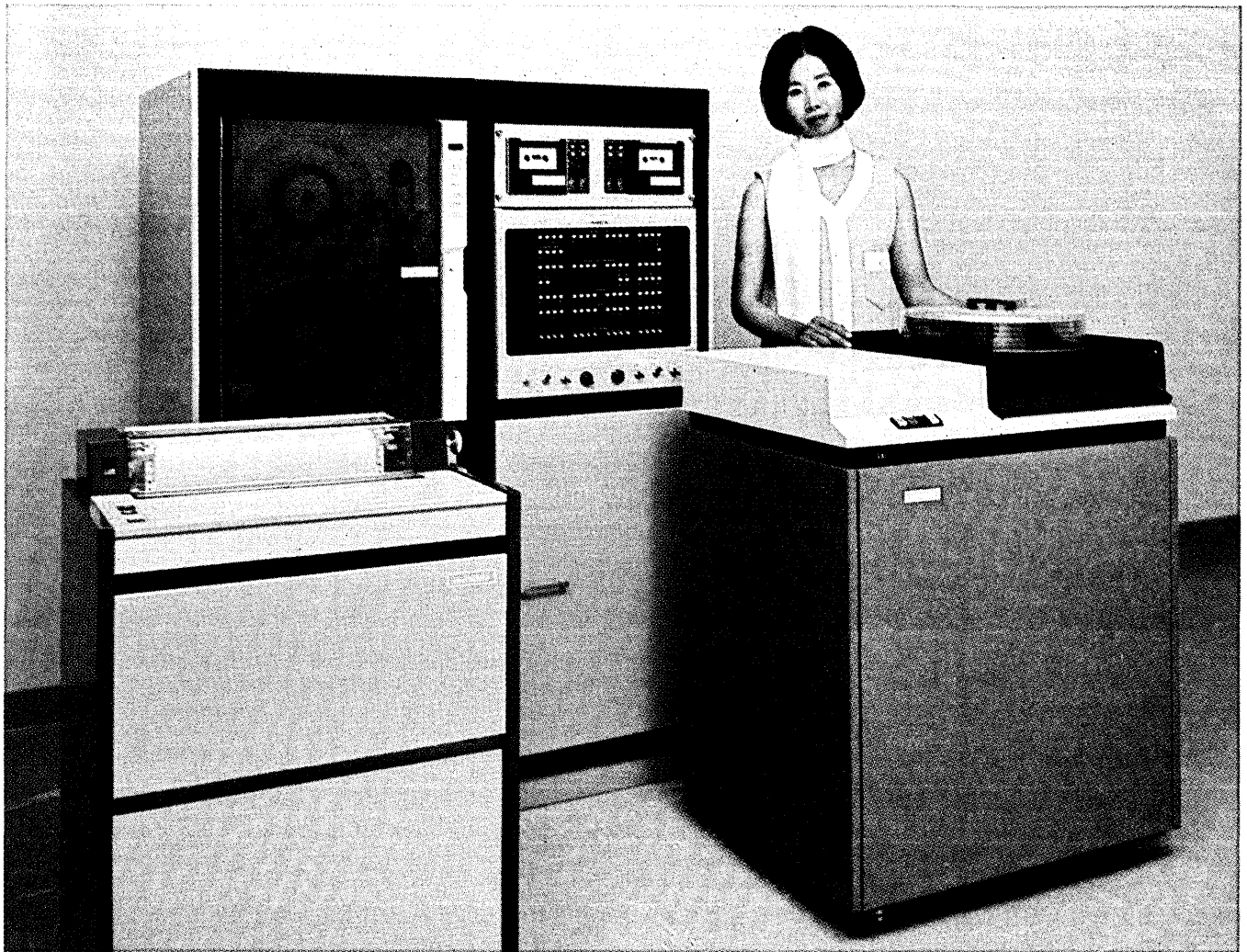
conclusion

Due to the fact that the State University Hospital was opened in 1966 with its various activities computerized, we have no basis for comparison when attempting to determine how much of a service we are performing—in terms of cost, or improved patient care. However, it must be recognized that many of the functions we are performing could not even be dreamed of under a manual system (e.g., laboratory results profile, automatic pharmacy update).

We feel that we used the best equipment available at the time that THOMIS was conceived.

As part of our continuing effort to improve our system we have ordered several IBM 2260 crt's. These terminals are to be installed during the Summer and Fall of 1970. This equipment will be used to improve both our inpatient and outpatient admitting procedures. The installation of the 2260 terminal in the laboratory for result reporting is expected to save several hours a day of clerical time, since the typing of hard copy on a 1053 is much slower than the display of the result proof list on a screen.

We are continuing to investigate new equipment with an eye towards improving the system wherever possible. ■



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AUTOMATION AND THE LIBRARY OF CONGRESS: 1970

a long-term project

by Paul R. Reimers and Henriette D. Avram

The Library of Congress is the library of the American people. Its first obligation is to meet the information needs of the Congress. Because these needs are so broad, and because Congress, through many enactments, has shared the resources of the library with the country, LC has taken on the additional functions of a national library. The automation program at the library provides computer support to what may be described as the most complex information system in existence. The effort utilizes commercial equipment, makes maximum use of available software, and requires system logic unique to Library of Congress needs.

*Automation and the Library of Congress*¹ (hereafter referred to as the King report) was published in 1963. It reports the results of a feasibility study conducted by a team of specialists to survey "the possibilities of automating the organization, storage, and retrieval of information in a large research library . . . whose activities are interrelated with those of other research libraries." The study followed initial efforts within the Library of Congress. Staff members, including top management, recognized the need to investigate the potential of automation for the library. An in-house committee was formed and, as a result of its deliberations, the library requested funds from the Council on Library Resources, Inc., for the feasibility study.

The conclusions of the survey team are better known to those in library automation than to the computer profession generally. Essentially, they are that, although the intellectual content in a large collection cannot now be retrieved, the automation of cataloging, searching, indexing, and document retrieval is technically and economically feasible. The team recommended that a group be established to administer the effort and that funds be requested for in-

depth studies. Upon completion of the design effort, the library should move to full implementation.

The Library of Congress assembled a system staff, now organized as the Information Systems Office.² The system described in the report was more rigorously defined by the Library of Congress staff.³ A seven-phase program was designed and the main goal of the Library of Congress automation activity became known as the Central Bibliographic System (CBS).⁴

1970 is upon us. The target date for implementation of the system according to the survey of 1961-63 was 1972. This optimistic target date will not be met. What conditions led to the fixing of 1972 as the completion date approximately 10 years prior to that date? What has transpired since the publication of the King report to change, not the direction, but the emphasis and schedule?

The King report was, in many ways, ahead of its time. It might be compared with Licklider's report, *Libraries of the Future*⁵. In emphasizing the user of the system and, as a requirement for satisfaction of the user, on-line consoles, there is a tendency to gloss over the problems inherent in the control of information and the need to solve these problems as a prerequisite to user satisfaction.

Weinstock⁶ distinguished between processing required for control of information and that required for reference by

¹Gilbert W. King, and others, *Automation and the Library of Congress*, a survey sponsored by the Council on Library Resources, Inc. Library of Congress, Washington, 1963.

²The staff has grown from a coordinating staff of 3 to an operating staff of 60.

³Phase I: Survey of the Present Manual System; Phase II: System Requirement Analysis; Phase III: Functional Description of a Recommended System; Phase IV: System Specifications for Equipment and Software; Phase V: System Design; Phase VI: Implementation of the New System; Phase VII: Operations of a New System.

⁴Major components excluded from the Central Bibliographic System are the Copyright Office, the Legislative Reference Service (the department within the Library of Congress that works solely for the Congress), and the Card Division.

⁵J. C. R. Licklider, *Libraries of the Future*, The M.I.T. Press, 1965.

⁶Melvin Weinstock, *Network Concepts in Scientific and Technical Libraries*. Special Libraries, May-June, 1967.



Mr. Reimers, as coordinator of information systems, is responsible for managing automation developments at the Library of Congress. Active in information system design for many years, he has been responsible for management and system engineering of projects in government and industry. He holds a BA and MA from the University of Buffalo, and an MBA from the Harvard Business School.

recognizing "... what can be done using computers, suitable linkages, and modules such as libraries to reduce access-time in locating desired references, and to reduce the time in getting documents to the requester. These are vital functions in the operation of a network. Although these functions and other associated reference services are the principal reason for the existence of the library, when we examine the day-to-day work done by the entire library staff, we find that such services occupy only a small portion of the library's total work load. These reference functions depend entirely on the efficient performance of a far greater spectrum of activities concerned with selecting, acquiring, classifying, cataloging, processing, shelving, and organizing the library materials.

"When we talk about the automation of information systems, we find a curious paradox. Everyone seems to be very concerned about automating the top part, the search function—the part everyone sees. Yet the portions of total library activity devoted to direct reference and search is only about 25% or less."

The concentration on the reference function in the literature minimizes the difficulties encountered to achieve this highly desirable goal.

The Library of Congress has about 60 million items: books, serials, maps, music, prints and photographs, manuscripts, and the like. The official catalog, the library's largest file, contains some 16.5 million records. An inventory showed that about 1,260 different files are used in the library's operations. The library has long collected comprehensively, and is now responsible for acquiring and cataloging all works, published anywhere in the world, important to scholarship. Materials flowing into the library today are written in 125 different languages, represented by 20 distinct alphabets.

During fiscal year 1969, descriptive and subject cataloging of all types of materials totaled approximately 200,000 items. In addition to providing subject and descriptive data and LC classification, the library also assigns Dewey Decimal classification to certain classes of material.

The Library of Congress acquires over 6-million library-related materials per year by purchase from over 2,500 dealers; by exchange agreements with over 22,000 institutions throughout the world; by transfer, gift, and copyright deposit. Although the library does not add all of this to its

collection, it does catalog and classify all material of interest to the American library community.

The most difficult type of material to control is serial publications. The library's serial record file, in addition to being the record of receipt of all serial publications coming to the library, serves as the center for information on retention, treatment, assignment, routing, and processing of serials. The serial record contains approximately 650,000 records on 1.2 million physical cards and represents 43 different languages.

One of the basic library functions is the recording and organizing of bibliographic data to facilitate access to, and use of, the material contained in the collections.

Bibliographic information in the catalog record is basically of two kinds: a description of a book and a notation to be used in locating the book. The locating notation also is a means for bringing together materials on the same and related subjects. The catalog record distinguishes one book from all others represented in the catalog. The formulation of the record, therefore, requires the application of a complicated set of rules for describing and analyzing the work.

In addition to providing a unique description of each item, the aim is to bring together the works of an author, to bring together editions of a work, and to bring together items on the same subject. Thus, each new record must be coordinated with existing records and with authority files for author names and subject terms.

The Library of Congress is different from other libraries both in degree and kind. It houses the largest and most varied collection of any library in this country and also provides a national bibliographic service. The U.S., unlike most other countries, does not have an organized national bibliography to announce materials published in the country. Through its printed-card service and book catalogs, the Library of Congress has assumed these functions. The library also maintains the National Union Catalog (NUC), which contains records of approximately 12.8-million titles, each record having posted to it the name of the libraries holding a particular title.

Prior to major systems analysis efforts on the Central Bibliographic Service an event took place that provided some of the experience needed to understand the complexity of the tasks at hand. The Council on Library Resources supported a study⁷ on converting cataloging data to produce a variety of printed documents by computer. A conference was held in 1965 at the Library of Congress and there was general agreement that machine-readable bibliographic data, provided as a by-product of LC's cataloging, would support automation programs undertaken or planned at other libraries. In that year, a report⁸ describing problems and solutions for recording bibliographic information in machine-readable form was published.

A series of meetings was held to discuss the report and to plan for future activity. It was determined that the Library of Congress should take the lead and conduct a pilot project to test the feasibility and utility of recording bibliographic information in machine-readable form for distribution to the American library community.

Under a grant from the Council on Library Resources, Inc., the Library of Congress implemented the pilot project, which became known as Project MARC (for MACHine-



Mrs. Avram has been at the Library of Congress since 1965, and is presently assistant coordinator of information systems and director of the MARC Pilot Project, MARC Distribution Service, and RECON Pilot Project. Prior to this she was a senior systems analyst at Datatrol Corp. and the Dept. of Defense. She has served as chairman of the National Special Interest Committee on Real-Time Processing, ACM, and is presently chairman, American National Standards Institute, Z39, Subcommittee 2 on Machine Input Records. She has contributed many papers on library automation.

⁷Lawrence F. Buckland, *The Recording of Library of Congress Bibliographical Data in Machine Form*, Washington, Council on Library Resources, 1965.

⁸Henriette D. Avram, Ruth S. Freitag, and Kay D. Guiles, *A Proposed Format for a Standardized Machine-Readable Catalog Record; A Preliminary Draft*, Library of Congress, Washington, 1965.

Readable Cataloging). Invitations were sent to 40 libraries, and 16 were selected as participants. Each participant had a commitment of computer time and agreed to report results. Participants were selected in accordance with three criteria: different kinds of libraries had to be represented; the use of the data had to cover a wide spectrum of operations and products; one of two computer configurations had to be available to utilize software written by the library.

The weekly tape distribution in 7- and 9-level form began in November, 1966, and continued until June, 1968. Programs were provided to produce certain standard bibliographic tools, e.g. catalog cards. During the pilot project, Library of Congress and participant costs and uses were monitored and LC procedures more exactly defined. Experiences were documented in a final project report.⁹

As a result of the pilot, the library community encouraged a continuing MARC distribution. Experience in use and recommendations from participants enabled the library staff to refine the magnetic-tape record format used in the pilot project and to issue *The MARC II Format*¹⁰. A new MARC system was designed and a test tape in the new format sold to interested users in the fall of 1968.

The full-scale distribution service initiated in March, 1969, allows libraries and service organizations to subscribe to weekly tapes which presently contain all English-language monographs cataloged that week by the Library of Congress. A worksheet is used by catalogers to describe each item; to record subject, classification, and other essential information. The LC catalog card is printed from this worksheet with a copy sent to the MARC editorial office. Here each of the fields is tagged by trained editors and the edited worksheet transmitted to an input typist. Worksheet data is input by an IBM MT/ST Model 5 and the inscribed tapes are converted to a computer-compatible tape by a Digidata Model 30 converter.

Records are formatted, edited, and put into working storage on the library's IBM 360/40 system. A printout is returned to the editorial office for proofing. This process continues until each record is free of errors and added to the master data base. Each week a subscriber receives a 300-foot minireel of tape containing new records (about 1,000) and records requiring updating that were distributed during a prior week.

More than 200 test tapes have been ordered so that potential users can experiment with live data. Although most of the test tapes are in libraries and service groups in the U.S., interest by foreign libraries is shown by orders from Australia, Canada, Denmark, France, Germany, Japan, the Netherlands, and the United Kingdom. Seventy-five subscriptions have been sold to date including foreign centers.

The MARC format reflects the close interworking of the project staff with standards groups. The American National Standards Institute (ANSI) Sectional Committee z39/sc2's proposed *Standard for Bibliographic Information Interchange on Magnetic Tape* is being evaluated by the ANSI board and by a working group of the International Standards Organization. The MARC Distribution Service uses all

applicable ANSI standards, e.g., tape labels, and the ASCII character set.¹¹

The proposed ANSI format has been widely accepted. It has been adopted by the three national libraries, the American Library Association (ALA), the Special Libraries Association (SLA), the Association of Research Libraries (ARL), the Committee on Scientific and Technical Information (COSATI), the British National Bibliography (BNB), and the International Atomic Energy Agency. The BNB implemented a United Kingdom/MARC Pilot Project and BNB now exchanges tapes with LC. The character set for Roman alphabet languages was accepted by the ALA and ALA is proposing to industry a print train for library use.

The Library of Congress defines format as containing three basic elements: structure (the proposed ANSI standard), content designators, and content. Structure is the physical representation on tape, capable of containing the bibliographic description for all forms of material; content designators are the labels to identify explicitly data elements for particular material; the content is the data itself.

The library has specified a MARC format for serials, for single sheet maps, and work is in progress on the format for motion pictures and filmstrips. All of these formats have the same structure, differing only in content designators where required and, of course, in content.

library of congress marc system

During the planning of the MARC system, which was being built to incorporate the revised MARC format and the operational MARC Distribution Service, the scope had broadened to include transmission from the Library of Congress to other libraries, as well as exchange of machine-readable data between libraries. Because it was recognized that there existed the possibility of future transmission of records for different forms of material and other related control information, the design called for a generalized data management system which also could serve related projects within the Library of Congress. The MARC system is modular, with each module expandable without the effect being felt throughout the system. The major subsystems deal with input, storage, retrieval, and output functions. Programs are table driven to handle variation in content designators and are parameterized to handle variations in field selection, format control, etc.

Although the system took longer to complete than if specifications had been narrower, the result has been that many other projects have been implemented in a short period of time. Some of these are briefly described below:

1. The Geography and Map Division houses, as part of its collection, 3 million single-sheet maps. A variety of book catalogs have been issued for internal use. The off-line retrieval subsystem has been used for production of specialized catalogs such as single-sheet maps pertaining to individual states.

2. Science and Technology (s&t) Division files were built and are maintained for the reference collection of the s&t reading room. This collection contains current and non-current material made up of monographs, serials, and technical reports. Book catalogs are issued for use by the reference librarians.

3. *Cold Regions Research and Engineering Bibliography* is compiled by the s&t Division for the U.S. Army Cold Regions Research and Engineering Laboratory and includes a weekly accessions list of articles and technical papers. These citations are input to the MARC system and a monthly current awareness listing is prepared. Quarterly and annual reports are published, the annual being dis-

⁹Henriette D. Avram, *The MARC Pilot Project: Final Report on a Project Sponsored by the Council on Library Resources, Inc.*, Library of Congress, Washington, 1968.

¹⁰Henriette D. Avram, and others, *The MARC II Format: A Communications Format for Bibliographic Data*, Library of Congress, 1968.

¹¹The ASCII 7-bit code was expanded to an 8-bit code to accommodate the character set required to include all Roman alphabetical languages. The chairman of the X3.2 Committee that developed the 7-bit code was consulted during the development of the 8-bit code and the library character set is now being considered as an extension of ASCII for a family of users by an Ad Hoc X3.2 Committee.

tributed through the Clearinghouse for Federal Scientific and Technical Reports.

4. The Hispanic Foundation publishes the *National Directory for Latin Americanists*, an internationally recognized reference tool. The directory will, in future, be produced by the Government Printing Office (GPO) Linotron. Members of the foundation staff also use the retrieval subsystem to answer specific queries from the data base.

5. The Legislative Reference Service (LRS) reviews current publications of interest to the Congress and maintains a file of citations of journal articles, government documents, congressional documents, monographs, and internal LRS reports. In addition to production of catalogs, this file supports an SDI system providing "current awareness" based on profiles.

Concurrent with the development of the MARC system, the first phases of the Central Bibliographic System studies were completed.

Both efforts presented some hard facts and dictated future plans for the automation effort at LC. Analysts and programmers on the staff of the Information Systems Office were introduced to the complexity of bibliographic information and library systems. The input problems for the multiplicity of required characters, data that cannot be bound by any rules, the requirement for the processing of variable length records, the complex relationships of records within files and across files were but some of the difficulties that frightened even the most seasoned. Not how to automate all functions, but the way to proceed to automate some functions, became clear.

The large mass of raw data about the processing and reference functions of the library collected during the first three phases of the system study had provided a picture of flow and loads. Working from projected inputs to the system from all sources, loads have been extrapolated to 1972 and 1980 as practical design points. From this the characteristics of the various system components can be drawn.

Additional studies are in progress to assist in a more rigorous definition of requirements, and the design work for certain components which will provide feedback information for future components has begun.

central bibliographic system

Studies. Two major studies have been let by competitive bid. The first is concerned with the specifications for all terminal devices which will be required for intermediate and full implementation. Work stations were described and terminal modules developed for each function. The state of the art as it currently exists and as it is developing is being evaluated to determine when terminals will be available.

The second study deals with the problem of computer equipment for the Central Bibliographic System. Because file management is so important in library work and computation secondary except for search strategy, the study approaches equipment selection through a study of file organization by modeling. The characteristics of an operating system to operate upon the file or files are determined. Existing operating systems are tested against these characteristics. Since operating systems do not exist separate from the hardware for which they are designed, selection of an operating system implies selection of hardware.

Design and implementation of components of CBS. A research committee has been formed consisting of librarians and systems analysts to determine what outputs will be most useful to the on-going library operation. The committee discusses potential system designs, measuring each against the current and projected needs of the library. As

the research group identifies areas of immediate payoff, subsystems are specified in detail and recommended to the librarian of Congress for intensive design.

The automation of the Order Division is the module closest to completion. The Order Division purchases works not available from other sources to augment the collection. Approximately 300,000 monographs and 700,000 serials were purchased during fiscal year 1969.

The project is mainly concerned with automatic control of material from the time of generating a request until the document is in the library and forwarded for further processing. A record for each order is maintained in a machine file where it is monitored to test and update the status of the item. Purchase orders, claims, and payment releases are generated as required. Designed for development to an on-line system, it will eventually provide up-to-the-minute information to staff members about any title on order or in process.

A second important control function is that of charging books after they have been cataloged. As in all reference libraries, the greatest use of the collection is in the reading rooms. Certain works are maintained in special reference collections. These are charged through the Loan Division, as are books borrowed by members and staffs of the Congress. Control is now maintained by manual and machine means; a preliminary design for a central charge file is underway. Both projects described above deal with typical functions of the Central Bibliographic System; producing records, searching files, monitoring actions, maintaining files, and outputting required forms. Thus they serve as models which might be applicable to the total CBS.

extended bibliographic services

The Retrospective Conversion Project (RECON) was instituted to meet the need for non-current bibliographic records. A growing interest in automation, availability of the MARC tapes, and growing acceptance of the format, has led to record conversion in many libraries. Uncoordinated conversion would result in incompatible data bases and high cost because of overlap in collections.

The Council on Library Resources (CLR) responded to a grant request from the library, and the responsibility for a study of the economic, technical, and bibliographic problems was undertaken by a working task force.

A report¹² published in June, 1969, stated the conclusions of the study and made specific recommendations on a pilot implementation. CLR granted funds for a two-year pilot project. In addition to experimentation with types of input devices and photocopying methods (to preserve the integrity of a file in continuous use), a technique will be tested of importance to conversion of current and retrospective data. Explicit identification of data elements and coding of conditions implicit in the record will be set by computer. The technique is significant for the reducing of human editing and the cost of converting complex records. It is estimated that approximately 70% of the records will be successfully processed by machine. The RECON data base will be a subset of the 1969 English-language monograph records not included in the MARC Distribution Service and all 1968 English-language monograph records. In order to explore the characteristics of foreign-language and older records, 5,000 research titles will also be tested through all techniques established for the 1968 and 1969 titles.

The Card Division receives more than 50,000 orders a day for printed cards from over 25,000 subscribers. With 63

¹²RECON Working Task Force, *Conversion of Retrospective Catalog Records to Machine-Readable Form; A Study of the Feasibility of a National Bibliographic Service*, Library of Congress, Washington, 1969.

million cards sold during fiscal year 1969, even a stock of 100 million cards was not adequate for effective service, and the manual operation required considerable time and manpower.

A design was developed to automate the functions of the Card Division in two phases. Phase I processes order slips from subscribers, creates a magnetic tape containing order information from each subscriber, and produces management reports; Phase II uses the order information and a machine store to print cards.

Order slips containing the subscriber number, the LC card number, and the type of handling desired, are processed by Recognition Equipment Inc. readers at 1,200 documents per minute, transferring the information to a computer printout and magnetic tape. The information is also recorded as a bar code on the back of each order slip. Order slips are sorted by LC card number and compared against a tape file of cards not in stock. Sequenced order slips for cards in stock are filled by manually drawing and placing cards behind each order slip. Order slips and cards are returned to the sorting equipment and resorted by subscriber number. Invoices and labels, prepared on a line printer, are matched with orders and cards and shipments mailed.

Phase II of the system will carry the automatic process a step further by printing the cards on demand. A general-purpose computer and a photocomposition device have been selected. Using the daily transaction tapes compiled during Phase I operations, records will be selected from mass storage. These records, sorted by subscriber number, are grouped to produce pages of cards for each customer. The final phase of composition will perform the necessary pagination, font extraction, etc. The photocomposed output will produce continuous direct-image, paper-plate masters containing card text and mailing labels. These masters will be developed and cut for offset presses. As the copies are produced, they will be automatically ejected, cut, stacked with address labels on top, packaged, and mailed. Phase I is in operation and Phase II is expected to be implemented by 1971.

subject headings

The seventh edition of the Library of Congress list of subject headings includes subject headings established and applied by the library from 1897-1964. This list was produced from a machine-readable file by the GPO Linofilm. The document illustrates one of the most difficult problems in library automation, the problem of file arrangement.

In order to organize information for effective use, it is necessary to arrange data in a sequence that depends on semantic content instead of a simple collation sequence (e.g., blank, A-Z, 0-9). The prescribed sequence was maintained with a unique number for each entry and an inter-polation was made, by a human, to file an added subject heading in its correct position. In addition, a term may appear wherever required for cross-reference. If a term is changed, corrections must be made at each occurrence of the term. The subject heading list in machine-readable form is being organized so that a posted correction will change all records with the same term. This organization destroys the prescribed sequence and the file must be resequenced from its maintenance back to its original sequence for publication. An alternative solution is to maintain two files linked so that changes in one update the other. In any case, additions to the file must be properly sequenced, a capability not possible with existing software merges.

Work is in progress to solve this problem. In the interim,

programs have been developed to assist the human editor and to translate records to the format for producing a new edition of the LC subject headings list by GPO Linotron.

The Copyright Office has traditionally maintained records separate from those of the traditional library operations because these files serve a legal rather than a bibliographic function. Differences can be seen most clearly perhaps in the recording of the author's name. As a legal description, Copyright records the author precisely as it is given on the work. Thus the same author may appear in the files in a number of forms. Bibliography, on the other hand, seeks to bring together all works by the same author by establishing a single form of name to be used regardless of chance variations that may appear in an author's work. The established form (name authority) is used in cataloging all subsequent works involving the person or corporate body.

The primary goal of the current Copyright Office automation project is the design and implementation of an information system to control every application, item, and fee received by the Copyright Office. Secondary implications of this primary mission are far reaching, however, and greatly increase the magnitude and scope of the study and the detailed analysis necessary to the success of this initial systems effort. Fiscal and control information in the initial accounting and in-process control system must be related to the flow and control of documents through the Copyright Office. Moreover, the relationship of automation in the Copyright Office to the library's over-all automation plans and presently on-going automated information systems must be carefully studied. The achievement of an operationally successful automated in-process and accounting-information system requires three levels of concurrent study and design:

- 1) The study and general design of an automated information system for the entire information flow of the Copyright Office;

- 2) The detailed analysis and preparation of systems specifications for the first components of the office's automated information system;

- 3) The formulation of management objectives to be served by the newly designed system and the detailed management analysis necessary to the efficient manual and mechanized flow of documents and items controlled by the automated information system.

legislative reference service

Because the Legislative Reference Service must react quickly to Congressional queries, it was the first of the library's activities selected for on-line input and access. 2,741 terminals have been provided to divisions so that data can be input and recalled in the operating areas.

The first service provided by means of terminals was the building of the data base required for the *Digest of Public Bills*. Legislation is numbered as it is proposed in both chambers of the Congress. After processing, bills are abstracted by LRS to be published for the information of members and staffs. At intervals during the Congressional year, the *Digest of Public Bills* is accumulated and published. Abstracts are input and edited by means of the Administrative Terminal System (ATS) on the library's 360/40. When publication is required, abstracts are recalled in bill number order, the index is produced, and copy furnished for publication by the Government Printing Office. In the future, the *Digest* will be photocomposed by the GPO Linotron.

This operation increases the usefulness of the *Digest* by reducing the time between cutoff and publication, and

provides a data base of proposed legislation. Two years of proposed legislation with Congressional action are now available in machinable form.

The 2,741 terminals installed in the LRS allow the division responsible for data to control its processing. Bibliographic input has been described under the MARC system; additions and corrections to the base can be made without interrupting the flow of other material.

The ARTS system is being used in other ways to support Congressional operations. Two committees of the House of Representatives, the Banking and Currency Committee and the Committee on the Judiciary, have 2,741 terminals tied to the library computer so that printed calendars can be updated easily and recalled on demand. With terminals for text editing in the divisions, the ARTS system is used to communicate requests received from the Congress by Inquiry Control to the specialized divisions. A machine record of transmitted inquiries is maintained so that information needs of the Congress can be analyzed in depth.

Completed studies have shown that urgent Congressional requests can be met through on-line retrieval by subject and content of bills and bill digests. A retrieval system, to be installed in 1970, will permit retrieval of substantive information contained in the digests as well as that in the most important current bills. Printer terminals used for ARTS as well as crt displays will be installed on a pilot basis with expansion possible.

Recognizing that an information system as complex as that of the Library of Congress may never be completely automated, implementing and advisory groups have moved to develop techniques within the framework of a logical

plan. Techniques include those required to process bibliographic information and to support and integrate on-going functions. The information in the 1,260 files can be reduced when multiple-work stations can access common machine files.

A second important consideration is that many decisions made by librarians are judgmental; algorithms cannot now be devised to make these intellectual decisions. The assignment of subject headings to a book in hand, for example, depends not only upon content and a list of approved terms but also upon other books in process and by books previously processed. Subject cataloging ideally relates one work to all others and decides whether it fits established terms or establishes new ones.

Over the period of active development of automation at the Library of Congress, significant insights have been derived from empirical trials and from theoretical studies. If the library had waited upon a total system concept before proceeding, little progress would have been made; if on the other hand, applications had proceeded in the absence of planning, much of the work might have to be redone.

"The present arrangement may be described as almost automatic in its character. . . . This is not a theory or an anticipation but a practical demonstration." The librarian of Congress was reporting not about current automation efforts but about the "electrical machinery for the transmission of books from the Library to the Capitol,"¹³ first operated in 1897. The library has continued to apply new technology as rapidly as it could be assimilated. ■

¹³Report of the Librarian of Congress, Document No. 13, 55th Congress, 2d Session, Washington, 1897.

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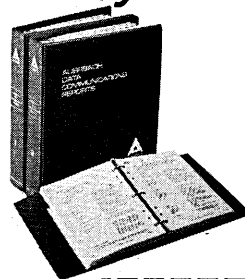
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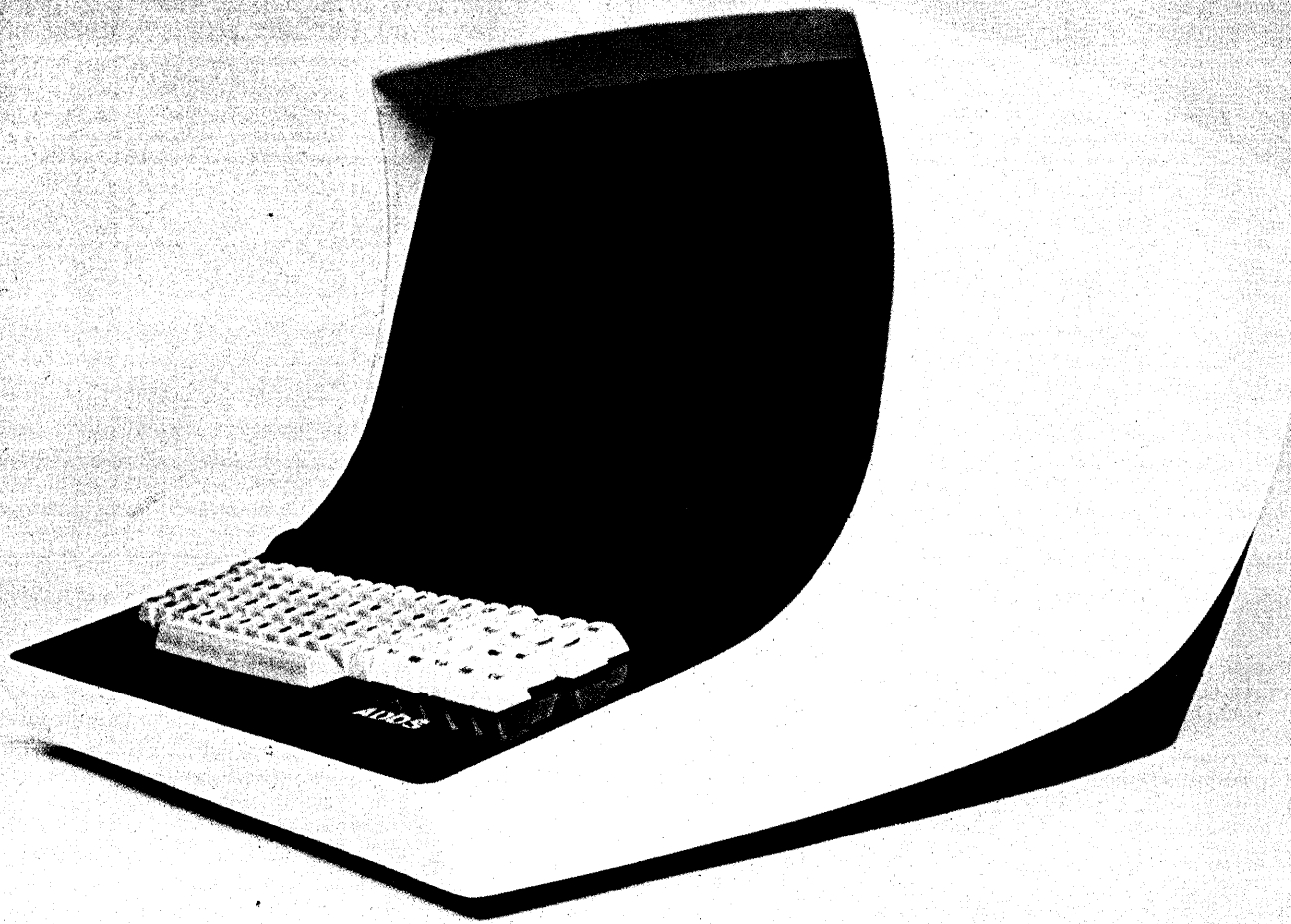
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The skin-deep part

The reality of appearance. A computer terminal is truly beautiful only when it combines aesthetics with fine engineering at the right price.

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The 9" TV monitor is a commercial product of long established dependability. We like its reliability and it lets us use standard raster techniques for high character legibility.

We added a built-in acoustic coupler option. The coupler is the best made. It operates over 40 dB attenuated lines in half duplex instead of 30 dB lines like other couplers. We make the coupler ourselves. It operates at 110 and 300 baud.

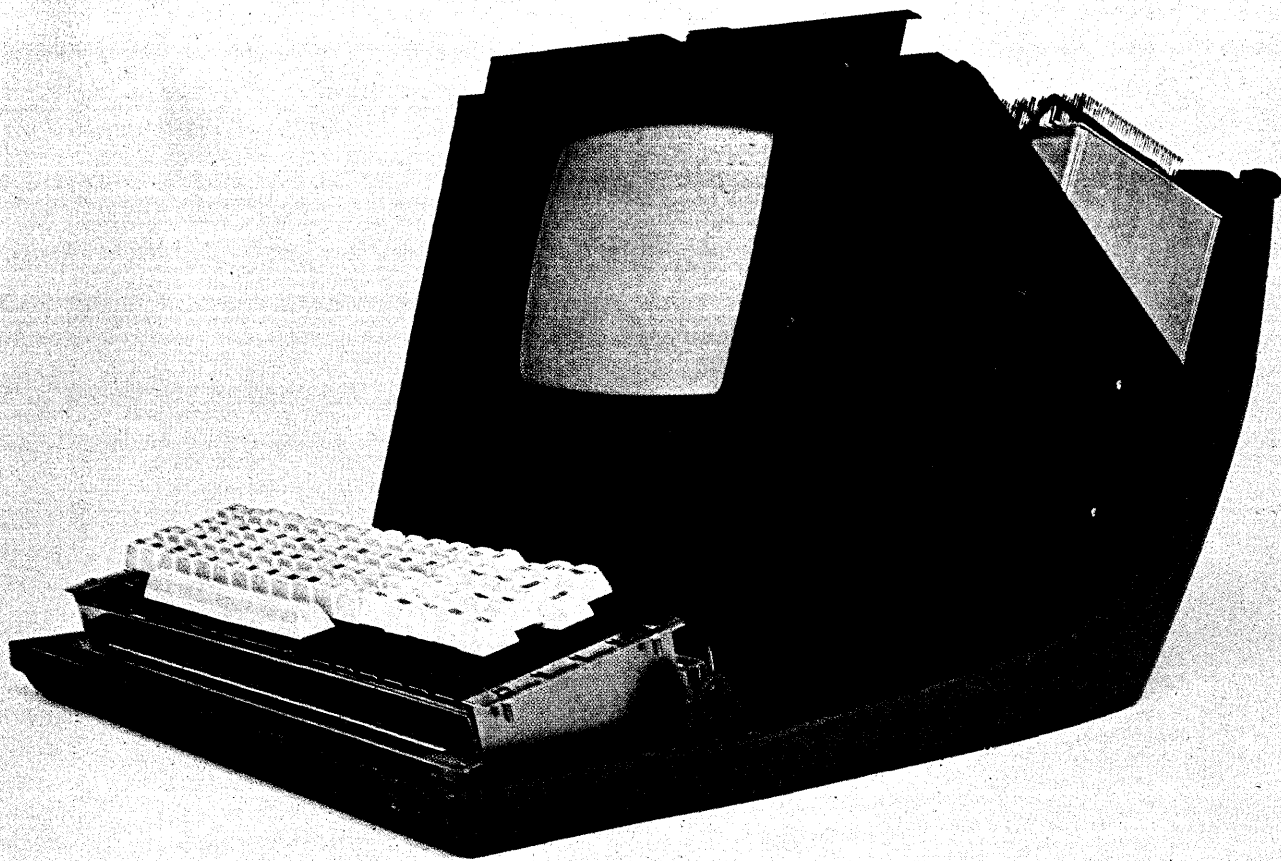
Then we put all this together in a snug case that lifts up for easy maintenance, added a plexiglas front panel, and we had our terminal.

In fact, we had three terminals, the Consul 800, the 840 and the 880. They display respectively 16 lines of 32 characters, 16 lines of 64 characters, and 20 lines of 80 characters. They cost respectively \$2995, \$3495 and \$3995. And they are all Teletype* compatible.

A la mode. The Consul will operate in three modes, page, message and conversational. The conversational has a special editing sub-mode. When you move the cursor to correct a mistake, the terminal automatically switches to the sub-mode. After retransmitting the corrected line, the terminal automatically switches back to the conversational mode.

In the message and page modes, you can edit several lines or a whole page of data before transmitting it.

*Registered trademark of Teletype Corporation



The beauty part

In both of these modes a look ahead feature saves transmission time. It scans ahead and if the rest of a line is blank, the cursor goes directly to the next line.

Fill in the blanks. Our terminal also has a formatting feature for fast, efficient data entry. The computer puts up a form, you fill in the blanks with variable data. The tabbing control skips over fixed data and lets you move directly from one variable data field to another. Only variable data is transmitted.

Thoughts on an Ode on a Grecian Urn. Making a good computer terminal is a matter of skill, experience and maybe a little luck. You design all sorts of engineering and operating features to make it a better terminal. And, in the end, you may have a machine that is not only superb electronic equipment, but a joy to behold.

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- Please send me a brochure on the Consul terminal.
 Please have a salesman call me.

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See a demonstration at the Seattle DPMA.

THE FBI'S COMPUTER NETWORK

 The FBI and other law enforcement agencies are in great debt to the computer industry for putting at their disposal so many new weapons in the war on crime. In 1932, when the dp field was in its infancy, the FBI recognized its potential and established a small unit which has now grown into the FBI's Automatic Data Processing Center located in the administrative division at FBI headquarters, Washington, D.C. Initially card-punch machines, verifiers, printers, and sorters were used to record arrest statistics from fingerprint cards. Over the years, each new development in data processing has been carefully followed and, where possible, applied to the FBI's law enforcement responsibilities, laboratory, and internal administrative and accounting operations. The bureau's edp center now services all headquarters divisions and field offices and performs the complete range of data processing activities from small batch jobs to a nationwide real-time information network.

The FBI was the first federal civilian agency to fully automate its payroll, and research conducted for the FBI contributed to the development of teleprocessing. The FBI was also one of the first federal agencies to utilize multi-programming.

Automation is evident in every major operation or activity of the FBI. At present there are three computer systems, consisting of two IBM 360 Model 50's and one Model 40 located at FBI headquarters, which are utilized to their full capacity 24 hours a day, 7 days a week.

Probably the most widely known of the FBI's computer operations is the FBI National Crime Information Center (NCIC), which began a pilot operation on January 27, 1967,

with 16 law enforcement agencies throughout the country on-line with an FBI computer in Washington, D.C. The NCIC was developed by the FBI with the assistance of an advisory group composed of law enforcement personnel from agencies that either had a computerized system or were in the advanced planning stages of such a system. Standard formats and abbreviations concerning descriptive data were established, as were procedures to be used in connection with this system. In addition, file applications were developed for stolen vehicles, license plates, vehicle parts, vehicles wanted in connection with the commission of a felony; stolen, missing, or recovered guns; stolen articles; and wanted persons. Subsequently, a file for stolen, missing, and/or counterfeit securities was developed, as well as a file for stolen boats.

The NCIC was designed to be a record index on wanted persons, stolen property, and criminal events. The records in NCIC refer an inquiring agency to the documented file which is maintained in the law enforcement agency which entered the record. Each record has sufficient data on which an officer can make a decision.

The record in the NCIC is the responsibility of the entering agency for the purposes of accuracy and validity. A regular schedule of validation checks is maintained wherein each record is reviewed by the originating agency to determine its current validity. A system of seven-character identifiers was developed to identify law enforcement agencies in the U.S. and Canada. These identifiers are used to determine the source of a specific record. Edits have been built into the system to insure that standardized codes are used and that basic minimum criteria are furnished prior to the acceptance of a record by the NCIC computer. Each agency has on-line capability not only to enter records but also to modify any part of and/or the entire record. Only an

This article was prepared by the FBI with the cooperation of director J. Edgar Hoover.

originating agency can modify or clear a record from the computer. This control is handled through programming and hardware. Other agencies which locate property or apprehend a wanted person may place a "located" addendum to the record. This type of message identifies the agency, the date of the location, and the case number in the locating agency.

The NCIC program is run on one of the FBI's two IBM 360 Model 50's, with the other Model 50 available for backup purposes. Each of these computers has 512K bytes of core and utilizes IBM's operating system (OS) which provides for multiprogramming with a fixed number of tasks. IBM 2314 direct access storage facility units are utilized to store the NCIC data bank as well as the system residence. Two IBM 2703 transmission control units—one for the main processor and the other as a fallback device—interface to Western Union Telegraph Co. communications lines. In addition, a Western Union transfer switch panel is utilized. This switch provides for the transfer of one or all circuits from one transmission control unit to the other whenever this becomes necessary. When a particular circuit or terminal malfunctions, it can be switched individually to the other transmission control unit for troubleshooting, without interfering with the operations of other NCIC circuits.

The indexed sequential file organization method is used for storing and accessing the records in the NCIC. Each record entered into the system is assigned a unique NCIC number which is generated by the computer. This number, which is self-checking, can be used to address and access records. Records can also be accessed through the use of data appearing in specifically designated search fields of a record as addresses. For example, a vehicle record can be accessed on-line through the use of a license plate number or a vehicle identification number. Each transaction, as it occurs, is recorded on a magnetic tape. This procedure provides a history of NCIC operations as well as a backup log for file re-creation purposes. FBI telecommunications operate under the basic telecommunications access method (BTAM), and the NCIC programs are written in assembly language.

Forty-nine of the 50 states, the District of Columbia, and Canada are tied to the NCIC computers through use of dedicated circuits. Alaska is the only state not yet connected. The concept under which the NCIC has been developed is that each state in the U.S. will establish a computer control terminal. Each state is then responsible for the development of an intrastate communications network connecting all duly constituted law enforcement agencies within that state to the control terminal and then, of course, to the FBI computers in Washington, D.C. In addition to state terminals, many of the larger cities and metropolitan areas in this country are also connected directly to the NCIC. However, with the establishment of a computer terminal within a state, the larger cities will then have access to NCIC through the state computer.

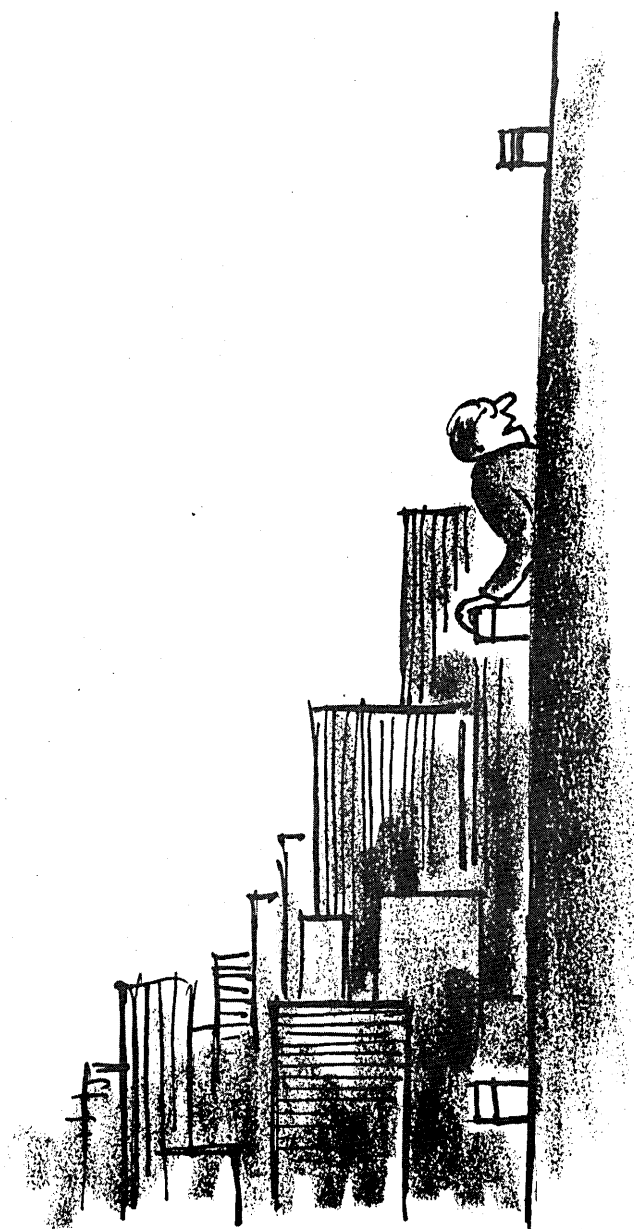
As of Jan. 1, 1970, there were 93 control terminals connected directly to the FBI's computers in Washington, D.C. Twenty-four of these remote terminals are computers. They consist of IBM, RCA, Univac, and Burroughs computers. The remaining terminals are Western Union Telegraph Co. Model 35 ASR teletypewriters which operate at 100 wpm, and IBM 2740 and 1050 terminals which operate at 148 wpm. Three 2,400-baud dedicated circuits are presently in use to the Kansas City, Mo., Police Department; the Maryland State Police, Pikesville, Md.; and the Metropolitan Police Department, Washington, D.C. The remaining dedicated circuits are 150 baud. At this time over 2,000 law enforcement agencies have direct access to the NCIC

through local or state computer terminals.

In January, 1967, NCIC began with a base file of about 23,000 records. As of Jan. 1, 1970, more than 1,737,000 active records were stored in the NCIC. A breakdown of these records is as follows:

Wanted persons	51,437
Vehicles	407,333
Boats	887
License plates	155,419
Articles	338,239
Guns	264,613
Securities	519,888

The average turnaround time in response to an inquiry from a remote terminal is 5 to 10 seconds. In calendar year 1968, approximately 4,200,000 transactions were handled, and in calendar year 1969, total transactions increased to 14,000,000. About 9,800,000 of these transactions were inquiries of the system. Over 470 "hits" a day are made by participating law enforcement agencies. A hit is a positive



"Miss Caulkins, come quick! There's a xebra going into the Xerox building."

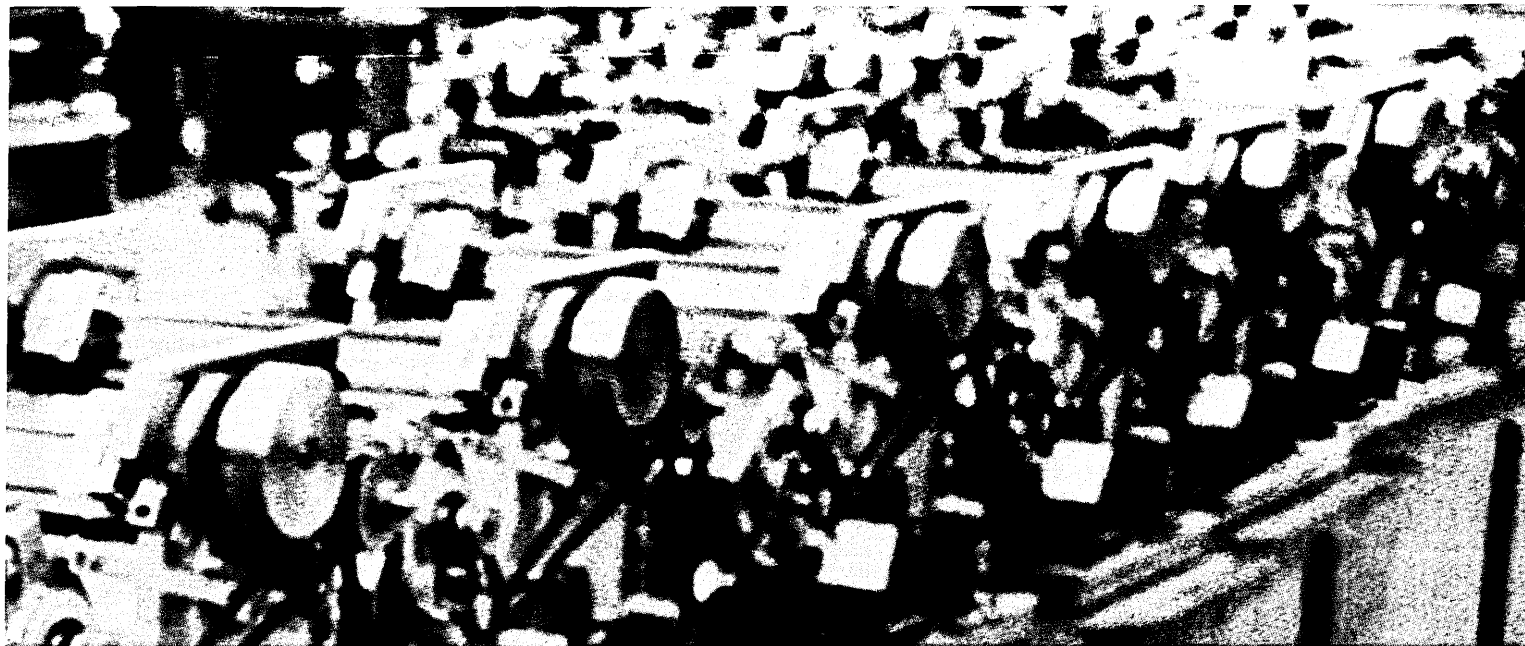
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**“To most people,
Mohawk means Data-
Recorders.**

**Yet today that’s
only 30 per cent of
our business.”**

Comments from Orrin B. Craigie, Vice-President, Marketing.



“When Mohawk was started back in 1964, the scheme centered around the key-to-tape device. After all, the punch card was an antique. It had been around since 1890. Someone had to develop a way to get information into a computer faster. Mohawk did it by going to mag tape. We figured: the third generation computers talk tape—why not speak their language?”

“Fine. The Data-Recorder has been very successful. Problem is, people always remember us for our tape breakthrough, and nothing else.

“Well, we can do plenty for encores. Forty per cent of our business is in data communications. We make card readers and card punches and card-to-tape converters. We’ve got over 8,000 line printers in operation all over the world. We turn out a fantastic line of digital strip printers.

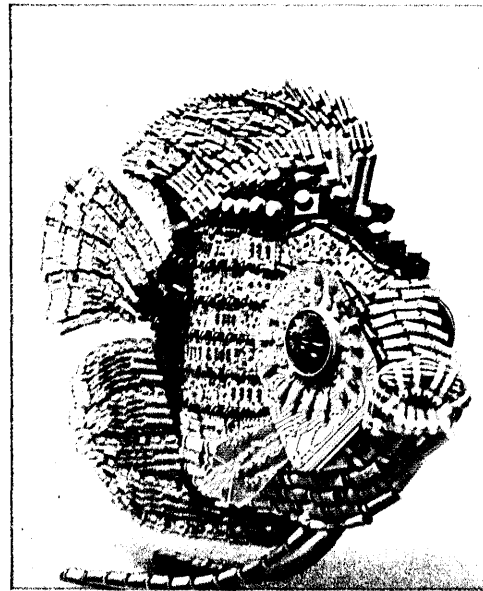
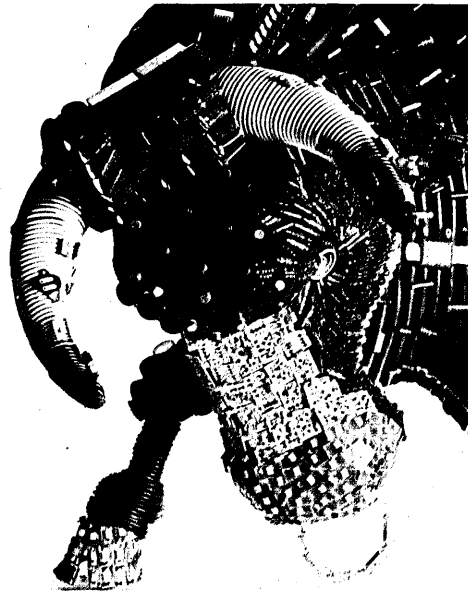
“Mohawk might have started out with a device, but it wasn’t anything

but a means to an end. The end was to structure a sales and service organization, a marketing network, large enough and good enough that Mohawk could sell and service anything it made anywhere in the country.

“After all, the computer business has always been loaded with hot hardware and brilliant ideas... but service has been quite another story. So the groundwork was laid very firmly for our service system. It’s rather funny, actually. We’re known for a breakthrough. Yet Mohawk’s success has really been based on a very ordinary concept, that of service.”

Mohawk Data Sciences Corp.
Herkimer, New York





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It's your own computerized menagerie – a portfolio of four 14" by 17" reproductions in full color from Honeywell's ad campaign.

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Please ship me one cat, one bull, one horse,
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match made by the computer between the participating agency's inquiry and an identical record already on file in the NCIC data bank.

The NCIC will continue to grow and develop during calendar year 1970, and at least 15 additional computer terminals will be added to this system. In addition to the state and metropolitan area terminals, NCIC is also interfaced with the U.S. Secret Service, U.S. Army, Navy, and Air Force, and the Royal Canadian Mounted Police at Ottawa, Canada. NCIC is a dramatic development in the area of law enforcement and the administration of criminal justice. It makes operational information immediately available to law enforcement personnel anywhere in the U.S. or Canada—thereby enabling the recipient of the information to make a competent decision concerning the situation with which he is confronted. To date the NCIC system has been responsible for recovering stolen property running into millions of dollars each year. An accurate evaluation cannot be placed on the many attendant benefits of the system—the lives of policemen saved by being forewarned that they are approaching cars reported stolen or operated by dangerous felons; improved case solution rates; investigative time saved by the early apprehension of fugitives; and crimes prevented by incarceration of individuals who make a career of crime. The NCIC is one of the most far-reaching developments in law enforcement in decades, and it is a monument to the cooperative spirit in that profession today.

laboratory applications

The FBI laboratory utilizes a number of reference and standard files for comparison with evidence submitted for examination. For example, if a typewritten anonymous letter is received, it is compared with type-style standards submitted by typewriter manufacturers to determine what kind of machine it was prepared on. It is then searched through a file containing other anonymous letters typed on similar machines to see if it can be connected with other cases. As such reference and standard files continue to grow, it becomes more and more difficult and time consuming to search them manually. With the advent of the computer and its capability to store innumerable identifiable features, it now appears that new classification systems can be devised which will enable file searches to be done rapidly and accurately in an automated manner.

Already in operation is the FBI's PROCHECK program, a computerized library of information on professional bad check passers. Fraudulent check cases are analyzed by the computer according to the description of the unknown subject, his method of operation, and the format of fraudulent checks he has negotiated (such factors include disguise techniques employed, writing styles used, unusual check-cashing procedures employed, etc.). After considering 70 separate factors, the computer provides a listing of names of suspects who may be involved in the current check case from its tape storage of known individuals. A laboratory expert then compares the fraudulent checks with samples of work of such known forgers to make a final identification.

In other units of the FBI laboratory, the computer is used to analyze data obtained from various processes. For instance, when an organic compound is illuminated with a broad spectrum of infrared radiations, certain frequencies of the incident infrared energy are absorbed which are characteristic of the molecular makeup of that compound. The infrared spectrophotometer then produces a strip chart of the varying intensity absorption bands or peaks. The unknown material being examined is identified by comparing the chart thus produced with thousands of reference

charts prepared from known compounds. Direct comparison of the charts is cumbersome and time consuming. A program has been designed to categorize compounds by their class, known physical and/or chemical properties, and by the frequencies and intensities of absorption bands. The computer then selects a limited number of spectra for direct comparison.

In neutron activation an unknown material is irradiated and the gamma ray spectra emitted are measured by a solid-state detector coupled to a multichannel analyzer. The data produced are often complex and computers have become a necessity for interpretation. Programs are available for determining such basic parameters as energies and intensities of photopeaks, identities of radionuclides capable of emitting gamma rays, and a quantitative assay of radionuclides expressed in per cent or weight.

a variety of uses

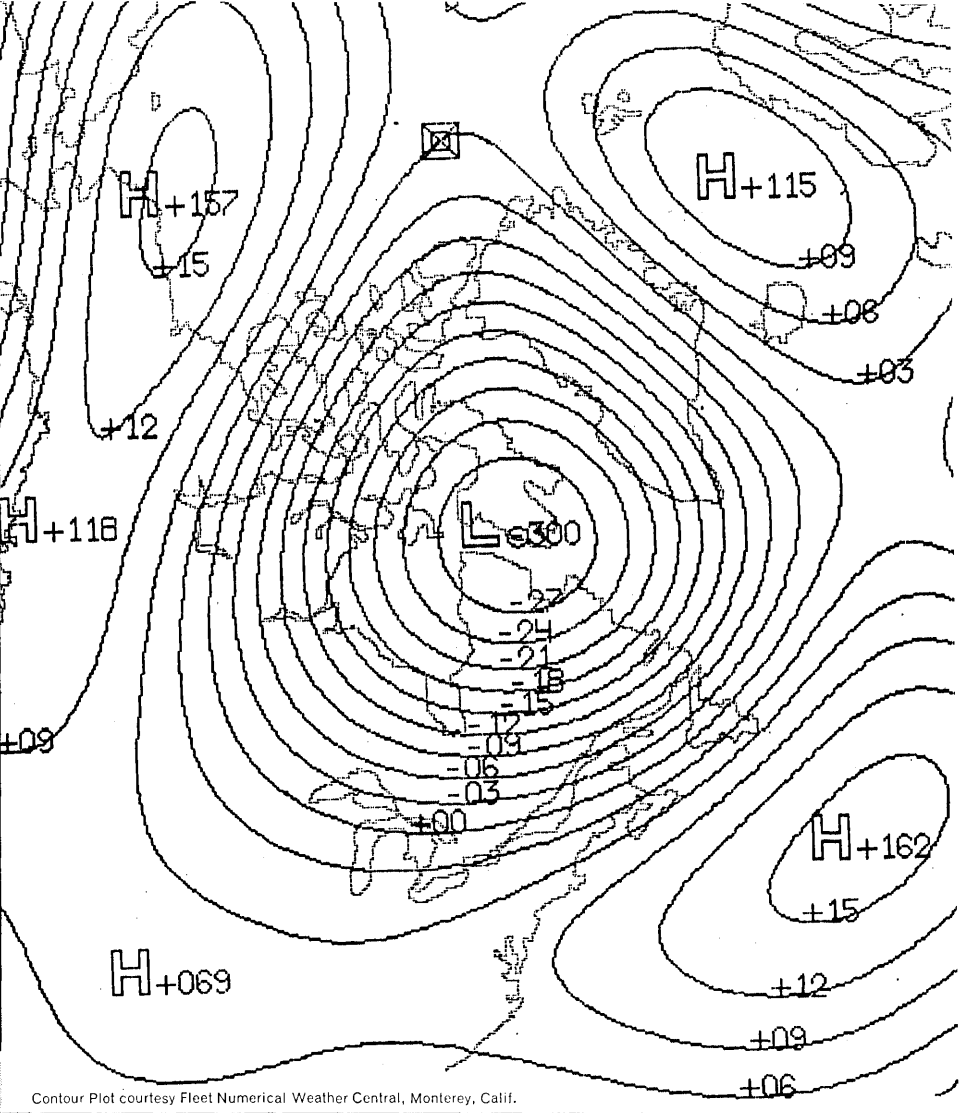
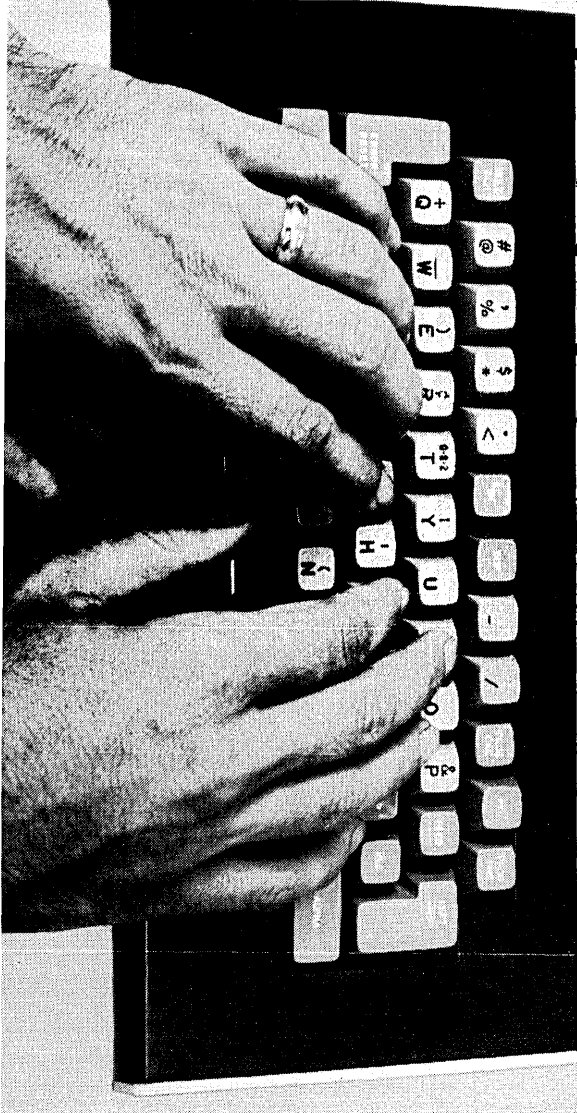
Other types of investigations have also benefited tremendously from the use of computers. The FBI is sometimes called upon to determine the actual cost to a contractor of projects involving contracts for millions of dollars. In one case alone, the FBI saved the federal government more than a million dollars by using the computer to penetrate the accounting system of 10 different interlocking companies. After hearing the agent testify to the results of his investigation, the company immediately requested a recess and settled out of court.

In civil as well as criminal cases, the FBI wants to see justice done. Those having rightful claims against the government should receive a prompt settlement and those who would dissipate the tax dollar with false or exaggerated claims should be exposed. The computer in a real sense "separated the wheat from the chaff" in a case involving damage to crops from a herbicide sprayed by a government agency. Liability was freely admitted, but the damage suffered was disputed. The defense against these claims required an analysis of 300,000 sales invoices covering four different crops grown on 20 different farms for a period of five years. It was estimated that it would take 100 agents more than 30 days to make this survey—and there was not enough time before trial even if that many agents could be spared to work full time on the case. Once again, the computer solved the problem and 40 pounds of printout sheets with the vital information was delivered to the U.S. Attorney before the trial.

During the trial, various interrogatories, depositions, and the testimony of the witnesses made it necessary to recompute portions of the previous analysis, and the figures were revised and updated as the trial progressed. The claims of some of the parties were shown to be just, but others were inflated, and more than one and one-half million dollars in savings to the federal government was realized from the FBI investigation.

The computer is especially effective in analyzing check-kiting schemes in which a complicated system of depositing bad checks in a number of accounts in different banks enables the depositor to operate on the money of the banks. On the other side of the counter, the computer can detect the "lapping" of deposits by dishonest tellers who can embezzle by delaying the recording of deposits.

Readers of DATAMATION who are part of the computer industry may well take pride in the industry's contributions to law enforcement. New developments in computer technology and other scientific fields, combined with an increased public awareness of the crime problem, may be the answer to the continuing rise of the crime rate. ■



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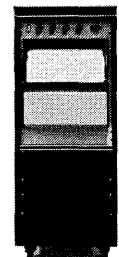
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MULTI-ACCESS COMPUTER NETWORKS

a conference report

by Phil Hirsch, Washington Editor

 AT&T may be more of a competitive threat to commercial data processors, not less, as a result of the FCC's tentative policy statement on computer utilities (See May, 1970, p. 166). So said Prof. Michael Duggan last month during an interdisciplinary conference on multi-access computer networks at the Austin campus of the University of Texas. Duggan, a former Justice Department attorney now on the university faculty, has been a perceptive FCC watcher for years. His conclusion was ironic, since an expressed purpose of the commission's recent statement is to promote competition among suppliers of commercial dp services. The three-day conference, sponsored jointly by the University of Texas and Mitre Corp., contained a number of other ironies.

Duggan argued that the FCC has laid the basis for letting Bell into the commercial dp market by allowing communication carriers to offer hybrid services in which dp is an "incidental component." This test "perhaps not coincidentally, is the same test utilized by the Comptroller of the Currency in ruling that '... national banks ... may make data processing services available to ... bank customers,'" he pointed out, adding that the commission has also said it has authority to regulate all dp services, whether communications-based or not. Although the FCC "does not wish to assert this power at this time," Duggan explained, the "potential for governmental regulation could easily become an actuality with a change in commission membership, a different viewpoint by the staff, or a change in the economic milieu of the data processing and/or communications industries."

Duggan's fears may be partially misplaced, judging from what other

speakers said. Advancing technology seems more likely than the FCC to propel Ma Bell into the commercial dp market. One way this could happen is suggested by the multi-access computer network being assembled by DOD's Advanced Research Projects Agency. The ARPA net was discussed in detail at the Austin conference by two of its chief architects—Dr. Lawrence Roberts, the agency's director of information processing techniques, and by his predecessor, Robert Taylor, now at the University of Utah.

Taylor pointed out that a major benefit of systems like the ARPA net is that they allow each user to tap needed resources located elsewhere—for example, bigger (or smaller) computers, specialized data bases or software. Taylor didn't say anything about the commercial ramifications of this concept, but they aren't hard to visualize.

Competing dp service bureaus, for example, could be linked to a central access point; the user who connected with the network at this point would then be able to get his job run by any of the systems. Compatibility might limit his choice, but the ARPA experiment hopefully will reduce that problem. Besides offering machine time of different types at different prices, the center could also link its customers to specialized data bases and to specialized support services, like program debugging or system simulation. In each case, if a number of suppliers were accessible, their competition presumably would enable the user to obtain better service at lower cost than he could buy through direct negotiation.

Would such a center be performing a communication or a data processing function? Probably the former, judging from what was said in Austin and from a careful reading of the FCC's tentative

policy statement. If that were the case, AT&T and other common carriers would be the only ones entitled to operate the centers. This advantage could easily give them monopoly control over dp prices and services, assuming large numbers of service bureau customers became convinced that they could save money by buying through a middleman.

This is one way the FCC's carefully constructed wall, separating dp and communications activities, could be breached by the carriers. Some other ways were proposed to the Austin conferees by Dr. Manley Irwin, formerly a staff consultant to the commission, whose ability to detect portents in FCC actions is widely recognized. Irwin suggested that:

—Separating carrier communication activities from carrier-supported dp activities, as proposed in the FCC's tentative statement, "cannot be pulled off with ease or precision" and "poses a very real possibility that disputes between carriers and noncarriers will breed long and involved evidentiary hearings."

—One way the carriers could expand the foothold FCC has tentatively given them in the dp market is by arguing that they have excess switching plants which—if used to support dp service center operations—would spread the carriers' overhead costs and reduce charges for all their customers. Irwin said, that "... the carriers exercise almost complete discretion in terms of their investment decisions ... it must be remembered that if carrier entry into data processing is premised on ... redundant capacity, then the arbiter of that decision may be the carrier itself."

—Bell and other major common carriers may be forced to buy more from outside suppliers. Present rules require competitive procurement of equip-

ment for international satellites, and a Presidential task force has recommended extending the same policy to domestic satellite operations. "If the satellite market is to be exposed to formal arm's length buying," said Irwin, "then someone is bound to ask why other segments of the telecommunications market do not merit competitive bidding as well." Recently, he added, this very point became the launching pad for a suit filed by IT&T against General Telephone and Electronics Co. GT&E purchased controlling interest in the Hawaiian Telephone Co., which has been buying its equipment from IT&T. International fears that it will now lose this business to GT&E's equipment-manufacturing subsidiary. If the court orders Hawaiian to buy at least some equipment on a competitive basis, "it will send reverberations throughout the computer and communications hardware market," said Irwin.

He clearly believes this would be beneficial. But one effect might be to weaken the present fragile alliance between suppliers of dp services and independent telecommunications equipment makers. Now, both groups have a vested interest in curbing carrier-financed dp networks. However, if the equipment for those networks had to be acquired via competitive bid, the equipment suppliers probably would see the problem differently.

In addition to the legal-economic issue of who will control multi-access computer networks, the Austin conference also considered some technical ones, like whether dp standards have been developed far enough to allow optimum use of networks. Ted Bonn, Honeywell's chief standardizer, said the answer to this question was "no"; furthermore, he wasn't very optimistic about the future. He said that "only a few of the standards that will be required (for networks) are being worked on at all, and progress is distressingly slow. The present situation borders on chaos. Divergent procedures are rapidly becoming entrenched in areas where there should be standards."

One remedy, added Bonn, would be for the government to support the technological development work related to development of standards—"... data descriptive languages and network control languages . . . are prime candidates for such funding. Some of the many communications standards . . . as well as applications standards . . . should also be considered . . . participation of industry in standards activi-

ties should be an allowable additional expense on government contracts, particularly for those in the computer field . . . (and) a registry of de facto standards should be established . . . a mechanism for information interchange on private standards . . . must be established. Our antitrust laws inhibit direct private interchange of this information among manufacturers. Open and public channels, such as through ANSI or BEMA, must be created."

None of the speakers predicted how fast multi-access computer networks would develop—possibly because there was general confusion regarding the meaning of the term. At times, the audience was led to believe that such networks are already here. Two papers, for example, were based on GE's multi-cpu Mark II system. Another paper, by Morris S. Davis of the University of North Carolina, discussed a sin-



gle-cpu "network" composed of a 360/75 connected to terminals at UNC and two other schools nearby.

The ARPA net comprises still a third configuration. While it contains multiple cpu's, the ARPA network is unique in that it includes different makes and sizes at various nodes, and is based on the idea that each node will perform different functions. By next November, said ARPA's Larry Roberts, the network is scheduled to become largely operational and, by next January, should have 14 nodes on-line. The sites, dispersed across the country, consist mainly of universities; they are interconnected by 50K bit-leased lines. Each node is connected to the line through a Honeywell 516 Interface Message Processor (IMP). The system is designed to handle an average traffic load of up to 23K bits/second/node. The initial configuration should provide an average transmission time of .5 seconds or less, node-node, when the load is below 16K bits/second/node. At higher levels, response time will

increase rapidly, but the IMP's will accommodate additional communication channels capable of handling a total of 203.4K bits/second. Communication costs are estimated at \$49K/node/year at the 16K bit traffic level, and at \$59K with a 23 K bit load. Each node is accessible through at least two communications paths, Roberts said. This arrangement should reduce transmission failures to no more than 30 seconds/year.

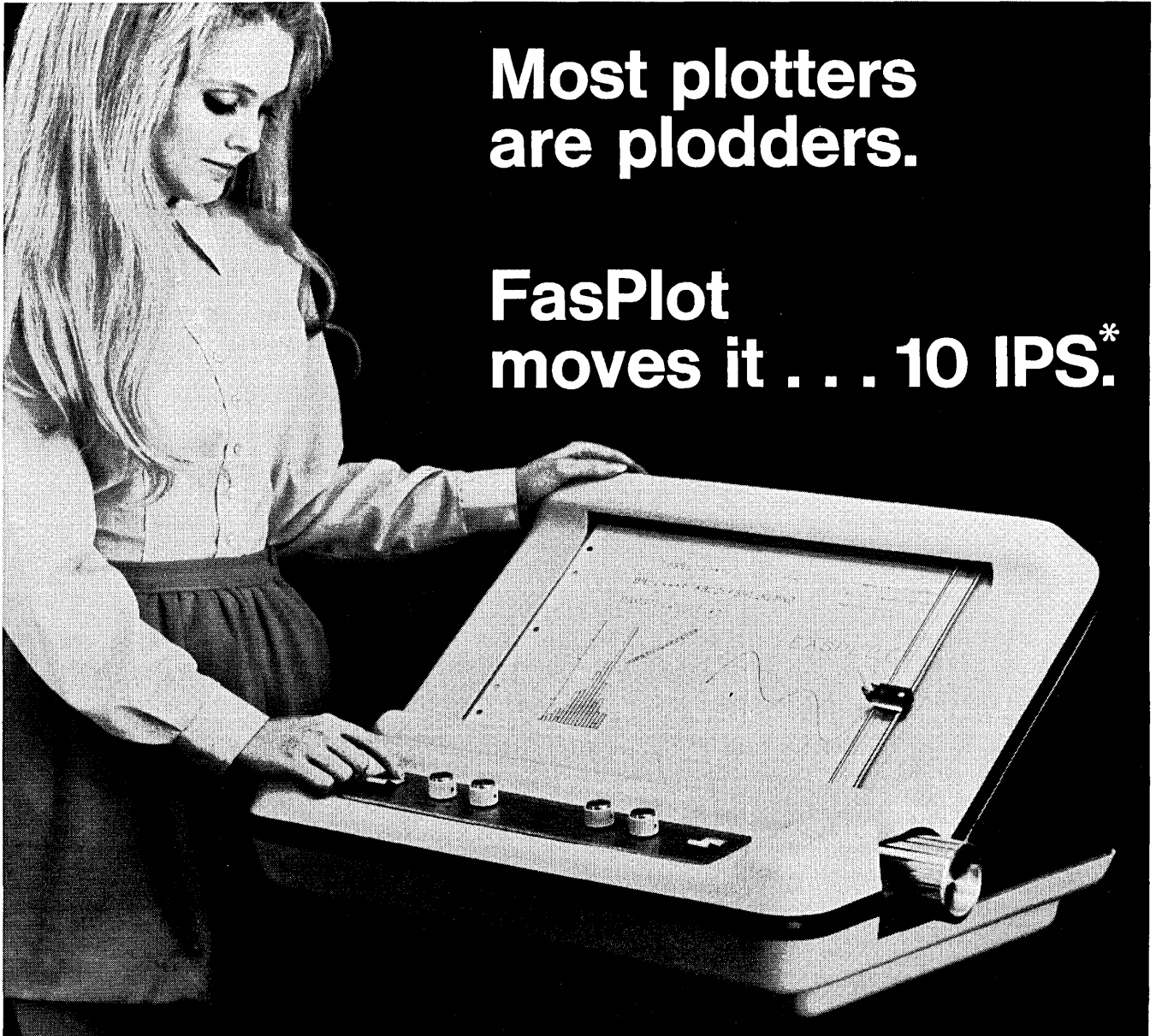
An alternative to ARPA's architectural scheme was presented by John Couleur, a ucc vp. He argued that a large, centralized computing facility was more economical than a dispersed system because "the efficiency and capability of computing systems rises exponentially with size and performance." Couleur then described, in detail, the configuration he had in mind. ucc is thinking seriously about building this system, we were told later by a knowledgeable source.

"By 1971, there will be some 40,000 IBM 360 systems installed and these installations will be potential customers for a utility," said Couleur. "... A suitable approach would be to take the 360 as a departure point (and) add . . . necessary features."

The main shortcomings of the 360, as Couleur sees them, are its lack of program relocation hardware (except in the Mod 67); the processor's difficulty in handling instructions longer than 12 bits and floating-point numbers over 32 bits; and the i/o system's tendency to discard interrupts under overload conditions. Couleur suggested remedies for each of these problems, including the use of block address relocation, a processor with the capability to handle 48-bit floating-point numbers, and provision of a pointer register for each i/o channel to take care of the interrupt problem.

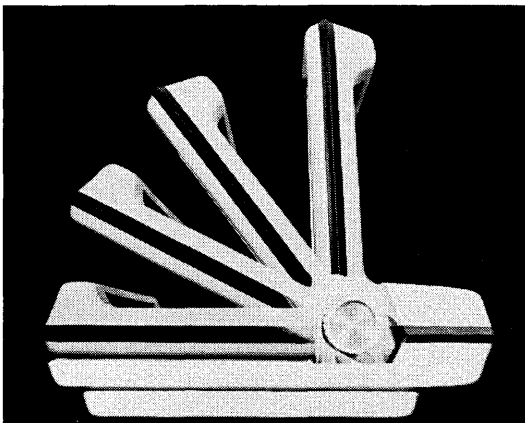
Couleur's system would consist of four processors sharing a single memory, and capable of initiating a new instruction every 25 nanosecs. Long-term storage would be provided by a laser write-once memory. The communications subsystem would permit 28 lines, with a capacity of 4K to 10⁶ bits/sec, to access the processor. A simplified user control language would also be used. "os/360 is probably one of the most difficult operating systems to use and implement, due largely to an unnecessarily complicated control language," Couleur added.

"It is possible to design and build a system which will support 3,000 to 4,000 interactive terminals and 30 to 40 high-speed terminals in a broad spectrum of usage. Such a system would allow the utility to establish rates on the order of one-tenth today's rates." ■



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COMPUTERS IN THE '70's

a conference report

by Tom McCusker, Senior Associate Editor

The symposium was billed by its sponsors as an "exciting trip into the world of computers in the 1970's." For the 215 users and manufacturers gathered at UCLA on three sunny spring days the "trip" involved a lot of looking back, particularly at the industry's shortcomings.

Russell R. O'Neill, associate dean of the UCLA School of Engineering and Applied Science, might have set this tone when he recalled in a welcoming address that the university's first attempt last fall to register students by computer was chaotic—with waiting lines at times growing to 6,000. That snafu was due to a lack of planning. During the winter a committee of administrators, faculty and students spent hundreds of hours scheduling this spring's registration and the university's second go around with a computer was a success.

The UCLA Engineering and Physical Sciences Extension sponsored the symposium with help from Informatics, Inc., Sherman Oaks, Calif. It was the sixth annual affair and its topic was "Expanding Use of Computers in the 70's." Interestingly, of the 15 who addressed the symposium, it was the last speaker who enunciated what turned out to be the main theme. Said M. H. Schwartz, of the Atomic Energy Commission, "We are here to make sure that the same mistakes are not repeated in the decade ahead."

The consensus was that progress in the 1970's will be evolutionary. It will be the era of the user, in contrast with the age of the inventor in the early 50's, the engineer in the late 50's and the programmer thereafter. The emphasis on hardware is giving way to software. Economics and a history of painful experience will force the user to modify his expectations and the manufacturer to tone down his promises.

The industry's biggest mistake of the 60's was in overselling users (and

deceiving itself) with the idea of a single large-scale integrated system. The concept of an on-line world, where any information needed to run a business would be available instantly to anyone who needed it, simply was unworkable. Of the reasons advanced for this by the speakers, the prevalent one was that top managers weren't able to define what they wanted and how their wants would change. Contributing to this was the inability of data processing managers to get together with top management as well as ineffective communications between the systems analyst and the programmer and between the programmer and the computer operator.

"Within data processing," said Dick

H. Brandon, of Brandon Applied Systems, Inc., "interdisciplinary communication is ineffective, non-standard and often beset by emotional and psychological conflict . . . The data processing manager has generated a credibility gap in communication with top management. The latter does not really understand data processing, and often fears it. Add to this the arcane jargon of the 'professional' and the process breaks down completely."

The solution seemed obvious—massive doses of education and training—but hard to implement, said Brandon. For instance, you can't motivate a programmer (he's making too much, anyway) and you can't instill fear (two hours after you fire him, he's got a new





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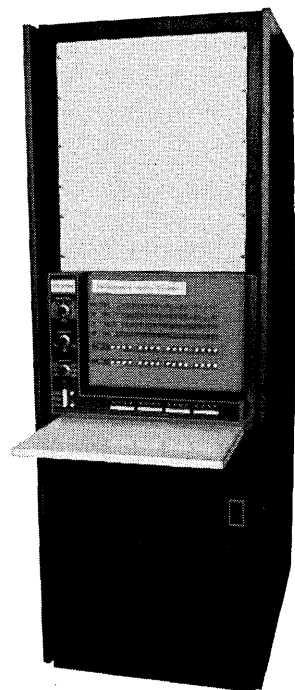
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A fellow panelist, Richard W. Hamming, of Bell Telephone Laboratories, predicted that the present "sorry, unsatisfactory breed of programmers" will be unemployable by the end of the 70's. "It is simply that as programmers they will not be worth what they cost . . . we will learn how *not* to do what we are now doing, much as we obsoleted the absolute binary programmer in the early 1960's." ("Yes," Brandon agreed, "but programmers are expected to form unions and maybe in 20 years these unions will require that you have one programmer with every computer.")

Schwartz cited three forces that will lead to more sophisticated customers in the 70's: soaring costs of information systems now require management to pay closer attention to the costs and to identifying and demanding better information and analysis; second, management's ranks gradually are being filled with men experienced in information and management sciences; and third, university graduates familiar with information processing are being employed in increasing numbers.

The "people" problem will continue to inhibit maximum utilization of edp. Resistance to change is inbred into our society and culture, Schwartz says. A user simply cannot be expected to agree that you can come into his company, make his life different and he'll gamble that nothing bad will happen to him. It was the people problem, added Erwin Tomash of Data Products Corp. in a paper on peripherals, that killed the full use of optical character recognition. They preferred key-to-tape entry because it resembled keypunching which they were used to. Although technology will change rapidly, Tomash said, human habit patterns will dictate a much slower change in peripherals. But widening use of computers, and thus peripherals, in the 1970's will reduce the cost and make them easier to use.

The software market will triple from an estimated \$5 billion in 1970 to \$15 billion by 1980. Dr. Walter F. Bauer, president of Informatics, lumps these components to come up with the accompanying table.

The figures do not include revenue of service bureaus whose potentially big role will be in providing on-line business data processing. But we'll be well into the mid-70's before customers and suppliers understand what is needed and the suppliers understand how to fill the need. The first big step, Bauer said, is to supply a system which

can be used by large numbers of installations with different applications and different ways of performing their data processing. Then specific applications packages could be developed and sold. There will be a mixture of suppliers—some with only the communications capability, others with software, others with the data processing plant and still others with systems applications packages.

GROSS SOFTWARE PRODUCT
(millions of dollars)

	1970	1975	1980
Purchased Software			
Products of independents	40	1,000	3,000
Products from manufacturers	10	1,000	2,000
Custom software	350	1,400	2,500
Total Purchased	400	3,400	7,500
"Free" from manufacturers	300	400	500
In-house supplied	4,300	6,200	7,000
	5,000	10,000	15,000

And what of unbundling? In the software market, it's a case of waiting for the other shoe to drop. How aggressively will IBM pursue software products? What is its plan? Is there a plan at all—or was the company forced to announce unbundling prematurely before there was agreement on a plan?

How well IBM will do in selling software products is the biggest question in the data processing industry for the coming decade, Bauer thinks, adding his observation that the company's top management basically is hardware oriented. Still, IBM with its very large sales organization can be expected to effectively promote sales of software products and all software organizations will profit as this point of view grows in acceptance.

In a technological forecast, Isaac L. Auerbach held out hope that the next decade would see information systems design evolving from an art to a science, providing us with a scientific means of specifying characteristics of a system in advance and measuring its effectiveness once it's completed. There will be a proliferation of output devices of all sorts, including flat-faced display tubes, which will be in wide use by the mid-70's, and the emergence of improved input devices, particularly those able to capture data at the source. One "wild idea" advanced by Auerbach was the use of pressure-sensitive material in inventory control. Removing an item from the pressure-sensitive material would trigger a mechanism to deliver data to a control point.

Other problems and challenges and some solutions were offered at the symposium:

Communications: Technology could decrease communications costs by a factor of 10 during the 70's and by another factor of 10 during the follow-

ing 10 years. (C. W. Spangle, Honeywell, Inc.)

Banking: By the late 70's the legislative obstacles to a "cashless society" should have been overcome, and the way would be open for implementation in the early 1980's. (Michael A. Levin, RAND Corp.)

Medicine: Much of the 70's will be taken up in gathering data and defining what must be gathered, all of it

able to be stored for quick retrieval. Meanwhile, considerable use will be made of time-sharing facilities, but pricing policies should be reformed from exponential to linear. (Anne B. Summerfield, RAND Corp.)

Europe: Computer utilization grows at a higher rate than in the U.S.—but only because Europe is just catching up. Of significance, the two European economic blocks, the Common Market (EEC) and the European Free Trade Association (EFTA), seriously are considering a high power cooperative data processing system to be implemented before the end of the decade with an operating system available before 1975. (Erling Dessau, United National Computer Research Center.)

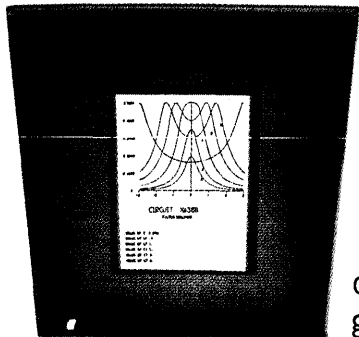
Privacy: The responsibility for insuring privacy of personal records rests with the industry. "We meet often to talk of such things as machines, programs and management. Couldn't privacy also be a continuing topic to be discussed, leading to the establishment of an ethic concerning it?" (Arthur L. C. Humphreys, International Computers, Ltd.)

The symposium presented more questions than answers and reviewed the past more than it offered prognostications; but it did provide the audience, consisting mainly of managers, marketing men, analysts and consultants, with guidelines based on history. As for the pace of the 70's, it was best predicted by Richard Hamming in a talk on user requirements in the scientific and engineering fields. Progress, he said, will be made "much more in small steps—small steps applied to specific situations, rather than in grandiose all-purpose systems."

"From the many small specific cases, we will slowly learn what it is we really want to do and how to create viable larger systems." ■

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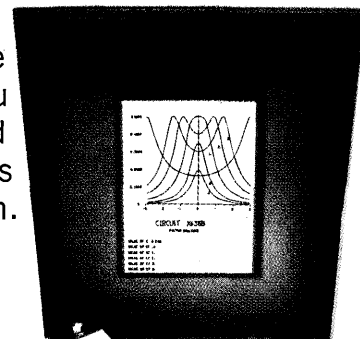
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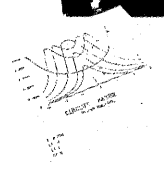
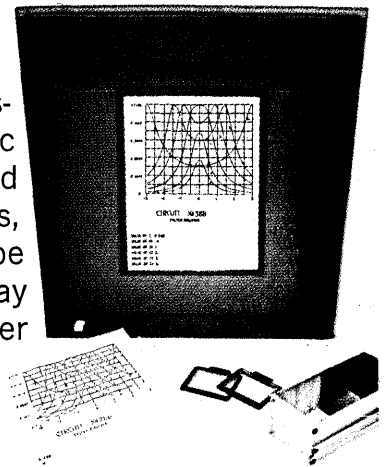
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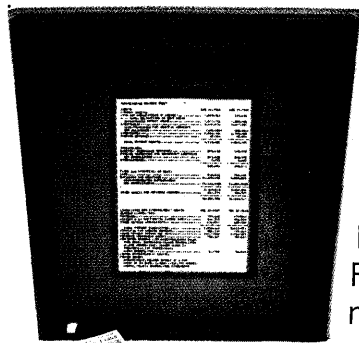
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Fourth, it features large screen capacity. How large? How's 4,608 alphanumeric characters spread over 64 lines 72 characters wide sound? That's the same format as a teletype. And for extra columns there's a 90° Character Rotation Mode to achieve a 93 character wide format. And it plots fast too. Twenty inches per second at 300 baud. With a three-speed switch so you can choose your own speeds down to 110 baud. A curve drawing short vector mode is also included.



about our new terminal read.

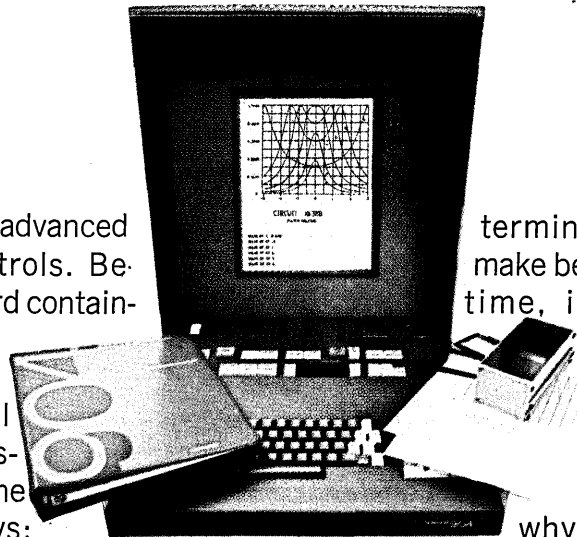
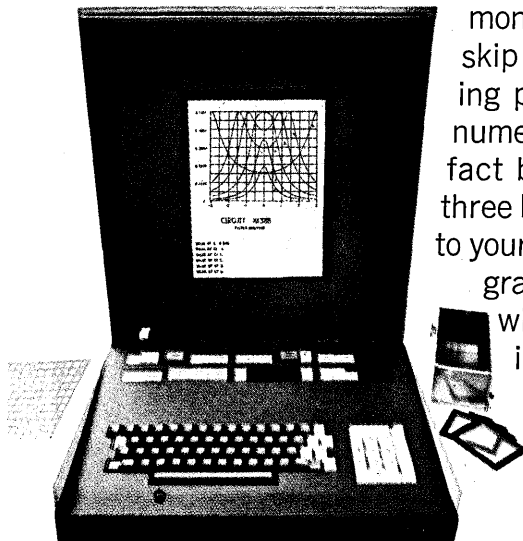


Fifth, is the CORNING 904's advanced keyboard and controls. Besides a main keyboard containing all 128 printable ASCII characters, there's an additional 14 key data entry island. It includes all the FORTRAN input keys:

numerals 0 through 9, space, backspace, period, and comma. They're also included on the main keyboard, but we repeat them on the data island keys for one hand data entry.

Sixth feature, and most important, its software support package. This is already a full package that includes 57 FORTRAN IV subroutines with more being added every

month. Enough to let you skip the tedium of converting programs from alpha- numerics to graphics. In fact by adding as few as three FORTRAN statements to your program you can get graphic output complete with scales and labeling. After all, if we're going to give you a



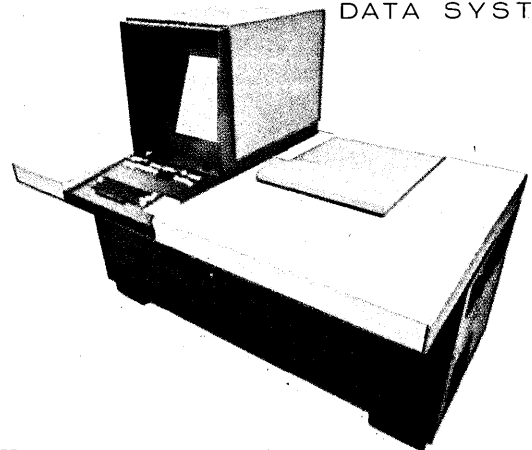
terminal like this to make better use of your time, it would be a shame not to have the software ready to go when you are. Which is

why we also make sure it's on time sharing company public files where you can use it right now.

There's just one more thing, the price. \$19,650. For the entire system, software and all, with delivery within 60 days after order. And you don't even have to buy the Corning 904, we'll lease it to you.

Want to know even more about our new terminal than this long ad was able to tell? Then go ahead and write for full details to: Corning Data Systems, 3900 Electronics Drive, Raleigh, North Carolina 27602. Or call (919) 876-1100. If you're a time sharing user, we'll help you make your time more worthwhile. In fact, just by reading this you already have.

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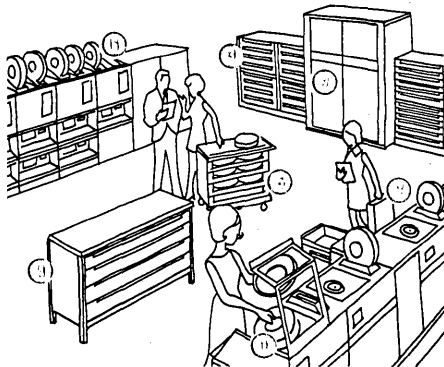
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DATA PROCESSING ACCESSORIES

ACM SEMINAR: BUSINESS SCHOOL COMPUTER COURSES

 A small conference on computer curriculum, sponsored by the Association for Computing Machinery and financed by an NSF grant, was held on March 2 at Stanford University, Graduate School of Business. The participating schools were several west coast universities which offer computing curricula in business. The University of California at Berkeley, Irvine, and Los Angeles, University of Southern California, University of Washington, U.S. Naval Postgraduate School, University of Hawaii, Stanford University, and University of Alberta were represented by 14 professors. The conference was directed by Fred Tonge, UC Irvine, and visiting professor at the University of Hawaii.

There were three general sessions: curricula for computer specialists, curricula for general managers, and functional computer-related course material. Each session devoted 15 minutes each to two speakers who gave the background at their institutions with regard to the particular topic. General discussion among the participants followed each keynote presentation.

Austin Hoggatt, UC Berkeley and Jim Cowie, U.S. Naval Postgraduate School, spoke for the first session on curricula for computer specialists. The specialist, as defined in the business sense, is different from one trained by a computer science department. Many of the schools have advanced courses in computer software or applications, but none really has a program to train the computer specialist who would manage information systems and/or computer centers as opposed to a specialist who is a programmer par excellence.

The program closest to this is offered by the U.S. Naval Postgraduate School and is a Computer Systems Management Program that combines courses from the computer science de-

partment and management department. There was some feeling that the computer specialist, as a sophisticated programmer, was a threat to the business world because he would be more interested in his own specialty rather than serving the needs of the business management, perhaps contributing to the high attrition rate of computer center managers. The possibility of study into a joint program between computer science departments and business schools was mentioned as a way of giving proper background for a computer science specialist.

Bill Massy, Stanford, and Rick Hesse, USC, spoke for the session on general manager curricula. It was the consensus that programming should be required of all MBA candidates and also some general background on computers. Also necessary are facilities that are easy to use and give rapid service. For student jobs, terminals are preferred but a fast batch system also seems adequate. The computer language should be simple to learn and diagnostics must be comprehensible. The methods for teaching large numbers of students have undergone several evolutions, with a preference towards smaller groups.

Morgan Jones, UCLA and George Prater, Washington, spoke at the last session on functional computer-related course material, where the biggest problem seems to lie. Initial exposure to computing comes via the specific department that handles computer curricula, but it is important that the functional areas then make use of the computer. The problems of involvement, training, and support of faculty were discussed, with everyone agreeing that there seem to be no ready solutions. Some suggestions for alleviating this were: portable terminals and programmed learning so that the professors could learn in the privacy of their own office; subsidize several doc-

toral candidates to write programs in the functional area and require their use in the curriculum; have functional areas develop their own teaching assistants and programs; provide funds for faculty to develop programs; and include a requirement specifying computer knowledge in doctoral programs so that future professors will not be ignorant nor intimidated by computers. Almost none of the schools required computer programming from their doctoral candidates.

In the functional areas especially, users relied heavily on canned programs or already written programs, versus the students writing small programs to solve problems. Most of the functional computer programs were in gaming and simulation for management, stock market analysis and math of finance for finance, auditing and simple information systems for accounting, linear programming, simulation languages and statistical analysis for operations research, and marketing games and statistical analysis for marketing.

Materials are being solicited from the various participants to illustrate curricula and programs already in use. The proceedings of the meeting are taped and a report will be published by the ACM.

Participating were: Charles Bonini, Stanford University; Hal Eyring, Stanford University; William Massy, Stanford University; Jerry Miller, Stanford University; Jack Moore, Stanford University; Norman Nielsen, Stanford University; Richard Hesse, USC; Austin Hoggatt, UC, Berkeley; J. Morgan Jones, UCLA; William Sharpe, UC, Irvine; George Prater, University of Washington; Fred Tonge, University of Hawaii; Peter Winters, University of Alberta, Canada; James Cowie, U.S. Naval Postgraduate School.

—RICK HESSE

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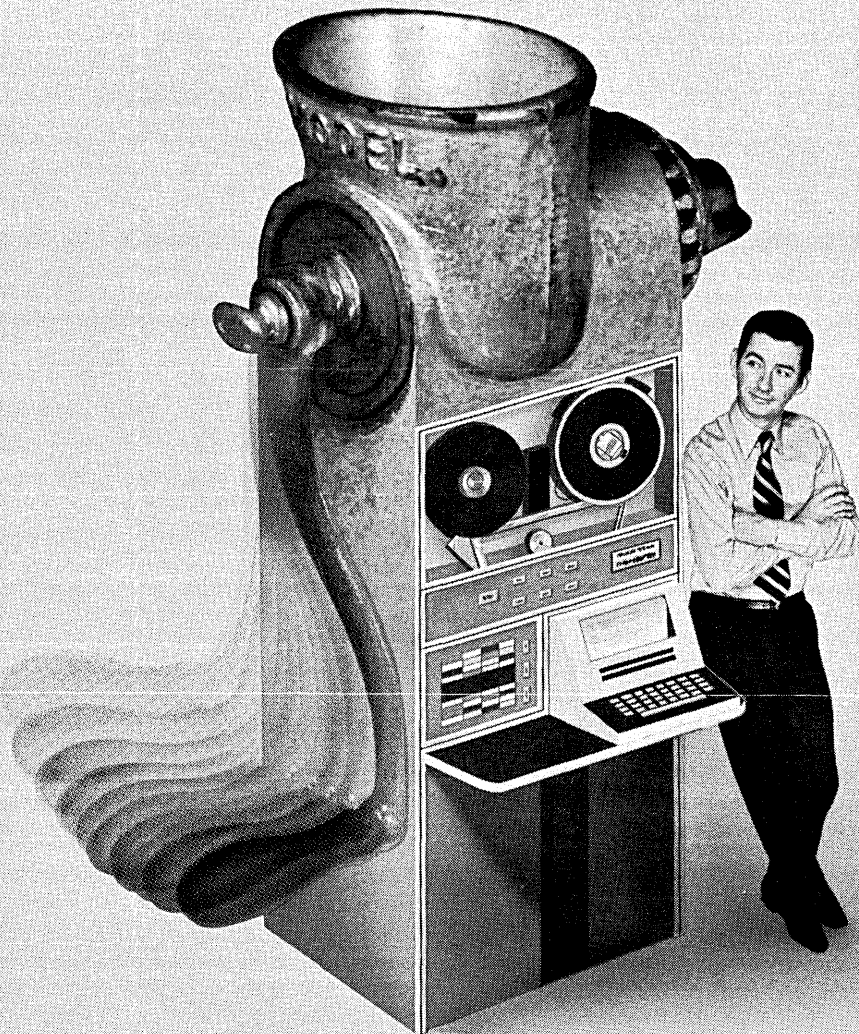
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CIRCLE 135 ON READER CARD

CORPORATE SIMULATION MODELS

In the jargon of today's youth, the broad theme sounded at the symposium on Corporate Simulation Models was "Tell It Like It Is." Represented at the symposium, held March 23-25 on the University of Washington campus in Seattle, were 31 states, the District of Columbia, and 6 foreign countries. This broad spectrum included academia, service as well as manufacturing industries, governmental agencies, administrators, and practitioners alike.

The 25 papers presented are available in bound volume from the Faculty Publications Office of the Graduate School of Business Administration, University of Washington, Seattle 98105. Rather than attempt to survey the totality of papers, I shall integrate some of the principal thrusts of the conference, noting contrasts and conflicts.

Thomas H. Naylor of Duke University set the tone for the conference, asking each speaker to (1) state the original motives for the model; (2) discuss the difficulties with the model (humanistic and technological); and (3) indicate the extent to which top management has become involved with the model. The resultant candor seemed well appreciated.

The range of papers presented points up again the diversity of definitions as to what constitutes modeling. The answer to what is modeling, in an analogous manner to what is beauty, can often only be obtained from the eyes of the beholder.

From the spectrum of papers, the following categorization of models emerges:

By application and use. Examples include inventory, capital investment, portfolio selection, plant location, cost accounting, training.

Total system/sub-system. The trend has been to integrate the total corporation into one model—with emphasis toward "what if" financial-type questions. The trends appear toward more integration—such as personnel requirements and manpower planning in relation to projected financial requirements.

Deterministic/stochastic. The corporate financial emphasis has largely led to deterministic models. Stochastic

models appear increasingly likely, as sophistication increases.

Mode. A great many models have evolved in the batch mode. The state of the art in time-sharing, as well as likely requirements for shortening response time, point toward tremendous growth for remote inquiry models.

In the final analysis, the model can and should be described in relation to the manner in which it serves management. Most importantly, models focus on need for data acquisition (rather than seat-of-the-pants judgment); serve as a forum for discussion of the future and its impact on the firm; are a



laboratory for experimentation; and can be a basis for appraisal (provide benchmarks by which to measure performance).

The major topical areas of the symposium included:

1. Linear programming vs. simulation approaches.
2. Top-down vs. bottom-up modeling.
3. Aggregate financial models.
4. Instant modeling.

lp vs. simulation

Jared H. Dickens of Boise Cascade and Robert C. Eads of Weyerhaeuser discussed the two extremities of this question. There is a certain appeal in using linear programming (LP) models for manufacturing operations such as wood processing. The company will

typically have several timber producing regions, various geographically scattered processing plants for different products, and constraints such as long lead times in growing a stand of timber, marketing and distribution problems, housing industry activity, and private and governmental conservationist pressures. Answers to specific questions such as how to increase profits, etc., can be explored using LP. Boise Cascade opted for LP. In contrast, Weyerhaeuser felt LP to be less of an interactive tool for line managers. With a simulation approach, the managers were brought into the model formulation process. This fundamental working relationship became of considerable assistance when implementing the modeling results. Additional benefits included programming simplification and reduction of the possibility of a too-efficient-to-be-realistic LP solution. Weyerhaeuser seemed satisfied with management use and acceptance of the simulation model.

Linear programming at Boise Cascade ran head-on into Instant Modeling, as marketed and sold by On-Line Decision Inc. of Berkeley, California. Dr. James Boulden, in outlining the modeling philosophy of On-Line Decisions stated: (1) there should be "immediate" return to management on their modeling investment; (2) the model should be integrated (not just a financial model); (3) the model should be general; (4) it should incorporate a modular approach; (5) it should be evolutionary, conversational, flexible; and (6) necessitate top management involvement.

Using the On-Line Decision method, one can access an economic series data file, business series data file, mathematical and statistical routines, including multiple regression and time series forecasting methods.

Boise Cascade has tended to use the On-Line Decision modeling approach. The implications of simplicity vs. complexity cannot be dismissed with a wave of the hand. Modeling, as promulgated by planning, operations research, or management sciences groups, may or may not be the management tool the specifications state it to be. Dr. Boulden's views on the interaction of model/management merit

CORPORATE SIMULATION MODELS . . .

further consideration in many companies.

Whether to aggregate or not? What is the trade-off in including more detail? Several papers addressed themselves to these areas of modeling. Morgan, Lawless, and Yehle from Dow Chemical presented an aggregate model oriented to answering "what if" financial-type questions. The present Dow model is a deterministic, accounting type that projects income and expense statements, balance sheets, cash flow statements, and certain performance measures. The model is macro—with no breakdown by businesses, products, or geographical locations. Dow developed their own model language, Planning Simulator 1. With ps1, equations and report generators are part of the data input—thus compilations are avoided each time an equation or report is changed. Uses of the model include comparison of depreciation methods, project cash flow analysis, evaluation of alternative capital investments plans, and estimation of capital spending.

Xerox presented two papers. Peter Redwood discussed a short term planning system model. In this bottoms-up

approach, forecasts of machines are made at the branch level and aggregated at both regional and national levels. Calculations of revenues and service expenses are made at the branch level and aggregated.

Product distributions (essentially normal) are derived. These distributions take into account new business, trade-outs to other copiers, trade-ups to other Xerox lines, etc.

The constraint of total production capability is matched against national demand. An allocation module distributes machines to the branch level by regional control totals using a linear allocation process.

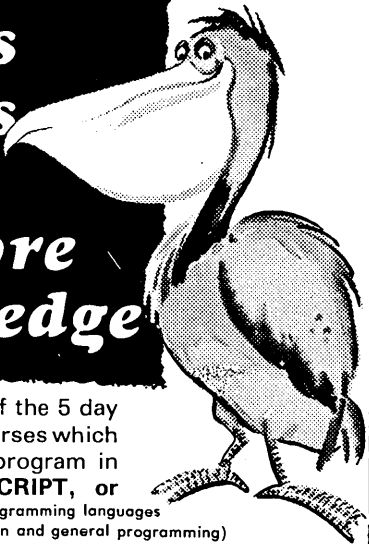
In the second paper, David E. Brown discussed the stages of development of another planning model at Xerox. The paper points up the advantages and impacts on management of bottoms-up vs. top-down modeling. The top-down model will tend to be highly aggregated, mathematically sophisticated. Management can usually obtain quick answers to "what if" type questions.

In bottoms-up modeling the lower level of aggregation usually gets middle management involved, thus increasing potential for utilization and acceptance. Data gathered to support this lower level of aggregation can serve as beginnings for a data base.

Esso Mathematics, Corning Glass, Deere and Co., and the University of Minnesota discussed financial and corporate planning models and their evolutionary problems.

J. Harry Goldie of the Boeing Co., the featured speaker for the only evening session, struck responses with his topic "Simulation and Irritation." This title could well have been "The Frustrations of a Corporate Planner with His Model." Goldie suggested that model builders take a critical appraisal of their developmental plans. Critical self-appraisal coupled with early and continued management awareness produce a superior end product. Goldie's comments seem timely and appropriate as model building, management sciences, and operations research enter the decade of the 70's. In the past, model development, testing, and validation have often occurred with little or no liaison with the potential users. Delays and completion time have lengthened beyond original estimates. Relationships with managers, planners, and administrators have deteriorated. Advances in crt, remote terminal, hardware, and software suggest the new role—involvement for the manager/user—early in the model building process. Those ignoring this role have not gotten the message of the 50's and 60's. —MATHEW J. KLEMPA

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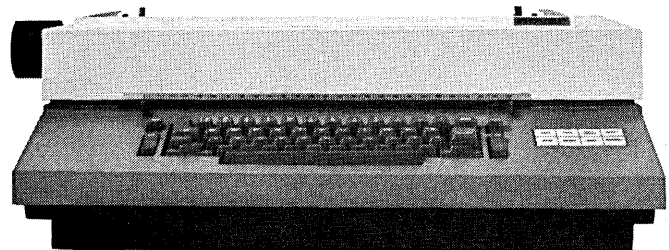
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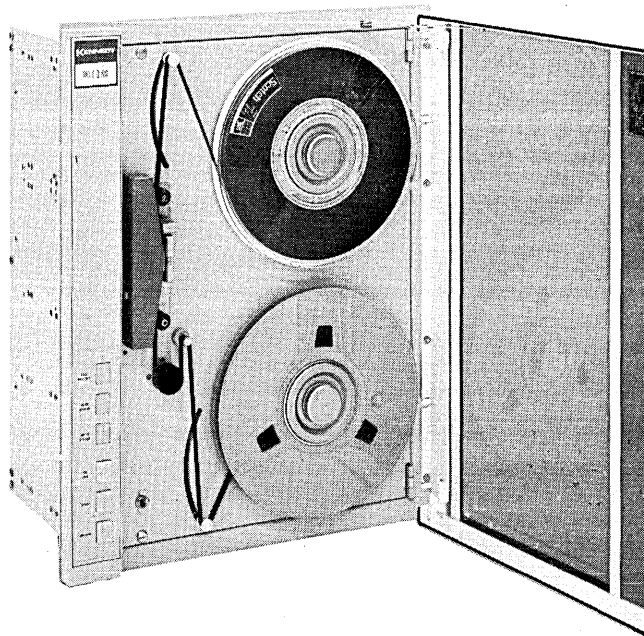
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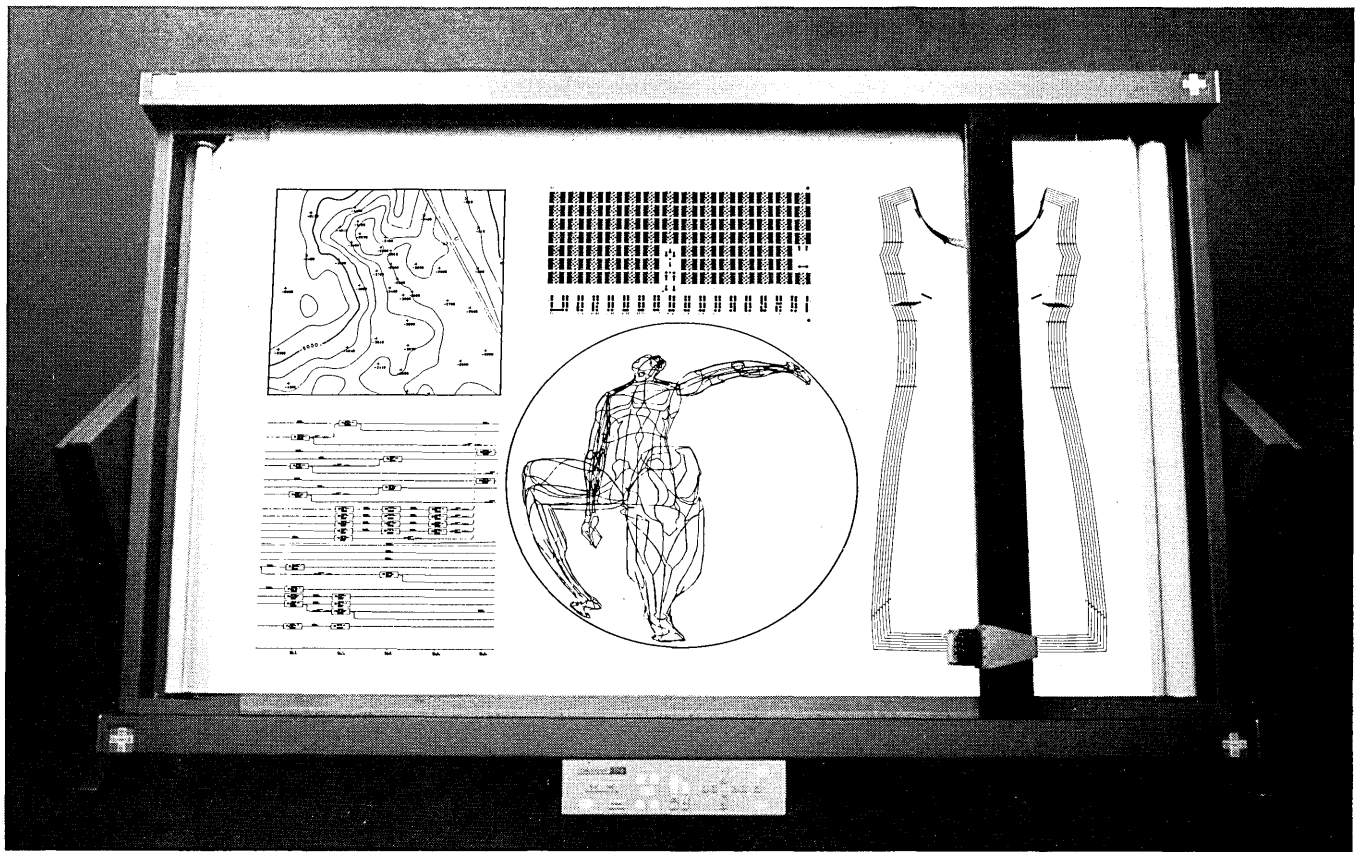
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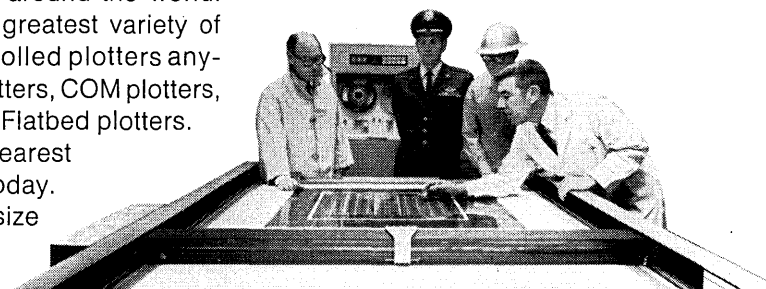
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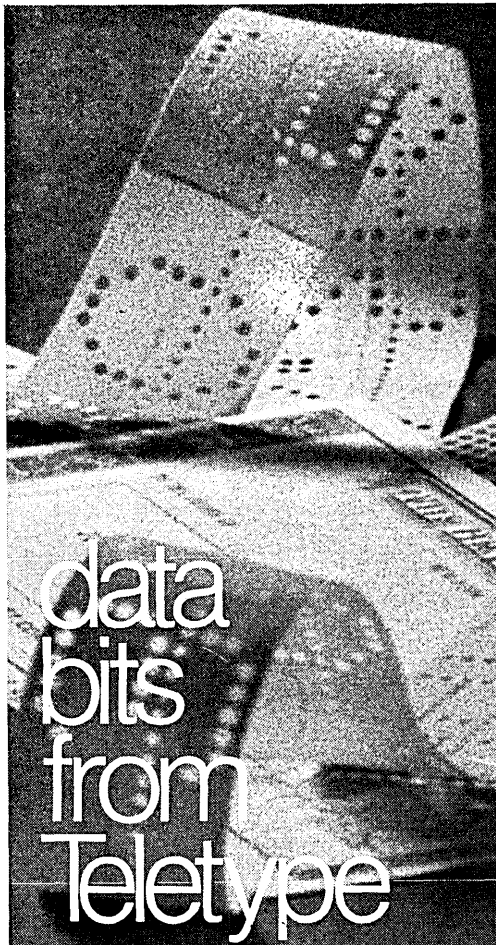
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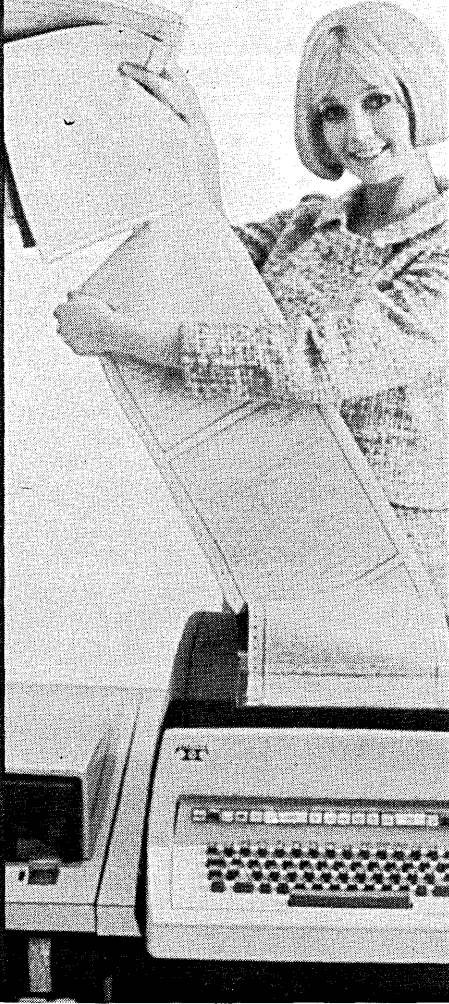
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THE STOCK MARKET GLOOM DEEPENS AS EDS AND OTHER COMPUTER ISSUES SAG

"Now you know and I know that one day the orchestra will stop playing and the wind will rattle through the broken window panes ..." — the Great Winfield, in *The Money Game*, by Adam Smith.

The day came in April for Electronic Data Systems stock. After a glorious rise from 16½, when it was issued less than two years ago, to about 160, it drifted downward for a few days to 150 and then fell in a heap. On that day, the final bid reported was 100. And in the next two days, after wild fluctuations, it was quoted around 60. A week later it was holding steady at about 70.

So the cry goes up on all sides: "What went wrong?"

Well, nothing went wrong — in the sense the questioners imply. Ross Perot didn't get run over, no one was found emptying out the till, the workers are not fleeing to join IBM, and college students are not holding EDS computers for ransom.

Instead, EDS continues on its well-managed way, with a strong position in one of the more promising submarkets of the computer business. In the latest quarter, it turned \$2 million net on revenue of \$14.5 million. In the same quarter last year, it had earnings of \$1.18 million on revenue of \$5.1 million. While this shows a lower profit margin — and while earnings are affected in a variety of ways by accounting practices — the comparison hardly suggests reason enough for the stock to roll over and play dead.

buyers and sellers

What went wrong is what always goes wrong — eventually — when a stock is selling at a maniacal price in relation to its earnings. Actually, EDS has been a real soldier in this horrible market and was one of the last to topple. But at some point buyers begin, at last, to beware.

These buyers and sellers, who place orders big enough to move a stock up or down noticeably, are not interested in "buying a piece of America," as a now-obsolete New

York Stock Exchange promotional slogan had it. In fact, no one who is seriously interested in making money in the market believes in buying a stock and forgetting about it. There may be several jolly grandfathers stoking their pipes and chuckling in their rocking chairs as they riffle through certificates from the original new issue of General Motors. But there are a whole lot more of them waiting for Amalgamated Buggy Whips, Inc., to make a comeback.

The real traders are interested in buying stocks that are going up and selling those that are going down, quickly. And when they are dealing in securities on the over-the-counter market the price swings that result tend to be more severe than those of stocks listed on the New York or American exchanges. Although many big, well-entrenched companies don't bother with getting listed on an exchange — banks and insurance companies are typical — most of the 10,000 or so over-the-counter securities that are traded frequently are those of smaller companies. And they tend to have fewer shares on the market, since each of the major exchanges requires a certain number of shares outstanding, plus a lot of other things, to take on a company for listing. Hence the wider swings: when prices are determined by bids, it's hard to buy or sell a large portion of the merchandise without affecting the price.

Besides, the over-the-counter market is not so much a market as a state of mind. Something like 4,000 financial companies buy and sell OTC stocks, thus making a market in them. It's not institutionalized as the exchanges are. As one gloomy trader said on April 22, "There is no over-the-counter market today."

some big board stocks

Meanwhile, over on the New York Stock Exchange, there have been some rousing losses, too — many of them starting earlier than the recent slump of EDS and other OTC stocks.

Mighty IBM, for example, was un-

der 300 in early May — down from its high of 387 this year, roughly a 25% loss. Memorex, which has seen 166 this year, was under 80 — about a 50% drop. Control Data has languished in the 40's and it had been as high as 122½ this year. University Computing was in the low 30's, down from just under 100. And Computer Sciences was around 13, compared to its high of a bit over 34.

Now that's a mixed bag of companies. Each of them is active in a different part of this business — but they're all down. And all kinds of different reasons have been given for their decline. Of course, typical spokesmen for the financial institutions have a marvelous way of interpreting news about a company as good or bad, depending on the trend of the market. If the trend is up, and a company has developed a new product: "This company's latest offering should round out the product line and it shows that an alert management is staying in the forefront of technology for this exciting industry." But bring out a new product in a down market: "Cautious investors should be aware of the large development expenses that may, even if the new unit is accepted in the marketplace, tend to depress the next quarter's earnings."

There are some shrewder people interested in these matters, though, and they have been questioning the exalted prices of computer stocks for some time. One of them is Barron's Alan Abelson — that scourge of creative accountants and ace interpreter of footnotes in annual reports and prospectuses. Way back in February, for example, he had some comments about University Computing's earnings: "... of the \$12.1 million (or \$1.80 a share) reported for January-September '69, \$6.3 million, or slightly over half, represented realized gains on investments (\$4.5 million from Gulf Insurance, the rest from elsewhere in the corporate bag)."

Now there's nothing wrong with making money by selling things you own, but it's not quite the same as selling something for a dollar that costs a dime to manufacture and is habit-forming. When you sell things you don't make, but inherit or acquire, there's a time coming when you will be out of things to sell.

These and similar dark thoughts have led those alert buyers and sellers mentioned before to reconsider the value and price of stocks that have anything to do with computers. And this attitude has now been distilled into the presently popular phrase "quality of earnings."

Since traders must be concerned mainly with what other traders think — not necessarily with what *is* — the

feeling spread that computer stocks are not "worth" the price represented by very high ratios of price to earnings. This ratio for the 30 old-line companies making up the Dow Jones industrial average is now around 13, but EDS stock was in the 300 range and many others were from 50 to 100. What's more, dozens of new companies have been appearing as new issues with infinite price-earnings ratios — they haven't shown a profit yet and really don't expect to for a while.

the general decline

This new look at the computer stocks (new for this year, that is, since the same thing happened in late '61 and early '62) was then compounded by the general slump in the market. And this, historically, is an unusually long and severe drop.

Here are some figures from Stand-

ard & Poor's Outlook. Using the S & P industrial stock price index, which covers 425 companies, the decline has been going on for about 17 months and, as of April, the index was down 21.6%. For comparison: the '62 drop lasted less than seven months and ended with a 23.1% loss in the index; the '56 and '57 drop went on for about the same length of time but showed a loss of only about 12%. But in the 1929-32 period it was 33 months and 85%. So cheer up; things could be worse. As our favorite financial writer, Mr. Abelson, noted recently: "Things always look darkest just before the bottom drops out."

Besides, President Nixon was quoted at the end of April as saying: "Frankly, if I had any money, I'd be buying stocks right now."

I know a couple of brokers who intend to call him up on payday.

—BILL ROLPH

AUTOMATION AND BANKING . . . WHERE, HOW & IF

The banking industry took a long hard look at the Wheres and Hows of its automated customer services during this year's National Automation Conference and an even harder look at the Ifs.

Projections for the future and summations of accomplishments to date were accompanied by warnings as the bankers rallied their heavy artillery to combat feared legislation and litigation.

But the fears as to what will happen to automation in banking as a result of H.R. 6778, the One-Bank Holding Company bill, and Supreme Court decisions giving data processing firms standing to sue banks appeared to be restricted to the podium from whence the warnings fell thick and fast. In the halls, the elevators, and over lunch, bank edp men talked expansively of edp services they are now providing and even more expansively of what they will be doing in the next decade.

bank edp services issue

The bankers issued their warnings and envisioned their visions with H.R. 6778 due for imminent public hearings by the Senate Banking and Currency Committee, hearings opposed by the ABA which favored postponement pending study by a Presidential Commission.

Although there was much talk of the so-called "laundry list" of activities the House-passed bill specifically

prohibits or severely limits to bank holding companies and their subsidiaries, few seemed to feel the Senate would go this far. Concern centered on the bill's prohibiting bank holding companies and their subsidiaries from providing data processing services except "as an incident to banking services, such as the preparation of payrolls."

"On the surface these data processing restrictions sound relatively innocuous," said John J. Balles, senior vice president, Mellon National Bank and Trust Co., Pittsburgh, "but they could lead to litigation."

Floyd F. Prouty, vice president, First National Bank, Boulder, Colo., also fears legal problems. He said banks could live within "these prohibitions" but would be placed in a position of having to justify even the upgrading of a system or installation of teleprocessing to the Comptroller of the Currency or the Federal Reserve Board. "Our jobs would be limited; our future would be frozen; and none of us would be happy." Balles went a step farther. In urging bank edp'ers to "help carry our case to Congress," he warned: "Don't sit back and let George do it. If so, you might find yourself unemployed — at least in a bank."

Matthew Hale, ABA general counsel, sees a bright spot. "These attacks on the performance of automated customer services by banks offer to banking an opportunity to meet the crises

in a way which will clear up once and for all the questions which have been raised about bank participation in this field and will provide a firm foundation for the performance of automated customer services by banks during the 70's and 80's to the benefit of banks and, more important in the long-run, of the bank customers who are demanding these services — industry and commerce, the government, and the public generally."

Balles said the bankers have a strong case "in terms of what is wanted by the public." He cited a survey of public and leadership opinion on banking conducted for the Foundation for Full Service Banks by Louis Harris and Associates which showed, he said, "a clear majority (58%) favored banks going into the data processing field."

The Supreme Court ruling giving data processing firms standing to sue banks followed a suit filed by a Providence, R.I., data processing firm and the Association of Data Processing Servicing Organizations (ADAPSO) against a bank providing data processing services and the Comptroller of the Currency. It charges national banks do not have authority under the incidental powers clause in the National Bank Act to perform data processing services for customers. This question has still to be resolved, but, notes Balles, standing to sue a federal agency, which formerly required a plaintiff to show Congressional intent to protect him, now can be denied only where there is clear Congressional prohibition against judicial review.

"incidental to banking"

"It thus appears," he said, "that both Congress and the courts will be heavily involved in the period ahead in a re-evaluation of the right of banks or bank holding companies and their affiliates to offer data processing services for customers. As a minimum, we can look forward to considerable confusion, delay, and litigation, even if we are finally successful in establishing our case." Hales said the ABA is "convinced that most automated customer services provided by banks are incidental to banking," and those, which are not are justified in order to make full use of equipment.

The bank involved in the Providence suit is providing services for the city of Providence which Hale described as "clearly incidental to banking and to the transfer of funds." These include tax collections, welfare and pension payments and payroll handling. Other principal automated customer services of banks, such as account reconciliation, accounts receiv-

news scene...

able, professional and other billing, the allocation of freight billings, etc., also are closely related to the transfer of funds, he said, and are incidental to banking. "These services involve the transfer of funds from one customer to another and foreshadow the automated banking services of the future — the automated payments mechanisms which are being developed by the ABA's Automation Committee and the Committee on Monetary and Payments Systems Planning."

payments systems

Payments Systems were a big part of the Where looked at during the conference. Gone from the conference vocabulary were the terms checkless and cashless society. Views presented ranged from a way-out picture painted by conference keynoter, TRW vice chairman Dr. Simon Ramo, of "a true synthetic intelligence system... which will make it possible to link banks together with computerized information systems, manufacturers, wholesalers, retailers and consumers, so that all transactions, purchases and shifts of accounts can be handled in a faster, more reliable and more economical electronic form," to a step-by-step approach to changing the payments system taken by the Monetary and Payments Systems Planning Committee (MAPS.)

As a first step in the MAPS approach, an Operations/Technology task force is assessing the ability of the banking industry to handle the check payment system at least at its present level of performance during the 70's. Russell L. Fenwick, vice president, Bank of America, told the conference this will set the stage for planning system changes by establishing motivation... is it impending disaster or the opportunity for improvement? The project schedule calls for submission of a study report to MAPS in September.

payments system alternatives

Second part of the task force's job is evaluation of payments systems alternatives. This has been under way for five months. At conference time, Fenwick said, the task force already had eliminated truncation of check-flow, either by non-return of checks or by holding checks at the bank of first deposit, as an attractive alternative. Still under consideration is a proposed variation of the basic Giro credit transfer concept, which is a system with the transfers initiated by ma-

chine processable invoices. Given customer acceptance and the requisite wide adoption of a standardized machine processable remittance document, Fenwick said, the concept has the potential to reduce paper handling. Of the longer range full electronic funds transfer concept he said, "technical feasibility is well established, but major questions remain open on economic feasibility as well as customer acceptance and implementation."

The alternative selected by the task force as the first step in improving the payments system is pre-authorized paperless entries — automatic deposits and pre-authorized billings. This system, Fenwick said, would operate within a legal framework of clearings agreements, indemnification agreements, and customer authorizations. A company would deliver magnetic tape containing pre-authorized billing or deposit data to its bank. There, entries for accounts of customers of that bank would be separated and retained for posting, and entries for customers of other banks would be transmitted or delivered via magnetic tape to a computer-based clearings facility — an automated clearing house — where entries from all banks would be sorted and distributed to the receiving banks. The concept can be expanded from a local to national scale by introducing a data communications network with regional switching centers. MAPS Legal/Legislative task force has endorsed the position that an electronic record can be substituted for a paper item without changes in existing code.

One paperless entries system is nearing implementation stages in California. The Special Committee on Paperless Entries (SCOPE) of the Los Angeles and San Francisco clearing houses is developing a program of exchanging paperless interbank entries through an automated clearing house to be operated experimentally by the San Francisco Federal Reserve Board.

international interest

That payments systems and the changes they face is of widespread concern to bankers all over the world was evidenced by the holding of a closed International Symposium on Payments Systems following the conference... a first. Gerald Lowrie, ABA Director of Automation and Payment System Planning, whose idea the symposium was, said his initial letters of inquiry evoked interest far beyond his expectations. He said the president of the Bank of Italy was so anxious to attend and to get as much out of it as he could that before coming he took a six-week crash course to become

fluent in English, a language he had never before studied or spoken.

The Automation Conference itself is reflecting growing international interest in automation in banking. Lowrie said international registrations have been increasing each year, and this year's total of 134 was the highest to date in spite of the fact that Japanese representation, usually the largest, was down significantly because of Expo '70. Total attendance at the San Francisco conference was 1,250, high for a west coast staging of the event, up from 900 the last time it was held in the west five years ago.

The accompanying show had 38 exhibitors as compared to some 60 last year in Chicago, but this was because of space limitations. Many were turned away. Crowd pleasers were the on-line teller equipment of Burroughs and IBM and the remote teller currency dispensers of NCR and Docutel; but by far the most noteworthy feature of the show was the proliferation of companies offering software packages, many of them new within the last year and most dedicated to banking. One such exhibitor said he was pleased by the interest shown by the bankers, but this couldn't compare to the degree of interest from his competitors both in the show and the "dozens who couldn't get in and are all over the hotels in hospitality suites."

banking software packages

Interest by bankers in use of software packages was widely reflected in the conference sessions and in the corridors, and the term "why reinvent the wheel" was oft repeated. One who used it was Joe F. Baldridge, Jr., vice president, Fort Worth National Bank, Texas, whose bank purchased a package in setting up a Customer Information File (CIF); and while he admits his system has been on the air only 17% of the time since implementation, he still feels it beats reinventing the wheel in terms of expenditure of time and money and that the bugs eventually will be worked out.

The other side of this coin was exposed by Ronald C. Harris, vice president of The First National Bank of Denver, Colo., which is developing its own CIF system under a five-year plan. They're now in their fourth year. "It takes time, but to-date it's functioned perfectly."

The people problem, common to all edp operations, continues to concern bankers. L. M. Williamson, assistant vp and manager of Bank of America's San Francisco data processing center, advocated "piracy, greed and violence" as the best means of selecting, training, motivating and retaining

operations personnel. By piracy, he referred to "our continual shanghaiing of promising young men and women from our own ranks." His center motivates by evoking greed — greed for higher salaries, more responsible positions, and challenge. The violence part, he said, "is our violent opposition to retaining our computer operating personnel as such! We encourage our personnel to identify with the entire organization."

Another aspect of Bank of America's approach to edp personnel is a program of employing the culturally disadvantaged. Richard L. Nugent, assistant chief analyst, staff development, said the program is proving successful both in terms of quality of the trainees themselves and in terms of a positive effect on staff morale which, he said, "provides concrete proof of a genuine commitment to equal opportunity shared by most young college graduates and their peers."

The entire banking edp community was charged with an obligation to do more of what B of A is doing by Whitney M. Young, Jr., executive director of the Urban League and the one conference luncheon speaker to receive a standing ovation. Young told his audience they are the ones who can bring minority groups into banking through "your new field — computers."

Another charge laid to the bank edp'ers was for "involvement now" in working toward automated securities trading. George C. White, Jr., vice

president of Irving Trust Co., New York City, who called the securities handling problem "far more grave than the check handling problem," said the banking and securities industries "face tragic obsolescence in securities trading if they do not look at how to accomplish settlement on the day of trading."

"We have seen the near collapse of back offices of some brokerage firms because the physical transfer of stock certificates lags behind the actual trades, often more than the allowed five days." He does not believe a machine readable stock certificate is the most advanced solution available because "today's computer and communications technology makes it feasible to eliminate the transfer of stock certificates altogether for many transactions." He sees the ultimate securities trading system to be an automated depositories system linked in some way to the coming electronic payments network.

And what is the ultimate in all of this electronic finance for the man on the street? Perhaps the mini-bank described for the Automation Conference by Dale Reistad, president of Payment Systems Inc., New York City. It would be located in a neighborhood shopping center and would contain automated equipment to handle virtually every banking service known today and some new ones.

Hit or myth? — said Reistad, "only time will tell."

— EDITH MYERS

and tape drives, plotters, controllers, numerical control gear and small systems should provide business.

Among the third party maintenance companies are RCA Service Co.; Honeywell, whose operation is part of the EDP Division; Management Assistance Inc.; Comma Corp.; SirVess, Inc.; CDC; UCC; and ITT. Most of them have declared themselves formally in the business within the past year, which means the first order of business has been to establish credibility. For those with connections, this has been easy. As one producer of data terminals said: "Customers know RCA; they haven't heard of SirVess; so if you're trying to establish a national market, whom do you choose?" The answer at this point is obvious, but there are indications that "name" is not the only criterion for selection.

entire network support

RCA does appear to have the longest history in third party maintenance (of the formal competitors). It got into the business 10 years ago by taking operation and maintenance responsibility for four 7094's. The systems were part of the government's missile warning system.

RCA Service also got into maintenance of Teletypes for the news services, then moved into leasing the machines with maintenance contracts and into maintenance service for terminal networks. The terminal service has brought contracts from American Airlines, BOAC, Telemex, and others. According to RCA, a big selling point is that they provide support for the entire network — from concentrators out — regardless of the mix of equipment.

The RCA Service evolution is responding to three stimuli: to get closer to the computer — it is thinking of getting into facilities management; to provide communication service — it is now leasing and supporting private telephone systems; and to get the most out of its work force. It claims to have the largest field force (225 locations) providing computer equipment maintenance to the general public. At present, the maintenance of independent manufacturers' peripherals is "most significant to RCA in terms of using its work force."

Honeywell EDP formed the Maintenance Sales Dept. in May, 1968, and now claims a work force of 1500 service engineers at 115 centers around the country. Emphasis for the department is on peripheral equipment, although there is no objection to supporting other makes of mini or larger computers, according to manager William Herbert. Contracts have been signed with Computer-

THIRD PARTY MAINTENANCE . . . FOR THOSE ABOVE AND BEYOND UNBUNDLING

The consensus on unbundling is that the cutting of the ties that bind will buoy the software business and permit inroads into every aspect of computer marketing, use, and service. One of the groups that is waiting for this to be proven is the small but slowly growing contingent of "third party maintenance" companies.

Thus far their only benefit from separate pricing has been what the Boston Computer Group in its study of maintenance alternatives for the federal government calls the ending of the "rental syndrome." The study explains that the manufacturer's rental policy disconnected the user legally and psychologically from equipment maintenance.

Unbundling encourages the user to accept responsibilities. He sees it as an acknowledgment of the independent line taken by larger, more ex-

perienced operations and also as an indicator that the manufacturer is not the pillar of support.

This acknowledgment is encouraging, but even though Univac has a totally separate maintenance contract and IBM offers one on purchased equipment, there is little total systems work for the independent maintenance companies. Their business, for the time being at least, is the installation and support of the products of the independent peripheral manufacturers.

nationwide market

This fast expanding group must, in order to compete effectively, offer national support for their equipment. And the multiplicity of terminal units, data entry units, modems, multiplexors, character and line printers, disc



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Optics, Computer Consoles, Computer Transceiver Systems, and some nine other manufacturers.

The MAI route into third party maintenance paralleled its evolution from leasing tab card equipment to marketing IBM-compatible peripherals. Its service organization was set up nine years ago to maintain equipment on lease and to recondition and reconfigure equipment moving from one lease to another. In 1967 the company offered maintenance service to companies owning their own IBM equipment and a year later to buyers of the peripherals it was selling. In February it announced expansion of the service, gave the operation division status, and appointed Noel Kile vice president.

There are 1000 service reps at MAI working out of 50 locations. It has three reconditioning plants at King of Prussia (Pa.), Rosemont (Ill.), and San Francisco. MAI claims revenue in excess of \$1 million for FY 1969 from maintenance, primarily of unit record equipment, but also some IBM 1400 computers, and tape and disc drives. Most of this business appears to come from equipment that the company has leased or sold.

University Computing's third party maintenance service also developed through its leasing activity. Its main interest is total systems support, and it has taken advantage of its background with large Univac computers; the company has contracts to take care of five 1108's other than its own. CDC and DEC installations are also maintained. However, UCC is prepared to work on IBM equipment and in April formally established the System Support Division, which will emphasize System/360 and mixed configuration maintenance. The division is headquartered in Los Angeles under Edward F. Kearns, former CSC vp, and is staffed with 225 maintenance personnel in nine locations. UCC also supports its leasing operation with a reconditioning plant in Dallas and maintains its own COPE terminals and the Datel product line.

traditional approach

The newest entries into the maintenance field are Comma Corp. and SirVess. Comma has declared its main intention is total system maintenance, but, like SirVess, it is also going after contracts with peripheral manufacturers. A big difference is in their approaches to building field staffs.

Comma's approach is the more traditional. It is taking them from other companies, among them IBM.

Founded in December, 1969, by Richard Puder, George Harmon, and Arthur Eickhoff, all former IBM field engineering executives, it is aiming to grab contracts for IBM 360 systems away from the computer giant. It also intends to do reconfiguration work for the leasing companies and to go after the mixed system market.

With financing of \$3 million, Comma has established four centers — Chicago, New York City, Los Angeles, and Dallas — which will be able to handle reconditioning and reconfiguration. The company is building its staff toward 200 and plans to add 10 sales and service offices before the end of the year. The ambitious Comma expects to have 3000 people in the field by 1975.

Puder, the financial man of the group and chairman and chief executive officer of the company, says growth is to be funded from revenue. He sees the \$2.5 billion worth of equipment owned by leasing companies producing \$60 million in reconfiguration work by the end of 1971. This equipment, he said, will be reconditioned one to five times in the next five years.

franchising

SirVess is a year older than Comma and started seeking business at the 1969 SJCC. Using the quiet approach of personal contact and word of mouth, the company has built its field network to some 15 locations and its customers to between 15 and 20 peripheral manufacturers.

Company management is from the manufacturing representative community. President Zeke Bogasian was vp of SBM Associates, and general manager Gene Snelling had been providing marketing services for manufacturer reps. Technical direction is provided by James Madar, an ex-Univac engineer.

The great departure at SirVess is its method of getting and holding FE talent. It franchises its service centers. According to Snelling, this will result in higher level personnel, less attrition, and thus better service.

A franchise, he said, is attractive to

the senior field engineer who has reached the top of the ladder and who, if he wants to continue to climb, must switch to sales. Another aspect of franchising is that the owner can attract talent for his operation with the offer of equity.

SirVess establishes franchises on a geographic basis. It charges about \$10,000 for a franchise, usually getting the first \$2,000 in cash and taking the rest out of revenue. It then guides the buyer in organizing his operation and retains administrative control by handling all invoicing, payment processing, and other support functions.

Contract arrangements with the service companies mentioned are similar. Whether for total systems maintenance or support of a product, they offer fixed-fee and time-and-material deals. According to Snelling, the advantage of a fixed fee for new products is primarily the convenience in setting lease rates.

The contracts are usually for one year with renewal clauses and 60- or 90-day cancellation. MAI, however, feels it can handle equipment other than IBM's only on longer term arrangements.

maintaining profits

Profit for the maintenance companies is an open question. RCA, Honeywell and UCC revenues are buried in corporate figures. MAI reports \$1 million in revenues but doesn't say whether the result was profits or losses. And SirVess, with at least a dozen contracts for equipment support, and Comma with one or two have yet to report on finances.

To one observer the prospect isn't too rosy. Those furnishing maintenance service to manufacturers must be prepared to wait for population growth to make their operations efficient. And the companies that are hoping to compete with IBM for total systems maintenance must buck what he considers a very high level of competence and below-cost pricing. Better to go after CDC and Univac, he said; they don't like maintenance and price accordingly.

— JOHN WESSLER

THE FIRST OF THE MOHAWKS ... WHERE ARE THEY NOW?

There are at least 40 different lines of key-to-tape encoders on today's market. Five years ago there was only one. Five years and a few months ago there

was only a wooden mock-up sitting in a basement. That mock-up, translated into steel and wire and magnetic cores, became the Mohawk Data

Sciences 1101 Data Recorder.

Although the industry was quick to acknowledge the Data Recorder by building copies, the Patent Office paid tribute to the basement inventors only several months ago. When this official recognition came, however, it found what was once a tightly knit group widely scattered.

Five men were named in the patents: George Cogar, Walter Bansinger, Tork Sekse, Joe Ming, and Laszlo Horvath. Of the five, Horvath is perhaps the most difficult to locate. His office hours normally find him 25 miles outside of Tempe, Arizona, 10 miles down a dirt road, then 4,500 or more feet straight up. He and his brother own and operate a sailplane airstrip called Estrella Sailport, and he spends many hours of his day aloft in long-winged motorless gliders, though not usually with an editor at the forward controls.

"Keep the nose down and feel for the lift ... there. It's a good one," he says.

Although their responsibilities in building the recorder were only roughly defined, Horvath did most of the system testing. Asked whether he had been surprised when his name was put on the patent application, he said "Not really. It would have been different if I had just worked on testing the unit or something, but we all worked as a family. I guess I didn't expect it, but I take things rather calmly, as they come. Tell you the truth, I didn't even think about what could be patented when I was working on it."

The "family" that Horvath talks about was an international one. Horvath had fled Hungary just after the revolt, Ming is of Chinese descent, Tork Sekse is Norwegian, and Bansinger a Swiss. Their one point in common was that all were working for Univac. Many of them had known each other. Sekse had worked with George Cogar on the Univac III and 1004. The two had met in 1956 when Cogar was managing field engineering training at St. Paul; Sekse came in for a 30-week course and became an instructor after only four weeks. He still works for Cogar at Cogar Corp. in New York.

Horvath worked for Cogar at MDS for three years before Cogar went off to form Cogar Information Systems (which later became Cogar Corp.) in 1967. Talking about Cogar, he said "He certainly has the capability of becoming ... well, maybe it seems funny to you ... but maybe his company has

IBM potential. I think he can see into the future quite far."

If he can, that was not always the case. Mohawk Data Sciences was formed by him in 1964 with several other Univac people to produce a "four times 1401." The reason MDS did not make such a machine has more to do with the founders' lack of foresight than with their understanding of the computer user's needs. On the surface, the four times 1401 seemed a good product for the period. IBM had announced the System 360 a year or so earlier and it appeared reasonable that some of the 1401 users would prefer to go to a faster, more powerful, compatible machine. No one ever proved out the theory, though, because MDS had insufficient financing to bring the machine to market.

"It took about a month after we set up shop to find out the business plan for it wasn't a good plan," says Cogar, "so then we were faced with the problem of what do you do to stay alive. And that's where the data recorder came from."

"We knew for a fact that the data recorder was considered by most companies over the years," says Sekse, "but the price barrier was always there and I think, if anything, it was breaking the price barrier that led to the success of the data recorder."

"I think it was perfect timing to bring it out when the price of components dropped so drastically," said Bansinger from his office as president of Mobydata, Inc. (a firm now in the throes of bringing a business oriented minicomputer system to life). "I knew about the 'four times 1401,' but I thought the recorder a better idea." Not everyone was as much in favor of the idea at the time, apparently.

"When we started with the data recorder there was tremendous skepticism on the part of the user that we had to fight initially," Sekse volunteered. "You get a lot of one-unit tries ... And I think we have to admit there was internal skepticism in the company. Definitely there was."

"But the idea is as old as the industry," Cogar adds. And, in fact, the inspiration for the recorder was the Unityper I, a device constructed for entering data into early Univac machines. Cogar had spent seven years with Univac, interrupted by a two-year stretch with Philco. He had worked on the Univac II and III, and set up the development program to produce the Univac 1004. Late in his Univac career, when he was technical consultant to the general manager of Univac's Philadelphia operation, he suggested that Univac build a low cost version of the earlier key-to-tape unit, but Univac never got to it.

The Univac experience with Unitypers I and II partly explained the company's reluctance to try again. Number 1 was produced concurrently with the Univac I and ended up being a very expensive machine due to the state of the art in the 50's. It was used by the military, but Univac was forced to offer card-to-tape and tape-to-card converters so that the "I" could be sold to other markets.

Unityper II was a modified Remington Typewriter. It had a small tape deck attached and was a character serial incremental recorder, but there were no provisions for checking the machine's output short of putting the tape on a drive and trying it.

By 1964, MDS's birthdate, the technology had advanced to the point where electronics were reasonable enough to keep the prices relatively low, and the technical knowhow had progressed sufficiently that a keyboard, memory, and tape unit could be built into a single, small, marketable unit.

"I think I'd be lying if I said I wasn't worried," says Ming. "The little time we had to do it in put the worry to us. We needed a product and we needed it fast." It took them four months and seven days, he remembers.

Cogar said of the prototype, "It didn't look like a lot but it worked." One of the things that made it work was a rap spring clutch taken from an IBM Selectric typewriter. It was used to back the tape up for the verification pass over the read/write heads. An IBM repairman was called to replace the unit in the cannibalized typewriter.

Another part that went into the prototype was copied from a part seen in a sewing machine. "Everything that we could see that we could utilize went into it" Ming continued, "we wanted to make it as simple as possible." And they did the construction themselves. The wooden mock-up that preceded the prototype, for instance, was made by Ming in his basement. "Later," he added, "on the company's second or third Christmas, we all autographed it and gave it to George (Cogar). He still has it someplace."

The first real machine was displayed at the Hanover Fair in Germany in April, 1965, and the first delivery was made in May of that year. The hurrying paid off. No one came out with a competitive device until two years later.

Cogar went on to hazard a guess "that even though the design is six years old it is probably still the most economical design of any of the recorders that are out. It was designed by people who understood exactly

how the operator would think right on through to how the machine was to be manufactured." The resulting product, for all its uniqueness, had only 14 moving parts.

They all agree that it was hard work. Would they do it again? In a sense Bansinger, Sekse and Cogar all have started over. "I probably wouldn't do it again," says Ming, now an assistant vp at MDS and the only

one still with the firm. "Those years took too much out of me. I'm the oldest one of the group, you know." And for Horvath, he is with his first love and it seems unlikely he will ever leave it. "Don't over-correct," he says from the glider's back seat, "just let it take you with it."

— R. A. McLAUGHLIN AND
JOHN WESSLER

ANTI-ESTABLISHMENT MOOD AT SJCC PANEL SESSION

Anti-establishmentarians in the audience apparently weren't listening when an IBM vp suggested, at last month's SJCC, that the biggest threat to individual privacy is not physical security of the files — which is basically a technical problem — but rather, uncontrolled data gathering — which is basically a philosophical and political problem.

The data user tends to ask for more than he really needs, said L. John Rankine, head of IBM's standards program, and the data supplier tends to give more than he's asked for, at least partly out of a fear that "otherwise, there is some privilege he might be denied."

Possibly it is wishful thinking to see significance in Rankine's words, but to an observer of social implications sessions at two earlier JCC's, it seemed that Rankine was opening a door that has been firmly bolted until now. At most, the door was opened only a crack, but it is probably more significant that the door was opened at all.

on being over 30

A possible result of this door opening process was suggested by Edward McIrvine, of Xerox, one of several audience participants who spoke after Rankine. McIrvine explained that he had been at the 1964 Democratic convention in Chicago and had helped turn away the kids who wanted to put an anti-Vietnam plank in the party platform. "Starting in January, 1965, I regretted that; and by 1966, I had cleared out of the party. I must say the radicalization that has taken place at the universities has not completely bypassed those of us who are past 30."

Virtually all of the other audience speakers tried to widen this toehold in over-30 land. The fact that they were largely unopposed, except from the platform, may be another barometer of change. For, at earlier social implications sessions, a substantial number of audience speakers defended

the status quo. Sidney Feldman, of Hillside Hospital, said Honeywell is "a disgrace to the industry," because it is so heavily engaged in military contracts, particularly antipersonnel bombs that "kill people but not property."

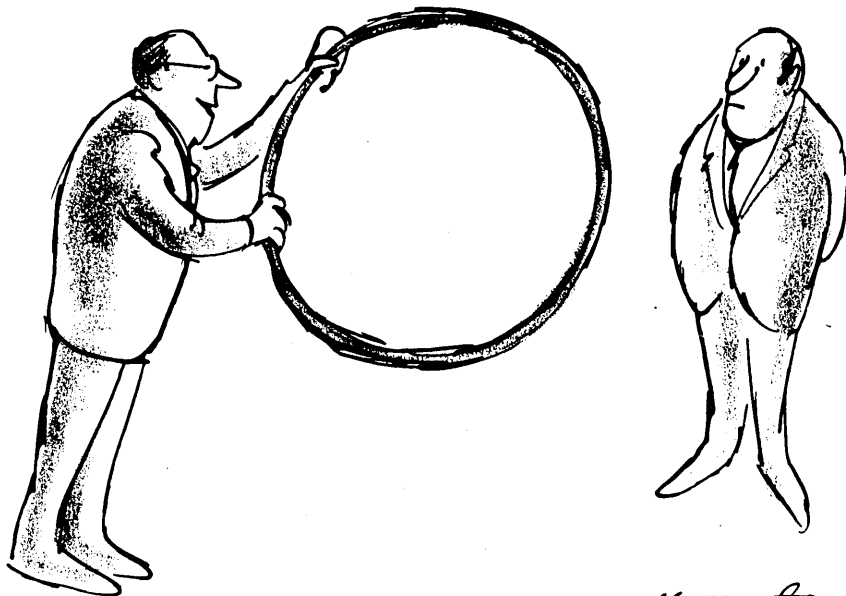
Ed Elkind, head of Computer Professionals for Peace, said, "we're going to end up dead" if we don't redirect the computer to socially useful channels. The way to do it, he added, is for computerniks to get involved by complaining to their employers and talking to their fellow employees. A more concise statement of this thought was presented by Herb Grosch, chief administrator of the federal dp standardization program, whose gray beard and long record of saying things in public that make the establishment uncomfortable probably qualify him a patriarch of the pro-

test movement. Grosch, paraphrasing Pastor Niemoeller's famous aphorism, said: "First, they shot blacks, but I was not black, so I did nothing. Then they shot students, but I was no longer a student, so I did nothing. Then they shot intellectuals. I was an intellectual, and it was too late."

If the computer industry is becoming more socially aware, it is also true that the shift will have to accelerate by several orders of magnitude before any significant results can be expected. The size of the remaining problem was indicated at last month's meeting by the featured speaker, O. E. Dial, of Baruch College, City University of New York. After listening to the often-emotional outbursts of several audience participants, Dial said, "I don't believe hysteria solves anything . . . Before we can solve any of the problems of our cities, we have to know considerably more about them."

People have been saying this ever since the '30s, at least; yet the poor — as well as several other urban problems — are still with us, and most of these problems are still as critical as ever. If New York City collapses under the accumulated weight of congestion, pollution, racial conflict, and its assorted other infirmities — a near-term possibility, according to what Mayor Lindsay said recently — Mr. Dial, who stressed that he lives in Manhattan rather than in its suburbs, probably will still be busily gathering information.

— PHIL HIRSCH



"You want that raise don't you, McKeldon?"

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news briefs

AT&T CONSENTS TO PROVIDE TAIL LOOP SERVICE TO MCI

Ma Bell is apparently willing to provide "tail loop" service to data and voice customers of Microwave Communications, Inc.; but even so, the FCC may not be satisfied. This possibility emerged at last month's SJCC after a technical session entitled "Data Common Carriers for the '70's." If FCC *does* push the phone company into offering more liberal system interconnection terms, the action would catapult the agency into new areas of regulatory responsibility, which probably would benefit users and suppliers of on-line computer services in a number of ways.

During a press conference that followed the technical session, panelist James R. Rae, assistant vp for engineering-planning in AT&T's long lines department, said that Bell is now willing to provide "tail loop" connections to customers of MCI's Chicago-St. Louis network, now under construction; but Rae added that Bell is unwilling to interconnect its long-haul lines with MCI's system.

A "tail loop" is a line running from each MCI customer's terminal to the nearest MCI tower. Rae's statement contrasts dramatically with Bell's position prior to last August, when MCI won its long fight to operate between Chicago and St. Louis. Then, the telephone company said it wasn't technically feasible to provide loop service. Almost certainly, Ma Bell's new attitude has been inspired by those words from FCC's MCI decision:

"... MCI's ability to market its services will be dependent on the ability of its subscribers to secure loop service from the other common carriers serving the service area... We are not unmindful of the fact that the carriers maintain that loop services is not technically feasible... However, insufficient evidence is contained in this record to support a conclusion that the proposed interconnection is not feasible... What seems a more likely obstacle is... the carriers' intransigence... Since (the carriers) have indicated that they will not voluntarily provide loop service we shall retain jurisdiction of this proceeding in order to enable MCI to obtain from the Commission a prompt determination on the matter of interconnection... We conclude that, absent a significant show-

ing that interconnection is not technically feasible, the issuance of an order requiring the existing carriers to provide loop service is in the public interest."

The basic question, though, is whether Bell — by offering tail-loop service — will satisfy the commission. MCI President Jack Goeken, who was one of the other panelists at the SJCC session, made it clear that he regards interconnection of MCI's system with Bell's long-haul lines as essential.

After the press conference, we asked a knowledgeable source what FCC's attitude would be toward Bell's interconnection scheme. "If MCI or its customers could demonstrate that long-haul interconnection is needed to provide significantly better service, the commission would probably order the telephone company to provide the service," he said. "But the commission

would have to be convinced that such an order would do more than just reduce costs for MCI's customers. It would have to be shown that qualitative improvements were likely as well."

Such an order would represent the first time FCC exercised any real control over agreements between communication common carriers, and this event could set an important precedent, since most of the organizations now hoping to offer specialized, data-related communication services would be able to offer much more if they could interconnect with AT&T.

The other part of Rae's statement — regarding tail-loops — suggests a second launching pad from which the commission could expand its regulatory power.

Bell, or its operating companies, could negotiate tail-loop agreements on a blanket basis with MCI, covering all of its customers. Or, the agreements could be negotiated directly with the individual customers. Rae didn't specify Bell's preferences, but it's probable that his company regards tail-loops as intrastate services except where they cross state lines. So, Bell probably would like to see tail-loop agreements negotiated between its



OH, TO BE IN ATLANTIC CITY — THEY WERE

Here are 2,342 of the 26,655 registered attendees at the Spring Joint Computer Conference in Atlantic City May 5-7. Shown is a portion of the second floor of the Convention Hall where over 300 exhibitors displayed their wares to each other and the milling throng (which was at times referred to as "the bored walk at Atlantic City").

Most of the really vital statistics

are not in yet, such as the number of corks popped (literally and otherwise), how many fillings were claimed by salt water taffy, and what was the job switching count.

The computer coterie will next meet in Houston at the FJCC, November 17-19, when it will happen all over again, with minor variations.

news briefs . . .

subsidiaries and MCI customers.

Our source sees a possibility that MCI will object to such an arrangement on the grounds that a blanket agreement negotiated with AT&T would cost the ultimate customer less and provide him with better service. If FCC went along with that argument, the commission would not only be exercising control over intercarrier agreements, but, in addition, it would be setting policy related to intrastate communications — which, traditionally, have been controlled exclusively by state regulatory agencies.

By reading between the lines of the MCI decision, it's possible to infer that the commission has already made policy concerning intrastate communication services. And recent court decisions have clearly set the stage for the FCC to take jurisdiction over services that move a message across both intrastate and interstate lines without altering its content. But it still isn't certain that the FCC really intends to move into this new area in a significant way. As our source put it: "The commission is being pulled in two directions simultaneously. The chairman (Dean Burch) wants to give the states more responsibility, but technology is creating a need for greater centralization."

The system interconnection issue will provide an opportunity to see which of these trends is strongest. On-line users and suppliers have a big stake in the outcome. Spokesmen for both groups argue that the present proliferation of control over intrastate services severely constrains the quality of on-line dp services and increases its cost (see Sept. '69, p. 135; April '70, p. 195; Jan., '70, p. 165).

BUY BUY OR BYE BYE VIATRON

Profit is the most important thing at Viatron right now. The quest for black ink in the ledger has led to a purchase only policy for System 21, price increases for the 2101 microprocessor and Viatape, and a 300-man layoff.

The objective is to reduce the overhead and get profits on current production, reported by Viatron to be 600 System 21's a month. Dr. Edward Bennett, the president, claims the cutback will produce savings of 8 million annually.

The people-cutback and end of rentals was a must according to Viatron. The present economic climate is unhealthy for the unprofitable, even those with high performance stock. Survival, said a company spokesman,

is for those companies that can show a return for stockholders and the security analysts.

Staff personnel — secretaries, receptionists, public relations, and advertising people — took the brunt of the layoff with only some 22 people cut from production. The work force now numbers around 900. The company said the production cuts were the results of termination of some development and transfer of some assembly functions to outside contractors.

The price increase has the 2101 microprocessor (an out-of-production report is being denied by the company) selling for \$1640 effective the 1st of May. It was \$960. The 2111 microprocessor, with twice the storage, still sells for \$1728.

The Viatape cartridge recorder price has doubled from \$192 to \$384. Systems with this unit will show the increase after July 1. Viatron also decided all black and white video displays are worth \$384 and ended the giveaway of initial units with systems.

Viatron has with this series of announcements dramatically reversed the marketing philosophy it initially professed so strongly, and added to the jaundice of its dealers in the marketplace. One dealer said, the news merely formalized the situation created by Viatron's last policy of 10- to 12-month delivery on rentals and three to four months ARO on sales. Some customers, he said, have changed their orders to suit the new terms and others have just walked out of deals. "New business will be tough to come by on purchase," he said, adding that Viatron was nothing to build business on.

A Viatron spokesman said there is no problem in finding buyers, although the dealers may find it a little more difficult to get firm buy orders than it was to get letters of intent for rentals. He couldn't give any figures on order backlog, only that company policy limited production commitments to 90 days.

Some dealers, said the Viatron man, are offering third party leasing to gain and hold customers. He also indicated the company is expecting healthy business in Europe because that edp market does not have the rental/lease orientation of its U.S. counterpart. It appears that the pressure for profit now has made Viatron backtrack on all fronts. Rental gave way to sales/rental and now has been written off completely with the plaint that the high cost of money and a need for cash flow left no recourse. Direct sales have been replaced by dealerships, though the economic reasoning is less clear.

Quotes last year of production of

5,000 units a month by late summer of 1970 and a 40,000-unit population by October of 1970 can be contrasted with the reality of 600 units a month now and for some time. The 600 figure is the basis for Dr. Bennett's profit equals production, people, overhead calculations.

An April 15 announcement stated production at Bedford would be restricted to a maximum of 1,000 units a month to reduce overhead and retain the price structure at that time. Nevertheless, as of April, 23, Viatron had assembled only 1,500 units.

Viatron's 500 to 600 customers with letters of intent for 14,000 units (July '69, p. 109) apparently have gone the way of the dollars the company has spent on advertising. And as the company rationalizes with the realities of today's market, it is not inconceivable that Viatron, which was going to sell terminals like toothpaste and have them populate the world at \$39 a month, may become just another terminal company because it has responded to the first instinct of business, to survive.

IBM UP IN \$, OFF ON QUOTA

The economic slowdown in the U.S. has thrown IBM "substantially" off quota for the first quarter 1970, board chairman Thomas J. Watson, Jr., told the annual stockholders meeting in Atlanta, Ga., last month. Unlike many of its industry counterparts, this does not mean a production slowdown or layoffs at IBM. "We have a large backlog," he said, and although some orders are being deferred in the U.S., "we have strong orders abroad" which are taking up production.

In that liberal oasis of the South, IBM did not suffer the anti-war picketing and shouting that turned the General Electric and Honeywell meetings into political brawls. A calm gathering of 1500 shareholders permitted Mr. Watson to express the IBM stance on major issues of the day: the urging that corporations pressure the government to end the war; the economy; and pollution. Overseas competition, the Xerox suit against IBM, and separate pricing were brief items. The latter surprisingly received little audience attention, possibly because the stockholders are satisfied that the new policy will add revenues to the coffers.

Commenting on the slowdown, Watson told attendees that "we are having our problems," but the computer industry is "not as responsive to the business cycle as other businesses." IBM's 1970 quota — not met so far — was based on a 10% increase over sales in '69, which was an out-

standing year for the firm. He reiterated the fact that, as in all of 1969, purchases were down again for the first quarter of '70 because the leasing firms and others had ceased buying. Thus, total gross income increased "only 2.1%" during the first quarter, but gross income from rentals and services was up 18.5%.

Even with the current economic situation, it is good to look at IBM, which has never been able to set a "de facto standard" of profitability that others have followed. The first quarter of '70 showed gross revenues of \$1,720,810,543 vs. \$1,684,718,577 for the same period '69. Earnings were \$230,261,417 vs. \$205,960,914 for the '69 quarter. IBM will have to hustle in the remaining three quarters to reach the revenue level of '69, although first quarter has traditionally been "slow." The '69 figures: almost \$7.2 billion in revenues, an increase of \$308.7 million over '68; earnings were \$933,873,194 — an increase of over \$62 million over '68. One-third of the gross and more than one-third of the earnings were attributable to operations outside the U.S., however, and there was a decline in gross income and in earnings from domestic operations. It appears that this is true in the first quarter of 1970 as well.

On profitability of separately priced services, Watson noted that they would have a profound effect on IBM in the next decade, but it was too early to decide about long-term profitability. Re system engineering contracts, he said that IBM was on target in January, February, and March, but since then business had scaled off somewhat because of economic activity.

The Federal System Division, which handles government contracts, is "down because government procurement is down." Personnel are being transferred from Huntsville (where NASA is) to IBM's Owego facility.

It is activities of this division, which means relatively little to IBM revenues (often placed at between a quarter and half a billion dollars), that the small, polite anti-war group there took to task. A. R. Appleby, chairman of the Los Angeles Business Executives Movement for Viet Nam Peace, rose to ask IBM that it cease selling computers of use in the war effort. "Certain companies are no more than extensions of the government. I hope this company is not headed in this direction," he said. At least, Appleby asked, if IBM does not stop selling "weapons," it should donate all proceeds to the victims of the war. Watson's firm reply to Appleby and others who made similar requests was that "I do not see how an American corporation can do other than respond to the

government if it thinks it is democratic." The requests that it exert pressure on the government to change any political stance is "taking power away from the voting public and placing it in the hands of a few thousand corporate officials."

Stockholder Robert Maslow "respectfully" tried to ask how IBM distinguished itself from the German Krupp corporation that said during World War II, in effect: "No one will be able to hold it against us that in time of emergency of war, we followed the path of duty." Mr. Watson suggested that Mr. Maslow read his history books very carefully and showed his only moment of anger in calling the Krupp comparison "profoundly insulting."

The chairman told the audience that IBM has set a fourth priority in its responsibilities: the "public" will be added to "customers, stockholders, and employees." Besides its activities with minority groups, such as the establishment of a plant in Bedford-Stuyvesant, IBM intends to be a "zero" contributor to pollution within 24 months — a task easier for electronics manufacturers than other industries, he added. IBM is also urging its employees to become politically active. (Watson, asked if he'd ever run for political office, amusedly pointed

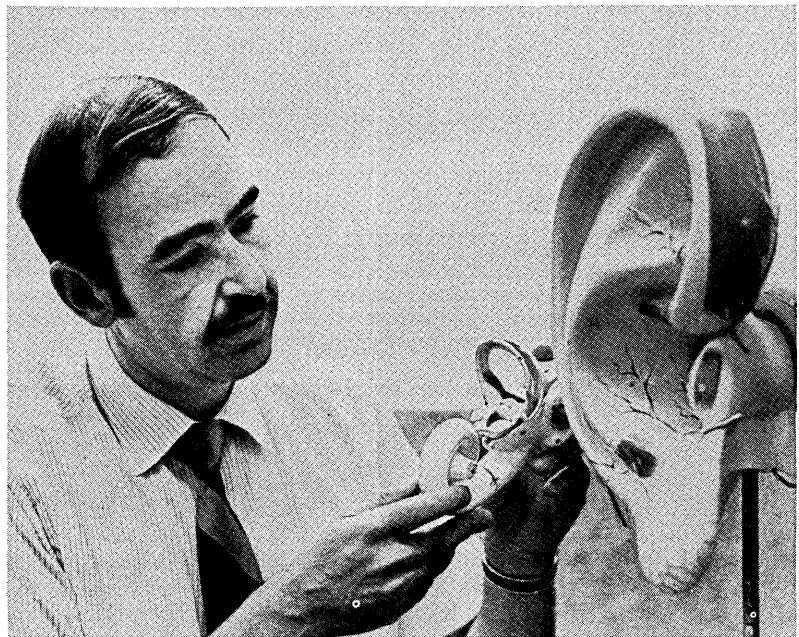
out he'd never been asked. "If anyone has a proposition to make, let me know.")

With projections in the press that the 21st century will be the "Century of Japan," it was natural that the question of competition from Japanese computer makers arose. Watson, gleam in eye, said "We talk about it a lot in IBM." He noted that IBM income from Japan is \$200 million/year and growing rapidly. Sony is partner to IBM on magnetic tape production, and IBM has recently received permission to set up a laboratory there. But competition to U.S. computer makers from Japanese manufacturers in the world market is "increasing."

Watson also noted litigation from Howard Levin (ex-Levin Townsend, executive) against IBM and the Xerox patent infringement involving IBM's new copier suit — both "unfounded" and to be defended. Watson said that the family of copiers (one announced) will not contribute to corporate profits as greatly as the typewriter, MTST, and dictating lines "in aggregate."

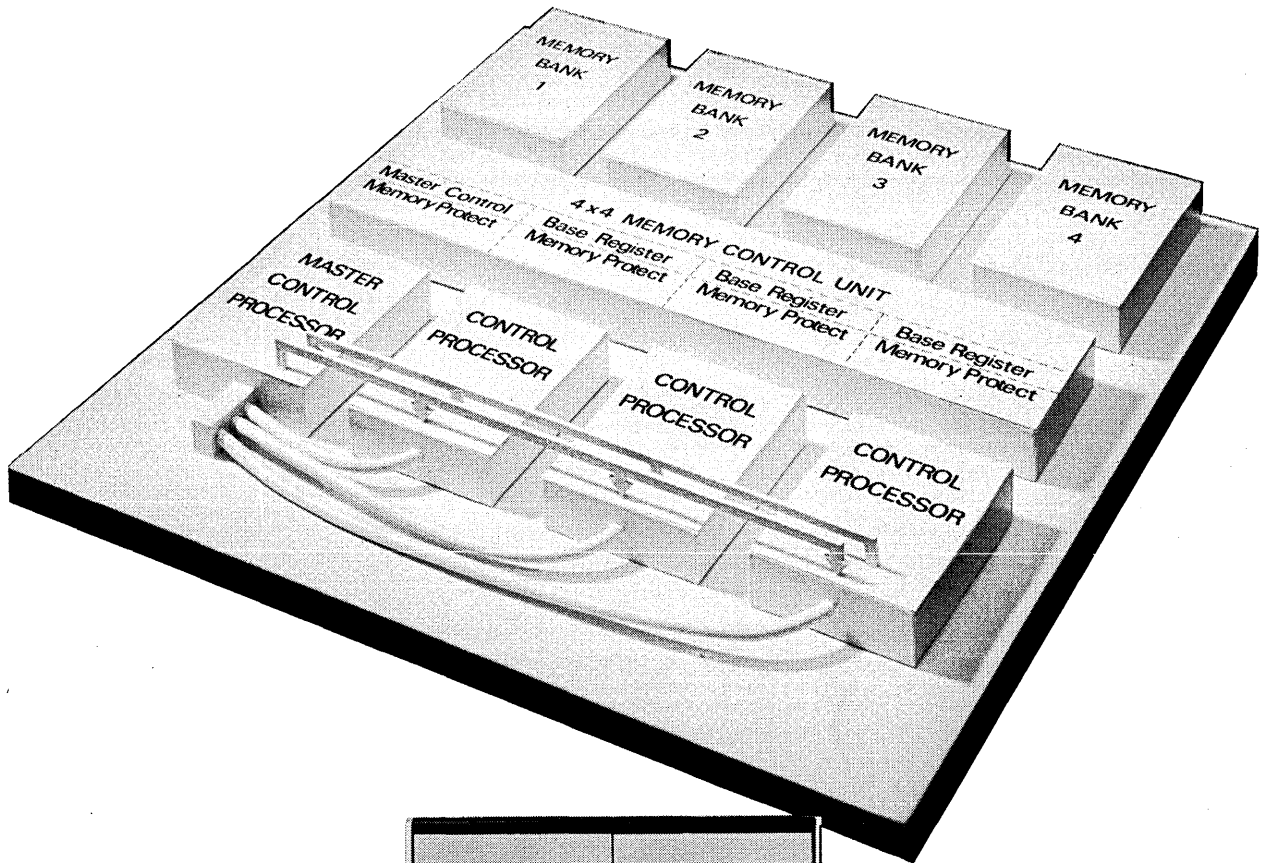
And in the exhibit area, where three IBM copiers cold-copied to the shareholders' content, a few in the crowd couldn't help calling them "Xerox machines."

(Continued on p. 187)



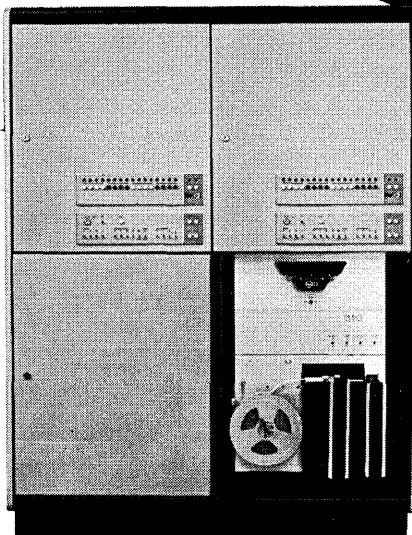
Dr. Alfred Inselberg, here holding a model of the inner ear used in anatomy classes at the UCLA medical school, has himself come up with an ear model which promises more educationally and could suggest remedies for some kinds of hearing loss. Dr. Inselberg, a mathematician at IBM's Los Angeles Scientific Center, has programmed a computer to simulate the workings of a portion of the human ear. His mathematical model of the inner ear (cochlea) has demonstrated that two types of wave motions are present in the inner ear's membrane, settling a decade-long disagreement among physiologists.

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EUROPE TO ESTABLISH DATA NETWORK STANDARDS

One of the most momentous developments for the future of data communications in Europe occurred last month when the Conference of Postal and Telecommunications Administrations agreed to the principle of establishing dedicated computer data networks within the framework of the national telecommunications systems. This was only one of the points of agreement reached over meetings in the past weeks to bring some order to the various standards adopted by Germany, France, the Netherlands, Britain, the Benelux countries, Scandinavia and others for handling data both on each domestic service and for the international connections between countries, an increasingly important aspect of the European scene.

The idea of dedicated networks could well be considered the tip of an iceberg, for the reasons behind such a development involve a gamut of other advances which are just beginning to emerge from European stables. But the basic fact is that the total computer-communication installations for Europe this year have been forecast at \$1.5 billion, with a 20% annual growth rate. It may be worth bearing in mind that the administrations considering a dedicated data carrier system are government agencies with total control of the telecommunications facilities in each country.

Specific hardware solutions for the carrier net will vary somewhat between countries, but the overall philosophy is along the lines of a scheme proposed by D. W. Davies of the National Physical Laboratory in the U.K. One object is to counter the trend among large users to set up private networks on lease from the telecommunications authorities, a practice which is draining limited communications resources.

A second purpose is to get cheaper transmission for the connection that is first established by telephone before switching over to data. There is a general increase in circuit-mile charges throughout Europe, and users are facing heavier and heavier bills for making links this way at distances greater than 50 miles. Furthermore, a dedicated network should also remove some of the constraints on the way certain terminals can be used in terms of the speed of data input into the transmission system.

There are some compelling arguments that this particular aspect could give renewed impetus to peripheral

development. The development of the peripheral industry has not lived up to expectations in general, and designs of United States origin still tend to dominate the market.

What the proposals add up to is a common data carrier system which takes on responsibility for accepting all inputs and for organizing the method of transmission. Basically, all data from a specified town or region is fed first into a local message switching and editing processor. These are in fact input-output exchanges to a handful of much larger processors at trunk exchanges that are themselves connected by high speed links. (These may be coaxial or microwave, depending on circumstances, but this is immaterial as far as the user is concerned.) The trunk links carry a multiplicity of messages simultaneously in a pulsed code modulation mode, and the receiving exchange reassembles the data into discrete packages for redistribution to its local exchanges.

Annual expenditure on the European re-equipment programs for the telephone services is probably over \$15 billion. For a variety of reasons, it is difficult to identify the tiny proportion of this spent on advancing data communications. But the introduction of a dedicated computer data carrier, if started soon, would need only a fraction of this scale of capital investment. The next stage in the development is to invite design studies from industry.

In the meantime, there are interim systems planned by some of the administrations. The West German Bundespost, for example, has signed an agreement with four companies for establishing a national computing utility. The system will be run by the Deutsche Datel-Gesellschaft Datenfernverarbeitung NBH, in which the post office has a 40% stake; Siemens, 20%; Nixdorf Computers, 20%; and A G-Telefunken and Olympia Werke, 20%. The headquarters will be at Darmstadt, the home of the big Bundespost communications research center. The utility will rent machine time and terminals, and sell software services. And users will be offered the service as an overflow to in-house facilities, if needed.

Another development from industry which is beginning to generate great interest in Europe is a new type of data communications facility which has been devised by ITT and has been hotly pursued by IBM. Briefly, the scheme involves using a single PABX exchange at medium- to-large organizations to handle all the voice, data and telegraph traffic into and out of the company or institution.

The idea as conceived by ITT has various options of operations, but the basic development is to put a 100-line

or more PABX exchange under computer control for automatically routing all messages. It includes facilities for automatically repeating calls first made on a busy line, for enabling memos to be generated and distributed in multiple format to a number of destinations from one header code, and so forth. The first ITT model PABX capable of taking over all the communications tasks, the Herkomat 3, has been demonstrated in Germany. But research groups in ITT laboratories have developed other versions in which an in-house dp system can take on the computer control portion of the job as part of its routine processing work.

The IBM computer-controlled PABX 2750 was designed by the firm's French Laboratories at La Gaude, and permission has been sought from the German post office to install a prototype at IBM's Frankfurt office.

CDC MAKES MOVES TO COMBAT SLUMP AND . . .

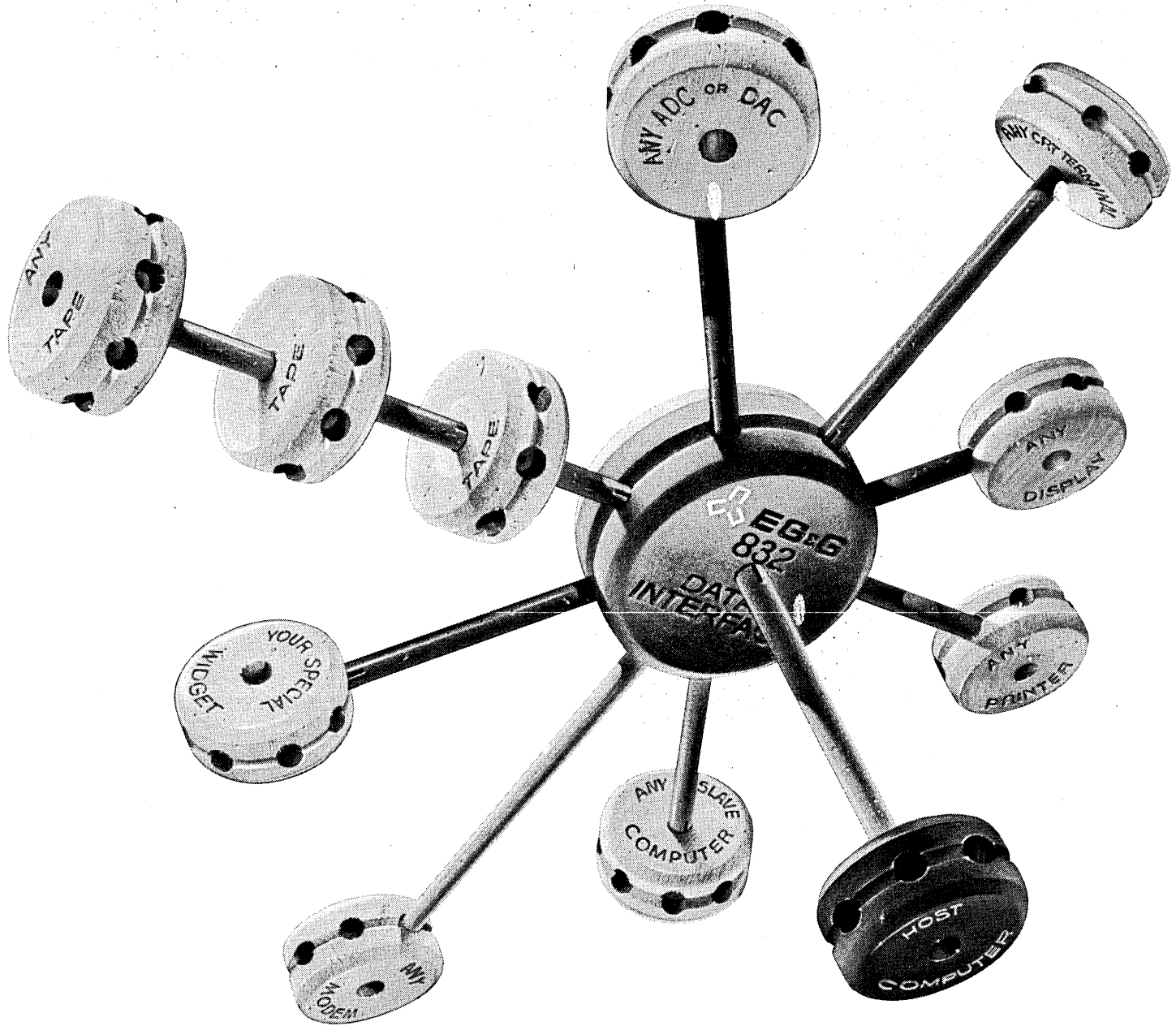
"Coincidence" was the word one Control Data official used to explain its ghastly financial news of recent weeks. "By coincidence," he said, "most of the programs affected by government cutbacks involved our computers." The long-arm-of-fate department showed up in CDC first quarter figures — a \$6.6 million loss in computer operations. But coincidence wasn't the whole story: nongovernment buyers of big equipment have "held back," too.

Taking the offensive, CDC chairman and president William Norris announced a new executive setup intended to streamline the way decisions are made at the top. Four men will make up an executive committee that will share responsibility for management. Besides Norris himself, the committee will be made up of William R. Keye, executive vice president (and a director), who will be chairman; Robert D. Schmidt, senior vice president; and Harold H. Hammer, vp and director. Committee members won't concern themselves with operations. Instead they'll make policy, establish goals, and decide how best to reach them.

Also established are four new operating areas — electronic data products, edp systems, marketing, and services. Each will be directed by a vp and group executive — Thomas G. Kamp, edp products head; Robert C. Hall, edp systems; Paul G. Miller, marketing; and Robert M. Price, services. A fifth area, not yet announced at this writing, will be finance and reportedly will be headed by Marvin G. Roberts, now vp of financial planning.

Despite the shattering first quarter

The world's only universally compatible interface for any mini-computer and all peripherals



The new EG&G 832 Data Interface

Now, for the first time, mini-computers and peripherals of all kinds can be interfaced simply, quickly and economically... with one standardized package. It saves you time. It saves you money. It frees your computer for more computing. It is the new EG&G 832 Data Interface.

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Computer-independent peripheral cards make the difference. Each of a wide selection of plug-in cards handles a different class of peripherals, modems, hardcopy printers, rotating or other mass memories, A-D/D-A converters, displays, satellite computers, or any digital

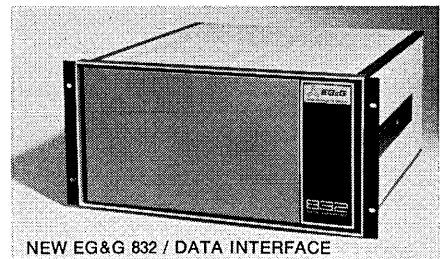
peripheral you can name. Or dream up.

Peripheral-independent computer cards also make the difference. They plug in too.

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NEW EG&G 832 / DATA INTERFACE

CIRCLE 190 ON READER CARD

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loss, some analysts felt that CDC would weather the year's storm and come out ahead. But Norris at the company's annual meeting predicted that computer operations would end the year in the red. Though he expected the second half of 1970 computer operations to pick up substantially, the gain would not be great enough to offset the disastrous first quarter. Even for 1971 he offered a less than bright picture, because, "a rise in large-computer sales will lag behind any improvement in the marketplace by a minimum of six to eight months due to the long lead time between order and shipments."

Helping CDC is the fact that Commercial Credit Co., its financial subsidiary, is making money and, says Morris, will show a "good increase in profit." Some thought that such an increase will run to \$36 million for the year and, if so, will contribute about \$2.50 a share in CDC's profit. Last year the subsidiary earned \$34.8 million.

REACTS TO IBM'S SUPER-SCALE 360/195

Control Data has reacted to IBM's introduction of the 360 series model 195, the top of IBM's line, by announcing not a larger machine, but a smaller one. In addition to carrying an implicit comment about what the Minneapolis manufacturer thinks of the size of its competitor's product, this announcement is expected to give CDC a better fighting posture in an unusual game being played at the top end of the super-scale line, a game that might be called "onedownsmanship."

It seems t¹ at IBM has been able to go to a customer and say that his workload does not require the power of a full-blown CDC 7600, but that a somewhat stripped 360/195 will do the job for less. Now CDC will be able to counter that sales technique by bidding on three smaller configurations of the 7600, three versions that will cost even less, CDC claims, than the 195's they will compete with. ("Less," in the terms being bandied about, still leaves big numbers after the dollar sign. Where there was a quantum jump from \$5 million for the top CDC 6600 machine to over \$8 million for the bottom of the 7600 line, the step may now be to something like \$5½ million.)

Specifically, the original 7600 was delivered with 512,000 words of large core (1760 nsec cycle time), 65K words of faster, 275 nsec cycle small

core, 15 channels, a large disc, an operator's station, two tapes, two printers, a card reader, a card punch, and a bill for about \$8.25 million. Now the machine can be ordered with 32K words of small core and 256,000 words of large core and only seven I/O channels for something like \$4.1 million without the peripherals. This is the smallest version offered. It can be incremented by adding either the other half of the small core, or the other half of the large core, or both — in which case it is only a few channels away from being full-grown.

These smaller configurations alone should help to expand CDC's markets at a time when things don't look so good for very large machines sales, but two additional parts of the announcement, covering software, will very likely do more. First, the 7600 is now unbundled. Second, and more important, a new operating system has been built for it. Called SCOPE II, the system's added features provide for multiprogramming in the small core for the first time, expanded multiprogramming in large core, 9-track tape support, interactive terminals support, and a data management facility.

COBOL and SORT/MERGE will be included, signalling a change from scientific orientation to commercial, too, and opening new worlds of customers to the company.

SCOPE Version II was designed to be compatible with CDC 6600 software to further expedite the move of 6600 users to the 7600 rather than to the 195. Source language compatibility stretches to almost everything but the control card stream. In addition, the new operating system is claimed to bring the monster machine closer to ANSI standard operation, a design goal the firm expects to reach eventually, and to be more information processing oriented rather than being optimized purely for number-crunching.

When the selling price of a stock plummets from over \$150 per share to just over \$40 as Control Data's has, something has to be stirred up. CDC's reorganization, this expansion of "smaller" machine offerings, and certainly the marketing advances to the commercial community should be enough to help.

GIANTS CLASH: XEROX VS. IBM

More legal action has been filed against IBM. When queried about this latest suit, an IBM pr man calmly replied, "Which one?" At least this time it doesn't directly affect the computer industry, so we needn't bother too much about its implications. Perhaps it will persuade IBM to remain in the

computer field, where it is usually challenged by far less formidable foes than Xerox.

The Xerox complaint alleges that IBM's new Copier infringes 22 Xerox patents, and seeks an injunction against the marketing of the new office copier. According to Xerox, IBM had sought licenses to use Xerox patents for purposes of manufacturing and selling xerographic office copiers in 1968 and again this year, but these requests were denied.

IBM is licensed to use xerography in "computer equipment," however, under terms of a 1955 agreement that applies to patent and trade secret information, and "confidential data and know-how to make, use, and sell xerographic plates . . . and xerographic powders . . . The license does not extend to office copiers." A similar agreement in 1951 had licensed IBM to use xerography in "data processing" equipment; this license has since expired. The Xerox allegations are clearly that IBM obtained information for use of xerography in its computer business, but is now making use of that knowledge in direct competition with Xerox in the office copier field.

IBM, of course, denied all allegations, this time with the intent to defend itself "with all its resources." (Whatever happened to "vigorously"?) IBM stated that it had not infringed any "valid" Xerox patent, or used any Xerox confidential information.

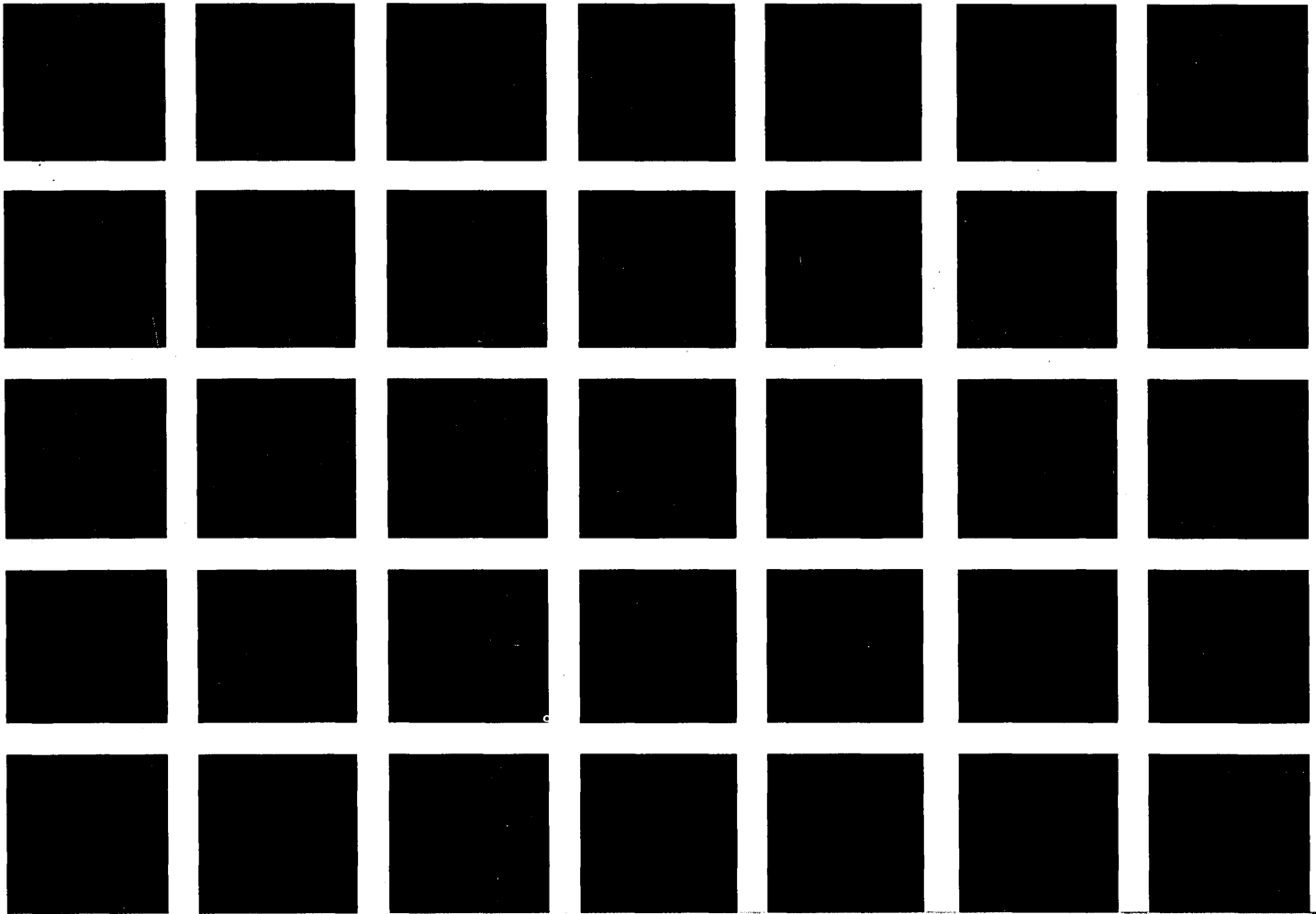
As for the 1955 license, an IBM spokesman said xerography is not used in any "current computer product line."

FASTEST ONE IN THE U.S. AND CANADA

Two companies have announced almost simultaneously that they are offering commercial dp for the first time on "the world's most powerful computer available to business and industry," namely, the IBM 360/85.

McDonnell Automation Co. celebrated its tenth anniversary by formally presenting its new \$12 million monster, which takes up almost 6,000 square feet in the company's St. Louis headquarters and features a four-million byte main core, as well as a direct access storage capacity of 1.7 billion characters. It never sleeps, requiring 13 operators in three shifts to keep it in perpetual motion, processing more than 1,000 jobs in a 24-hour period, and an average of eight jobs concurrently. McDonnell previously used a Siamese-twin arrangement with an IBM/65 and 75 joined together, which was only a third as fast. One of the things McDonnell is happiest about is modified software that makes it possi-

our optical mark reader goes for \$95 a month



and that's no optical illusion

We call it the Easy Reader. And you've probably read it lately. You know why. No special markers are needed on the information. It's as easy as getting all records printed on a single card. It's also easy to use. You can use it to read records from your computer. You can use it with magnetic cards. The Easy Reader interfaces directly into a computer — eliminating key punching and paper or magnetic tape in other applications. It can be used for magnetic tape and also used as a remote data terminal. If an employee can write, he can prepare and enter data. It's that easy. You also have more flexibility in designing cards, since no marking marks are required. Data positions can be laid out in almost any arrangement. Cards can be divided into data fields; they can include pre-printed instructions, as well as space for handwritten information. We've made it all a little easier. Just give us a call and we'll show you how much.

easyReader 

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ble to correct malfunctions quickly, avoiding disastrous downtime.

Remote batch processing on another 85 is being marketed in the U.S. by EDP Resources, Inc., White Plains, N. Y., company that has a three year agreement with Systems Dimensions Ltd., of Ottawa, Canada, which not only paid \$12 million for its system, but reputedly paid it in cash. The Canadian 85 is housed in an impressive building especially designed for it. Like its U.S. counterpart, it has an 80 nsec cpu, but suffices with two million bytes of memory. Multiprogramming allows concurrent processing of 15 different jobs that usually take less than a minute to complete. There are 2780 terminals available on the 1130, System/360 or U92/9300 systems. Users with installed terminals have access capability.

IBM/360 PROJECT MANAGER IS DPMA MAN OF THE YEAR

Dr. Frederick Phillips Brooks, Jr., whose work has been recognized as one of the most important influences in the development of third generation equipment, has been selected the 1970 DPMA computer sciences man of



Dr. Fred P. Brooks, Jr.

the year. As project manager for the IBM System/360, Dr. Brooks was responsible for the line management of the architecture and engineering development of Models 50, 65, 75, and the first phase of Model 91. He also coordinated the engineering of Models 20, 30 and 40 and the specification and engineering of the I/O devices and software development. Dr. Brooks is currently chairman of the

Dept. of Computer and Information Science at the Univ. of North Carolina on sabbatical at the Univ. of Twente in The Netherlands. The award will be presented to him in absentia at DPMA's 19th annual conference being held in Seattle June 23-26.

GE, HONEYWELL ARE MORATORIUM TARGETS

Moratorium Day demonstrators in New York picketed GE and Honeywell headquarters. Since it was also tax day, April 15th, emphasis was placed on the tax dollars which these firms obtain through government contracts.

The demonstrations were supposedly organized by the Computer Professionals for Peace, according to their press release, but the group was not at all in evidence at GE, and picketers said the demonstration was organized by the Midtown Peace Coalition, an association of peace groups. At Honeywell, however, a CPP banner was being carried, and Edward Elkind, CPP Chairman, seemed to be in command.

Neither lunch-hour demonstration had much to do with computers, and the demonstrators were too young to be "professionals" except possibly professional students. Even the issue of peace was clouded by placards supporting labor movements and Black Panthers. A recent CPP newsletter indicates the group is in fact diversifying into other areas and deemphasizing computers, running the gamut of New Left interests from support of the Panthers to ecology.

More than a hundred demonstrators appeared at each of the picketings, outnumbering the small clusters of spectators and platoons of helmeted police. Leaflets distributed at the GE demonstration said the firm gets one cent of every U.S. tax dollar, while the Honeywell leaflet stated that 34% of the company's total 1969 sales were "aerospace and defense." One demonstrator carried a sign reading, "Kill Honeywell and Dow, Kill, Kill, Kill."

A rally following the demonstrations was chaired by Elkind, who at first neglected to introduce himself. It featured speakers on war, labor, housing, social work, and Puerto Rican activism. No one, including Elkind, mentioned computers.

COM GETS CROWDED RECEPTION AT MICROFILM CONVENTION

Systems to microfilm the massive output from computers and facilitate its retrieval accounted for less than 10% of the \$386 million microfilm industry

last year — but probably 100% of its attention.

The interest was reflected vividly at the four-day National Microfilm Association annual convention in San Francisco this spring where any event with "COM" (Computer Output Microfilm) in the title was an instant sell-out. Two COM user conferences were standing room only affairs. On the morning the convention opened, the scene inside the packed grand ballroom of the Sheraton Palace Hotel where COM exhibitors were housed was likened by one perspiring exhibitor to the inside of a cable car at rush hour during one of San Francisco's rare heat waves. Some 500 visitors elbowed their way along crowded four-foot wide aisles, while outside the hall the waiting line to register grew to 400 at times. Charles B. Baker, of the Robert Heller Associates market research firm, who discussed the COM market during one of the sessions at the nearby Hilton Hotel, left the hall with a briefcase bulging with business cards from members of the audience who mobbed him after the talk, hungry for more information.

Baker said COM and related machinery and materials represented about 8% of the microfilming business last year, about \$30 million. This will soar to \$270 million, or about 35%, in 1974 and close to a billion dollars, or half of the \$1.9 billion microfilm industry, in 1979.

He said his company is constantly updating the figures. Those he gave at the convention were valid as of the end of January. He said the largest growth area for computer output microfilming will be in business uses, with microfilming of engineering drawings and other graphic material accounting for a smaller portion of the COM market.

The National Microfilm Association lists three components of COM: (1) The microfilm (Computer Output Microfilm) produced by a recorder from computer generated electrical signals; (2) The recorder (Computer Output Microfilmer) which may be either on-line or off-line converting data from a computer into human readable language and recording it on microfilm; and (3) the method for doing it (Computer Output Microfilming). The association believes there are 38 known manufacturers of COM recorders, and the number is growing.

During two user conferences at the convention, the association sought to explore some of the infant industry's technical problems. Among them: a need for better film and processing chemicals to match the high speeds of computer output; the variations in density of microfilm produced by computer and that by conventional/-



Humble? Hell. Who's got time to be humble?

We plan to be the leading manufacturer of computer peripherals in three years.

Not the biggest. The best.

It's a decision not idly arrived at. Particularly when you consider there are over 70 other companies trying to do the same thing.

However, we'll make it.

We'll make it because of the way we're going about it.

You probably haven't heard about us. In spite of the fact we've been in business nearly two years. We've spent the time working on the best

data communications terminal made, dollar for dollar. Not talking about it. Designing

it. Building it. Testing it. Manufacturing it.

And now we're ready to talk about it.

Our PDM 6633 is a masterpiece of simplicity. There are only 5 key working parts.

And yet it outperforms and outprices its competition by such a wide margin we've deliberately understated the specs.

Here are some of the basics: It's an impact printer which operates at 30 characters per second. It features a 132-character-wide carriage plus ASR with a tape punch and reader.

The whole story is in a booklet we've just finished. It's yours for the asking.

The PDM 6633 is our first product. There's more to come. When they're ready, you'll hear about them.

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Now there's a multiplexer
as dependable as an ICC modem.

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it operates without constant monitoring,
so you won't see lots of colored lights

The advantages are inside,

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save communication costs.

You won't be dazzled — just impressed.



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predominance of COM systems designed only to take output from IBM equipment (a complaint voiced by users of Control Data and GE computers); too little understanding of each other's disciplines by the microfilm and data processing experts.

NMA officials believe the answers to most of these problems lie in a set of standards now being drawn up by the association. First draft of a standard covering quality of microfilm produced by COM recorders and film duplicated from it has been published, and another is due concerning formatting and coding. But users are pressing for even stiffer action, such as the establishment by NMA of a user group — "an organization," said a representative from Sears Roebuck & Co., "which would give smaller users of COM the same kind of leverage with their suppliers that larger users enjoy." Charles P. Yerkes, NMA's treasurer, promised that the association's directors would act soon on the recommendation.

Gustav Bujkovsky, who recently left General Dynamics Convair Division to become a microfilm consultant, told a users' meeting that although half of the information coming out of computers today is accounting information, very little of it is microfilmed. He said accounting departments don't want it. They are used to working with paper, and he cited studies showing they suffer stiff necks and eye fatigue looking at documents through microfilm viewers. The implication was that COM firms have more than just technical problems on their hands.

George Harmon, NMA's new president, said the association's main effort in the next 12 months will be in keeping the dp and microfilming industries abreast of each other's disciplines. "We truly have a marriage of both industries," he said. A logical offspring, he said, is the reverse of COM — putting microfilmed data into computers (CIM). Harmon's company, Information International, Inc., manufactures a system for this purpose, the PFR-3, in which filmed data is transferred to mag tape.

The convention's attendance of 5,000 fell short of the 8,500 at Boston last year and was well below the 12,000 expected. This goal probably will be reached next year when the convention moves to Washington's Sheraton Park Hotel where it will be held jointly with the bi-annual convention of the International Micrographic Congress, an organization of 17 associations having to do with micrographics.

URBAN LEAGUE GRADUATES LOOK FOR PLACE IN THE FUN

The sharp rise in programmer unemployment in the Southern California area as a result of aerospace layoffs is a source of frustration and hardship not only for those laid off, but also for those people in training who had high hopes of finding a waiting and welcoming industry for their recently acquired talents.

The Urban League Data Processing Training Center in Los Angeles (April '69, pp. 175-177) has had considerable success since its inception in September of 1968 in placing its programmer, keypunch and operator graduates in jobs in private industry. Concentrating almost solely on the training of unemployed or underemployed citizens with demonstrated aptitudes for a vocation in computers, the Center has placed 187 of 208 graduates, 35 of whom are programmers, 65 computer operators, and 87 keypunch operators. But it's getting tougher.

Supported by IBM, which has supplied equipment and instructors for the effort, and the Bank of America, which donated the spacious building on L.A.'s South Figueroa Street and continues maintenance of it, the Center has become a model of its kind; and its training, which leads students into the kind of job performance cul de sac (cranky managers, inconsistent orders, etc.) they must expect, comes very close to being the real thing.

However, in spite of having turned out what it considers to be well qualified personnel, the Center now has unemployed graduates on its lists and this doesn't set well with John Adams, director of the program (Adams recently earned his law degree and will shortly join IBM's legal staff at Armonk), who heretofore has been able to offer the usual blandishments of a job upon graduation to his students (none of whom pays for or earns anything from the training). Now, it's an employer's market.

But the Center is more than willing to compete, to pit the talent of its graduates against that of others for the same jobs. All it asks, says Adams, is an equal shot at it. More than 80 firms have hired Center-trained personnel, but primarily as keypunch or machine operators, "backroom, out of sight" personnel. The "front room, shirt and tie" people are harder to place, Adams asserts, and he cites those firms that have no compelling reason (such as an equal opportunity employment clause in a federal contract) for hiring minority citizens as being mainly responsible for this. Among such firms are insurance companies, supermarket chains, banks and department stores.

Adams wouldn't even mind token

hiring by an organization anxious to be able to point and say they have "one" in the company. "A job," he says, "is a job. And if we can just get a couple of feet in the door to show what we can do . . ."

PAY-FONE PAYROLL SYSTEM PLANS GOING NATIONWIDE

A North Hollywood, Calif., company plans an expansion nationally for its 360/30-based payroll service that requires only a touchtone terminal at the user's office. With its Pay-Fone service, the L. Greenwood Co. produces paychecks overnight at a price of \$5 per pay period plus 30 cents a check.

The firm, which opened a branch in San Francisco in March, will add others this year in five western cities and has plans to open a center in Chicago next January, followed by New York in December. It also is considering centers in Texas and Florida.

There currently are 500 California subscribers with some 25,000 employees, and somewhere between 1,000 and 2,000 are anticipated within a year. Subscribers use coded plastic cards and a touchtone console to phone payroll data to the center. The keyboard is used to enter variable data.

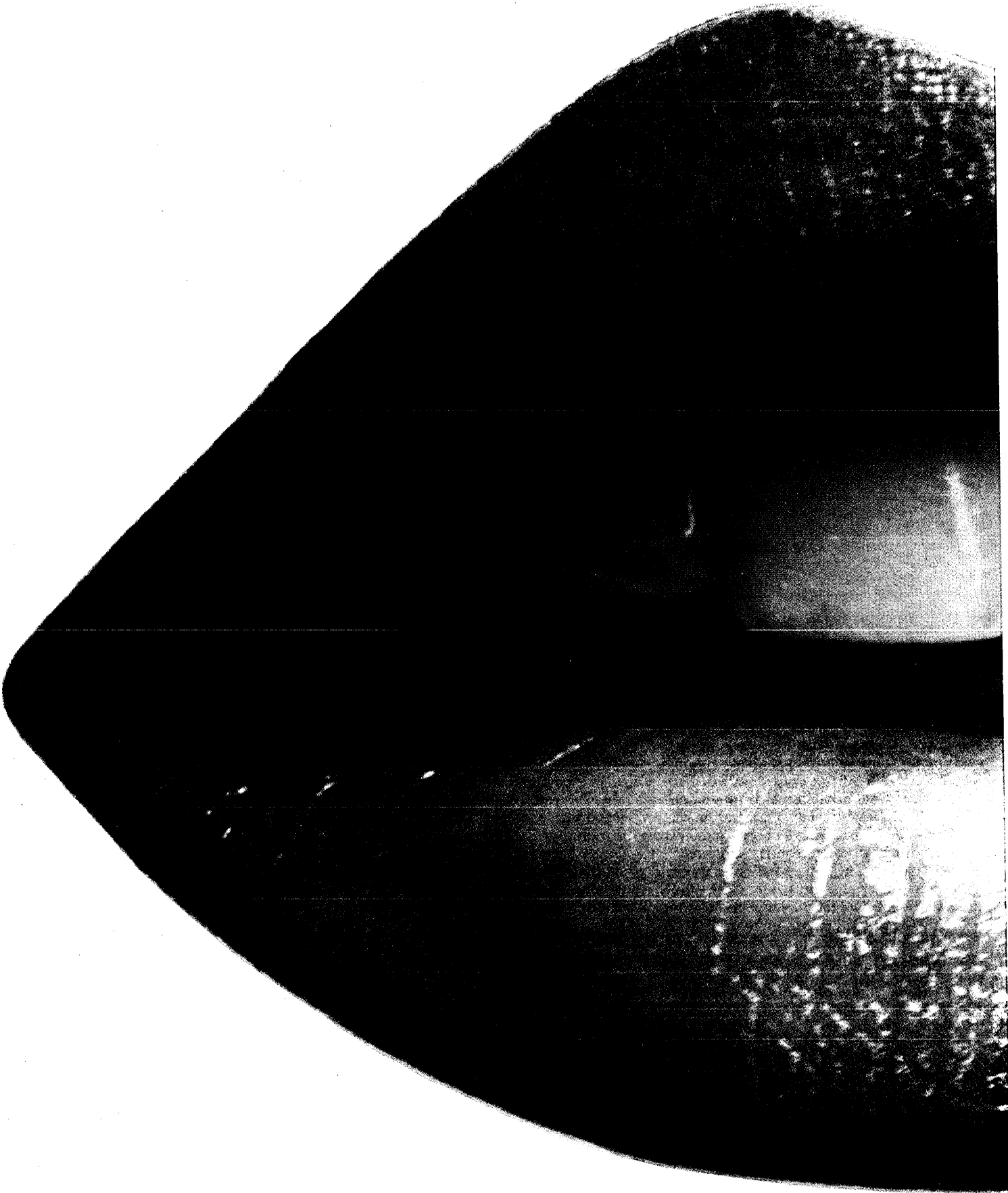
Lewis Greenwood, president, said any firm with from 10 to 1,500 employees is a prospect. Largest now on the system has 550, but one with 950 is interested. He claims his prices run about 50% below that of most banks. His charge per check is three to five cents lower, and accompanying management reports are supplied as part of the base charge. In addition, most banks charge customers extra for processing payrolls in less than in four days, while Greenwood delivers overnight.

COMPUTER, SHIFT THOSE STOCKS

The most recent additions to the stock exchanges' automation portfolios are the American Exchange's automatic switching of odd-lot orders from brokerage house to trading floor and the New York Exchange's electronic accounting for collateral pledges on broker loans.

The direct link of brokers' wire rooms and AMEX floor trading posts started last month. It bypasses member firms' floor booths and gives the order directly to the stock specialists. This is the first phase in complete automation of order execution at the exchange.

The NYSE collateral pledging is a pilot program aimed at reducing paperwork by eliminating the shuttling of stock certificates back and



We taught our data entry system to

Now there are two trains of thought about data entry. One of them is that you should teach girls to talk to a computer in the computer's language. It's called key-punch. Or key-to-tape, or key-something. The other is to teach the computer to talk the girls' language. It's called simple. We caught the second train.

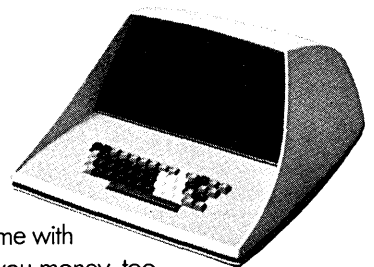
We invented the ENTREX™ 480 data entry system. It's the fastest system going: built around its own computer and disk, it controls up to 64 individual DATA/SCOPE™ CRT key-stations. To us, it's a CRT-to-disk data entry validate/verify system, with magnetic tape output. To her, it's a typewriter and a nifty little tv screen:



Speak a new language: Dumb Blond.

...ne can be the dumbest blond you can find. It's so easy to use, a girl can be trained to operate it in a couple of hours. If a girl can type, she can enter data on our system. If she can read, she can verify it on the DATA/SCOPE™ 480-character display. And she can get out of any jam by merely pushing the exclusive

"Help!" button. We knew you could save time with our system. What we wanted to do is save you money, too. But you'll probably only believe that when you see it. So, see it. Write or call ENTREX, Inc., 113 Hartwell Avenue, Lexington, Ma. 02173, (617) 862-7230.



ENTREX

CIRCLE 29 ON READER CARD

Finally. A remote batch terminal with a built-in modem.

The Daedalus 711 Programmable Data Terminal. Here's the terminal which can be a data acquisition device during the day and a remote batch terminal at night transmitting at 100 CPS via its own modem.

It's also the terminal which formats, edits and verifies data remotely by means of stored programs at a practical, nearly-errorless speed over standard voice grade lines. Which means our terminals will provide your communications system with a number of economies. First, the Daedalus 711 Programmable Data Terminal transmits only pertinent data. So your CPU doesn't get bogged down doing routine tasks. Secondly, it shortens your transmission time and reduces your transmission costs. Third, it means you transmit correct concise data that doesn't have to return to the terminal site for corrections. And fourth, you don't have to be troubled with selecting and purchasing modems and interfacing them into your system.

Our modem, by the way, is in the bottom drawer next to the memory. The memory that makes the Daedalus 711 Programmable Data Terminal programmable. The memory we use for storage of programs and data.

So you can program this terminal to do one task on Monday, another one on Tuesday and so forth. And then change programs as often as necessary by pushing a button.

Plus within this terminal is a Universal I/O. Which makes it capable of individually addressing up to eight peripheral devices.

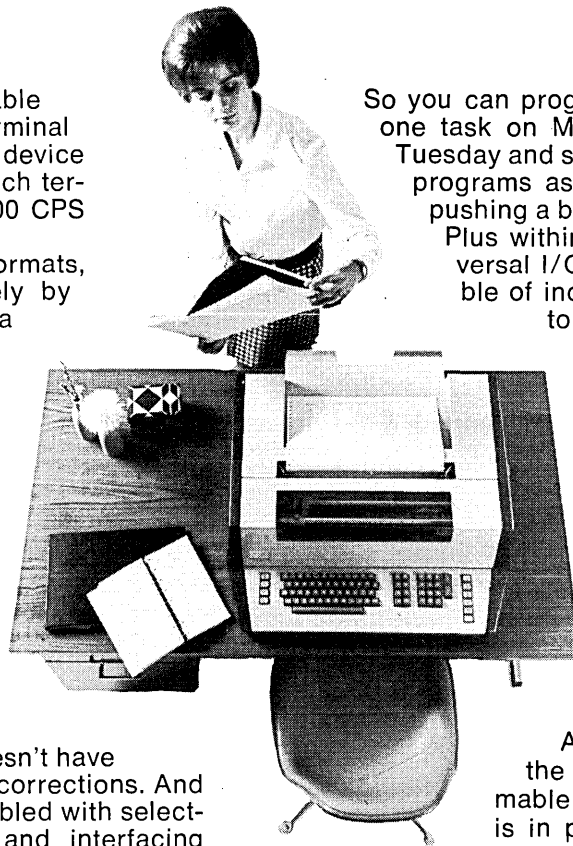
And there's dual magnetic tape cassettes to provide you with an economical, reusable medium for your message.

Another medium, hard copy, comes out of our simple, computer-type printer which is twice as fast as the typewriters you find in other terminals.

And the best part about the Daedalus 711 Programmable Data Terminal is that it is in production and is being delivered. Contact us for more

information about the 711: Daedalus Computer Products, Inc., P.O. Box 248, North Syracuse, New York 13212, (315) 699-2631.

Daedalus. The new company making computer history happen overnight. Every night.



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forth between broker and banker. The exchange's Central Certificate Service has been planning the program for two years. A major task was the formulation of procedures to insure the safety and availability of the shares that would satisfy bank examiners. Ten banks are involved in the program. Each is custodian for a portion of a securities pool established for collateral. When a bank makes a loan, the CCS merely notes a change of the stock it holds from custodial to pledged status. So far \$20 million in loans have been processed through the system.

KEEPING EDP PERSONNEL: TWO APPROACHES

The six-year-old industry-sponsored Diebold Research Program surveyed 500 companies and learned turnover among data processing personnel is higher than for any other occupations. This is no surprise.

But the study delved into the whys and the wherefores and came up with guidelines which might help some edp managers hold on to their best employees. The approach, it indicated, should be different for college graduates and non-college employees, with the former posing the biggest problem since "turnover among college educated data processing personnel in the survey is as much as 50% higher than it is among non-college graduates." There are two reasons for this, says Diebold: the college grads aspire higher, and campus recruiting techniques leave much to be desired . . . too many recruiters concentrate on selling company image rather than on candidate selection.

The best way to keep the college grads, the study showed (and again no surprise) is high wages. The wage level should "ride the crest of the wage spiral . . . that level at which only ten per cent of the companies in the area are paying more."

Formal in-house training programs, about which college graduates apparently couldn't care less, mean a lot to the non-college people who "seem to view their work as a semi-profession in which they will remain." The study showed turnover among non-college educated personnel varies as much as 50% as a result of a well administered training program. The college educated want to move into line management where their attrition rate is 2% annually, compared to the over 20% attrition rate of comparably educated systems analysts.

Increased demand as new users enter the field led most of the companies

surveyed to fear that the current job-hopping and pirating will get worse in the immediate future, but some saw hope in recent developments that might reverse the trends: the educational requirements being lowered to reflect the real requirements of systems analysts and programmers; and

the growing maturity of the computer industry, the introduction of simpler programming languages, and the anticipated elimination of the manual effort required to convert the programs for operation on a different model or generation of computer.

EARLY WARNING SYSTEM FOR AIR POLLUTION IMPORT/EXPORT

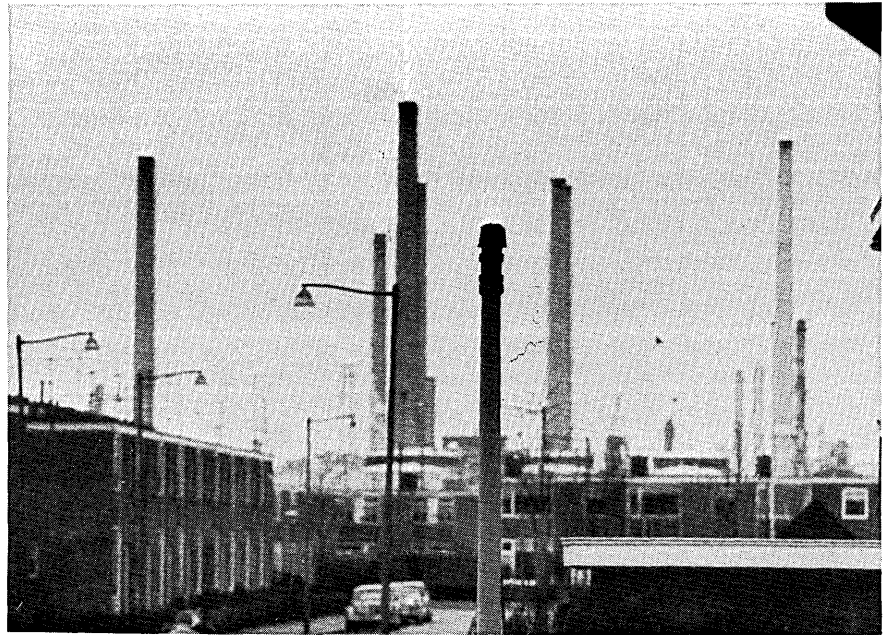
"Welcome sulphur dioxide,
Hello carbon monoxide,
The air, the air is everywhere,
Breathe deep while you sleep,
Breathe deep."
Breathe deep."

(from the musical, HAIR)

The Dutch government has made the first move in a national defense system that is to keep a 24-hour watch of airspace over its territory and that of adjoining sea and land boundaries. But on this occasion the intruder is not an

In brief, the Dutch government has taken a leaf out of the air defense or air traffic control book by building a network of remote surveillance stations that constantly feed data to a central computer that provides an automatic alert about impending trouble.

The development has been done under government contract at the laboratories of the electronics giant N.V. Philips Gloeilampfabrieken, at Eindhoven. It hinges on collecting information about the levels of concentration of sulphur dioxide in the atmosphere from a network of electrochemical cells surrounding the industrial area.



Air pollution detector pipe in foreground, with pollution emitting pipes in background, all doing their thing near Rotterdam, Holland.

airplane or missile, but the toxic substances released into the atmosphere by heavy manufacturing industry. The first stage has come into operation to protect the environment surrounding Rijnmond, a heavily industrialized region centered around Rotterdam, which has been the site of massive development of petro- and industrial chemicals, power generation and engineering over the past 20 years.

The detectors are located at street corners on pipes that look like street light stands. On top of each one sits a metal canister into which a stream of air is sucked. Measurements of the level of contamination are obtained by analyzing for sulphur dioxide concentrations in the air stream: this chemical was chosen because its concentration varies directly in relation to the amount of other harmful agents in the

atmosphere at this height from the ground.

Transmission of signals to the computer center is performed by a combination of the Philips Multi-Tone Telesupervision System and rented existing telephone lines; the Multi-Tone units are included with each sulphur dioxide monitor. Hub of this real-time network is a Philips P 9201 which monitors each detector once a minute and computes changes in the atmosphere at each station every hour.

Data from each site includes the concentration figures, values for wind speed and direction, plus factors for day and nighttime conditions that influence chemical composition of the atmospheric environment. Rising values in pollutant are immediately logged by the alarm system and printed out together with the assessment based on a meteorological model indicating a possible buildup over the locality due to prevailing weather conditions for at least the next six hours.

Action to reduce the pollution is taken by issuing instructions to industry to reduce emissions into the atmosphere until the source of the contamination has been established either within the area or as an export commodity from elsewhere.

The Rotterdam scheme is the start of a national network in what the Dutch government responsible for the interior describes as a national air pollution management program. And the first system is the start for establishing actual air pollution levels in order to measure short term critical concentrations for immediately instructing industry to control effluent. It also will help in assessing potential air pollution levels if a given volume of industry is applying for permission to develop in a particular area. And it should yield trends in the potential air pollution level for long term prediction purposes.

This is important in developing an international air pollution management scheme for Europe because some countries are vulnerable to export of airborne contaminants from others. Sulphur dioxide concentrations in Sweden, for example, have been increasing because of prevailing cloud drift from the heavy industrial belts in the south of the Continent and from the U.K.

The beginning of this year marked the start of European Conservation Year in which the governments of

Europe have been meeting to consider international action for protecting the air, water resources, coastal waters and regions liable to inefficient urban and industrial development.

COMPUTER-RUN CITIES? THEY'RE ON THE WAY

Moving toward optimized automation of municipal government, six cities are implementing prototype Municipal Information Systems under contract to the U.S. Dept. of Housing and Urban Development (HUD). A HUD spokesman said \$4½ million of the \$12 million in funding has come from local (city and state) sources, including contributions. The remainder, he said, "is a mix of federal monies."

Two of the six cities are working in a three-year program toward total municipal operations systems. These are Charlotte, N. C., and Wichita Falls, Kansas. The others are in two-year programs aimed at implementation of municipal subsystems. They are Reading, Pa., physical and economic development; Long Beach, Calif., public safety; Dayton, O., public finance; and St. Paul, Minn., human resources and development.

In each case the city is the major contractor to HUD and has let subcontracts to a systems firm and a university. These include: for Charlotte, System Development Corp. and the Univ. of North Carolina; Wichita Falls, BASYS, Inc. (a Booz, Allen & Hamilton subsidiary), and the Univ. of Kansas; Reading, Univac and Franklin Institute; Dayton, Westinghouse and the Univ. of Dayton; Long Beach, Mauchly-Wood and California State College, Long Beach; and St. Paul, Airies Midwest Corp. and the Univ. of Minnesota.

The six cities were selected by HUD from 79 applicants from 30 states who submitted proposals to participate in the program with HUD and the Urban Systems Inter-Agency Committee (USAC). USAC is composed of representatives from HUD and the departments of Transportation; Health, Education and Welfare; Labor; Commerce; and Justice; and the Bureau of the Budget; Office of Economic Development; and Office of Civil Defense, Dept. of the Army.

The two total systems, when implemented, will be the first attempts at optimum automation of all day-to-day operations of municipal government. But, noted Steve Gottlieb, on-site MIS project leader in Wichita Falls for BASYS, total computerization will depend upon "maximum value at minimum cost." Gottlieb, who is heading a 10-man on-site project team, said they are not interested in designing a large

scale system "for the sake of having one." Their aim is to design a system which will be efficiently and economically operable by the city "after we leave." The team, part of a task force that also includes city and university representatives, is working within the city's present and anticipated budget.

In addition to functions actually computerized, Gottlieb said, many will be automated but "without benefit of computer." Wichita Falls, at present, has an IBM 360/30 and already has computerized some municipal functions, including traffic flow, police and fire department operations, some financial work, and billing. Gottlieb said these operations will be continued and integrated into the proposed system but will have to be upgraded, as will the basic computer configuration.

The Wichita Falls task force is in the "functional analysis" phase of its work, talking to city officials and studying what they do now to determine the city's data requirements. Simultaneously, BASYS is similarly evaluating governmental operations in Washington, D.C., and Fresno, Calif., because "they wanted us to and because they represent complete divergence both in terms of geographical location and in terms of types of government." These studies, said Gottlieb, will enable BASYS to design a system for Wichita Falls which will embody functions they don't know perform but which might be desirable and also to evolve a basic MIS design which can be molded to all municipalities, whatever their size, geographic location or type of government.

Like BASYS, Systems Development Corp. is in initial planning stages in its total MIS project for Charlotte. SDC said the Univ. of North Carolina will provide "some help" in the system design phase but basically will use the study and the resulting system for teaching.

Like Wichita Falls, Charlotte's municipal operations already are partially computerized. Some automation exists in 10 areas, and this will be upgraded and interlocked in the final pilot system. SDC said it will use Census files in planning, adding that "complete privacy is insured."

The completed system, according to SDC, will computerize physical and economic development; purchasing; public finance; public safety; law enforcement; location of police and fire stations; employment; traffic surveillance; cost review; manpower allocation; street maintenance; education; coordination of health, welfare and recreation activities; scheduling; land zoning; accounting and bookkeeping (day-to-day); payroll; purchasing;

A ● The Devonshire from Devonshire ●
● it'll make a name for itself

(This is the answer. Turn page for question.)

news briefs . . .

voter registration; and libraries.

Progress of the two three-year total systems programs and the four two-year sub-systems programs will be reviewed by HUD and the other cooperating agencies in quarterly sessions.

COMPUTER LEARNING TO OFFER NEW SYSTEM MONITOR

Computer Learning and Systems Corp. unveiled a system monitor this month, and announced that next month it would begin full scale marketing of an upgraded version of its CASE system. Each new product will be licensed or leased; alternatively, they — along with other "CLSC proprietary tools" — will be combined into a "P/E evaluation service." This consists of a one-time total system audit. Afterward, for an additional fee, CLSC will correct weaknesses uncovered by the audit and guarantee to improve throughput by a stated percentage.

CLSC also reported plans to offer a 2314-compatible disc drive "shortly." This unit will have an estimated access time of 30 nsecs, vs. 75 nsecs for the 2314, and will sell for about 25% less than the IBM unit.

CASE III will sell for \$50K to licensed users, vs. \$30K for its predecessor, CASE I. CASE III will lease for \$3K per month, vs. \$2K for I. The monthly maintenance charge, \$500 per month, remains the same. CLSC vp Bill Thompson said the new version, like the old one, will be offered through franchisees on a one-time application basis, besides being licensed/leased direct. CASE III, which requires a 256K byte core, is already programmed to run on CDC-6000's, and by next month will be available in a 360 version. Later, it will be adapted to GE 635's and Univac 1108's.

CASE III's big advantage, according to staff specialist Steven Heller, the chief architect of the new simulator, is that it produces more accurate results than earlier packages, including CASE I, while providing the user with a more flexible model and a model-modification language that's easier to use. Also, the new package answers a number of key questions related to system performance on the basis of actual measurement; previously, these questions either couldn't be answered or had to be extrapolated. For example, CASE III reports how many jobs can run concurrently under a wide range of conditions, the extent to which the operating system looks at resource requirements for a job before bringing it into core, and the constraints imposed

by lack of a contiguous memory on a system's ability to handle additional jobs.

The new monitor, X-RAY, sells for \$50K and leases for \$2,350 a month under a one-year lease. It analyzes performance of all the generally known systems except CDC's 6000 and 7000 series. An X-RAY capable of probing these systems is on the way.

X-RAY analyzes four main areas of system performance: configuration utilization, overhead software efficiency; problem program efficiency, and data base element activity. According to Jerry Clay, director of product management, "it is the only monitor capable of evaluating all four of these components. Also, because X-RAY is hardware-based, it eliminates certain environment distortions associated with the use of software-based monitors." For information:

CIRCLE 398 ON READER CARD

BIG BELL BUBBLES PORTEND PROBLEMS

The trouble with Bell Labs' bubbles has been that they were too big. The rare earth iron oxides, called orthoferrites, used in the experimental magnetic bubble memory device (Nov. '69, p. 162) are now being abandoned in favor of uniaxial magnetic iron garnets which permit smaller bubbles.

Use of the new material was revealed by Andrew H. Bobeck, supervisor of Fundamental Memory Components, in a talk at the International Magnetics Conference. As reported in *Electronic News*, Bobeck said orthoferrites resulted in an operational bubble diameter of .0015 inch, for a density of approximately 25,000 bits per inch — far short of the desired goal of one million bits. To reach the latter density, bubbles cannot be larger in diameter than one mil.

If the switch to new material is successful, it could bring bubble memories a step closer to reality than they were at last report, but they're still years away. Revelation of the switch should also aid R&D activities of other organizations.

THE CONTINUING STORY OF LEVIN-TOWNSEND

Levin-Townsend Computer Corp. is still negotiating for money; IBM is still waiting for money; and Howard Levin is suing. The situation for the leasing company is basically the same.

It has begun and ended merger talks with Boothe Computer Corp. and Standard Prudential, the New York City financial conglomerate, and terminated and resumed discussion of sale of \$50 million worth of leases with an unnamed group. The Prudential

Standard negotiations were ended because no agreement could be worked out that satisfied it, Levin-Townsend, and IBM. IBM has given Levin-Townsend an indefinite extension on \$11.2 million it owes in back payments on equipment.

Levin-Townsend's money situation in another sector has been eased by a loan of 12 million Canadian dollars to its real estate subsidiary, National Equity. The money, from Equitable Life Assurance, is on a mortgage for two Canadian Shopping Centers that cost the company \$18 million.

And Howard Levin has filed a \$750 million anti-trust suit echoing the claims of previous leasing company actions against IBM. He is doing it as a shareholder, and apparently because Levin-Townsend would not.

MERGERS MADE EASY WITH MUSTANG SYSTEM

A computerized "merger-maker" system was announced in Dallas May 4 by J. B. Harvill, president of Mustang Computing, Inc.

The system will be operated by a Mustang subsidiary, Corporate Synergy Technology (COSYTE) and will function as a clearing house for detailed, confidential and anonymous information about businesses and industries, large and small, worldwide. President of COSYTE is Ed Clayton. General Manager is Ralph Iredell.

Heart of the system is a Dallas-based data bank containing information coded in such a manner that not even the 360/44 operator knows the identity of the companies interested in merging. An inquirer can learn all he needs to know about a potential seller or acquirer without knowing the identity of his specific location other than by a zone area. Interested parties may even choose to correspond anonymously at their discretion and still remain completely unidentified.

COSYTE does not participate in actual negotiations. The firm is geared to bring together companies that have reasons to pool their interests in order to accelerate their corporate growth and development objectives. Through the centralized system, expense and executive wear-and-tear due to the "search" is eliminated. The system not only directly aids principals but is said to be equally valuable to bankers, investment bankers, stock brokers, accountants and attorneys who may subscribe on behalf of their client firms.

Payment is based on an initial fixed fee, which can vary from as low as \$17.50 to as much as several hundred dollars per company listed, and on a percentage of the proceeds from any acquisitions made as a result of the COSYTE search.

Q • What do you call the first and only
• communications processor
that actually
cuts your computer overhead,
saves you line charges,
interfaces to any terminal,
concentrates data,
controls hundreds of lines,
or just a few,
and gives you remote batch and
on-line operations at the same time?

Devonshire
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news briefs...

new services...

An automated way of keeping tabs on the value of loan collateral, called Margin Monitor, is being offered to small and medium-sized banks, which find values of their securities altered daily in these fluctuating times. The original data on collateral in the loan portfolios — prices of common stocks, bonds, chattels — is fed into a central computer by typewriter terminal, or by optical scanning off-line. Thenceforth, all portfolio changes can be registered and kept up to date on-line, with printouts of portfolio summaries available. Bank Computer Network Corp. maintains that this system can protect banking officials from possible negligence actions. . . .

A spare parts depot for computers that also furnishes original system parts and assemblies has been established by Comtech Electronics, Inc., at Farmingdale, N.Y. The company claims it has a production capability of from "one to a million pieces" for both original equipment and replacement/spare parts. It is willing to tackle almost any part of any-sized system: mainframe, minicomputer, data logger, converters, readers and sorters, terminals. Replacement parts that can be provided include equipment for Bunker-Ramo, Burroughs, Control Data, Digital Equipment, GE, IBM, NCR, RCA. . . .

A design staff for the computer and electronics industry is operating at the Precision Fabricators Division of Tyco Laboratories, Inc., Garden City, N.Y. The firm's designers consult on custom metal enclosures needed for computer equipment, and then make sure they meet requirements for wiring, mounting, and easy access for maintenance. All designs are tested for proper ventilation of electronic components. The service goes along with the company's products at no extra charge. . . .

Information Resources, Inc., Amherst, N.Y., claiming to have scored a major breakthrough in computer linguistics, is offering to provide independent translators for any programming language which will run on any selected group of computer systems. Using the translators, a client can develop a program without being hampered by its use in only one system and feel free to change systems in future when advantageous. The translators also would be a boon to companies with more than one type of system. IRI is demonstrating its translating capabilities by conducting audience participation sessions showing the steps involved in conversion for

the ABACUS language. . . .

The American Society for Information Science has agreed to operate one of the ERIC (Educational Resources Information Center) clearinghouses funded by the U.S. Office of Education. The clearinghouses are located nationwide to distribute educational information in various subject areas. The ASIS clearinghouse, now dubbed ERIC/CLIS, will specialize in acquisition and processing of research reports and documents dealing with operation of information centers and libraries, and training of information specialists, with news of technology used to improve operations. Output of the clearinghouses is listed in two monthly publications, *Research and Education* and *Current Index to Journals in Education*, and each clearinghouse also issues reports and bibliographies on topics in its field. ERIC/CLIS is located at ASIS headquarters in Washington, D.C. . . .

For manufacturers who have to put out catalogs, parts lists, and other complicated compilations of that ilk, Metacomputer Sciences, Inc., Irvine, Calif., has a computer photocomposition setup that takes care of the whole process: indexing, collating, updating and revising, and typesetting. Their META comp system turns out camera-ready copy for the printer. Software for their photocomp unit includes more than 250 type fonts and sizes; their printer is IBM's latest 2680 crt,



This Credit-Check terminal in the Queens branch of Macy's New York is now one of 104 counter-top terminals in a pilot test of automated credit authorization under way since last summer. Soon it will be a part of the largest on-line computer terminal network in the retail industry. Macy's has contracted with Credit Systems, Inc., Colmar, Pa., to expand computer credit authorization equipment to all branches in its New York territory. When completed in October, the system will have 1,704 terminals in 13 branch stores.

for which they have devised programs that enable elimination of pasteup by preparing full pages — numbers, headings and all — in one operation. Original data goes into memory banks that make it possible to revise and update at much less cost than heretofore.

new companies...

Now more than ever, self-starters must be very brave or very well subsidized, preferably both. Apparently one of the brave ones in tune with the times is **Sycom Computer Systems**, Ann Arbor, Mich., which plans to offer a series of low-cost software items to IBM 360 FORTRAN and COBOL users. A package of 40 useful subroutines is priced at less than \$1 each (see New Software). President Phillip R. Schlesinger says the package is fully guaranteed to the extent of its purchase price. . . . **International Data Terminals, Inc.**, can't be regarded as just another hopeful in that field, since it has fairly good backing: Western Union Corp., which has a 50% investment. The other two quarters of the venture are held by Data Research Corp. and Western Union Computer Utilities, Inc., the dp center franchising arm of WU. Nothing like having a ready-made customer. IDTI will be hq'd in Ft. Lauderdale, Fla. . . . Levittown, Pa., has a new integrated circuit and core memory company called **Mnemotek**, which is fortified by a contract to supply specialized memories to NASA. . . . Ira Clark, who chaired the original Exec 8 design team, has formed **United Software Corp.**, Jenkintown, Pa., to stalk his own large-scale software game. So far, three manufacturers, a consulting firm, and a common carrier have been captured. Most of his 12-man staff are Exec 8 designers. . . . In Dallas, **Construction Data Systems, Inc.**, has been launched, with branch data centers in N.Y.C. and L.A., to furnish MIS to building contractors. The proprietary programs available from the company conform to the 16 cost section categories recommended by the Association of General Contractors and the American Institute of Architects. . . . In Columbus, Ohio, **Compu-Serv Network, Inc.**, has begun time-sharing operations with a DEC PDP-10, says it can service up to 63 users simultaneously. One of its software features is a program called LIDIS, for life insurance companies. . . . **American Computer Concepts, Inc.**, Norristown, Pa., is a "member" company of Diversified Technologies, which will deal in facilities management, software, programming and systems design. Its president is Jack H. St. Onge, who left a position as director of MIS for Univac. . . . Another facilities manage-

ment entry, **Payne Computer Services, Inc.**, has been set up in N.Y.C. as a division of Bruce Payne Associates, a management consulting firm, which says PCSI is "already in the black" after a six-month test operation. . . . A natural outgrowth of Scientific Control Corp.'s difficulties is **Technical Computer Services, Inc.**, started in Dallas when two SCC field service execs were hired by the bank to furnish stop-gap computer maintenance when the company was temporarily adrift. Deciding that it was nice to be needed for themselves, Richard Stine and Charles McKinney formed their own company and staffed it with ex-SCC men who also have had experience in many other companies. . . .

mergers and acquisitions . . .

Canada and beyond is where the merger action is of late. **Com-Share (Canada), Ltd.**, agreed to come under control of **Polymer Corp., Ltd.**, the Toronto-based major world producer of plastics and rubber, in order to "expand in a more tangible and positive manner;" that is, to get enough money to do it. The plan is to spread its time-sharing activities into Europe, with the help of U.S. **Com-Share, Inc.**, which is licensing its software and technology to its Canadian counterpart for a 20% slice of the pie. The license not only covers the U.K. and Europe, but also Japan. Canadian C-S, previously hooked up to U.S. computers, will install a Sigma 7 of its own in Toronto. . . . **Computing and Software, Inc.**, based in L.A., has completed acquisition of **Aquila Computer Services, Ltd.**, and **Berthieume St. Pierre, Theriault & Associates, Inc.**, joint Montreal companies previously owned by a Calgary real estate developer. They specialize in furnishing dp and proprietary packages to the insurance industry, and will so continue, augmented with C&S extended capabilities. C&S also expanded its proprietary programs library by acquiring **Think, Inc.**, in L.A., and **Hodes-Daniel Co., Inc.**, Elmsford, N.Y. consumer finance servicer. But it dropped discussions to acquire **Mortgage Associates of Milwaukee . . . Computer Investors Group of Canada, Ltd.** is now wholly-owned by **CIG International Capital Corp.**, N.Y.C., which bought the outstanding half-interest from Canada's **Great Universal Stores, Ltd.**, to broaden the base of CIG's computer leasing operations, which already extend overseas. . . . In France, the country's major hardware producer, **Compagnie Internationale pour l'Informatique**, acquired **Compagnie de Systems et Peripheriques Associes aux Cal-**

culateurs (Sperac), leading software firm, forming a more integrated whole to face the expected expansion of the European Common Market. France wants to instigate a European co-op incorporating its Plan Calcul. . . . **Systems Engineering Laboratories, Inc.**, has come out of Florida and once again picked off a San Diego, Calif. company, up-and-coming **Computer Peripherals Corp.**, to use their fixed head disc drives in SEL's digital computer systems. The Ft. Lauderdale organization recently acquired another San Diego company, **Spectral Dynamics. . . . Computer Dimensions, Inc.**, will move from Dallas to California when it takes over dp operations from **Budget Industries, Inc.**, in L.A., under a \$2 million contract. The agreement also calls for CDI to take over Budget's 80% interest in **Miller-Ellis Computer Systems, Inc.**, an L.A. software company. . . . Back in Dallas, **Datamedia Computer Service, Inc.**, which claims to be the largest punch-card voting machine manufacturer in the country, has negotiated to absorb **Voting Instruments & Products**, Northbrook, Ill. And **Mustang Computing, Inc.**, has bought a programming and systems design house, **Dean-Folsom & Associates, Inc.**, as part of its growth plan in computer utility and supplies, and petroleum exploration. . . . **Tracor Computer Corp.**, out

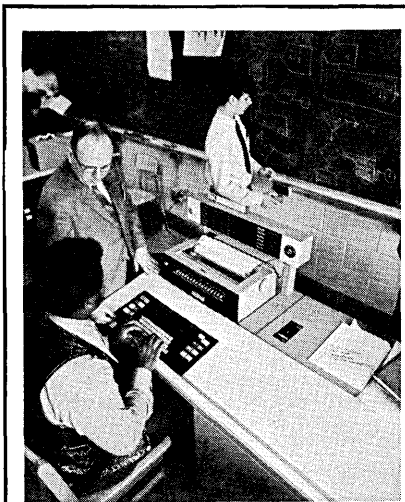
of Austin, has agreed to acquire L.A.'s **Computer Planning Corp.**, along with its subsidiary, **On-Line Sciences, Inc.** CPC's offices will be combined with Tracor's in L.A., Chicago and Washington, D.C.; its Honolulu office, according to management, is a "going thing," and will remain intact. Tracor thinks the combination will give it "total responsibility" for client dp. . . .

- Responses from candidates for ACM office to a letter asking their positions on the need for increasing awareness of social implications of technical activities have been received by Dan McCracken, Paul Armer and William Dorn, authors of the letter. In a statement released by the three, they professed themselves highly encouraged with the responses in that a majority of the candidates expressed "a sincere sympathy with the idea that computer professionals should adopt a habit of seeing technical activities in social context." As a result, the group withheld specific endorsement of candidates, stating that "If this is an accurate indication of things to come, we look forward to a new era of social consciousness in the ACM."

- Univac has reorganized itself, with emphasis on the word "worldwide." It is now composed of two operational units: **Worldwide Marketing and Services**, presided over by executive vice president, G. H. Geick and **Worldwide Development and Manufacturing**, with G. G. Probst as executive vice president. Univac's defense systems operations, formerly part of the **Federal Systems Division**, will become part of **Development and Manufacturing**, while FSD's systems support group will join **Marketing and Services**.

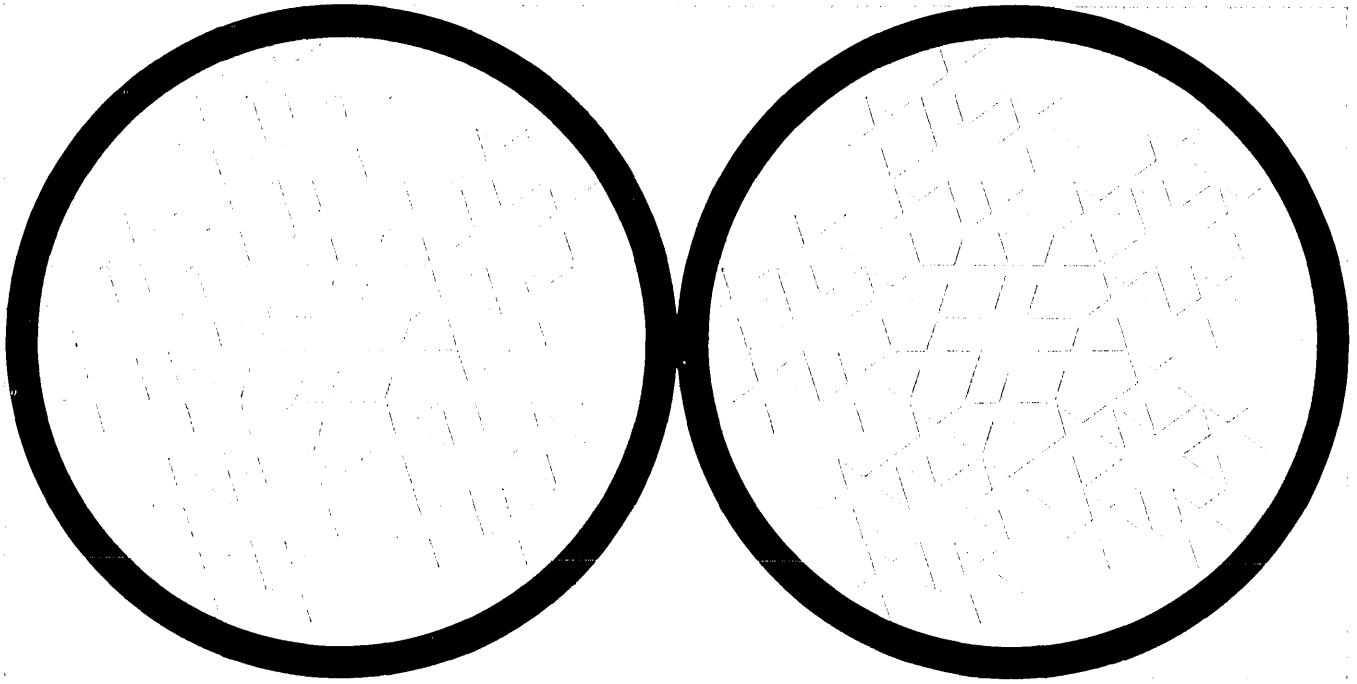
- Bunker-Ramo has a new president and chief executive officer. In unexpected shift, Dr. Milton E. Mohr resigned and George S. Trimble Jr. was elected to succeed him. Dr. Mohr's resignation was reportedly prompted by personal reasons. Trimble, who also became a director of B-R, was deputy director of the **Manned Spacecraft Center** in 1968 and '69, and prior to his election was a vice president of **Martin Marietta Corp.**

- RCA is trying harder to become Number Two. It figures if its computer deliveries continue in their present pattern, after doubling in the first quarter, it should achieve that position this year, up from fifth place last year. Chairman and president Robert W. Sarnoff jubilantly announced that RCA's new computer accounts already



How long does a cup of coffee stay warm? These students at Baltimore Polytechnic Institute have answered this and other pertinent questions using their IBM 1130, one of few high school computer installations dedicated to student use. It is used to help students in classroom assignments and to teach computer programming. Uses range from solving college-level math and engineering analysis problems to problems like the cup-of-coffee question. The answer to this problem, created and solved by a tenth grader: at the start the coffee was 180°; in five minutes it dropped to 164.9953007; and in 65 minutes, it cooled to room temperature of 70.76° . . . no longer warm.

**There is a computer system
10 times more cost effective than
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news briefs . . .

have increased threefold so far this year. Reporting to stockholders at the company's 51st annual meeting in part of Madison Square Garden, he predicted growing worldwide need in the '70's to gather, communicate and process information for "all uses," and said RCA's goal was to deal mainly in computer-based information systems and diversified consumer and commercial services, leaving radio and television manufacturing to "mature" on the vine.

- It's not the two-way wrist radio/tv of Dick Tracy but it is the nation's largest state-wide computerized law enforcement information retrieval and data transmission system. It's called CLETS (California Law Enforcement Telecommunications System) and it was turned on last month. The \$5 million system links more than 450 California law enforcement agencies to computerized files in Sacramento and Washington, D.C. Twin RCA Spectra 70/46 computer systems in Los Angeles and a pair of 70/46 computers in Sacramento act as message switching centers. The system includes more than 900 teletypewriter terminals and some 37 million computer-stored records. Software was developed by Informatics, Inc.

- The IRS Western Service Center at Ogden, Utah, installed two General Electric Pac-4020 process computers just in time to handle April income tax return information from 10 western states. The Mid-Atlantic center in Philadelphia had to wait until May for its GE system; and Kansas City is getting one this month. Two more IRS centers, the North Atlantic in Andover, Mass., and the Central in Covington, Ky., are not scheduled to get theirs until December. Those in Austin, Tex., and Chamblee, Ga., are already operative. By putting tax return data directly on mag tape, the systems are expected to save punching and processing about 400 million cards a year nationally. The whole undertaking is worth some \$20 million; the IRS plans to purchase all the systems outright eventually, but for now is leasing them from GE for \$1 million annually, except for the one in Austin, which it bought for \$3 million. The Ogden system includes two disc controllers, six DSU 160 disc storage units, tape handlers, and 500 key-station terminals.

- This year, computer products are expected to take up three times the

booths than last year at WESCON (Western Electronic Show and Convention). From August 25-28 Hollywood Park, the Los Angeles racetrack, will be exhibiting software and peripherals instead of horses. WESCON organizers say they are emphasizing computers this year because their co-sponsor, WEMA, decided to include information technology concerns in its membership and because of "the absence of a major computer exhibit and convention in California in 1969 and '70." The computer division of the show will also feature eight technical sessions devoted to its field, under the direction of Dr. Gerhard Hollander, of Hollander Associates, and Dr. Eldred C. Nelson, TRW. Computer-related exhibits probably will amount to about 10% of the 1100-booth show, which will also display components and microelectronics, science systems and communication equipment, circuit packaging and solid-state fabrication at the Memorial Sports Arena cross-town.

- A new 28,000 sq. ft. facility for the Univac Federal Systems Div. will open in the Valencia Industrial Center near Newhall, Calif., late next month. It will accommodate more than 200 employees, mostly programmers and system analysts, who will operate the computer center and work on software development.

shortlines . . .

United Air Lines will be using Univac equipment again after all, now that the two have settled their ill-fated Unimatic contract. United is buying three 1108's, will use them for message switching, material control and flight information and planning. . . . Pianist Roger Williams is lending his name to a chain of music centers that give computerized piano instruction. Students are supposed to play "Autumn Leaves" by the third lesson — with both hands. The firm involved is International Music Corp., of Dallas. . . . A special panel of the Computer Science and Engineering board of the National Academy of Sciences will study computer solutions to library problems for the next 18 months. Operational prototype computer-based libraries will be analyzed by panel members from IBM, Honeywell, Stanford Research Institute, and universities. . . . The U.S. Patent Office has arranged to computerize itself by commissioning International Computaprint Corp., Fort Washington, Pa., to set up a full text data base, keyboarded from original patent application files by using its proprietary DACS (Data Acquisition and Correction System). . . . AFIPS has

initiated a Distinguished Service Award for "outstanding individuals who have rendered extraordinary service to the computing field through their accomplishments on behalf of the Federation and its committees." First award went posthumously to Dr. Walter Hoffman, late AFIPS treasurer. AFIPS also has an important new member, the American Institute of Aeronautics and Astronautics (AI two A), which has joined as a constituent society. . . . The Federal ADP Users Group has been formed for government agencies located in the District of Columbia, Maryland, Virginia and West Virginia "with a view toward optimizing the effectiveness of government operations." It plans to conduct seminars, equipment demonstrations and arrange other sharing activities. . . . Transamerica Computer Co., Inc. will come up with \$12 million in the next two years to support Astrodata, Inc.'s manufacturing, marketing and servicing of electronic data sorters, plug to plug compatible with System/360's under standard OS, and freeing the cpu from humdrum sorting tasks. In return, Astrodata is issuing Transamerica purchase warrants for 250,000 shares of stock at \$10 a share. . . .

call for papers . . .

Congress 71, Ljubljana, Yugoslavia, August 23-28, 1971. Sponsored by the International Federation for Information Processing (IFIP). There will be two kinds of program presentations: invited papers comprising one-hour surveys and half-hour reports on recent advances in special-interest topics; and submitted papers dealing in original work or results in seven major fields — (1) numerical mathematics; (2) mathematical foundations of information processing; (3) computer software; (4) computer hardware and systems; (5) systems for management and administration; (6) technological applications, and (7) sciences and humanities. Abstracts should be 100 words, in seven copies; papers themselves should not exceed 3,000 words in five draft copies, the first page to carry: title of paper; author's name, country, affiliation and mailing address; topic classification of the paper; language of oral presentation (English, French, Russian or Spanish); statement of originality. Authors should also arrange for security or company clearance. Both abstracts and papers should be submitted in English not later than November 30 to Prof. C. C. Gotlieb, Vice Chairman, IFIP Congress 71 Program Committee, Institute of Computer Science, University of Toronto, Toronto, Ontario, Canada.

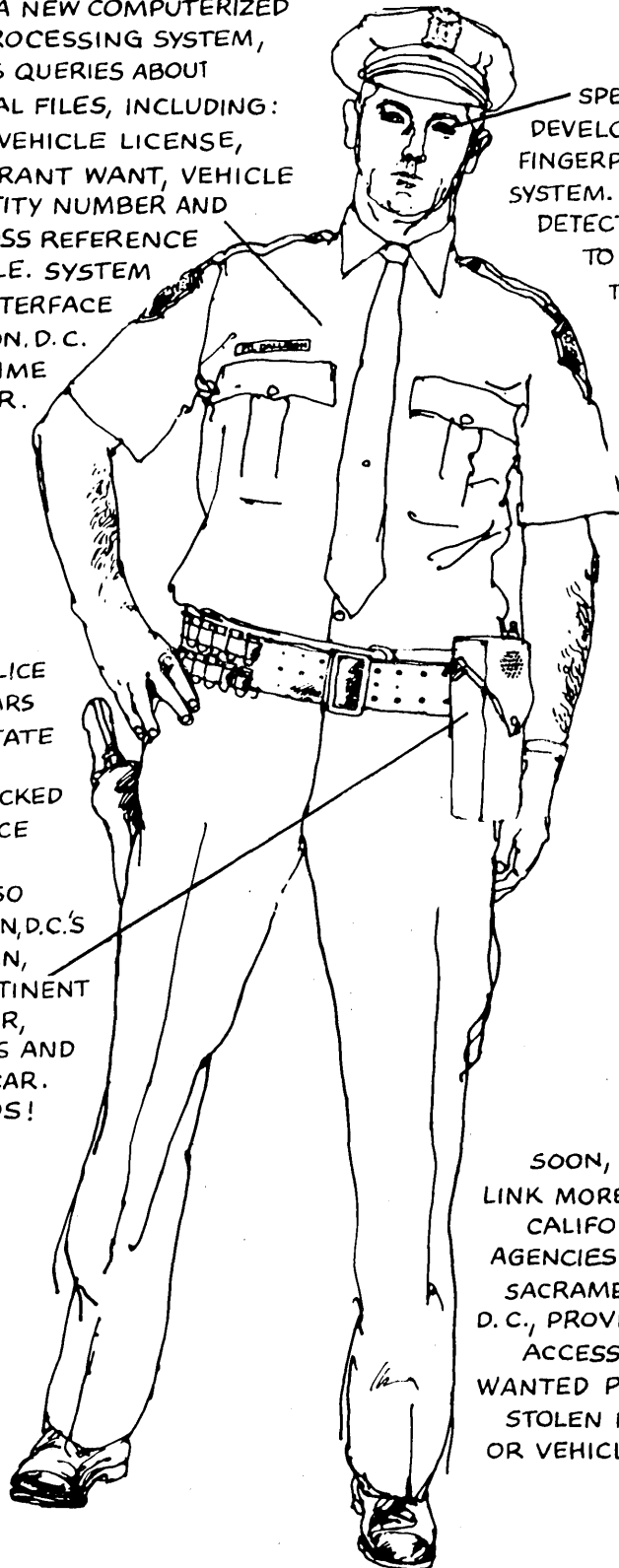
OUR NETWORK ALLOWS AN UNDERMANNED POLICE FORCE TO PROTECT LARGE POPULATION AREAS. IN SECONDS, ALERT, A NEW COMPUTERIZED TELEPROCESSING SYSTEM, ANSWERS QUERIES ABOUT SEVERAL FILES, INCLUDING: NAME, VEHICLE LICENSE, WARRANT WANT, VEHICLE IDENTITY NUMBER AND CROSS REFERENCE INDEX FILE. SYSTEM

CAN ALSO INTERFACE WITH FBI'S, WASHINGTON, D. C. NATIONAL CRIME INFORMATION CENTER.

SPECIALISTS ARE DEVELOPING A COMPUTERIZED FINGERPRINT CLASSIFICATION SYSTEM. USING OUR NETWORK, DETECTIVES WILL BE ABLE TO IDENTIFY "SCENE OF THE CRIME" FINGERPRINTS WITHIN SECONDS.

OUR NETWORK LETS POLICE CHECK OUT SUSPICIOUS CARS BY RADIO. OUT-OF-STATE LICENSES ARE CALLED TO HEADQUARTERS AND CHECKED THROUGH THE STATE POLICE COMPUTER SYSTEM. IF NECESSARY, THEY ARE ALSO RUN THROUGH WASHINGTON, D.C.'S SYSTEM. IF A CAR IS STOLEN, COMPUTER TRANSMITS PERTINENT FACTS, VIA TELETYPEWRITER, BACK TO HEADQUARTERS AND THEN TO WAITING PATROL CAR. ALL WITHIN 15 SECONDS!

SOON, OUR NETWORK WILL LINK MORE THAN 450 CALIFORNIA LAW ENFORCEMENT AGENCIES TO CRIME FILES IN SACRAMENTO AND WASHINGTON D. C., PROVIDING INSTANT ACCESS TO INFORMATION ON WANTED PERSONS, LOST OR STOLEN PROPERTY, FIREARMS OR VEHICLES.



Data communications helps enforce the law and protects the public.

Next time you're moving information, remember—no one knows more about moving it than the people who run the world's largest communications network.





**What English queen
had six fingers
on one hand?**

Don't lose your head over a little historical trivia. We'll give you a big hint: She lost hers. Not good enough? Henry VIII's second wife?

Not yet? The hexadactyl was Anne Boleyn, of course.

But it's not trivia we want to expand your mind with. It's a simple fact: Vermont Research is the memory company. We're the company that

expands the capabilities of your computer with the best drum and disk memories available. And we're the company that has just expanded our own capabilities.

We've introduced a new controller and two new memories: a disk with a 1 million bit capacity, and a drum with a 143 million bit capacity.

But you probably know that. Otherwise we'd like to help you with your memory.

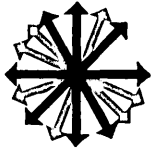
**Vermont Research
CORPORATION**

Precision Park - North Springfield, Vermont 05150
Tel: 802-886-2256 TWX: 710-363-6533

DRUM AND DISK MEMORIES - CONTROLLERS

EXPAND YOUR MEMORY

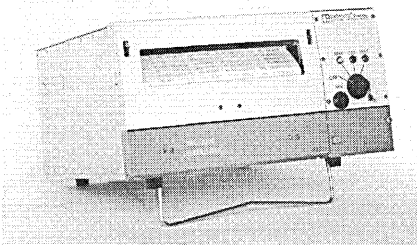
CIRCLE 124 ON READER CARD



new products

cassette-loaded printer

The Model mc 3000 uses an electrolytic printing process to produce up to 80 5x7 dot matrix characters/line at speeds of 3000 lpm. The paper is housed 350' at a time in cassettes that can be replaced in four seconds. Input signals are the standard 64-character ASCII format, either six bits parallel or serial. Complete interfacing is provided. The current production model



is mil-spec, but a commercial version is in the works and will sell for considerably less than the \$12,650 price of the ruggedized unit. LITTON INDUSTRIES, Englewood, Colo. For information:

CIRCLE 361 ON READER CARD

character recognition

For the System 21 it's optical character recognition in three units: one for reading one-inch paper tape, the second, a manual feed document reader, and the third is an automatic feed card reader.

The company has announced that it will produce a line of typing and printing machines to support the special font used, Viafont, in addition to letting others use it for similar devices on a royalty-free license. A Selectric-type ball is being prepared for it, too. The reading technology will also be available on license when the patents now pending are secured; but there will be a price on this.

The ocr units will work as peripherals to the System 21 terminal via standard data channel. Formatting, error correction, data manipulation, and recording are under control of the terminal's microprocessor. Visual clutch and manual insertion and deletion are possible through the units' crt and keyboard. Recording can be on cassette, punched cards, or computer-compatible tape.

The ocr-6101, the paper tape reader, has automatic feed provision for 200-foot rolls. Read speed is 80 character positions/second, and record length can vary up to 80 characters. The device will be priced at \$2400.

The document reader, ocr-6102, is priced at \$4800. It reads documents ranging between 3-11 inches in length and 2.125-11 inches wide. An option permits reading of paper tape and documents one inch in width. Record length varies up to 80 characters, and reading speed is 80 character positions/second, as in the ocr-6101.

ocr-6103 accepts cards with fixed width of 3 3/4 inches and length up to 9 3/4 inches. Data may be typed in six lines of 80 characters. Record length and read speed is the same as the other units, but document handling is automatic. A 250-document feed hopper and stacker are included. The ocr-6103 sells for \$2700.

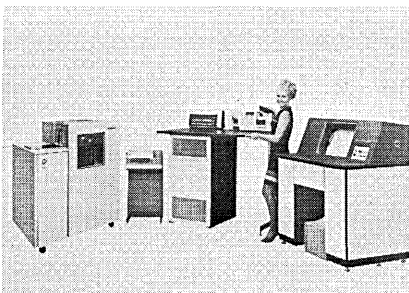
Deliveries are scheduled for this fall, VIATRON COMPUTER SYSTEMS CORP., Bedford, Mass. For information:

CIRCLE 356 ON READER CARD

communications cpu

Communication computers are spreading like rumors, and this vendor has acknowledged the fact by introducing the dc1000 series. This is a twin group, six-model series that handles off-line processing, communication concentration and remote peripheral control.

The dc1100 is the lower part of the series. The three 1100 models are pe-



ripheral controllers, with core storage ranging from 4K to 32K bytes in 4K modules. Data transmission rates range from 1200 bps to 9600 bps.

The dc1200 units are peripheral controllers and terminal concentrators. They handle 64 low speed communication lines at the rate of 45 to 1200

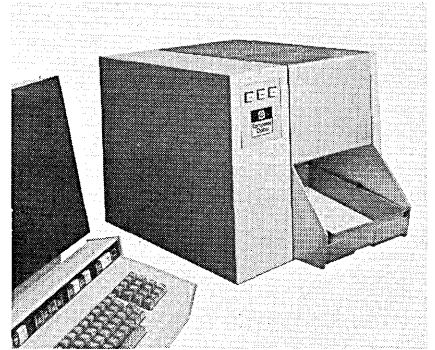
bps in controller mode and 4800 bps in concentrator mode. Memory size range is the same as that for the dc1100. Both the dc1100 and dc1200 units are internally programmable and can be used for off-line data processing.

Lease rates for the dc1100 range from \$778 to \$1,411 a month. Purchase price is \$35,760 to \$62,280. The dc1200 leases for \$938 to \$4,992 a month (on short term contract) and has a purchase price range of \$40,800 to \$281,420. Deliveries will begin in second quarter 1970. BURROUGHS CORP., Detroit, Mich. For information:

CIRCLE 355 ON READER CARD

crt hard copy

The Video Image Printer produces hard copies from crt display. The unit takes the image via the crt's coaxial cable and reproduces it in high contrast black and white on an 8 1/2 x 11 paper. Printing speed exceeds 2 ips at a per copy cost of 2-4¢ depending on usage. Although intended for use with the firm's co-70 terminal (Feb., p. 205), it will operate with any crt



which produces characters using a compressed tv raster. Price will be about \$5K, and deliveries will begin around the end of this year. COMPUTER OPTICS, INC., Bethel, Conn. For information:

CIRCLE 354 ON READER CARD

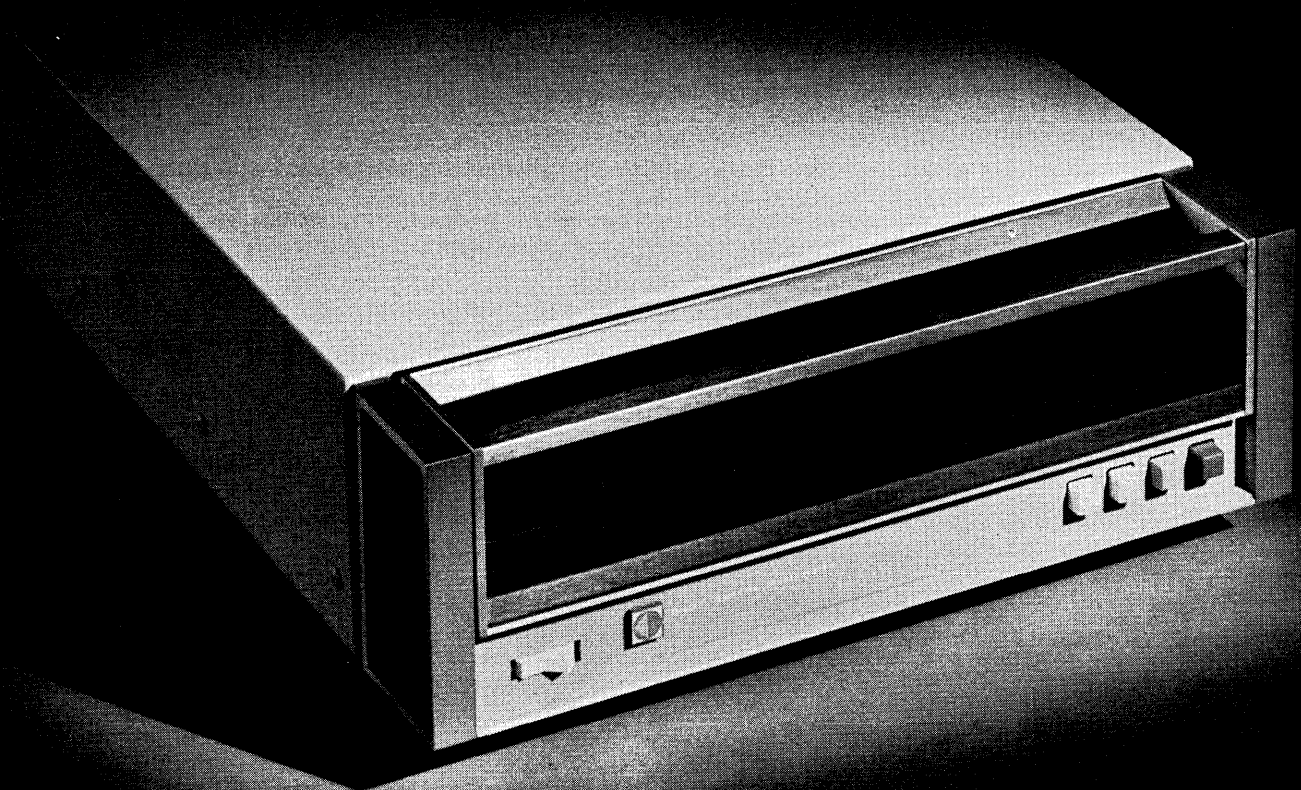
reader/sorter

High-volume throughput and recognition of a wide variety of type faces is the claim for the model 4080 optical reader/sorter. Character recognition of "the range of print quality created in a real-world environment" is accomplished through two linear arrays of photodiodes.

The 4080 will handle documents ranging from 3.5 to 7.5 inches long and 2.5 to 4.2 inches wide. Its rate is 2400 cps or 1000 intermixed documents/minute. There will be 6- and 12-pocket models, both capable of continuous loading and unloading. Output is either 7- or 9-channel tape.

Deliveries begin next year. The

Diablo disk drives,
when "almost"
isn't good enough!



Get two Diablo Model 31 single cartridge drives for less than the price of an "almost 2"*

Diablo is delivering now, so if you need two, buy two! Look at the advantages: simultaneous operation, system flexibility and back-up, at less cost, to boot!

Low initial cost — low maintenance cost

Diablo Series 30 drives cost less to buy because of their designed-in simplicity. They cost less to maintain because they have fewer moving parts—there are no field adjustments, potentiometers, belts or pulleys. They cost less to repair because they are designed from the ground up for replacement maintenance. The Model 31 weighs only 35 pounds, can be carried by one man, requires no set-up on installation.

Complete configuration flexibility

In addition to the Model 31, Diablo Series 30 drives include the Model 32, providing 2 removable disks, and the Model 33 with a removable disk and one fixed disk. All three models are available at 1100 BPI (12,000,000 bits per disk) or 2200 BPI (24,000,000 bits per disk) so you and your customer can select the exact configuration of disks and densities required.

Compact, cool, quiet

Diablo drives are smaller than conventional units—four can be stacked in a standard desk-high cabinet. Diablo drives are cool, dissipating less than 100W of power in normal operation. And, they are quiet because of their small blower size and because there are no impacting parts.

If your company is designing small systems for the seventies, you'll want to look at Diablo drives. After all, when you're aiming at the fastest growing segment of the computer market, "almost" just isn't good enough, is it?

***Representative Model 31 prices**

annual quantity	model 31 drive	power supply
1	\$4950	\$300
150	\$3220	\$250
1000	\$2470	\$200

You're right! Almost isn't good enough!
Send complete technical literature on Diablo Series 30 disk drives.
Name _____
Company _____
Address _____
City _____ State _____ Zip _____

when almost isn't good enough



new products ...

price is expected to range between \$200K and \$300K, depending on customer options. FARRINGTON MANUFACTURING CO., Springfield, Va. For information:

CIRCLE 357 ON READER CARD

compatible tape drive

The 5420 Model-7, a plug-to-plug replacement for the IBM 2420 Model-7 tape drive, will lease for \$895/month, including maintenance, which is 12% lower than the IBM price. Further, the \$895 is for unlimited use; IBM gives you 176 hours. The 1600 bpi phase encoded, 9-track unit has a tape speed of 200 ips and a transfer rate of 320kc, the same as IBM's offering.

A special feature of the 5420-7 is "pneu-latch," which provides for automatic reel latching and perfect tape tracking. Either cartridges or regular reels are automatically threaded. Power windows are standard. Other features include flip-down tape path access, prealigned non-movable head assembly, and front access electronics.

The 5420-7—which will sell for \$43,500—is scheduled for fourth quarter deliveries, and you may take advantage of the vendor's 30-day free evaluation. TELEX COMPUTER PRODUCTS, Tulsa, Okla. For information:

CIRCLE 360 ON READER CARD

two minicomputers

The latest extensions of the 360-inspired architecture that has to date attracted over 400 installations are the Interdata 5, a general purpose computer that is now the vendor's most powerful model; and the Model 1, designed for specific applications, such as industrial and process control systems.

The Model 1, a reincarnation of the short-lived Model 2 brought out in 1967, is a bit- and byte-oriented 47-instruction machine. Eight- and 16-bit instructions can be used in coding, and skip and test options take care of byte handling and loop control.

Memory for the little machine starts with a 2K, 1 usec core, expandable in 2K modules to 16K. ROM available in 2K modules can be intermixed. The core is organized in 256-byte pages, two of which are directly addressable by primary instruction word.

Standard I/O features include a serial port for teletypewriter and four hardware priority interrupts. The latter can be expanded to eight. Its I/O bus is compatible with other Interdata I/O, which provides a mini-disc, drum, mag tape, paper tape, printer, card

PRODUCT OF THE MONTH



interactive plotting

It may not be long before an engineer can complete his drawings on his drafting machine and know that a computer record—complete with his textual notes and corrections—is on file as soon as he finishes. We are not quite there, but the Interactigraphic I may be the next thing to that hypothetical system. In fact, the Interactigraphic I may be used that way, digitizing as the drawing is made and entering text from two keyboards, but the amount of computer storage required to support that application is expensive.

The machine is intended for another related purpose. It allows a designer to make a drawing, then digitize it, correct it or add to it through an interactive crt with a joystick, then replot the updated

version. The system is marketed with a crt terminal, a 58-key keyboard, and a 34x44-inch digitizing/plotting surface. The digitizer is accurate to .002 inch and the plotter can move at up to 9 ips.

In the base configuration the Interactigraphic I sells for \$47,500. The device can be augmented with a larger drawing surface, an auxiliary keyboard, a 30 cps hard copy printer for text, and an interactive graphics language package (the basic set comes with only FORTRAN callable subroutines). The machine is not complete in itself; it requires a datalink of some sort to a computer, but can be delivered with serial or parallel ANSI I/O interfaces. COMPUTERVISION CORP., Burlington, Mass. For information:

CIRCLE 352 ON READER CARD

reader, and communication equipment. New additions to the peripheral line are a twin cassette drive—250K store per cassette, 300 cps transfer rate, priced at \$2500; and a multiplexor unit available in a 128-line module at \$2600. The multiplexor can be stacked to handle 2048 lines.

Up to 256 I/O devices can be attached to the Model 1. In addition to multiplexor I/O, two selector channels are available, and up to four of these can be added to the processor for simultaneous I/O and processing.

Software with the control computer includes an assembler, which requires 4K of memory; a text editor; debug; loader; diagnostics; monitor; events monitor; and an assembler and simulator that produce object programs that can be run on Models 3, 4 and 5.

Model 1 will be available in September, priced at \$4,650 with the 2K memory. For information:

CIRCLE 362 ON READER CARD

For the Model 5 the vendor claims more real-time programming power per dollar than any other computer available today. A major feature for this new top of the line is foreground and background processing. The manufacturer feels this greatly enhances its chances in the instrumentation, process control, manufacturing, and data communication system markets.

Model 5 has a 113-instruction repertoire compatible with Models 3 and 4; an 8-, 16-, and 32-bit word length and 16- and 32-bit instruction words; 16 accumulators (15 usable as index registers) and eight floating point regis-

ters; and direct addressing of up to 64K bytes of core. Memory begins with 8K and expands in 8K modules. An optional mass core module can add another 64K. The machine has a 400 nsec micro-coded processor with ROM control of arithmetic and logic functions, plus internal and external data transfer.

I/O for this machine also handles up to 256 devices. There are 16 levels of priority interrupt with expansion by modules of 16. I/O options include a selector channel that will accommodate up to 25 high-speed devices, and an I/O processor that can be used to control the bulk of I/O while the Model 5 processes. All of the company's peripherals are compatible.

Software for the Model 5 includes a tape operating system, Basic Operating System (BOSS), and Real Time Operating System (RTOS); interactive FORTRAN; FORTRAN IV compiler; an assembler; and math library.

Combinations of software and hardware features have been used to divide the Model 5 into four configurations: The 5/1 and 5/2 use BOSS with the assembler and interactive FORTRAN. The 5/2 also adds a second 8K of core, high-speed I/O, and the FORTRAN compiler. The 5/3 and 5/4 use RTOS, 32K core with memory protect and the lower units' software complement, plus a 16-line hardware interrupt module. The 5/4 is extended with drum storage and a selector channel.

Prices for Model 5 start at \$12,900. First deliveries are expected in early July. INTERDATA, INC., Oceanport, N.J. For information:

CIRCLE 363 ON READER CARD

smaller minicomputers

The MAC 16, available for about 18 months, now has two siblings. One is called the MAC Jr. and has most of the features of the original, including a 16-bit word size, 2 usec add time, 1 usec core cycle time, a programmed data channel with addressing for 255 devices, and an optional multiplexor channel. It has different packaging, an integral power supply, and is priced without the teleprinter console at \$7,900. It is delivered with 4K of memory (expandable to 8K) and with four hardware interrupt levels (expandable to 16).

The second addition to the family is only slightly different from the MAC 16. It comes with direct memory access, power fail and restart, a 60 cycle clock, and wiring for plug-in memory expansion. These features were listed as options on the first 16. It also comes with eight built-in interrupts (expandable to 64) instead of four. Priced

without the teleprinter it goes for \$11,200. In comparison to the \$11,950 single unit price of the original 16 (priced with teleprinter) this seems to be a deal.

Both of the machines are hardware and software compatible with their predecessor. Software includes an assembler, editor, FORTRAN IV for the 8K versions, a math library, hardware diagnostics, and a simulation program called MACSIM. The assembler and MACSIM are also provided in versions for larger computers like the 360 series and the Univac 1100 series; this allows for checking and assembly code much

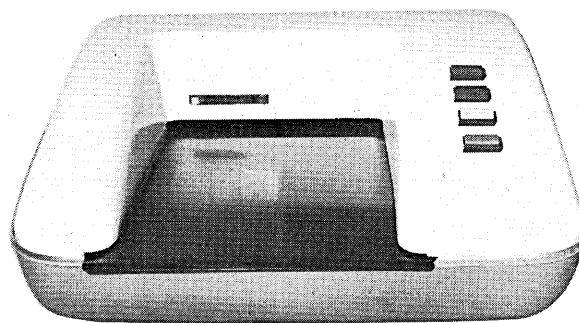
more quickly than is possible on a mini. LOCKHEED ELECTRONICS CO., Los Angeles, Calif. For information:

CIRCLE 358 ON READER CARD

paper tape keyboard

The first of a planned line of electronic keyboard units for computer input and typesetting applications is the Electro/Set 430 which produces punched tape output. The 430 includes a standard typewriter-like alphanumeric keyboard, plus function keys. An electronic interlock circuit al-

an ocr system for less than \$10,000



If that's not impressive enough how about error rates below .01% at 60 characters per second, choice of output codes, standard output interfaces to magnetic tape—data modems and minicomputers and your choice of colors no less. The story of the Dataflow Optical Page Reader is destined to be a best seller among people with a source data problem.

||| DATATYPE CORPORATION
1050N. W. 163rd Drive, Miami, Fla. 33169 (305) 625-2489

CIRCLE 177 ON READER CARD

Put the other plotter maker on the spot. Ask him for a comparative demo. His and ours. We'll show up.

What you'll find (if he accepts the challenge) is that our incremental plotter is faster, more effective and costs less.

And here's what you get for all that less money. Delta Control.* An exclusive. Lets you move up to 1443 steps in X and Y from a single command. (That's not a special or an extra, either. It's standard.) That's why we can reduce computer write time as much as 30:1.

What's their name is trying to duplicate Delta. By adding on a computer. Which cost you thousands extra. Many thousands.

You'll find we out-versatile the other brand, too. Because ours is the only incremental plotter that can operate on-line or from three off-line inputs: mag tape, punched tape and punched cards. And, computer extra or not, we're the only ones with programmable step size, speed control and a foul-proof manual plot interrupt.

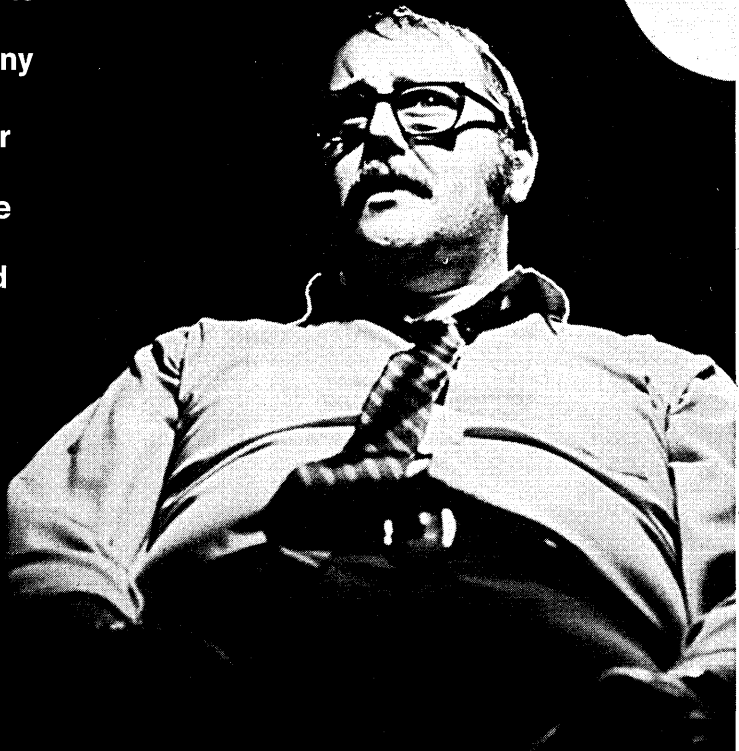
In case that's not tempting enough, we throw in the software. No charge.

At this point, when the other guy's folding his hardware and silently stealing away, we

toss in the clincher. We can deliver in 30 days.

To put us to the test, just call collect (213) 781-7100. Ask for Demo Service. Or write UCC Graphic Systems Division, 14761 Califa Street, Van Nuys, California 91401.

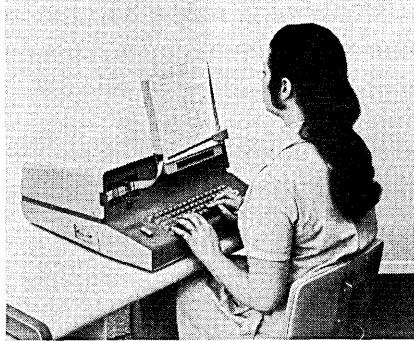
*patent pending



UNIVERSITY COMPUTING COMPANY
GRAPHIC SYSTEMS DIVISION *First in Business Graphics*

new products ...

lows the keyboard to handle operator speeds between characters as fast as three use without any loss of codes. Output is 6-, 7-, or 8-level on 3/8- or 1-inch punched tape. The entire code structure can be changed by replacing a circuit module.



Standard features include a choice of Teletypesetter or secretarial shift, a bank of mode indicator lights, copyholder, and a job key that backs up the tape a single code at a time. Options include a last word delete feature that enables the operator to rub out the entire last word on the tape by touching a single key. The 430 is now in production. Prices start at \$2,865. FAIRCHILD GRAPHIC EQUIPMENT, Plainview, N.Y. For information:

CIRCLE 359 ON READER CARD

600 cpm reader

The C600 is designed to read 80-column cards at speeds up to 600 cards/minute. It reads column by column, accepts cards in any format, and is front-loaded and unloaded. Sufficient control lines are provided for operation with general-purpose computers or remote terminals. Available as either table model (C601) or rack-mounted unit (C602), design emphasis is on simplicity and ease of maintenance. Protective features include feed stop and operator attention lights (for output - hopper - full, output - hopper - empty and three-successive-pick-failures), motor shut-down on card jam, and front cover interlock switch.

Input hopper capacity is 900 cards; output hopper, 1000. On-the-fly loading and unloading is possible with at least 200 cards in the input hopper. The table model is 16" high, 15" deep, 22" wide, and weighs 35 lbs. Rack-mounted model is 16" high, 15" deep, 24" wide, and weighs 30 lbs. Their price is about \$2,700; delivery in six months. PERIPHERAL DYNAMICS, INC., Norristown, Pa. For information:

CIRCLE 353 ON READER CARD

microfilers

Attempting to cover all the bases, this firm is offering computer output microfilers which are more expensive and less expensive than its first-born, the COM 600. The less expensive model is called the COM 400 and is intended for line printer replacement service. The system includes a 7- or 9-track tape drive, a 64-character set, image rotation controls, a crt display, a forms overlay feature and a 16mm/35mm camera. The 400 can put down lines at a claimed rate of 23,680 lpm maximum (17,080 lpm considered "typical") taken at a rate of 36kc from printer tapes. It runs \$68,000 full price and is also offered on a rental basis. It is also available in a slightly higher version (with a microfiche camera) called the 500.

The more expensive model is the COM 700, which features an on-board 4K computer, a line printing rate of 31,750 lpm maximum (18,880 "typical"), an input rate of 40kc, and an incremental plotting rate of up to 100,000 points/sec (50,000 points/sec is the rate for random plotting). The computer imbedded in this version of the line is the Digital Equip. Corp. PDP 8/L, which is expandable in the 700 to an 8K size. The camera offered is a 16/35/70/105mm version. With it, fiche can be produced at a rate of three per minute using 132-character lines, 64 lines per page, and a 24X reduction. The 700 sells for \$141,500. BETA INSTRUMENT CORP., Newton Upper Falls, Mass. For information:

CIRCLE 365 ON READER CARD

165 cps printer

The Mach 1's printing speed of 165 cps translates to 60 lpm. The printing structure uses 5x7 dot matrix characters, six 132-character lines/inch. Multi-copy forms with up to four carbons may be used. Paper is pin fed, adjustable for 6 to 14-inch forms. Transmission rate is 300 bps serial and up to 25,000 cps parallel. Code is ANSI, 63 characters. The \$2400 single-quantity cost is attained through the use of "unique drives that have a greater impact power and higher speed than any others we know of." And there are few moving parts. Deliveries begin in November. CENTRONICS DATA COMPUTER CORP., Hudson, N.H. For information:

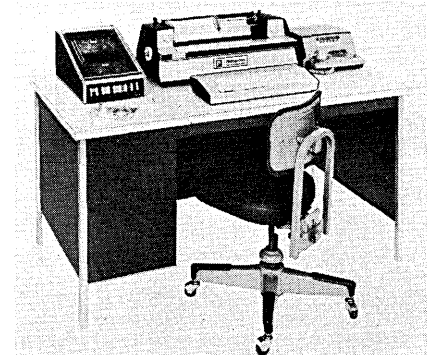
CIRCLE 367 ON READER CARD

batch/t-s terminal

Gemini joins the growing number of terminals with both batch and time-sharing capability. This unit features a full alphanumeric typewriter keyboard

plus a 10-key numeric pad for adding machine functions. It is programmable, using a 1024 character memory and two incremental or synchronous 180K character magnetic tape cassettes that use instrument grade tape. A 25-30 cps split-platen impact printer is used, permitting on-line retrieval without disturbance of batch transaction handling. Total platen width is 18 1/4 inches, and paper is pin fed. The unit transmits and receives at 110 cps and will operate unattended.

Comparison of competitive i/o terminals is difficult because of the various approaches taken, but the Gemini seems to most closely resemble the Burroughs TC-500 or the Daedalus



711. The Gemini was designed by the vendor, a software house, primarily for use with its MIS software package, and will be manufactured by an OEM who had not been finally selected at press time. Price will be almost \$11K for single units, dropping to under \$10K in quantities of 40. Deliveries should begin later this year. FACTSYSTEM INC., Chicago, Ill. For information:

CIRCLE 364 ON READER CARD

tariff guides

A Microfiche Tariff File, a compendium of phone line charges, is available compressed into less than 10 inches of 4x6 microfiche cards, providing the equivalent of over four feet of loose-leaf shelf storage. Guides to either interstate or international communication rates and policies are available. Price is \$256 for either guide, or \$414 for a combined interstate-international guide. Second copies are \$148 and \$222, respectively. Annual fees for monthly updates are \$195 and \$292, with second copies running \$97.50 and \$146.50.

Also available is a Quick Rate Reference Guide containing pertinent rate data for telephone and record communication offerings of the common carriers summarized in 3 1/2 x 7" loose-leaf form. It is divided into interstate and international coverage as is the Microfiche Tariff Guide, with an equally complicated price structure:

new products...

\$67.50 for the first interstate or international guide; \$102.50 for the combined guide; \$47.50 and \$82.50, respectively, for additional copies; and \$20 and \$34 for monthly updates for one year, with second copies for \$6 and \$10.50. But that's not all—order 500 or more Microfiche Tariff Files and you get a free microfiche viewer. CENTER FOR COMMUNICATIONS MANAGEMENT, Ramsey, N.J. For information:

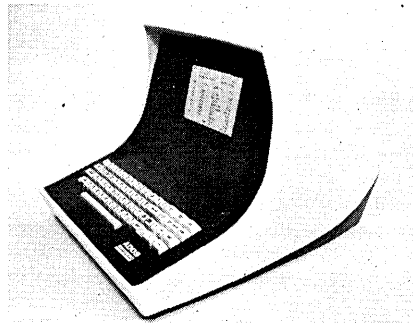
CIRCLE 370 ON READER CARD

crt/key-board terminals

The Consul series of desk-top crt/key-board terminals display up to 1600 characters and have complete editing and formatting capabilities. All three models—the 800, 840, and 880—are Teletype compatible and employ a 9-inch tv monitor. The 800 displays 16 lines of 32 characters, and the 840 displays 16 lines of 64 characters—both are aimed at firms with specialized computer access requirements. The 880 displays 20 lines of 80 characters and is intended for time-sharing use. Characters are displayed in black on a white display page centered in the screen, and this provides margins that

enable the user to anticipate the end of a line.

A standard EIA RS-232-B interface is provided for connection to a customer-supplied modem. A built-in modem is optional and provides either acoustic coupling or hardwired connection to a Bell Data Access Arrangement. Data



can be transmitted in half duplex at 110 baud or 300 baud (switch selectable), or units can be provided with a parallel interface for local connection to a computer.

Three modes of operation are available: conversational, page, and message. Models 840 and 880 have a formatting feature which allows the display of both fixed and variable data. Fixed data displayed on the screen appears as gray characters (half tone), while variable data is black. Prices are \$2995 for the 800, \$3495 for the 840,

and \$3995 for the 880. Delivery requires 90-120 days ARO. APPLIED DIGITAL DATA SYSTEMS, INC. Hauppauge, N.Y. For information:

CIRCLE 369 ON READER CARD

pdp "appliques"

The dictionary defines an applique as a "cutout decoration fastened to a larger piece of material." But this vendor is trying to do more than decorate the PDP-8 with its line of hardware "Appliques" that are intended to relieve software complexity and conserve core space by adding more hardwired functions to the 8's instruction set. The units are easily field installed via the I/O bus, like peripherals, and require no modification to the computer frame.

Prominent among the series is the model SA804 High Precision Arithmetic Unit (All Modes), which provides variable length precision to 48 bits or 12 digits; BCD or binary, signed or unsigned modes; normalization to decimal format; quadruple precision arithmetic operations; and floating point mode. Commands include load accumulator, add, subtract, multiply, divide, store accumulator, and shift arithmetic.

Other Appliques are a standard precision extended arithmetic unit (binary), an index register unit, table

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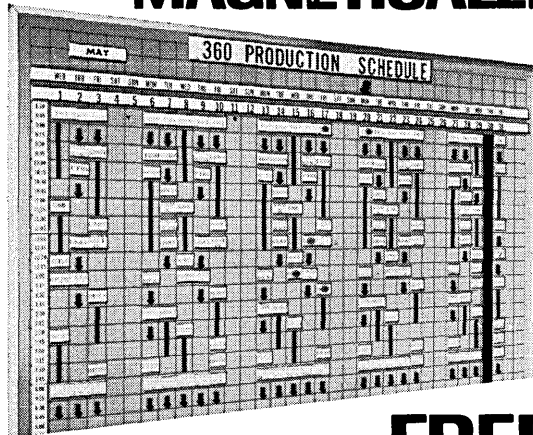
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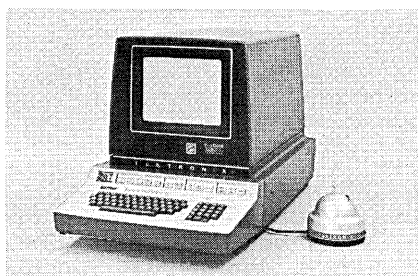
DATAMATION

look-up unit, data break multiplexor, internal timer, real-time clock, and list stack unit. Unit prices range from \$1500 to \$3000 depending on functions included. Delivery requires 90 days. SYSTECH INC., Clifton, N.J. For information:

CIRCLE 372 ON READER CARD

interactive graphics

It would seem that the addition of the 4901 Interactive Graphic Unit and the optional joystick to the existing T4002 crt terminal will put this largely OEM-oriented vendor even more in competition for end-user sales. The interface unit allows for attaching the joystick (or other input devices), and both are software supported. The software permits coordinate identification, display rotation, overlaying, "menu picking" and other frequently



repeated functions. The crt on which the terminal is based is a storage tube that does not require refresh hardware, and the terminal alone sells for \$8800. The graphics interface goes for \$450 and the joystick—for moving the cross-hair cursor around on the screen—for \$250. TEKTRONIX, INC., Beaverton, Oregon. For information:

CIRCLE 366 ON READER CARD

stored program crt terminal

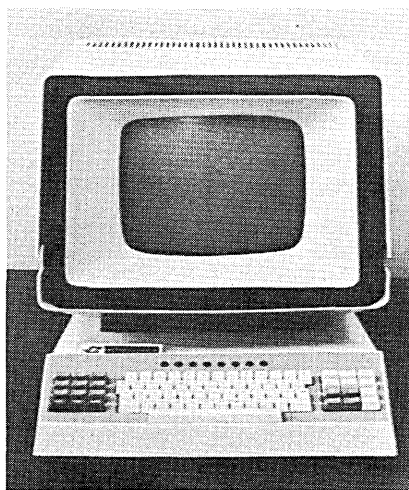
First product of a 16-month-old firm is the Stored Program Display 10/20 which contains its own general purpose stored program computer with core memory, interrupt structure, and arithmetic capability. This enables time-sharing users to perform nearly all editing and format checking off-line. The 10/20 can connect to time-sharing services and elect to operate as an IBM 2260, Uniscope 100, ASR 33 tty, or as any other standard terminal. Since it has its own memory and interface logic, the 10/20 may also be connected directly to a cpu within a site, or to any communication line modem.

The crt used displays 64 characters per line, with up to 30 lines (interlaced), for a total of 1920 characters, or up to 15 non-interlaced lines, for 960 characters. Character generation is by 7x10 dot matrix, 525 line raster. The 10/20 processor, of the firm's own design and manufacture, is a 16-bit machine which is slow-add/subtract time of 3.2 usec—but intended

for heavy data processing, with a set of 58 instructions. Core memory has a 1.6 usec cycle; its standard configuration is 1K (16-bit) words, expandable to 2K for a dual configuration which includes two crt's and keyboards, but only one processor. This latter configuration handles the same number of lines, but results in a lower cost per operator position. Communication is synchronous to 4800 baud, asynchronous to 2400 baud, half or full duplex, with RS 232 standard.

Standard 10/20 software includes terminal emulators, assemblers, program load and dump routines, and other utility routines. An assembler is being written to enable users to prepare programs for the terminal on their mainframe computers; this assembler utilizes a subset of FORTRAN in an effort to provide wide applicability. An assembler will also be provided to operate on the Honeywell 316.

The 10/20 is aimed at both OEM's and end users. Price per unit in quantities of 50 is \$5800, dropping to \$3200 in quantities of 200. The dual configuration, in a quantity of 50, runs \$7,790 each, or \$3,895 per operator position. The units are already in pro-



duction, first deliveries have been made, and present lead time on orders is three to five months, depending on quantity. INTERNATIONAL COMPUTER TERMINALS CORP., Marlborough, Mass. For information:

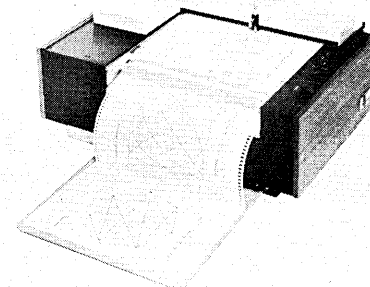
CIRCLE 373 ON READER CARD

small plotter

The management of this firm decided to build a plotter for time-sharing users that was both faster and cheaper than those already on the market (which we take to mean CalComp and Houston Instrument, among others). The model they produced was named the 230 and is claimed to be up to 25 times as fast as the competition. There is no secret in how the speed-up was

accomplished; the 230 can travel at its maximum speed of 270 increments per second in any direction. The competition may run at 300 increments per second, but can only go in one of eight directions.

A flat-bed machine made to take Z-fold paper, the 230 accepts inputs at 110 baud and can be driven by Cal-



Comp or HI plotting commands, but this kind of operation cuts its speed down to that of the other plotters. An input language called ZPLOT is available for generating outputs to drive the machine at rated speed. The unit price of the plotter is \$6,250. ZETA RESEARCH, Lafayette, Calif. For information:

CIRCLE 368 ON READER CARD

1130 communications

Users of IBM 1130's will be able to link keyboard terminals to their computers by attaching the Multiple Terminal Communications Adapter, a special-order device that permits 2741 communication terminals or teletypewriters to be linked to a single 1130 over as many as 16 remote and local communications lines.

The MTCA will allow the 1130 to act as a central message-switching facility or enquiry-processing system. The adapter requires an 1130 disc system with at least 8K word main memory. Prices vary according to the type and number of terminals and the communications lines used. For example, an MTCA supporting six 2741 terminals over a switched phone network would rent for \$518 per month and sell for \$21,530. First shipments are scheduled for October. IBM, White Plains, N.Y. For information:

CIRCLE 374 ON READER CARD

machine-source recorder

Input to the DATA-KAP 882 Machine-Source Incremental Recorder is directly from a cash register, time clock or office machine with an electro-mechanical matrix, through a plug-in connector to the machine. Numeric data is recorded in BCD, ASCII or EBCDIC format, 32 characters/inch,

new products ...

even parity, on standard computer-grade 150-mil four-track magnetic tape cassette with a 200K character capacity. The recorder may be free standing or mounted directly to the machine. The error check locks the input machine, and end-of-tape sensors will stop it. The single unit price is \$1200; quantity discounts are available. ELECTRONIC LABORATORIES INC., Houston, Texas. For information:

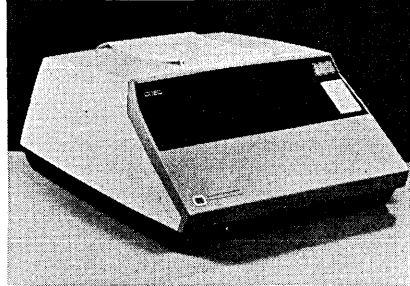
CIRCLE 375 ON READER CARD

mini printers

First products of a year-old firm are two desk top impact line printers designed for use with minicomputers, remote terminals, etc. Up to six-part forms may be used. The Model 200 prints 80 columns at 205 lpm, and the Model 400 prints 132 columns at 410 lpm. Both printers utilize 64 character sets, with up to 128 characters optional on the Model 200 and 48 or 96 characters on the 400. The printers use a patented logic technique to automatically adjust each print line for maximum speed for the particular character set contained in the buffer;

therefore, the stated speeds are minimum, with the 205 lpm unit typically averaging over 250 lpm.

The units contain a small processor utilizing TTL logic with MOS circuits for the complex timing, buffering, and control portions of the printer, and a simple mechanism for the print position. A belt with individual characters that easily snap on and off is used. Maintenance should be minimized by



the use of factory sealed bearings, stepping motor paper drive, direct drive to character belt, and individual motors for the multipass carbon coated mylar ink ribbon. Prices for the 200 and 400 in single quantity are \$6900 and \$8900, respectively. OEM price for 50 units is \$4300 and \$5500. Deliveries begin this month. ODEC COMPUTER SYSTEMS, INC., E. Providence, R.I. For information:

CIRCLE 371 ON READER CARD

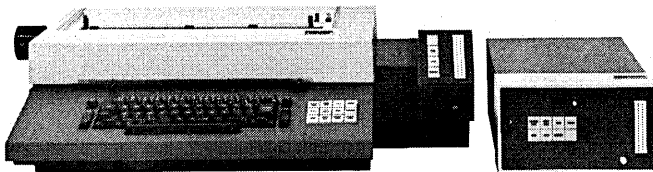
tty enclosure

The Model 1026 SOUND OFF DAMPENERS is designed to reduce noise levels of Teletype Model 33 ASR and Telex Model 32 ASR teletypewriters. The units are made of lightweight aluminum with exteriors finished to complement the original equipment. Installation does not require fasteners or machine modifications. A hinged Plexiglass lid covers the top and front, and vents provide proper air flow. Model 1026 sells for \$149.50. VAN SAN ASSOC., Pasadena, Calif. For information:

CIRCLE 378 ON READER CARD

tape conversion

The Universal Tape Converter will be of greatest interest to companies doing a lot of communication between computers and 5- and 8-track Teletypes. The system allows duplication of any 5- or 8-channel paper tape without code conversion; conversion from any 5- or 8-channel paper tape to any other of the same with code conversion and formatting; conversion of any 5- or 8-channel paper tape code to any 9-track magnetic tape code with constant or variable length records, and vice versa; conversion of any 9-track magnetic tape code to any 5- or 8-channel paper tape code with addition



This terminal has two magnetic units. It performs all the off-line power typing functions better and for less money. And in addition, offers two-way communication capability with a computer. It's the new 5-51 System.

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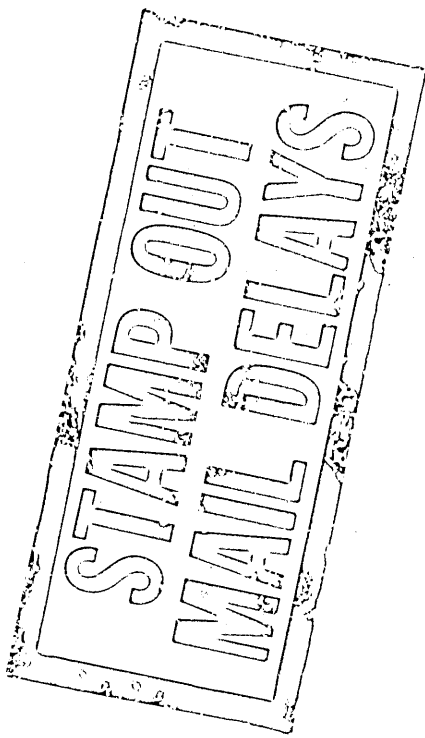
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CIRCLE 110 ON READER CARD

new products...

or deletion of characters based upon character position within the record.

Options include 7-track magnetic tape capability, 7-track to 9-track mag tape conversion (and the reverse), and 7-track magnetic to/from 5- to 8-channel paper tape conversion. Other features may be changed to fit user requirements. The basic system is selling for \$25K and delivery is 60 days ARO. INSTRUMENTATION TECHNOLOGY CORP., Northridge, Calif. For information:

CIRCLE 377 ON READER CARD

semiconductor memory

One of the components of Illiac IV, the supercomputer being built at the Univ. of Illinois that was designed to have some 256 processors and to operate at speeds that still seem mythical, is being offered to everyone as a starter set for his own super machine. The component is a 200 nsec memory module composed of four cards of 2Kx16 bits (expandable to 16 cards), plus one controller electronics card. The 4303 memory module delivers as many bits as you need for something under 10¢/bit. Although the price comes to \$13,000 for the 128K-bit standard building block, this compares acceptably with the plated wire components with which it will compete. FAIRCHILD CAMERA AND INSTRUMENT, Mountain View, Calif. For information:

CIRCLE 380 ON READER CARD

high-speed data set

The TDM-330 (latest in the DigiNet line) is a high-speed short-haul data set that provides synchronous serial binary transmission at 2400, 4800 or 9600 bps over physical, four-wire circuits up to three miles in length. It is equipped with built-in test facility and automatic line equalizer, permitting installation and fault isolation without use of test equipment. The new TDM-330 reportedly facilitates operation of many high-speed peripherals at rated speeds. Price is under \$1,000. GENERAL ELECTRIC COMPANY, Lynchburg, Va. For information:

CIRCLE 381 ON READER CARD

distributor's accounting

In this age of specialization, a mini-computer manufacturer has prepared a hardware/software system just for office products distributors. The system handles billing, accounts receivable, accounts payable, general ledger, sales analysis, payroll, and commodity

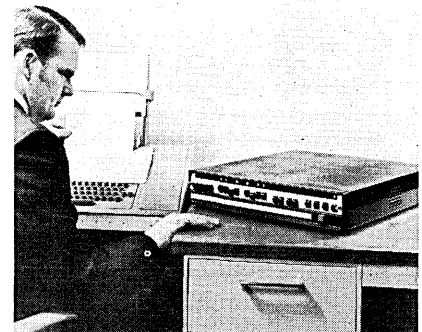
catalogs. The package is called AP-2 and uses the DIBOL business language. Its big advantage, says the vendor, is that all of the programs needed to operate the system are provided for the dealer so that he won't have to hire expensive computer operating personnel.

The processor is an 8K PDP-8/I with Teletype, line printer, paper tape reader and mag tape storage. The only thing not included is input preparation. You can get that from another manufacturer for about \$60 or \$75 a month, the company said. AP-2 may be purchased for \$59,000. Leasing can be arranged through a third party for about \$1,500. The first system has been delivered. DIGITAL EQUIPMENT CORP., Maynard, Mass. For information:

CIRCLE 383 ON READER CARD

minicomputer

Minicomputers are busting out all over this month, and here is one from a company not yet a year old. Called the MD708, the mini is meant to be small and cheap for applications requiring a communications controller, peripheral controller, or translator. An 8-bit ma-



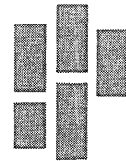
chine, the 708 comes with 1K characters of core (expandable to 64K), a 1.6 usec processor cycle time, its power supply, control panel and cabinet for less than \$3,000 in quantities of 25. The machine understands over 100 instructions and has a macro assembler to make it easier to talk to. Its manufacturer claims that I/O interfacing and all the standard peripherals are available. (Customers looking for a portable model will be pleased to note this one weighs 25 pounds.) MONITOR DATA CORP., Newport Beach, Calif. For information:

CIRCLE 376 ON READER CARD

acoustic/inductive couplers

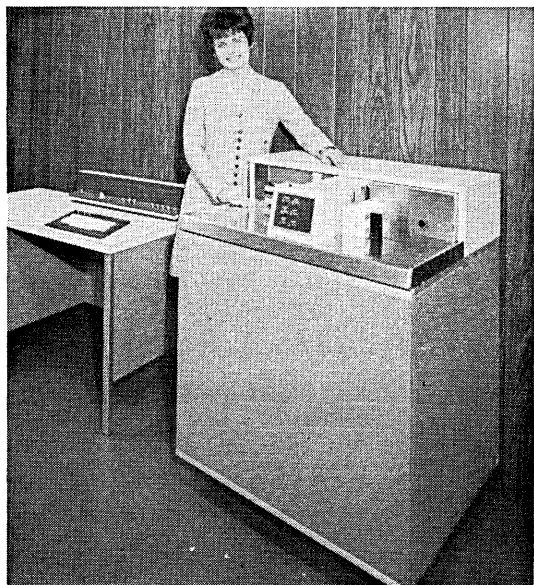
ForData Models 1210 and 1610 acoustic/inductive data couplers, replacements for Models 1200 and 1600, have an increased baud rate of 300 (up from 175) and a telephone line sensitivity of -35 db, an improvement over -30 db for the earlier models. Front

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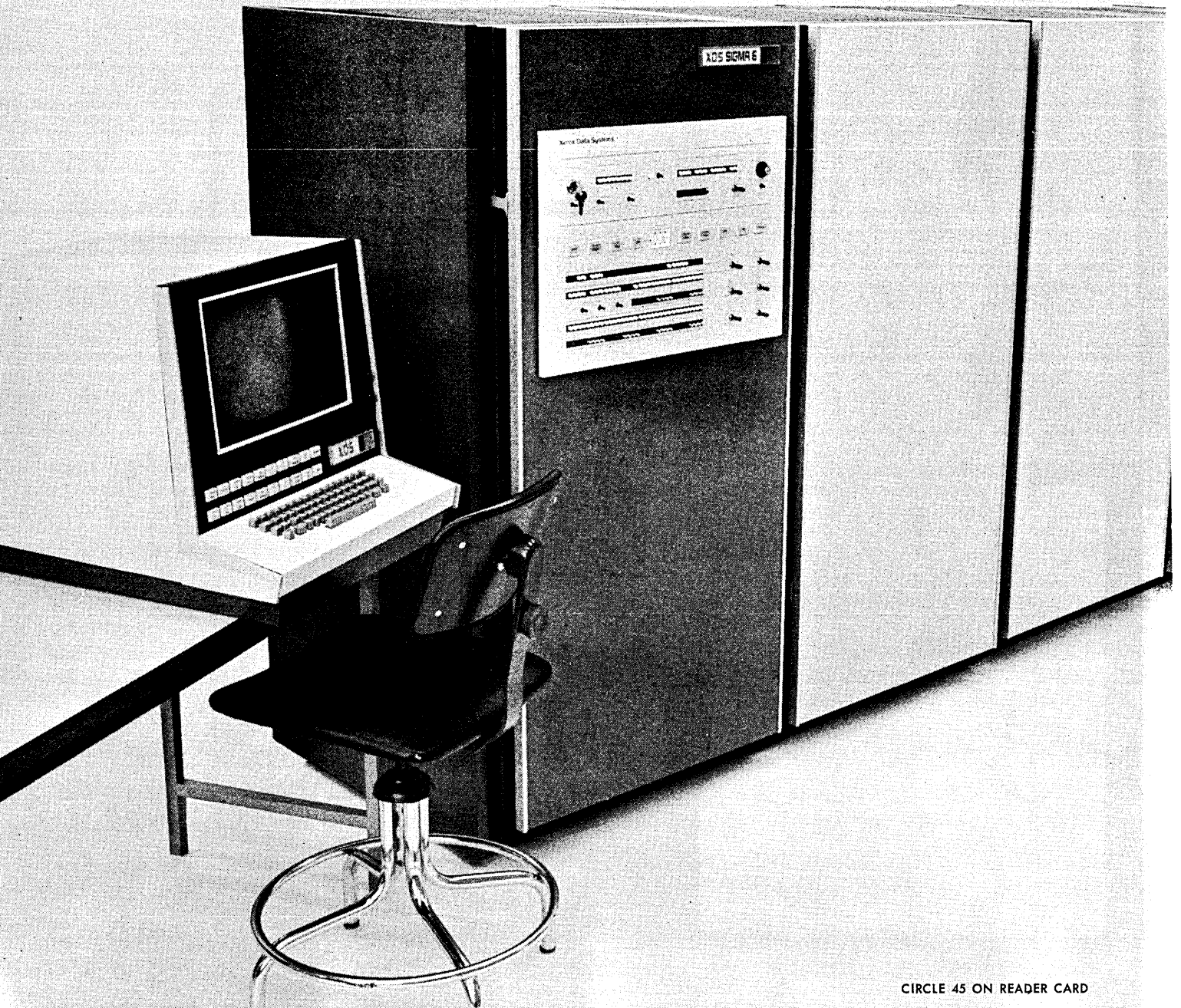
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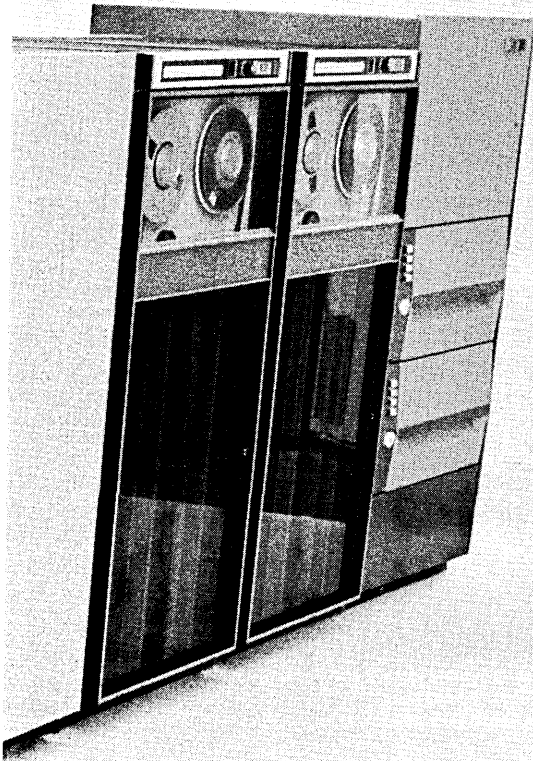
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Introducing Sigma 6. Sigma 6 is a medium-size, 32-bit general purpose computer for users who want to run a lot of batch, and maybe a 24-user time-sharing system at the same time.

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Sigma 6 comes with decimal arithmetic, byte string handling capability, a hardware memory map, dual memory access, and all the other features that make a business machine good.

It uses proven Sigma software, including a generalized data management system, a file management system which works both in the batch mode and on-

line, and a number of application programs.

What's more, it's virtually impossible to outgrow the capabilities of the system, because Sigma 6 can be field-modified to become an even more powerful Sigma. And because the software is compatible, you'll be able to use all the programs you developed for it without modification or conversion.

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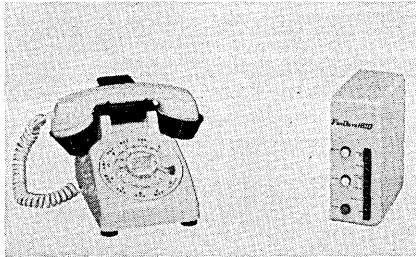


CIRCLE 50 ON READER CARD

new products...

panel switches have been added for invert or upright operations.

Both Model 1210 for originate-only operation and 1610 for originate, answer and/or automatic answer operation can connect to telephone lines through the Bell System Data Access Arrangement or through an acoustic/inductive telephone adaptor which fits over any 500 series telephone without interfering with normal use of the phone. The couplers are fully compat-



ible with Western Electric 103 data sets and interface with terminal units conforming either to tty or EIA RS-232B standards. The units have circuits which use the Bell System "handshake" routine to establish the transmission link to insure turn-off of echo suppressors.

Price tags of the new models are identical to those of their predecessors, \$245 for the 1210 and \$395 for the 1610. FORD INDUSTRIES, INC., Portland, Ore. For information:

CIRCLE 379 ON READER CARD

mini-drums

This line of head-per-track drum memories for mini and midcomputers comprises four models with storage capacities of from 128K to 5 million bits. The smallest unit, the Model 588, has a 1MHz transfer rate and sells for \$1500. The 5 million bit capacity Model 488 has a 2.4MHz transfer rate and an \$8750 purchase price. In between there are the 500K Model 388 with a 1.9MHz transfer rate and the Model 788 with a 3 million bit capacity and a 1.5MHz transfer rate. Read/write amplifiers, track selection drivers, data encode and decode logic are integrated in a standard package. CALIFORNIA PERIPHERALS, Anaheim, Calif. For information:

CIRCLE 384 ON READER CARD

core memory

This modular memory system, the SC-2365 Magnetic Core Memory, can be ordered with 32K (8-bit plus parity) bytes up to 16 million bytes. It has a cycle time of 700 nsec and an access time of 350 nsec. The memory is the first OEM memory product from the

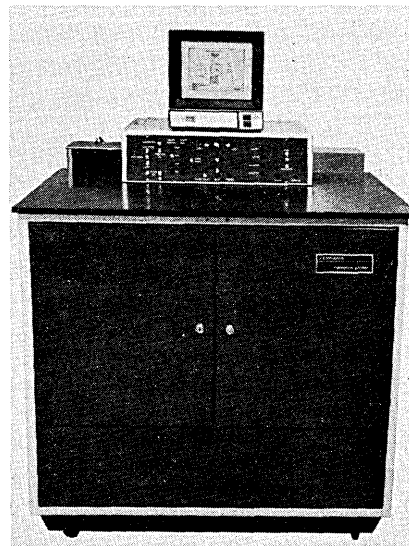
vendor, who developed it for his own IC-7000 time-sharing computer, and represents an improvement in this computer's memory from 1 usec to 700 nsec. Up to one million bytes can be packaged in a 72x38x78-inch cabinet, and up to 16 such cabinets can be connected to form an integrated system of desired capacity.

The system is self-contained and can be connected as main memory to several processors such as the IBM 360/65 and to the channel controller of the 360/67. It was designed to adapt to a variety of computer systems without change in circuitry. It is flexible in word size as well as in gross storage capacity. Data widths varying from a single byte to multiple words can be handled. A one million byte configuration is priced at \$850,000. STANDARD COMPUTER CORP., Santa Ana, Calif. For information:

CIRCLE 385 ON READER CARD

microfilm plotter

The ADE Microfilm Plotter is designed for production of graphs, histograms, engineering detail drawings, maps, and all types of listed data; its particular forte is the verification of numerical control tapes. Input, in ANSI code, can be in either paper or magnetic tape, or on-line interfacing with a computer.



Standard output is a fully processed 35mm aperture card, produced within 60 seconds. The ADE utilizes a 3M Filmsort 2000 film processing unit. Options include a Tektronix Model 611 Storage Display crt, a vector generator, upper and lower case character generators, and a forms overlay projector. Components are manufactured in Scotland, and assembled in Toronto. Prices start at \$55,600 (U.S.) with delivery in three to five months. FER-RANTI-PACKARD LTD., Toronto, Ont. For information:

CIRCLE 382 ON READER CARD

keyboards

This series of keyboards uses a switching technique on which the patent is pending, and the manufacturer shies from saying more except that they work well in high humidity. The keyboards have a basic configuration of seven rows including space bar and two formats — typewriter and key-punch. Seven- or 8-bit ANSI and any of four levels of encoding are standard options. Fully encoded keyboards sell for less than \$100 in quantities of a thousand or more. The company is courting the OEM's with delivery in 30 days or less without charge or obligation to production quantity prospective users. CONTROL DEVICES, INC., Woburn, Mass. For information:

CIRCLE 387 ON READER CARD

mini/maxi peripherals

Perceiving a bull market for low-cost peripherals, this manufacturer is producing a clutch of devices, including tape drives and discs. The magnetic tape series combines IBM-compatible tape drives with controller, 7- and 9-track heads, rack mountable, with models for 7-inch reels (7½ ips) and 10½-inch reels (25, 37.5, 45 or 75 ips) and transfer rates up to 60kc. Packing density is 200, 556, and 800 bpi with NRZI recording techniques and up to 1600 bpi (and double the transfer rate) with phase encoding. The self-contained systems are available 30 to 60 days ARO at between \$9,500 and \$29,700.

The series D disc system is a controller and one to eight fixed head discs with a per disc storage capacity of either 500K or one million bits. Disc access time for the block-oriented system is 8.5 msec per block. Standard block size is 128 words. Price range is \$6,200 to \$14,700. Delivery time is 90-120 days ARO.

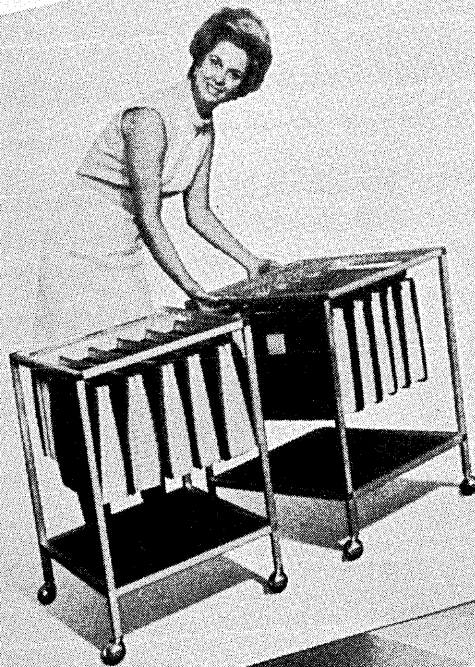
The DT disc-tape system combines any four of the previously described disc and tape drives. Price range is \$14,500 to \$42,200 with deliveries in 90 to 120 days. The company is marketing the peripherals to both OEM and end users. PER DATA, INC., Hicksville, N.Y. For information:

CIRCLE 390 ON READER CARD

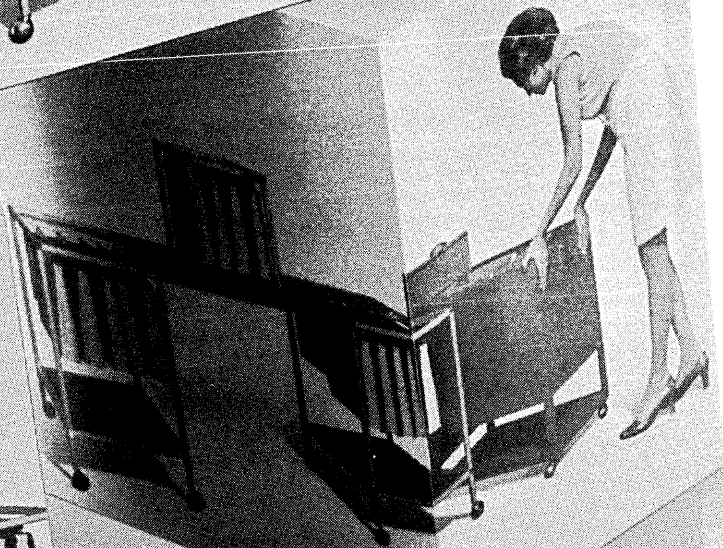
semi-automatic retrieval

This system combines microfilm storage and retrieval with video transmission and remote viewing. Designated the SD-550, it can store any number of pages of data—depending on the type of microfilm file and film form (i.e., aperture card, microfiche, film strips)—and transmit the images via Videocon and coaxial cable to any number of high resolution video terminals within a 1500 to 2000 foot radius. The moni-

Roll in one or more National Control-Rack(TM) units for convenient floor data referral. Takes any size binder in multiple configurations.



Link two or more floor-type modular control stations with National Connect-A-Ref(TM) units that double as handsome desktops.



Protect print-outs with a fully enclosed, locking Control-Rack(TM) for confidential or restricted material.

National has a print-out storage system that's building-block simple.

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plus a complete selection of modular floor and desk-top referral and retention units. Meaning you can add-a-unit-here-add-a-unit-there and, literally, block out a record-keeping system that meets your exact requirements.

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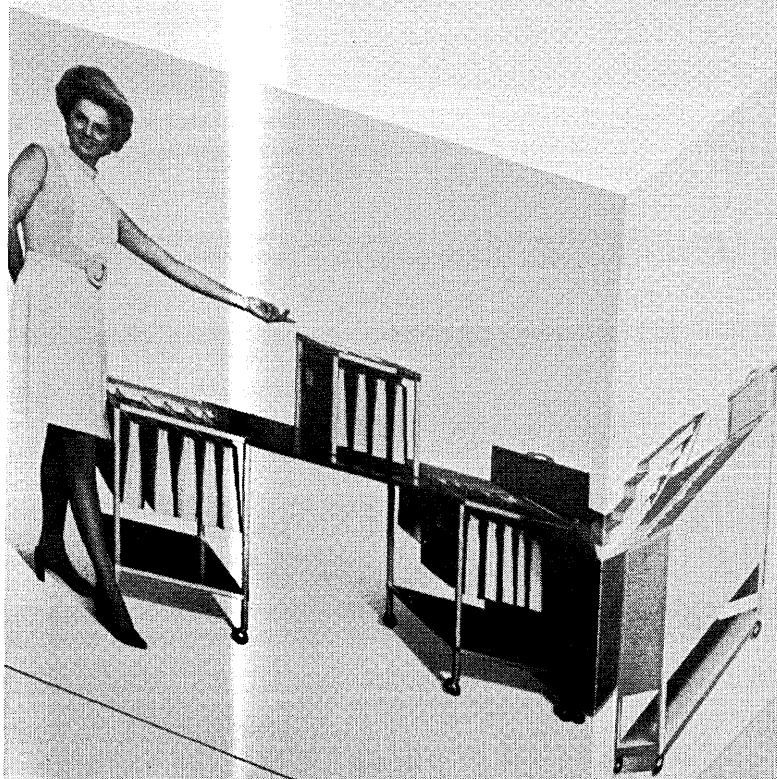
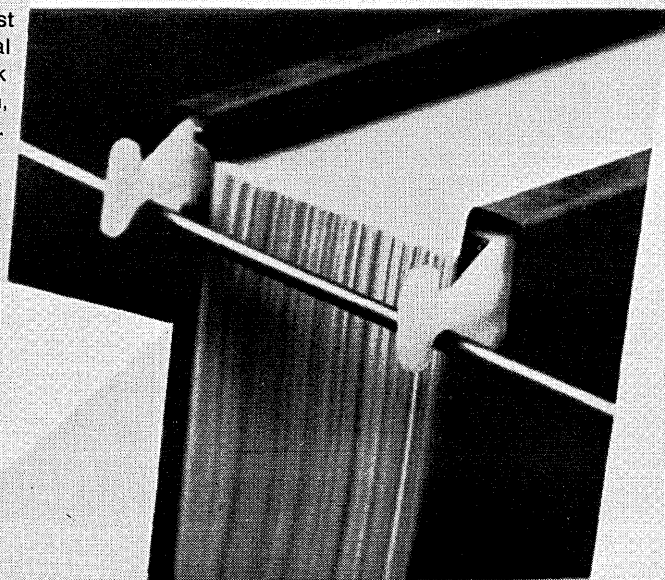
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Simplify binding and hanging of burst and unburst print-outs with National Hang-A-RefTM Data Binders. Hook slides out to hold binder in suspension, retracts for carrying and reference.



Top off your complete housing system with handy Control-RackTM units for convenient desk data referral at desk, table or modular stations.

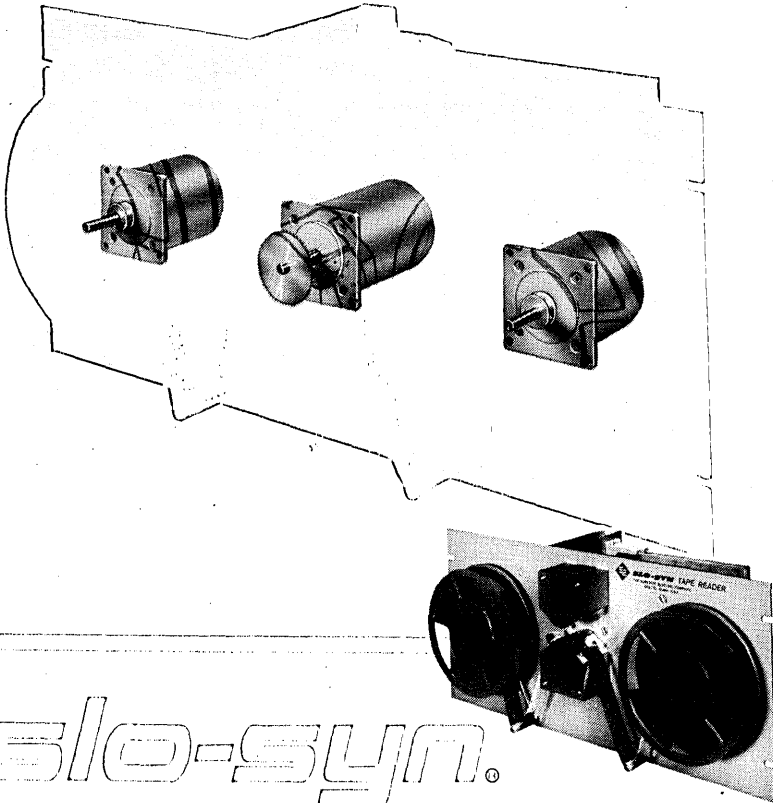
CIRCLE 89 ON READER CARD



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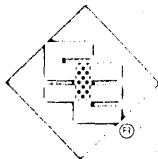


slo-syn.

Photoelectric Tape Reader

Maintenance? Hardly ever — not enough to even mention. The secret lies in simplicity: NO detents, ratchets, belts or gears; NO clutches or mechanical drives; NO on-off switching servos. Just three reliable SLO-SYN motors — one stepping motor advances the sprocket and two torque motors drive the reels and tension the tape.

There are models with 15-volt signal levels for discrete components and 5-volt signal levels for integrated circuits. Reading rates are up to 125 characters a second asynchronous. All field offices have demonstrators for your personal evaluation. For full information, contact them or write, wire or phone:



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CIRCLE 123 ON READER CARD

new products ...

tors, under transmitter control, can spot focus and zoom-in on specific areas of the documents being viewed. There is also a unit to produce hard copy at the viewer station.

In operation the monitor operator keys in the code for the document he wants to view. The operator searches the automatic file for it, retrieves it, and inserts it in the transmitter. The viewer then controls focusing and po-



sitioning of the image. The system can be structured for simultaneous viewing by different view stations or single station viewing. Its developers see it as the system for a dynamic file, one with much editing and updating.

The price for a single transmitter and a monitor is \$20,000. File price varies with type and size. DIEBOLD, INC., Canton, Ohio. For information:

CIRCLE 386 ON READER CARD

computer fiche viewer

Among the uses of this microfiche reader is viewing computer-generated fiche. The unit, the 7502, has an 11½x15½-inch screen. Also available are 24x15½-inch and 42x15½-inch screens. All are non-glare, high resolution with a 10° tilt and high/low intensity switch. A self-opening carrier accommodates all standard fiche sizes and aperture card formats. It is now available for \$265. GAF CORP., New York, N.Y. For information:

CIRCLE 388 ON READER CARD

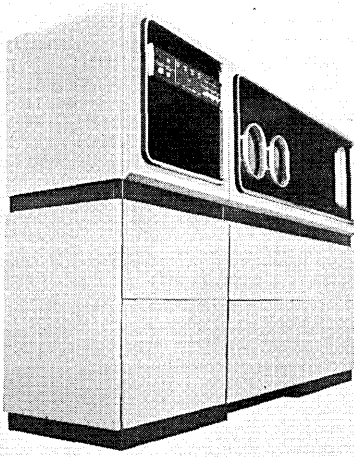
photoplotter

The UNIGRAPH 22 needs no darkroom, special environmental conditions, or expert installation, so it can be located anywhere where the production of PC masters is desired. The system is composed of three modular units, each of which is available separately: the photoplotter, the developer, and an enlarger/printer.

Glass masters are produced on the 6" x 6" x-y table and may be enlarged with a distortion factor of less than 0.01% up to 22" x 22" on either glass or Mylar plate. Artwork production is at speeds of either 3.2 or 6.4 ips. The controller is an 8K Micro Systems 810. Input is via cards, with mag tape

available optionally.

UNIGRAPH 22 is expected to be used most in the manufacture of printed circuits, but will also find applications in architectural drafting, cartography, flow charting, schematic/logic diagrams, LSI-MSI masking, and mechani-



cal drawing. The system can be purchased for \$75K or leased on a three-to-five year plan. UNIVERSAL GRAPHICS, INC., Newport Beach, Calif.

CIRCLE 399 ON READER CARD

small controller

The PDP-14/L is a smaller version of the PDP-14 programmable controller. It is designed to replace electromechanical relays in 20- to 80-relay systems. Inputs, such as push buttons and light switches, can range from 16 to 64, while outputs (solenoids and motor starters) can number between 8 and 64. Memory for the 14/L is 1K of 12-bit word, alterable ROM.

Applications for the unit include machine tool control; control of process machinery in the petrochemical, food, and textile industries; and control of security systems, power and pipeline networks, and traffic signals. First deliveries are set for mid-summer. Price of the PDP-14/L is under \$4,000. DIGITAL EQUIPMENT CORP., Maynard, Mass. For information:

CIRCLE 391 ON READER CARD

microfilm n/c plotting

The Coradicom 330 is a plotting, editing, and verification system for numerical control tapes used in automatic design and drafting. It includes the Ferranti-Packard ADE Microfilm Plotter with a PDP/8-L minicomputer and an ASR 33 tty. The programmable system can output a finished microfilm aperture card positive in one or two minutes, depending on time required for the entire plot, and issue corrected, edited tapes.

The system is intended not only for

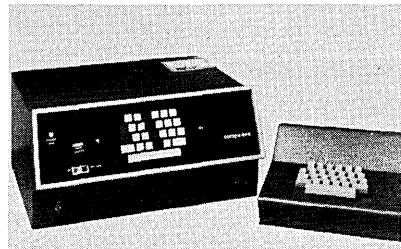
verifying tapes, but also for editing and modifying tapes so that designers of artwork can immediately see their plot developed at a speed of 330 ips and can simultaneously obtain a microfilm hard copy positive for detailed study and verification. The 330 can draw linear, circular, or curve-linear interpolation, as well as plot alphanumeric characters in both upper and lower cases in two sizes. A basic system starts at \$64K and requires 60 days ARO for delivery. FAULCORADI INC., Skaneateles, N.Y. For information:

CIRCLE 392 ON READER CARD

t-s terminal trainer

The Compu-Kee Model 40 series of training terminals simulate the major functions of popular computer terminals, enabling users to train personnel in keyboard and procedural skills without paying for any time. All you've got to do is pay about \$150 per month on a one-year lease of the trainer.

The components of the unit include a program console with a lighted display panel and punched tape reader, and a keyboard. The console and keyboard configurations are changeable for simulation of different terminals.



Keyboard configurations include alphabetic, numeric, and alphanumeric character sets, permitting the Model 40 to be used in the teaching of keypunch, calculator operation, etc. KEE, INC., Baltimore, Md. For information:

CIRCLE 389 ON READER CARD

i/o terminal

The CT-100 i/o terminal, designed for use in digital data acquisition and management networks, has a five-column strip printer and is capable of entry and printout of fixed and variable alphanumeric data and/or query responses with simultaneous printout of alphanumeric data. Both print and send speeds are 10 cps. The communication code is ANSI. The unit has a 12-pushbutton standard telephone touch-tone keyboard; a block alphanumeric keyboard and full ANSI keyboard are options. The CT-100 is selling for \$1200 in OEM quantities. ELECTRONIC ARRAYS, INC., Northridge, Calif. For information:

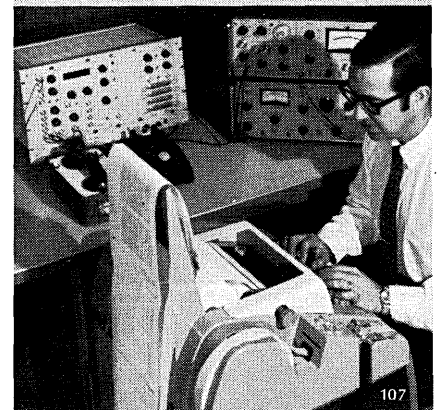
CIRCLE 394 ON READER CARD

Unprecedented Computer Power for the Lab

Harness the full power of interactive time-sharing computers to simplify data recording and speed data analysis with our Model 131 Instrument/Computer Interface System. This new P.A.R. system links your laboratory instruments directly to a remote computer over ordinary phone lines. While your experiment is running, instrument output data is simultaneously fed to the computer where it is reduced, correlated or interpreted. Just seconds later, results are back in your lab!

You can use the Model 131 to process analog or digital data from 1 to as many as 90 similar or different instruments. It also provides an added capability for using the computer to monitor and control experiments, tests and open-loop processes. And the analytical capabilities of certain laboratory instruments can even be extended through the Model 131.

The modularized Model 131 System is easily expanded as your instrumentation and data processing requirements grow. Price of a typical system is less than \$4,500. Teleprinter and acoustic coupler available at nominal extra cost. Complete details are available in P.A.R. Bulletin T-206A. For a copy, write Princeton Applied Research Corporation, Box 565, Princeton, New Jersey 08540, or call (609) 924-6835.



CIRCLE 42 ON READER CARD

WHEN ORDERING PARTS, PLEASE SPECIFY PART NUMBER, PART NAME AND INCLUDE SIZE, CLASS, CODE AND SERIAL NUMBER STAMPED ON DATA PLATE.

MAIN BODY PARTS

PART NO.	PART NAME	MATERIAL	REFERENCE NUMBERS		
			#2	#3	#4
39	NUT	STEEL	26582	26582	26582
40	NUT	STEEL	23194	23194	23194
41	STUFFING BOX STUD	COLD ROLLED ST	22950	22950	22950
42	STUFFING BOX BOLT	STEEL	44867	44867	44867
43	CLAND	STAINLESS STEEL	22948	22949	22949
44	CAP SCREW	STEEL	90080	90080	90080
45	STEM PACKING SET COMPLETE	MOLDED RINGS	23318	23319	23319
47	NUT	STEEL	36760	36760	36770
48	BONNET BRONZE VALVE	CAST BRONZE	28733	29509	29499
48	BONNET IRON VALVE	CAST IRON	28732	29508	29498
49	BONNET GASKET	SHEET PACKING	18527	49654	49655
50	BOLT BRONZE VALVE	STEEL	40210	44880	36530
50	BOLT IRON VALVE	STEEL	28945	33754	36530
51	MAIN BODY SCREWED BRONZE VALVE	CAST BRONZE	47071		
51	MAIN BODY SCREWED IRON VALVE	CAST IRON	47070		
51	MAIN BODY FIG 125 LB IRON VALVE	CAST IRON	47072	36864	36831
51	MAIN BODY FIG 250 LB IRON VALVE	CAST IRON	47073	36863	36830
51	MAIN BODY 150 LB BRONZE VALVE	CAST BRONZE	47074	42898	42900
51	MAIN BODY FIG 300 LB BRONZE VALVE	CAST BRONZE	47075	42899	42910
52	BOTTOM CAP GASKET	SHEET PACKING	18334		
53	CAP SCREW BOTTOM CAP	STEEL	91300		
53	BOLT BOTTOM CAP	STEEL			
53	NUT BOTTOM CAP	STEEL			
56	INNER VALVE V-PORT	STAINLESS STEEL	31242	37455	33374
56	INNER VALVE QUICK OPENING	STAINLESS STEEL	31243	37456	33357
57	SEAT RING V-PORT AND QUICK OPENING	STAINLESS STEEL	29859	31231	31232
58	BOTTOM CAP 150 LB BRONZE VALVE	CAST BRONZE	15744		
58	BOTTOM CAP 300 LB BRONZE VALVE	CAST BRONZE	15744		
58	BOTTOM CAP 125 LB IRON VALVE	CAST IRON	16343		
58	BOTTOM CAP 250 LB IRON VALVE	CAST IRON	16343		
59	INNER VALVE GUIDE BUSHING	STAINLESS STEEL	27042	27043	27043
56	INNER VALVE V-PORT	STAINLESS STEEL	35797	44262	44237
56	INNER VALVE QUICK OPENING	STAINLESS STEEL	40453	44263	44275
57	SEAT RING V-PORT AND QUICK OPENING	STAINLESS STEEL	35796	36523	35517
58	BOTTOM CAP 150 LB BRONZE VALVE	CAST BRONZE	15744		
58	BOTTOM CAP 300 LB BRONZE VALVE	CAST BRONZE	15744		
58	BOTTOM CAP 125 LB IRON VALVE	CAST IRON	16343		
58	BOTTOM CAP 250 LB IRON VALVE	CAST IRON	16343		
59	INNER VALVE GUIDE BUSHING	STAINLESS STEEL	27042	27043	27043
56	INNER VALVE V-PORT	STAINLESS STEEL	28999	32805	37811

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8 1/2" x 11" page

Your printouts.

MAIN BODY PARTS

When ordering parts, please specify part number, part name and include size, class, code and serial number stamped on data plate.

Part No.	Part Name	Material	Reference Numbers		
			No. 2	No. 3	No. 4
39	Nut	Steel	26582	26582	26582
40	Nut	Steel	23194	23194	23194
41	Stuffing box stud	Cold rolled steel	22950	22950	22950
42	Stuffing box bolt	Steel	44867	44867	44867
43	Cland	Stainless Steel	22948	22949	22949
44	Cap screw	Steel	90080	90080	90080
45	Stem packing set complete	Molded rings	23318	23319	23319
47	Nut	Steel	36760	36760	36770
48	Bonnet bronze valve	Cast bronze	28733	28609	29499
48	Bonnet iron valve	Cast iron	28732	29508	29498
49	Bonnet gasket	Sheet packing	18627	49654	49655
50	Bolt bronze valve	Steel	40210	44880	36530
50	Bolt iron valve	Steel	28945	33754	36530
51	Main body screwed bronze valve	Cast bronze	47071	—	—
51	Main body screwed iron valve	Cast iron	47070	—	—
51	Main body fig 125 lb. iron valve	Cast iron	47072	36864	36831
51	Main body fig 250 lb. iron valve	Cast iron	47073	36863	36830
51	Main body 150 lb. bronze valve	Cast bronze	47074	42898	42900
51	Main body fig 300 lb. bronze valve	Cast bronze	47075	42899	42910
52	Bottom cap gasket	Sheet packing	18334	—	—
53	Cap screw bottom cap	Steel	91300	—	—
53	Bolt bottom cap	Steel	—	—	—
53	Nut bottom cap	Steel	—	—	—
56	Inner valve v-port	Stainless steel	31242	37455	33374
56	Inner valve quick opening	Stainless steel	31243	37456	33357
57	Seat ring v-port and quick opening	Stainless steel	29859	31231	31232
58	Bottom cap 150 lb. bronze valve	Cast bronze	15744	—	—
58	Bottom cap 300 lb. bronze valve	Cast bronze	15744	—	—
58	Bottom cap 125 lb. iron valve	Cast iron	16343	—	—
58	Bottom cap 250 lb. iron valve	Cast iron	16343	—	—
59	Inner valve guide bushing	Stainless steel	27042	27043	27043
56	Inner valve v-port	Stainless steel	35797	44262	44237
56	Inner valve quick opening	Stainless steel	40453	44263	44275
57	Seat ring v-port and quick opening	Stainless steel	35796	36523	35517
58	Bottom cap 150 lb. bronze valve	Cast bronze	15744	—	—
58	Bottom cap 300 lb. bronze valve	Cast bronze	15744	—	—
58	Bottom cap 125 lb. iron valve	Cast iron	16343	—	—
58	Bottom cap 250 lb. iron valve	Cast iron	16343	—	—
59	Inner valve guide bushing	Stainless steel	27042	27043	27043
56	Inner valve v-port	Stainless steel	28999	32805	37811

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Computer printouts are amazing for the vast amount of information they provide, the incredible amount of eye-strain they cause and the unbelievable amount of money it costs to duplicate or publish their content.

What this country needs is a good off-line peripheral printer that produces typographic print — in legible, readable, formatted pages, ready for reproduction. In other words, printouts you can read — no matter how many you need.

Introducing the Photon 7700 Typographic Peripheral Printer. Introducing printouts in book-quality typography. Introducing formatted pages on phototypesetting films, papers or offset masters. Introducing, therefore, tremendous savings in the duplication of your computer reports.

The Photon 7700 Printer is magnetic tape driven and comes with a basic software package. It holds and automatically mixes two sizes of two different typeface assortments. Each assortment consists of capital and lower case alphabets, numerics, punctuation and symbols. Average output speed is 300 lines per minute.

You can start saving time, saving money and saving your eyesight with this coupon. Computer Graphics Division, Photon, Inc., Wilmington, Mass. 01887

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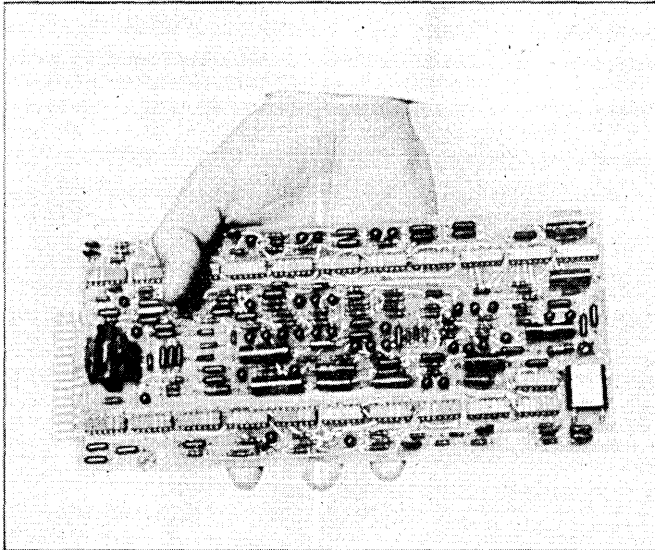
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Address _____

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Tel-Tech Modems

for the communications user



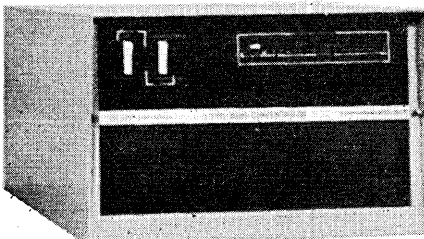
and the OEM design engineer who demand more economy and error-free performance

Now the advanced Tel-Tech digital approach to data set design will solve your data communications problems once and for all.

Tel-Tech's data sets will transmit data flawlessly at speeds ranging from 0 to 2400 bps. They are direct Bell replacements, and their purchase price is as low as \$200 in small OEM lots. Users can buy them and write them off quickly, rather than continue paying high monthly rentals and building up no equity.

Extraordinarily compact and crystal controlled, they require no tuning, tweaking or trimming. Each modem is contained on a single, small PC card (two cards for the 2400 bps model), ideal for integral terminal installations. All modems are available as cards alone, rack-mounted, or in desk-top cabinets.

When you need an economical, error-free modem, check with Tel-Tech. Call or write:

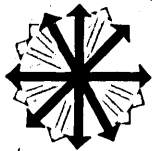


And look into our high-performing new multiplexers, too!
The 38-channel TTC-2000



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new software

program performance

PROGLOOK measures the performance of any user program that can be run under OS/360 MVT, and enables the user to ascertain what action is necessary to improve the performance of the program. The package consists of two programs: PROTIME, written in 360 Assembler F (or G) level, uses the interval timer to catch a picture of any program running under it and records this information in a data set. PROG- PLOT, written in FORTRAN G with 2 Assembler subroutines, accepts the specially formatted data sets and prints summaries of the observations. Working in conjunction with each other, the programs are subject only to the constraint that a task cannot attach more than 254 subtasks. The package consists of 2,000 cards and costs \$275. For further information, the documentation is available in the form of a 23-page bound volume at \$2.50. COSMIC COMPUTER CENTER, Athens, Ga. For information:

CIRCLE 320 ON READER CARD

disc sort/merge

A new sort/merge program offers OS/360 users improved performance for disc sort applications. With the new program, the speed of disc sorts is expected to be 4 to 40% faster than IBM's 483 sort/merge program. The degree of performance improvement depends on the amount of core storage allocated to the task. The new program includes all previous features and options of the 483 sort/merge. It is scheduled to be available this month for \$80 per month under license. IBM, White Plains, N.Y. For information:

CIRCLE 323 ON READER CARD

cdc data management

The Multiple Access Retrieval System, MARS-III, is a generalized data management system that conserves mass storage by requiring only a single data base. It can accommodate up to 60 simultaneous time-sharing users on a Control Data 3300 or 3500 cpu which contains information consolidated from many data files. Data is entered into the files only once and then the MARS-III software system expedites retrieval and display of data as the requests for it are received from the user via an English-like query language.

The MARS-III subsystems—data base

manager, inquiry, multi-access, and data extractor—run as a series of tasks under the Master Operating System, and utilize the paged-memory capabilities of the 3300/3500 systems. This allows the concurrent, multiprogramming features of Master to be utilized in addition to the MARS-III functions.

Hardware requirements are a single 3304-2, 3304-3 or 3514-4 cpu with a minimum of four tape drives. Core of 98K is recommended on-line to permit both the MARS-III functions and batch processing. With 65K core, however, any single MARS-III function can be performed, but with reduced multiprogramming. Price is \$300/mo. plus \$500 installation fee. CONTROL DATA CORP., Minneapolis, Minn. For information:

CIRCLE 321 ON READER CARD

subroutines at \$1 each

XPAK/360 contains more than 40 subroutines which are written in machine language and are callable from FORTRAN or COBOL programs. The routines perform functions that are difficult or expensive to do in the higher level languages, such as moving characters or digits, moving zones, performing arithmetic on packed decimals, Boolean operations, shifting, comparing logical characters or packed decimals, converting EBCDIC to packed decimal, making supervisor calls, setting the program interrupt mask, finding addresses, and storing registers.

The routines can be used on any 360, with the exception of the decimal instruction subroutines which require the decimal instruction machine feature. A guarantee of satisfaction is issued with each set of routines, and a 10% discount on the \$35 total price can be taken for prepaid orders. Parcel post mailing costs less than \$1. At this price, you cannot afford to write your own. SYCOM COMPUTER SYSTEMS, Ann Arbor, Mich. For information:

CIRCLE 322 ON READER CARD

library maintainer

This library creation and maintenance program has been priced at \$380, supposedly in the belief that it will not pay a user to write his own, and that it will not be difficult for him to obtain authorization for the expenditure. The

price should also discourage competitors. The program is called SMR for Store, Maintain, and Retrieve. It allows a user to construct library files from punched cards, alter and update them, and to have them punched or printed at will. SMR also enables resequencing (by 10's or 100's). The program is commanded by control cards of a simple format, and operates on IBM 360 series computers. It is available in either PL/I or COBOL versions. Its creators claim that SMR makes it easy for anyone to follow the history of a card file through multiple updates and to determine what was done to the decks at each step. BVC SYSTEMS SERVICE, San Francisco, Calif. For information:

CIRCLE 324 ON READER CARD

call/360 graphics

The Service Bureau Corp. is offering time-sharing plotting capability for the first time, through its CALL/360: BASIC system. Called MINI-MIS PLOT, or MMPLLOT, the plotting program is part of the regular library, available to users at no extra charge. A ball element typewriter terminal is used. To produce graphics, the user instructs the computer to incorporate MMPLLOT into the program about to be run. He then specifies the physical characteristics of the intended chart. As the program prepares a tabulated report, it also supplies MMPLLOT with the data to be displayed in the graphics.

When the user is ready to plot, he inserts a special high-resolution ball element. The resulting graphics have a resolution of .033 inches both horizontally and vertically, and can print up to 900 dots per square inch. Plot size is a maximum of 13 inches wide and 150 inches high. A command change expands small graphs into larger versions or changes the shape. CALL/360 rates are \$11/hour connect time, \$9/min. cpu time, and \$1.50/month per unit of 3440 characters storage. The minimum charge is \$100/month. THE SERVICE BUREAU CORP., White Plains, N.Y. For information:

CIRCLE 325 ON READER CARD

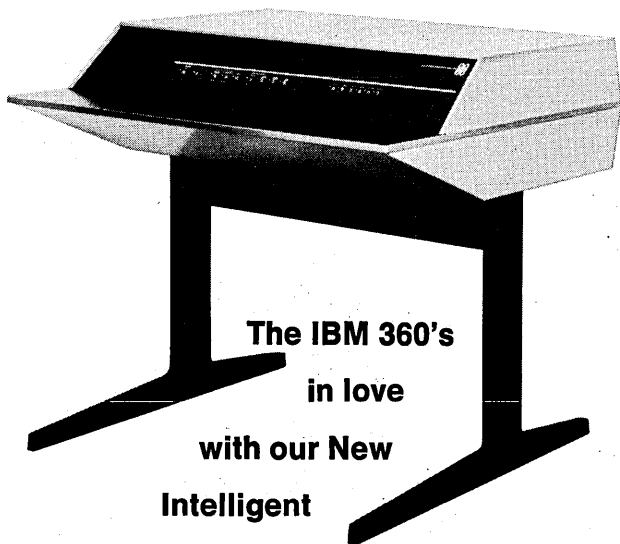
os/360 mvt monitor

SUPERMON enables the OS/360 MVT user to monitor hardware and software performance over a given period of time. It's a software monitor, written in Assembler F (or G) level, and produces a series of reports which aid in the identification of areas of low utilization and performance bottlenecks. Up to 11 reports are generated, followed by a page which summarizes both these reports and the run itself.

Monitoring is performed by counting various events and using a sampling technique which makes it possi-

IBM

SYSTEM 360



The IBM 360's
in love
with our New
Intelligent
Remote Batch Terminal

That's because it will do things that IBM's offspring, the hardwired 2780 won't. To be specific, the M&M intelligent terminal will handle 4800 bits per second with multi-record capability and, on top of that, can run with HASP, which allows the computer center to specify I/O devices at the terminal. But, we're not limited to romancing with the System 360. Our terminal will interface with the UNIVAC 1108, RCA Spectra Series, Control Data 3000 and 6000 series, XDS Sigma Series, General Electric 400 and 600 series, Digital Equipment's PDP 10, plus some less well known names.

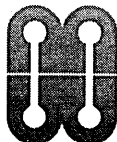
Other charming characteristics include: 2000 bits/sec dial-up and 2400,



4800, 9600 bits/sec leased line, half or full duplex (2 or 4 wire), basic 4Kx16 memory expandable in 4K increments for on-site data processing, EBCDIC, ASCII and Special Codes operator selectable, terminal to terminal communication, interfacing with a wide variety of peripherals which can be added any time without wiring modification and a "swap-out" field maintenance program that virtually eliminates down-time.

It's all wrapped up in a neat package that includes the most wanted features in the \$20,900 basic price at no extra cost!

Call now for details on this beauty.



M&M COMPUTER INDUSTRIES, INC.

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new software ...

ble to obtain a significant amount of performance data with very little additional systems overhead. The basic monitor comes in the form of a box of 3,000 cards at \$310. The documentation is available in the form of a 24-page bound volume at \$2.50. COSMIC COMPUTER CENTER, Athens, Ga. For information:

CIRCLE 326 ON READER CARD

1130 accounting

The last count we saw for the number of IBM 1130's in the world was something in the neighborhood of 4000, and this number seems smaller than it should have been. Whatever the count, this accounting package is headed at a large potential market. Written in FORTRAN using IBM's commercial subroutines, the package includes programs for generating general ledger, income statement, balance sheet, status reports, accounts receivable and payable, time and cost billings, payroll, cost analysis, mailing labels, and journal entries. The system is built for a configuration with at least one disc but adapts to multiple disc or multiple tape and disc configurations. The entire system runs approximately \$20,000, but any module is available separately. LARRY SMITH AND CO., San Francisco, Calif. For information:

CIRCLE 327 ON READER CARD

information management

Complaints about IBM's IMS/360 Information Management System are not rare, and more than one replacement package has been offered. This one, DART-I, claims to do much more than IMS/360 with far less hardware. DART-I operates under OS/360 MFT II or MVT. The system divides the 360's core into a front-end region, one or more on-line message processing regions, and one or more batch regions.

Incoming messages are edited and queued, given a priority rating, then dispatched to the appropriate user message processing program. Written in COBOL or PL/I, those message processors are checked out in a batch region with an on-line environment simulator package which is included with DART-I.

Core savings are claimed to result from replacing IBM access methods (QTAM, BTAM, ISAM, OSAM, and DL/I are eliminated), from dynamic buffering, and from minimizing static control blocks and channel programs. Disc throughput is said to be increased through the use of techniques such as automatic file reorganization and "skip mode" recording. Over-all savings, in

comparison to IMS/360, are claimed to be as much as 350K bytes of core, five 2314's, and 30 hours per week in a large configuration (although any configuration where one could *save* that much would be "giant" and not "large" by most people's standards).

The price of DART-I will be about \$60,000 including support for any four terminal types, 30 man-days of training and consulting, user documentation, and maintenance for three years. After three years, maintenance goes to \$350/month. COMRESS, INC., Rockville, Md. For information:

CIRCLE 328 ON READER CARD

t-s personnel inventory

The Personnel Inventory Program allows immediate access to information regarding personnel throughout a firm's organization. This could include statistical data such as salary, termination, etc., or information regarding the capabilities of individuals. It should be useful in planning manpower allocation and resources in an organization. The PIP package runs on a time-sharing computer, but the vendor is not a t-s service. Rather, you pay \$250 for the installation of the program by the vendor, then pay a rate adjusted according to the charges of the local t-s service you are plugged into. SHARED APPLICATIONS INC., Ann Arbor, Mich. For information:

CIRCLE 329 ON READER CARD

minicomputer basic

This version of the Dartmouth extended BASIC was written for the minicomputer genre rather than for a specific machine, and its vendor offers to tailor a version for the product line of any minicomputer manufacturer. A short special-purpose interpreter adapts the 4K conversational program to the host machine. The resulting compiler lacks the function statement of the full extended BASIC, but has new commands for real time control. Given an 8K memory, the system will adapt to a multi-terminal time-sharing operation. An adapted version of the program runs \$40K. SOFTWARE ASSOCIATES INC., Arcadia, Calif. For information:

CIRCLE 330 ON READER CARD

isam and faster

More replacements for IBM's ISAM and FASTER program products have been developed. The ISAM replacement called AMIGOS, is said to offer all the same features and options of ISAM, but with 50 to 300% faster record retrievals. AMIGOS core requirements are about 9K plus 600 bytes per file, as opposed to 16K and 3K, respectively, for ISAM. Existing programs require

minor modifications to linkages to the access method.

The FASTER substitute, called Hyper-FASTER, provides a "multi-thread" monitor for FASTER, permitting processing of up to 10 transactions concurrently; FASTER processes only one transaction at a time. Hyper-FASTER includes AMIGOS. Core requirements are about the same as a normal FASTER, 60-70K, and present FASTER users will require no additional core. Price of AMIGOS is \$15K for a 10-year license, or \$500 per month lease, plus a \$1500 installation fee. Hyper-FASTER leases for \$1K per month plus \$1.5K installation; installation is included in the \$38K 10-year license arrangement. Leases are cancellable on 90 days' notice. Next IBM targets will be IMS and DL1. COMRESS, Rockville, Md. For information:

CIRCLE 331 ON READER CARD

information management

The Univac 9400 Information Management System (IMS), designed for smaller business firms with information retrieval problems, enables the user to obtain immediate answers to requests for information, display records and reports, and permits him to update records at time of transaction via remote or on-site terminals. Instruction vocabulary is nontechnical, and built-in password security system prevents unauthorized access. The package requires at least 65K bytes of main storage and either three 8411 or two 8414 disc drives. Available this summer, it is free to 9400 users. UNIVAC, Blue Bell, Pa. For information:

CIRCLE 332 ON READER CARD

autocoder to 360

The CONVERT/70 system, which translates IBM/1400 Autocoder programs to 360 assembly language, is now being offered as a software package as well as a service. The program is written in Autocoder, and up to 98% translation in tape system conversions is claimed (disc takes more hand conversion). The \$4800 basic system price includes on-site implementation and training, and an introductory \$25 conversion run of one program through CONVERT/70 is being offered. OCCIDENTAL COMPUTER, Los Angeles, Calif. For information:

CIRCLE 333 ON READER CARD

letter generator

The General Letter Package (GLP) is said to significantly reduce the programming time required to generate personalized computer letters. Via control cards containing data unique to each letter, GLP provides variable information and performs format ad-

new software...

justments. The program is written in assembly language to operate under IBM DOS. A minimum 40K partition is required. Input is through text cards, and output is a tape for a 1403 printer. GLP sells outright for \$5K, and a lease plan is available. PROGRAMMING SCIENCES CORP., Washington, D.C. For information:

CIRCLE 334 ON READER CARD

sales scheduling

Sales-Call is intended to give marketing management the ability to monitor and help schedule the activities of its sales force. Salesmen in the field are notified by computer printout reminders which accounts are to be called on during the next time period. Reminders also contain pertinent information regarding the account. Management, in turn, receives a report of the activity of each salesman, and accounts which have been ignored or not serviced on a timely basis are identified. The package is written in COBOL, requires 32K bytes, and runs on any System/360 Model 30 or larger. It includes documentation and self-customizing features to permit its use in any industry

with either a product or a service for sale. Price is \$1500. SYSTEM IMPLEMENTATION CORP., New York, N.Y. For information:

CIRCLE 335 ON READER CARD

payroll

The new version of the Self-Adapting Payroll System (Aug., '69, p. 176) provides for OS as well as DOS operation and has a multi-tax feature that permits processing of all state taxes and any number of other local and special taxes. Also standard are unlimited deductions and customized labor distribution tapes. The COBOL system operates with a minimum of one disc drive, two tape drives and 48K (the initial version required 64K) of core on any IBM 360/25 and up. The \$11,500 purchase price includes complete source code and listings, user manuals, and operation manuals. OCCIDENTAL COMPUTER, Los Angeles, Calif. For information:

CIRCLE 336 ON READER CARD

network optimization

A communications optimization service aligns I/O devices in a user system in the most economic geographic manner, while concurrently obtaining maximum line utilization. User input is the

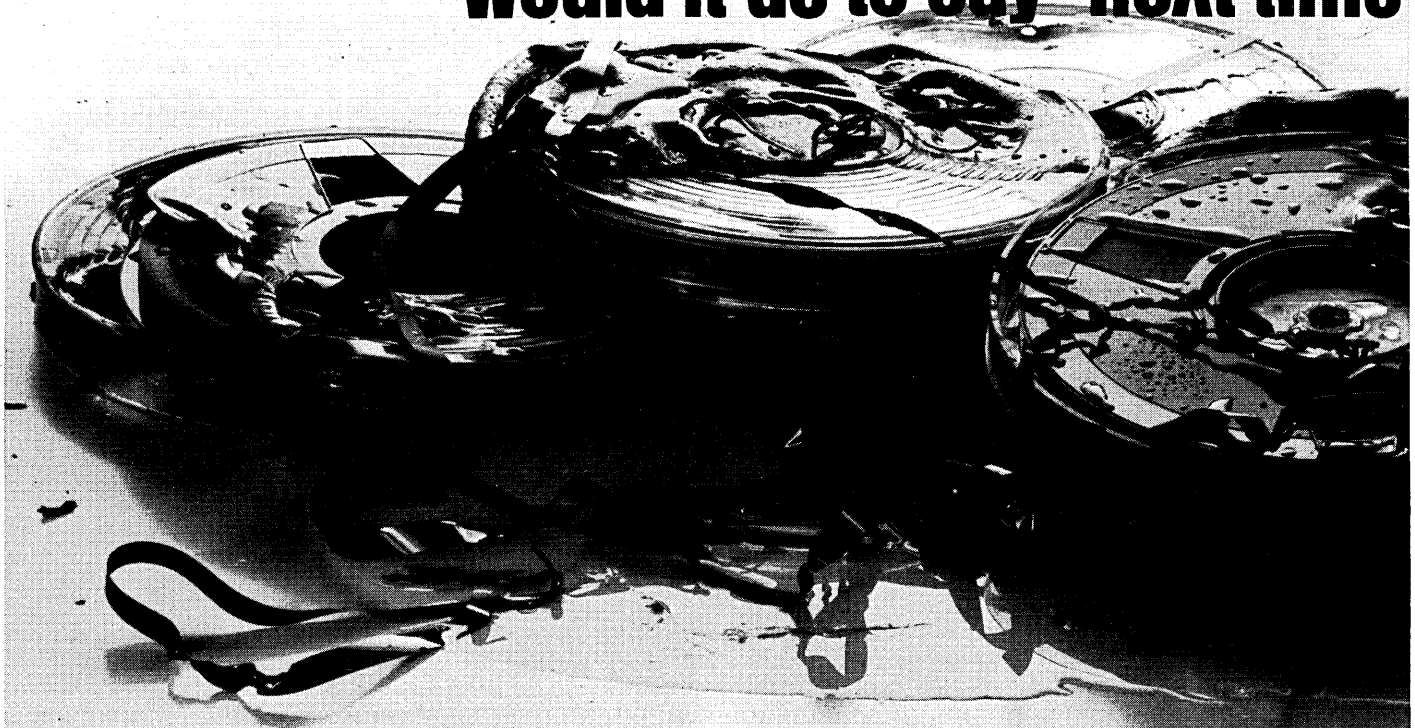
geographic location of the I/O units, the traffic generated and received by each, the type of communication facility used, and the per cent of line utilization desired. The system analyzes the traffic volumes, determines each I/O device's geographic position in relation to the central site and other I/O units, and then aligns the most economically within the limits of traffic capacity for each line. Output consists of a list of I/O points in the order in which they should be aligned. Mileage charges for each line sector and the total cost for each line is also printed. Basic fee is about \$3K, but is variable according to the size of the user system. GCP INDUSTRIES, INC., New York, N.Y. For information:

CIRCLE 338 ON READER CARD

OS communication

OSCAP, an Operating System Communication Program, is designed to provide complete message switching capability in an OS/360 multiprogramming environment. It is said to represent an improvement over IBM's CCAP, while requiring only a fraction of the resource available in System/360, enabling other user application to run concurrently without degradation in performance.

Once your data control center goes up would it do to say "next time



OSCAP provides such functions as message retrieval and relief, header analysis and formatting, and disc queuing and intercept. Messages may be of any length and can be routed to multiple or alternate destinations. Any user designated terminal can act as supervisor and broadcast messages and enquire of the system. Network statistics are kept for printed reports and off-line billing routines.

The system can be expanded or modified to suit user needs, and can be installed in 60 days. Support exists for both switched and leased lines. OSCAP operates under OS/360 MFT or MVT, and requires an IBM 2311 or 2314. Core requirement is a 40K partition for a typical 20-line system containing 50 terminals. Price is \$40K, or \$1500 per month under a minimum one-year lease. COMPLEX SYSTEMS INC., New York, N.Y. For information:

CIRCLE 337 ON READER CARD

back office

The Brokerage Accounting System Elements are a group of programs designed to help brokerages solve back office paperwork problems by calculating the effect of security trading on most key areas of brokerage activities. The programs generate up to 75 reports reflecting status of purchase,

sales, stock records, dividends, transfers, customer statements, and fails. The BASE system input is trade execution data sent from the floor of a stock exchange to the brokerage, or from the firm's order room in the case of ORC trades. This data is punched into cards and input daily. BASE can be used with System/360 Models 30 and up having at least 64K core and operating under DOS. It is scheduled to be available under license in the second quarter of next year at \$800 per month. IBM, White Plains, N.Y. For information:

CIRCLE 339 ON READER CARD

decision table to cobol

DETOC III is the latest version of the DETOC (Dec. '69, p. 235) decision table to COBOL processor. The new system processes both limited and extended entry decision tables, and uses an enhanced shorthand for clarity and ease of modification. A selective objective trace facility enables detection of logic and control errors, and a source language library for the updating and control of source language programs and decision tables is included. DETOC III is available with training, installation, documentation, maintenance, updating, and a warranty against failure. It operates within 65K of any system supporting COBOL or PL/I.

Purchase is \$15,200. INFORMATION SYSTEMS LEASING CORP., Jenkintown, Pa. For information:

CIRCLE 341 ON READER CARD

360/20 dos cobol

The DSI COBOL-2 Compiler for the 360/20 (Nov. '69, p. 433) is now available for DOS as well as tape systems. The DOS version has all the features of the tape version and will support disc I/O fully. For example, files may be organized as indexed, sequential, and direct. It is fully upward compatible with existing IBM COBOL compilers. Minimum core is 16K. Rental is about \$300-\$400 per month on leases running to a total of around \$10K. DECISION SYSTEMS, INC., Paramus, N.J. For information:

CIRCLE 340 ON READER CARD

newspaper business

Reporter, a business system for newspapers and graphic arts firms, processes payrolls, circulation accounting, bills for advertising, and handles accounts payable and general ledger functions. It is available either as a software system or a complete turnkey installation including PDP-8 and associated hardware. All input and output are in simple English statements.

in flames, what good we'll install Fenwal?"



The time to prevent the loss of invaluable records or the ability to process data is now. Today. Before a fire wipes out your computer, payrolls, production control or customer orders.

A Fenwal Fire Suppression System prevents just that. Fenwal, the only producer of explosion suppression systems, uses the same high speed technologies to extinguish fires instantly, safely and cleanly.

Using a variety of sensors, a Fenwal Fire Suppression System can detect and extinguish fires long before other systems begin to react to the flames! Instantly, chemical suppressants knock out the blaze without endangering personnel or causing equipment shutdown. Downtime is eliminated, equipment left clean, your records intact, because the entire area is left dry.

Isn't it time you called in Fenwal to look over your plant? Write today for Fenwal brochure "Engineered High Speed Fire Protection Systems." Fenwal Incorporated, Main Street, Ashland, Mass. 01721.



CIRCLE 189 ON READER CARD

new software...

Prices are about \$35K for software, installation, and training, with hardware running to an additional \$50-100K depending on user requirements. FORDAX CORP., Wellesley Hills, Mass. For information:

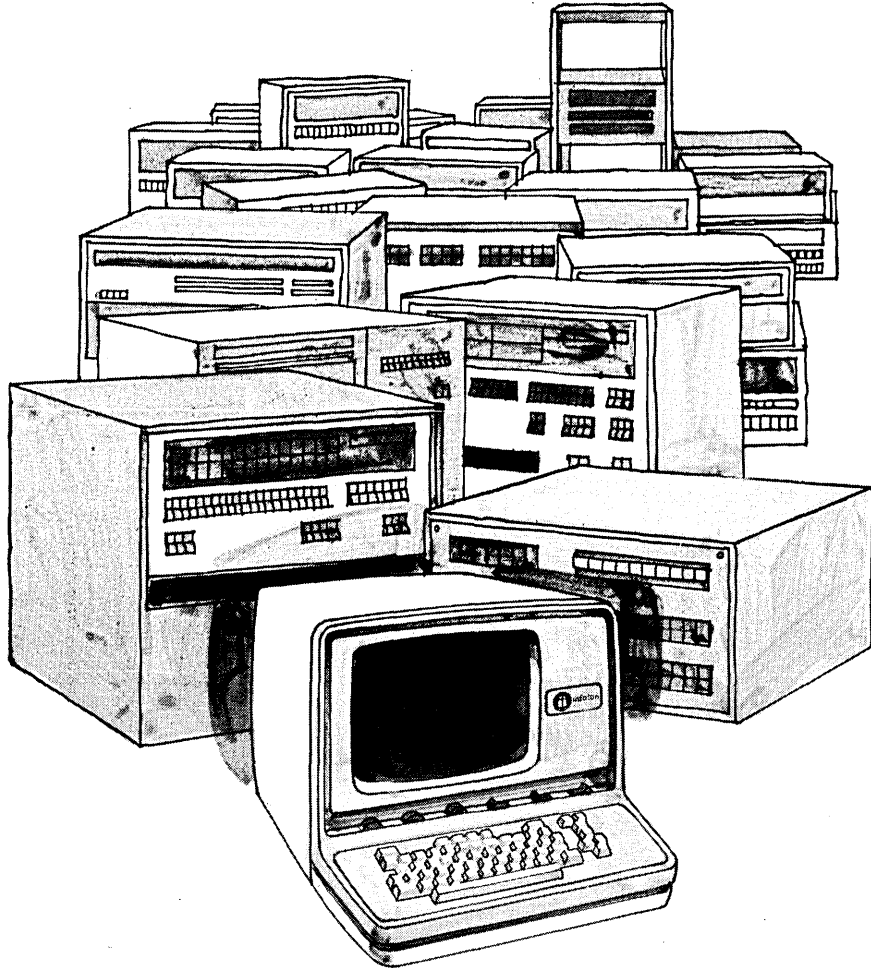
CIRCLE 342 ON READER CARD

data retrieval for t-s

The Shared Applications Information Retrieval program (SHIRT) is for use by time-sharing vendors to provide an economical, user-oriented information

retrieval program. The package uses English language to facilitate use by noncomputer personnel in maintaining a file and retrieving information. Information created from the use of SHIRT may be presented to the user in a listed fashion or in a formatted report. The package is written in FORTRAN, with some assembly language, and will be customized as necessary for any t-s system that supports FORTRAN. Price is \$18K for a perpetual license. SHARED APPLICATIONS INC., Ann Arbor, Mich. For information:

CIRCLE 343 ON READER CARD



Fussy, she ain't.

Vista makes it big with any mini-computer.

Vista is an alphanumeric display terminal that's fast, silent, easy to read. Far more efficient than her ancestor, the KSR-33 teletype. And completely compatible with whatever mini-computer you're using.

A completely self-contained, stand alone unit, Vista comes with keyboard, video presentation, control and refresh electronics, data phone interface and power supply. All keyboard operations, including cursor movement, are transmitted and received permitting software editing. Standard interfaces connect to modems up to 1800 baud. Parallel and current loop interfaces are available as options. Vista is available for immediate delivery, for as little as \$1495.00. For further details, write for our free brochure or call.



Infoton

Infoton Incorporated, Second Avenue, Burlington, Massachusetts 01803 (617) 272-6660
560 San Antonio Road, Palo Alto, California 94306 (415) 493-0615

CIRCLE 196 ON READER CARD

project reporting

TARGET is designed to optimize the use of manpower at edp installations of large corporations. It provides reports by group, project, system, program, and analyst/task. Information provided includes current time and cost data, critical status information, and summary information for each report level. The reports also include programmer and analyst backlog and history information.

An analyst worksheet is generated weekly, documenting the effort expended and remaining on a given project. TARGET is also said to be useful for reporting and monitoring the progress of engineering projects. It is written in COBOL, runs under System/360 DOS, and requires 44K. Three-year lease is \$4500 including documentation. COMPUTER BUSINESS CONSULTANTS, INC., Chicago, Ill. For information:

CIRCLE 344 ON READER CARD

statistical analysis

UNISTAT is an integrated package of FORTRAN IV programs that operate under control of an executive system using one set of control cards. Capabilities include random data generation, data preparation, plotting and tabulation, correlation analysis, linear regression analysis, multivariate and univariate analysis, multivariate variance analysis, nonlinear estimation, nonparametric analysis, variable reduction operations, and matrix operations. Blank modules are provided for future expansion.

UNISTAT can run on any moderately large-scale system with a FORTRAN compiler. For example, a typical minimum configuration on IBM equipment would be a 32K 360/40 with six I/O units. The \$15K one-time lease price includes installation comprising program checkout on the user's machine, on-site training courses for analysts and operators, manuals, and guaranteed maintenance service. A monthly rental plan is also available. UNIVERSITY SOFTWARE SYSTEMS, Los Angeles, Calif. For information:

CIRCLE 345 ON READER CARD

check spelling routine

Pro-Check is a routine which translates numeric amounts to alphabetic for spelling out the amounts on checks. For example, \$17,543.18 becomes SEVENTEEN THOUSAND FIVE HUNDRED FORTY THREE AND-18/100. The user inserts the routine in any program entering the numeric amount to a fixed field, performs the routine, and receives the translated amount from another fixed area ready to be moved into his print line. It is written in

COBOL and is intended for the System/360, on which it can also be inserted into an assembly language program. Maximum line print size is 60 characters, and up to \$99,999.99 can be translated. \$225 (TWO HUNDRED TWENTY FIVE) gets you the cards, documentation, and instructions in the mail. SCORPIO DATA SYSTEMS INC., Tallman, N.Y. For information:

CIRCLE 346 ON READER CARD

contractor bids

The Construction Estimating Program enables the IBM 1130 to produce a summary of cost estimates for an entire building project as well as any of hundreds of separate cost factors involving labor, material, and equipment. In a typical application, the contractor would assign a unit cost to the work factors and enter the information into the computer along with information on the construction project's specifications. The computer will calculate and print out estimated building costs enabling the contractor to make a more accurate bid on a particular project. The program utilizes information from the Associated General Contractor Manual's Standard Divisional Coding System. It is written in FORTRAN, requires 8K, and will be available next month at \$50/month under license. IBM, White Plains, N.Y. For information:

CIRCLE 347 ON READER CARD

paper tape editor

Paper tapes for the Varian 620i can now be edited only one line at a time using the CORRECT program, this vendor states, but with the addition of EDIT a user will be able to alter taped information in large blocks. EDIT can operate on a machine with only 4K of memory, but can also take advantage of larger systems. In a 4K machine, the program will read in and operate on about 4000 characters. The program allows for adding to or deleting or altering or displaying (typing out) any line of text in core, then provides for typing the corrected text or having it punched on tape. Features include a string mode search and two operating modes, command (for typing, punching, and clearing buffers, etc.) and text (for entering data). The EDIT program is marketed for \$200. SYSTEMS RESEARCH LABORATORIES, INC., Dayton, Ohio. For information:

CIRCLE 348 ON READER CARD

architects' abacus

Designed for use by architects, ABACUS is useful in budgeting expenses and controlling costs. It evaluates the fiscal status of each job an architectural firm has in progress. Reports provide current and accumulated expenses, broken down and assigned to categories

covering such aspects of jobs as projected costs and actual expenses for labor, direct job, and out-of-pocket expenses. It is written in BAL and runs on System/360's with minimum 32K core. ABACUS was developed by Professional Dynamics Corp. and is being marketed at \$5K. NATIONAL SOFTWARE EXCHANGE, Great Neck, N.Y. For information:

CIRCLE 349 ON READER CARD

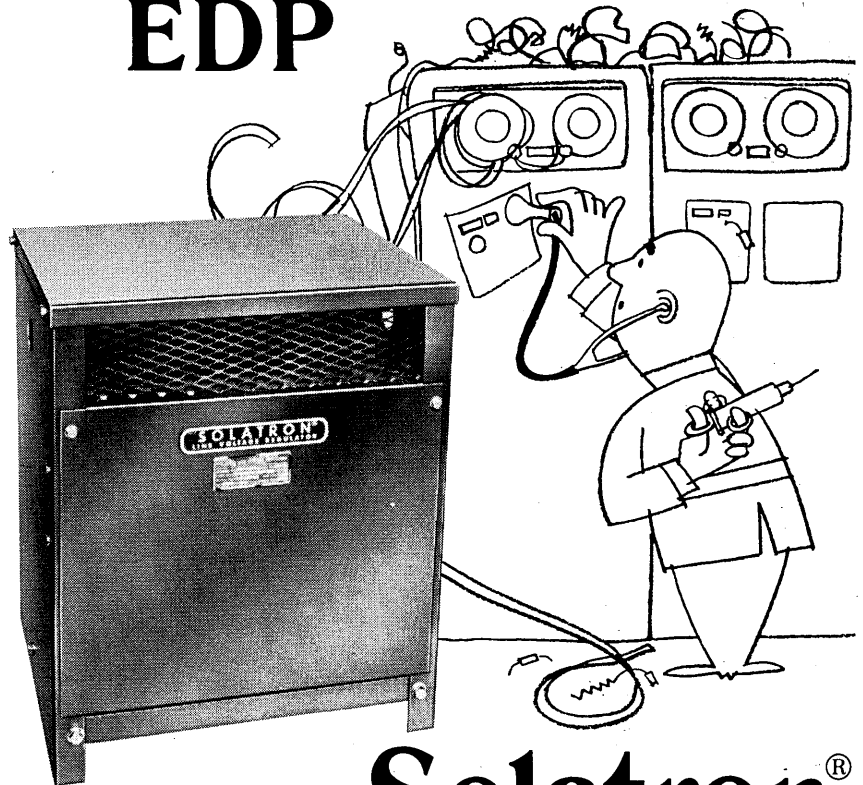
md's billing for s-b's

This system is for service bureaus who want to provide billing and accounts receivable services for physicians, den-

tists, and veterinarians. Billing statements are produced monthly. Automatic dunning is available. Input data can be edited and captured at any time, and any or all doctors may be processed on each run. Reports produced tell which patients are delinquent, which services are producing the most income, what the trend is in collections, etc. The system is written in COBOL, and runs on System/360 with minimum 20K core and four tapes. Price is \$6200. THE COMPUTER GENERATION, INC., Atlanta, Ga. For information:

CIRCLE 351 ON READER CARD

R& for Up Tight EDP



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Suffering from digit drops? Parity loss? Losing your mind over sick components and damaged circuit cards... not to mention total memory loss?

The symptoms show... *You've been exposed to input voltage dips and surges!*

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system spotlight

information for
this series is invited
applications submitted must
be installed and operational

LOS ANGELES POLICE DEPARTMENT AUTOMATED WANT/WARRANT SYSTEM

message switching

It was harder to get arrested in Los Angeles a few years ago, even though the L.A. Police Department had several hundred thousand outstanding warrants and wanted person entries on file. The problem was that these warrants and "wants" had to be accessed manually, and this process could take 15 minutes or even more in unusual circumstances. The system worked well enough that important criminals were apprehended. But because police officers in the field were understandably reluctant to hold persons in their cars or standing on a side-walk somewhere for an extended time—often to find out they were "clean"—many warrants were never served. So the files got larger, the searches took longer, and the officers became even more reluctant to detain people they stopped.

The problem is now being cleared up with a computer-based message switching and data retrieval system called the Automated Want/Warrant System. Using AWWS, the average response time to an inquiry from the field has fallen well under 10 seconds. In addition, or because of this, the number of arrests made on outstanding warrants in the first quarter of 1970 was over 75% more than the first quarter of last year.

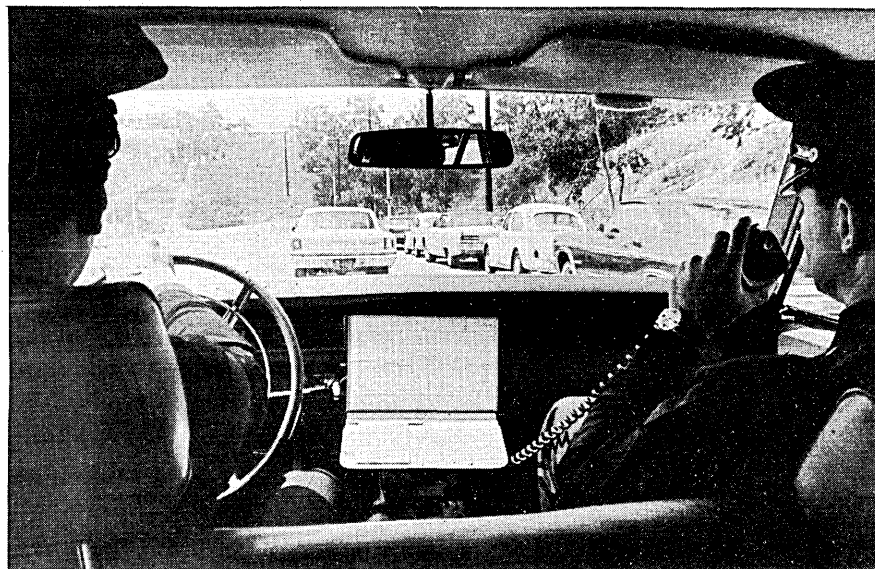
computers and peripherals

Two SEI 800 Data Editors with 16K
(16-bit) words of core storage;

1.8 usec cycle time
Two SEI 810 Data Interfaces
20 SEI 820 Control Units
Two SEI 892 Drum Storage Units (one
million characters; 8.5 msec
access time)
plus 52 Model 835 crt terminals, 48
lines to teletypewriter terminals,
and interfaces to four other computer
systems.

Recently a patrol car in Los Angeles

stopped a car for a traffic violation and before the citation was written the car's driver was arrested and taken to jail for having 45 outstanding parking tickets against his record. The arresting officers had run a routine check on the man and on his license plate number using the AWWS system. They were notified within seconds of the backlog of tickets, and by the time they brought their man to the nearest sta-



AWWS gives LAPD officers in the field access to data banks maintained in Los Angeles, Sacramento, and Washington, D.C., and runs a "want" or license number check in seconds.

tion a warrant for his arrest was waiting for him.

Checking the driver's record was an easy process. The officers gave his name and description and driver's license data to an AWWs operator at the LAPD Communications Radio Room. The operator entered these through the keyboard of a Scantlin Electronics crt terminal, and the data was matched against warrants on file at the L.A. City Data Service Bureau's IBM 360/50 installation.

When such a match is found in the 360/50's files, the following information appears on the operator's crt: warning information for officer safety (how dangerous is the man), number of want/warrants pending against him, level of crime for the warrants (misdemeanor or felony), and a list of wants or warrants for lesser offenses on file against the suspect.

The officers could have gone farther. They could have checked his license plate against stolen vehicle listings kept on the California Highway Patrol's IBM 7740 in Sacramento, his driver's license and plate number against the driver and vehicle registration files on the Department of Motor Vehicles' RCA 70/45 in Sacramento, and both him and his vehicle against the 360/30-based wanted person and stolen vehicles files kept by the National Crime Information Center in Washington, D.C.

The ticket-dodger had tangled with a message switching and data retrieval system that not only involved the four computer centers mentioned but also the L.A. County and L.A. City Western Electric FAST (Fully Automated Switching Teletype) networks which reach to 47 associated law enforcement agencies in the greater Los Angeles area. (Given a little more time to get on-line, AWWs may also be connected to the L.A. County Justice Data Center's 360/50 for access to booking procedures and to the California Law Enforcement Telecommunications System through an RCA 70/-55.)

AWWs follows the suspect beyond arrest. When a man is booked and processed, the booking information is sent to the agency's records division where a search based on fingerprints is made. If an arrest record is found, any aliases or AKA (also known as) names which the suspect may have used are also checked against the AWWs files, and any matches that are found are transmitted to the concerned jail facility. Whether or not additional matches are found, the warrant record on file is updated with the individual's booking number, name, and warrant number, and that record is locked from further inquiries.

hardware

The Scantlin Data Editors tie the system together, acting as coordinators for the activities of the other parts of the system, storing input formats for use as required by the display station operators, buffering, and providing editing and updating facilities. (Oddly, because the LAPD is restricted by law to using existing city computing facilities and cannot have its own computers, AWWs was built around the general purpose, 16-bit "Data Editor" instead.)

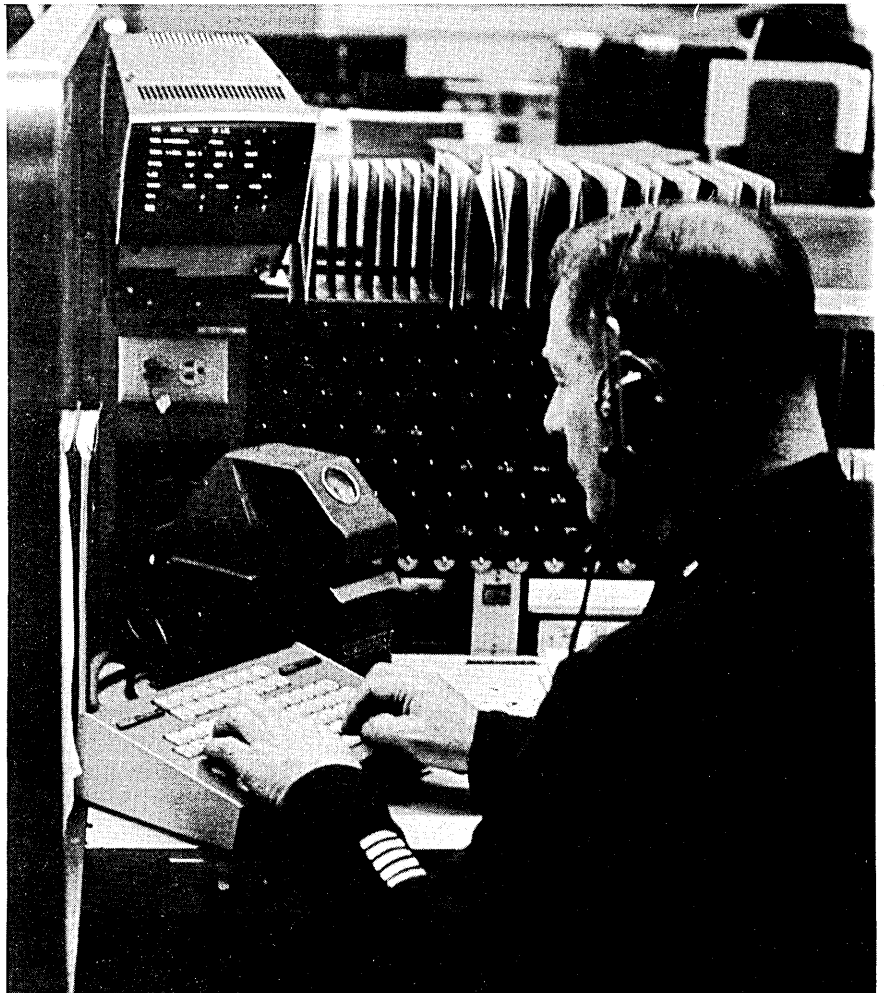
The system uses redundant configurations consisting of one Model 800 Data Editor, one Model 810 Data Interface, and one Model 892 drum each. The 810's provide 16 group monitors with eight communications line terminators each; they in turn connect to the Model 820 controllers. The 20 controllers, which can be switched between processors, link to the incoming lines, which presently tie in some 52 crt's and 48 tty's at speeds ranging from 75 baud to 2400 baud.

Since a number of data bases already existed when AWWs was proposed, the method of interconnection to the computers followed the rule that

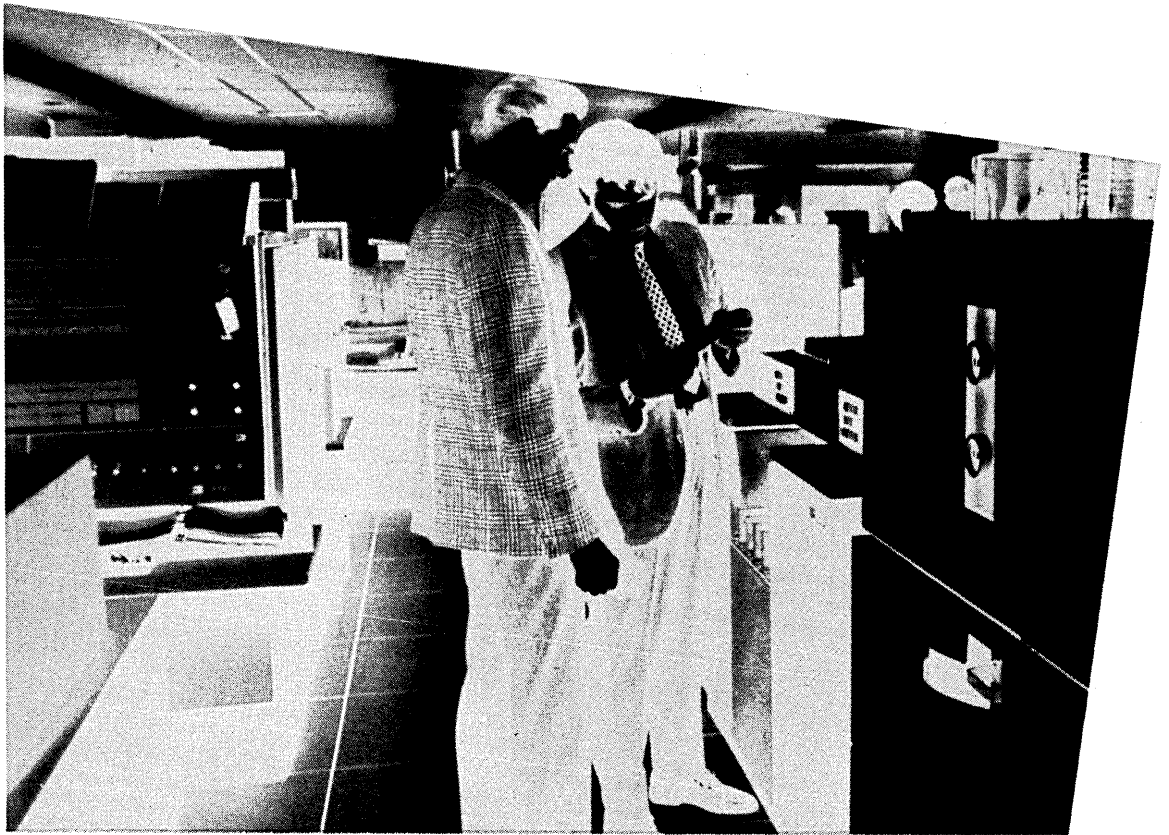
the Scantlin Data Editor would operate as though it were a terminal supported by the host computer's software. Thus, in communicating with the IBM 360 systems, the Data Editor looks like an IBM 2260 crt operating through an IBM 2848 Control Unit. To the RCA systems, the Editor looks like an RCA 720 Video Terminal. To the California Highway Patrol IBM 7740, the 800 appears as an 83B2 Teletype terminal. In interfacing to the FAST tty networks, it looks like multiple teleprinters.

Standard EIA interfaces were used in all cases, so it was unnecessary to build special interface stunt boxes or to modify existing computer programs like IBM's BTAM.

There are some 30 major routines in the software set, many with multiple subroutines. Written in Scantlin's assembly language, SASS, the code comprises about 48,000 instructions. Its design goal was instantaneous response, and therefore a good deal of drum/core swapping goes on. The swapping is facilitated through the use of a complex set of terminal logic states and routines for dynamically allocating core and drum space. ■



There are 52 crt terminals in the automated want/warrant system at present, but the number grows rapidly as more law enforcement agencies are tied in.



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Now, for the first time, there's a way to monitor total system performance.

Our new X-RAY enables you to "see inside" your computer system to determine operating efficiency and to pinpoint ways to dramatically improve performance and reduce costs.

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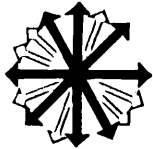
X-RAY is available under purchase, lease, or service plan. To find out how X-RAY can improve your operations (actually pay for itself many times over), contact us for more information.

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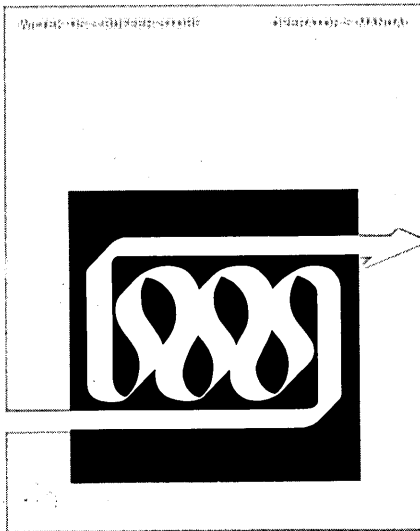
CIRCLE 128 ON READER CARD

DATAMATION



new literature

FOR BUFFER BUFFS: Eight pages of fold-out describe and tell how to operate a single unit for on-line storage, buffering and data rate conversion. Independent tape drives are provided for an input write mechanism and an output read mechanism, with double-sprocketed 16mm mag tape temporarily stored between them (the storage bin can hold 50 feet). Read and write capability runs to 333 eight-bit char-



acters/sec and storage to 50K characters. The ns-3 unit is assembled in four replaceable modules: chassis, tape transport, power supply and electronics. Dimensions are about 20 sq." x 5" high. Functions are diagrammed, and full specs are listed on end page. WILTEK, INC., Wilton, Conn. For copy:

CIRCLE 300 ON READER CARD

A REAL CASE: While aids for students who want to be computer-matched to their ideal college have been well publicized, this four-page brochure describes an aid to the college admissions office. Ominously entitled *A Case Study of a Potential Reject*, it details the College Application Statistical Evaluation system for compiling comparative data on would-be students and shaking out the more gravelly applicants, eliminating paperwork and red tape just in time for the summer crunch. Data is summed up in pertinent report formats, and the system is supposed to be flexible enough for institutions with wide diversities. It is

already operational in Massachusetts colleges and reportedly will soon be used in other parts of New England. PHI COMPUTER SERVICES, INC., Arlington, Mass. For copy:

CIRCLE 302 ON READER CARD

EXPORT PACKET: A non-profit, worldwide trade organization is offering information packet on overseas representation for software, computers, peripheral equipment, as well as more generalized literature on export/import, licensing, and joint ventures. The organization also furnishes its own current periodical, describing its activities and benefits. THE INTERNATIONAL EXPORT ASSOCIATION, London, England. For packet:

CIRCLE 301 ON READER CARD

VEGAS BLACKJACKED: Computer-verified system for winning at the 21 tables in Las Vegas is offered by its originator, who now is barred from playing that game in that town's casinos. The inventor, formerly a computer programmer and stock market analyst, says the system is so simple a grade-school child could use it, even in a four-deck game. Calculations are not involved. GOLDBERG COMPUTER SYSTEMS, Hollywood, Calif. For sample:

CIRCLE 303 ON READER CARD

NUCLEAR COMPUTING: The 652-page proceedings have been published on the Skytop, Pa., conference on computer systems in experimental nuclear physics held in March, with Columbia University and the Atomic Energy Commission participating. CONF-69031. Price: \$3; microfiche, \$.65. CLEARINGHOUSE, U.S. DEPT. OF COMMERCE, Springfield, Va. 22151.

PLOTTING A SCRAPBOOK: Plotting and regular teletyping are combined in data terminal described in 30-page "scrapbook" with illustrations of various graphological "Typagrams," including voltage and phase angle vs. frequency, polynomial and cycloid plots, as well as management graphs for gross margin, cost of sales and pre-tax profits as a percentage of sales, break-even analysis for manufacturing

operation, and percentage of investment in various categories. Reportedly, these Typagrams can be produced in less than three minutes by remote t-s computer. TYPAGRAPH CORP., San Diego, Calif. For copy:

CIRCLE 307 ON READER CARD

\$2 CODASYL COBOL MANUAL: If you can't afford an ANSI manual, there's recourse to the new CODASYL COBOL '69 manual, published in limited quantities by the Canadian government. If you want one, hurry—last year's edition went quickly. CANADIAN GOVERNMENT SPECIFICATION BOARD, Ottawa, Ont. For information:

CIRCLE 306 ON READER CARD

PAPER PARADE: More than 300 data communications paper products — "rolled and folded"—are listed in supplies catalog comprised of four sections, each with a buyer's guide that describes product characteristics and recommended uses. Appended market surveys also inform the buyer what specific equipment is currently utilizing what items. In addition, the catalog details a complete line of perforator tape handlers also available. PERFECTION PAPER MANUFACTURERS CO., Philadelphia, Pa. For copy:

CIRCLE 304 ON READER CARD

VOLUME BY MINI: A minicomputer designed for measuring volumetric efficiency and horsepower is described in eight-page brochure that gives details on the equipment and its operation. The computer can be used in the field (its present application is at cross-country gas line pumping stations); no data translation is required, but printed data is produced for later analysis. Diagram plotters or paper tape punch are optional. ANN ARBOR COMPUTER CORP., Ann Arbor, Mich. For copy:

CIRCLE 305 ON READER CARD

FIXER-UPPER: A four-page brochure designed for "retailers who would rather be in the retail business than the computer business" explains how specific

A dirty tape can put a computer down.

Depressing. Dirty tape causes data dropouts. And dropouts cost you money. That's a bad scene.

RCA Computer Tape helps keep computers up.

It's a special formulation that

starts cleaner. Every inch of every reel is tested and certified in the cleanest of white-room conditions. (No statistical testing for us.)

And it stays cleaner, longer.

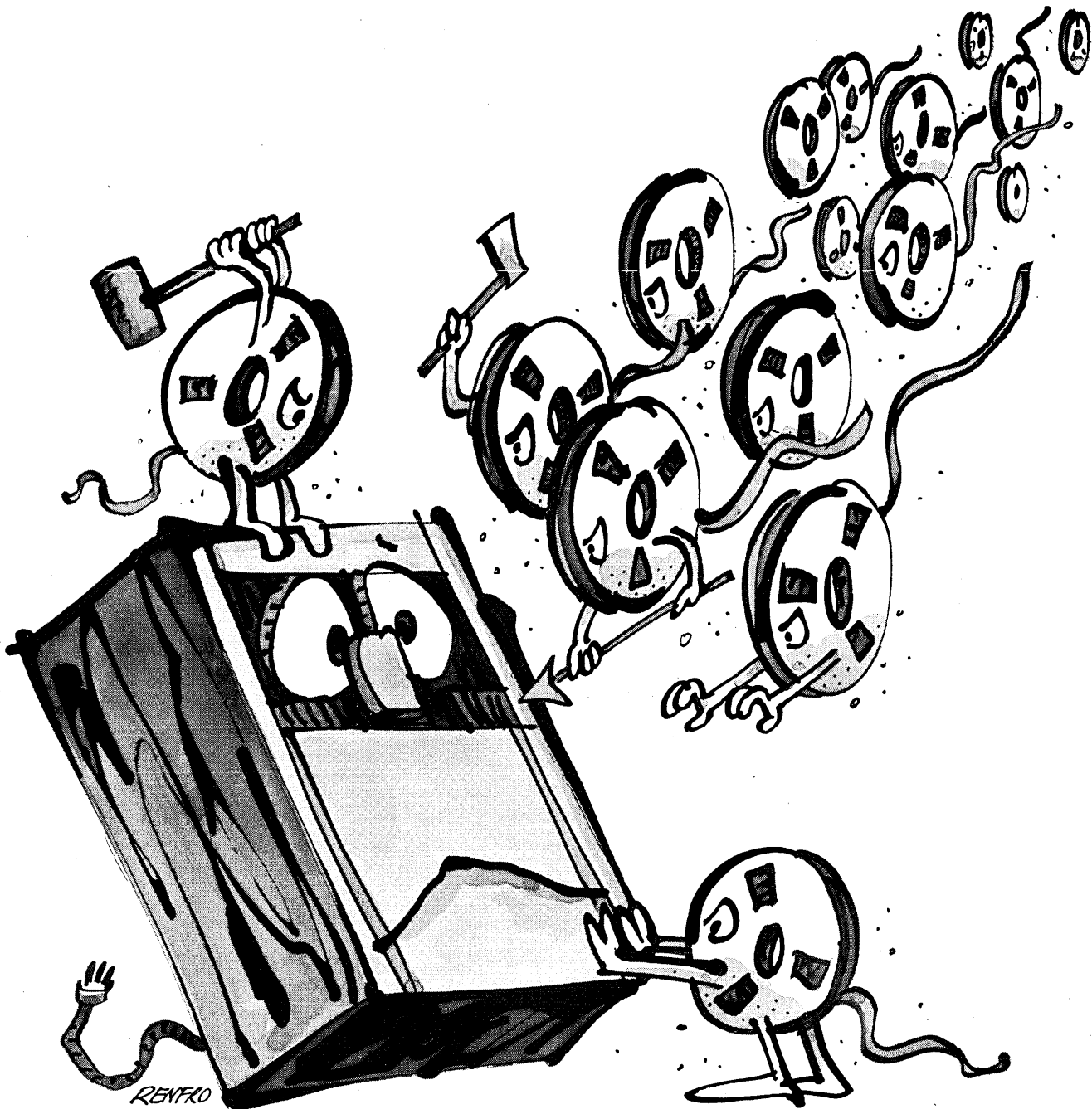
Result? Fewer dropouts, more

efficient computing.

Show your computer what a good scene really is. Write RCA Magnetic Products, 201 E. 50th St., New York 10022.

Our tape makes it.

RCA Computer Tape



new literature ...

dp applications can be made for individual retail businesses in data collection, sales analysis merchandise/inventory control, accounts receivable, sales audit, accounts payable/vendor analysis, payroll, general ledger, personnel assignment and delivery scheduling. Development of new hardware/software, proprietary packages, and even nuclear science, is included. **SCIENTIFIC RESOURCES CORP.**, Montgomeryville, Pa. For copy:

CIRCLE 309 ON READER CARD

ANOTHER LANGUAGE: Conversational language for engineering applications, called **FOCAL**, is detailed in 32-page pamphlet. **FOCAL** is used with small computers to solve square roots, sinusoidal expressions, and series evaluation. **DIGITAL EQUIPMENT CORP.**, Maynard, Mass. For copy:

CIRCLE 308 ON READER CARD

STANDARDS HIGHLIGHTS: Activities of the National Bureau of Standards from July '68 through June '69 are contained in 243-page paperback that includes an account of those at the Center for Computer Sciences and Technology, as well as the history of the program at that division of NBS. A report on the metric system study is given, and another section of the booklet deals with developments in various fields at the Institute for Applied Technology. Appendices list NBS organization, staff, research associates and advisory committees. **NBS SP-325**. Price: \$1.25. **CLEARINGHOUSE FOR FEDERAL SCIENTIFIC AND TECHNICAL INFORMATION**, Springfield, Va. 22151.

ARE YOU TRANSPORTED? Four-page brochure itemizes line of IBM-compatible read/write tape transports in different reel sizes, which can accept asynchronous data rates to 300 characters/sec and continuous to 1000/sec. Incremental recording at the latter rate is also standard in some models, as well as bi-directional continuous speeds of 12½ to 25 inches/sec. All specs are given. **CIPHER DATA PRODUCTS**, San Diego, Calif. For copy:

CIRCLE 310 ON READER CARD

HEARTBEATS: Use of computerized electrocardiogram (EKG) data is announced in four-page brochure describing its collection, transmission and

analysis for mass screening. A central computer compiles the information from remote terminals within 24 hours. The system is based on U.S. Public Health Service research to establish test patterns and interpretive criteria. **BIOMETRIC SYSTEMS, INC.**, Jericho, N.Y. For copy:

CIRCLE 311 ON READER CARD

APPLYING APL: 16-page condensed manual gives the basic rules and regulations governing APL, and applications of the general purpose language. Samples of usual routines are included, with a summary of system commands, standard keyboard operators, mixed and hybrid functions. Successive steps take the operator from connection to signing off, all with illustrations. **INDUSTRIAL COMPUTER SYSTEMS, INC.**, New York, N.Y. For copy:

CIRCLE 312 ON READER CARD

MARKET MODELS: A system for predicting product sales potential is described in *Premart*, 16-page booklet that delves into mathematical techniques for simulation after the relevant preliminary surveys have been outlined. Variables in both survey questioning and final calculations in the problem model are taken into account. Data in-

put then incorporates the standard and more left-field considerations, with proportionate assigned values. **RESOURCE MANAGEMENT CORP.**, Bethesda, Md. For copy:

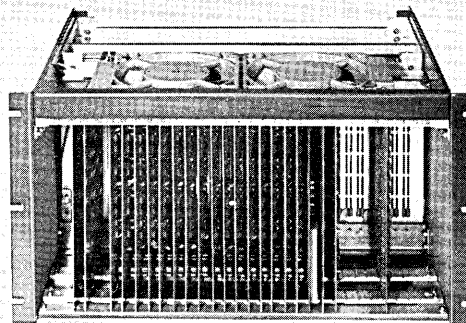
CIRCLE 313 ON READER CARD

VARIABLE SHIFTS: 11 pages of application notes describe MOS integrated circuit shift registers, electronically variable from 1 to 64 bits, allowing the user to select, or change, the length of the register without changing leads on the input or output. The notes discuss clock options, power dissipation, interfacing, and a test circuit, with application examples. **ELECTRONIC ARRAYS, INC.**, Mountain View, Calif. For copy:

CIRCLE 314 ON READER CARD

COMPATIBLE DATA: Full duplex FM transmission of synchronous serial binary data is described in 24-page operations booklet on **VA300** sets (Bell 103A type). Speeds are from 0 to 300 bits/sec over switched or direct dial telephone network. Illustrative procedural charts are plentiful throughout. Parameters for measuring error and different types of distortion are furnished, with setups for performance

What Memory-System Maker Is Speeding Up the Cycle Time— But Holding Down the Price?



HS500R

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Beef up your technology with Toko's 500 nanoseconds Memory System without raising your costs.

Now rolling off the production line, Toko's HS500R Memory System offers the following key features:

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CIRCLE 183 ON READER CARD.

computer & control abstracts

An INSPEC Publication
The Institution of
Electrical Engineers
The Institution of Electrical
Electronics Engineers, Inc.

APRIL 1970

ABSTRACTS 8117-8680



COMPUTER & CONTROL ABSTRACTS FROM IEEE

Computer science and electrical engineering are related—sure. But even as kissin' cousins, their personalities are very different.

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CIRCLE 130 ON READER CARD

new literature ...

testing and laboratory evaluations. VADIC CORP., Palo Alto, Calif. For copy:

CIRCLE 315 ON READER CARD

READY RATES: Reference guide gives private wire data communications rates between 40 major U.S. population centers, in 1600 combinations. The scheduled rates are according to tariff, both type 3002 voice-grade, and type 1006 teletyper. Price, \$1. CENTER FOR COMMUNICATIONS MANAGEMENT, 67 South Franklin Turnpike, Ramsey, N.J. 07446.

MANAGEMENT AND MIS: 11-page reprint of "Training Management for MIS," speech given in March to the central New York chapter of ASM, highlights the problems caused by lack of proper management involvement in the development of its own information systems; the advantages of management involvement; and procedures to be followed in the initiation, development, and implementation of MIS. BARNETT DATA SYSTEMS, Rockville, Md. For copy:

CIRCLE 316 ON READER CARD

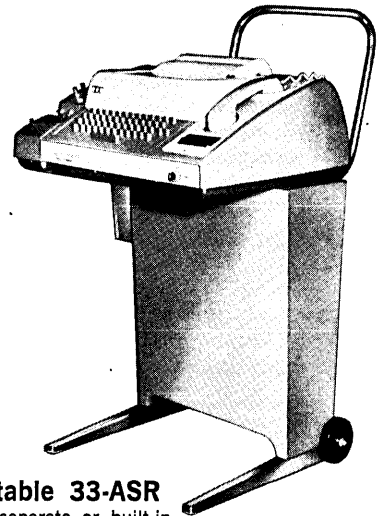
GLASS MEMORIES: Four-page applications note describes glass digital memory modules developed for use in buffers and how they are arranged for different configurations. Addressing techniques are explained and diagrammed, including continuous data input, nonsynchronous and synchronous random word rates, and parallel channel operation. How to interconnect modules for greater performance is also covered. CORNING GLASS WORKS, Corning, N.Y. For copy:

CIRCLE 317 ON READER CARD

PROGRAMMER'S PROGRAM: 12-page announcement and study guide contains information on the examination for Registered Business Programmer to be given Oct. 10 by DPMA, also contains an application form that must be filed by August 1. The reasons necessitating the exam and the scope of its questions (150, taking approximately 2½ hours to answer) are detailed, and the 92 test centers (plus 13 in Canada) are listed. DPMA 505 Busse Highway, Park Ridge, Ill. 60068.

KEEP CONTROL: Three illustrated bulletins (24 pages aggregate) describe software, programmer's console pro-

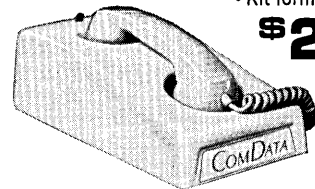
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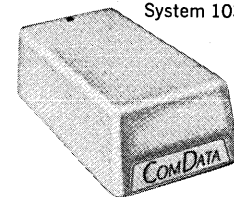
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CIRCLE 161 ON READER CARD

DATAMATION

gram, and formatter for Prodac mini-computer that was introduced last year for process control and might be used by the manufacturer in future for more general purpose applications. Software includes task executive call, i/o control system with read routine and write initiate routine. Programmer's console describes minimum and basic console configurations, with 11 extendible options. The formatter is a set of FORTRAN software routines. WESTINGHOUSE ELECTRIC CORP., Pittsburgh, Pa. For copy:

CIRCLE 318 ON READER CARD

KEEP MOVING: Handsome 26-page, full color illustrated, diagrammed, glassine-windowed brochure presents transit ideas devised with the help of computer simulation for use through, in, and around cities, and at airports, shopping centers, industrial complexes, educational facilities and other institutions. Current projects are depicted, including San Francisco's much-vaunted BART (Bay Area Rapid Transit). The modular parts of mobility systems—traction and vehicle—are detailed, along with controls (including Prodac, see above) and communications. WESTINGHOUSE ELECTRIC CORP., Pittsburgh, Pa.

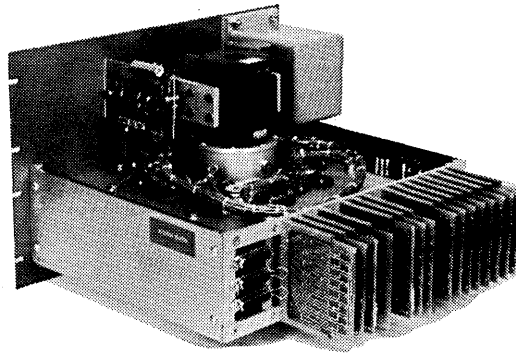
MODULAR MONITOR: A data communications monitor that accommodates all line-coordination systems is described in bulletin sheet explaining the operation of its four units: remote connection, line selection, control, and printing. The monitor can function with either synchronous or start-stop transmissions, provides a hard copy record of every character that appears on the data link in all codes, and handles speeds up to 7200 bps. SPECTRON CORP., Cherry Hill, N.J. For copy:

CIRCLE 319 ON READER CARD

FOUR-IN-ONE: Four brochures with four pages each describe four different data entry and retrieval systems devised with the use of Message-Composer. The titles: *A System for Receiving/Inspection*, *Daily Attendance Reporting System*, *Inventory Control Data Collection System*, and *Job Reporting Data Collection System*. Problems encountered in these tasks are covered, with solutions. NORTH ELECTRIC CO., Galion, Ohio. For copy:

CIRCLE 299 ON READER CARD

Save \$1000 or more right now on a quality disc memory with head lifters.



Our model 10128 magnetic disc memory will give you inexpensive mass storage.

- Up to 4,000,000 bits
- 8.4 milliseconds average access time
- Head lifters to eliminate disc contact starts and stops
- Sealed construction
- Choice of interfaces

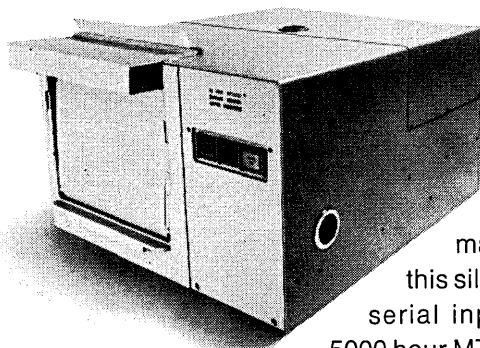


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CIRCLE 67 ON READER CARD

Nothing can print so much so fast.

Litton Datalog's MC 8800—the Ultra High Speed Printer that's not for everyone.



If you need the incredible speed of 6000 lines a minute, 88 columns per line, from any digital source, you must get the MC 8800 — nothing in the world can match it. But along with speed, this silent, non-impact printer offers serial input, modular construction, 5000 hour MTBF and easy computer compatibility as well.

It's a package that's truly unique, truly state-of-the-art. If you need less, take a look at other Datalog fiber optics printers; but if you need unequalled capacity, call us about the MC 8800. Datalog Division of Litton Industries, 7801 E. Belleview Avenue, Englewood, Colorado 80110. (303) 771-2010.

**DATALOG DIVISION
LITTON INDUSTRIES**

CIRCLE 126 ON READER CARD

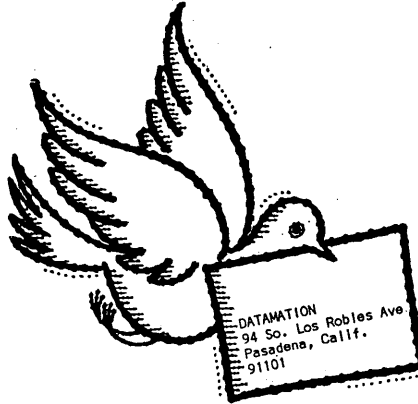
letters...

where he claims "there is no rational job progression" . . . "and in the absence of any career planning, the talented people, both military and civilian, leave to join industry." As for the people leaving the civil service for industry, I just don't see any stampede. You win a few, lose a few, and some are rained out. Having worked in both, I think neither government nor industry is as monolithic as Mr. Patrick implies they are; some companies and some government agencies have good career planning, while others have none.

Having worked as a consultant for both government and industry, I'm quite sure Mr. Patrick knows this very well. However, his statements make a good lead-in for a body blow against his critic. For right after saying that the federal government has no career planning, he goes on to prove this by saying that his critic is "a clear example of the federal personnel system," and he marvels that his critic "has 17 years government computer experience and still does not understand the important facets of the WIMMIX debate."

Sweeping generalizations such as these make it difficult for the reader to buy what Mr. Patrick is saying.

A. R. SORKOWITZ
Arlington, Virginia



how it's done

Sir:

After reading and rereading your article "An Optical Data Link for Remote Computer Terminals," I am still titillated rather than informed.

This system offers an excellent approach to satisfying the need for rapid, high volume, point-to-point communications without getting involved in

frequency allocations and line costs. The fact that it was accomplished by the do-it-yourself procedure makes it even more interesting.

However, the fact that several key questions of interest are not answered leaves the reader searching and uncertain. Modulation method is the key point not mentioned—was it emitter modulated? Q switched? B plus modulated? or what?

Incidentally, the General Electric 402 claims 40.8 kilobits operation over up to 10 miles of plant cable without repeater (so why use atmospheric transmission and suffer precipitation/lithometer outages when you can string your own cable) and OPTAN infrared transceivers (Computer Transmission Corp., Los Angeles, Calif.) are commercially available and do the same thing up to 250 kilobits.

PAUL ADAMS
Washington, D.C.

Mr. Jack R. Baird, author of the article referred to above, replies: First of all, the type of modulation used was the simplest of all possible methods; that is, the light emitter was turned on for a 25 microsecond period to transmit a binary one and is turned off for the same period to transmit a binary zero. Bear in mind that a light-emitting diode is not a laser. The light output from the light-emitting diode is approximately proportional to the current passing through the diode under forward biased conditions.

In answer to the second question, it is true that the GE data set can operate over as much as 10 miles of cable without repeaters. In the installation at the University of Colorado we are communicating over a distance of 1 kilometer; however, we do not own the intervening property. Bids were obtained to install a buried cable and the lowest bid was \$65,000. We do not claim that the optical system should be used in all installations, for if hard cables can be installed or already exist they indeed provide superior service.

The University of Colorado system operates at a 40.8 kilobit data rate. This is by no means an upper limit to this system, but was selected to satisfy the requirements of the remote terminal already installed.

terse nurse

Sir:

This is an open letter to all of your readers. I am a Record Librarian working as a committee member in planning a conference on the computer with regard to the Medical Record and the Record Librarian specifically. This conference is to be held in Niagara Falls, New York, in September. I would be most appreciative of any material available that will make the conference an up-to-date, vital event. Please address all correspondence to:

MARY W. FLOSS, R.R.L.
E. J. Meyer Memorial Hospital
462 Crider Street
Buffalo, New York



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year around
deep inside,
warm feeling.

Space contributed as a public service by this magazine.

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Now the 704 has a 1 μ s 4k memory that's expandable to 32k for those big data performances. And DMA to get to it — fast.

The 704 has 4 addressable registers and 74 instructions. It's big in software. Over 400 programs and sub-routines available off-the-shelf. Software that most small computers don't even offer. All field proven and working.

Like our exclusive executives and monitors for disc and mag tape operating systems or for batch processing. And our 360-compatible superset of USASI FORTRAN IV. And

our conversational FORTRAN in just 4k. And the only small-computer Sort/Merge package. And the fastest, most accurate math library in the class. (Try us with a benchmark.)

And the Raytheon Computer 704 is just as big in hardware. With options like hardware multiply/divide, bootstrap and a high-speed, real-time Array Transform Processor. And interfaces that let our computer talk to anything you've got. Analog or digital. Processing or control. One-of-a-kind or OEM.

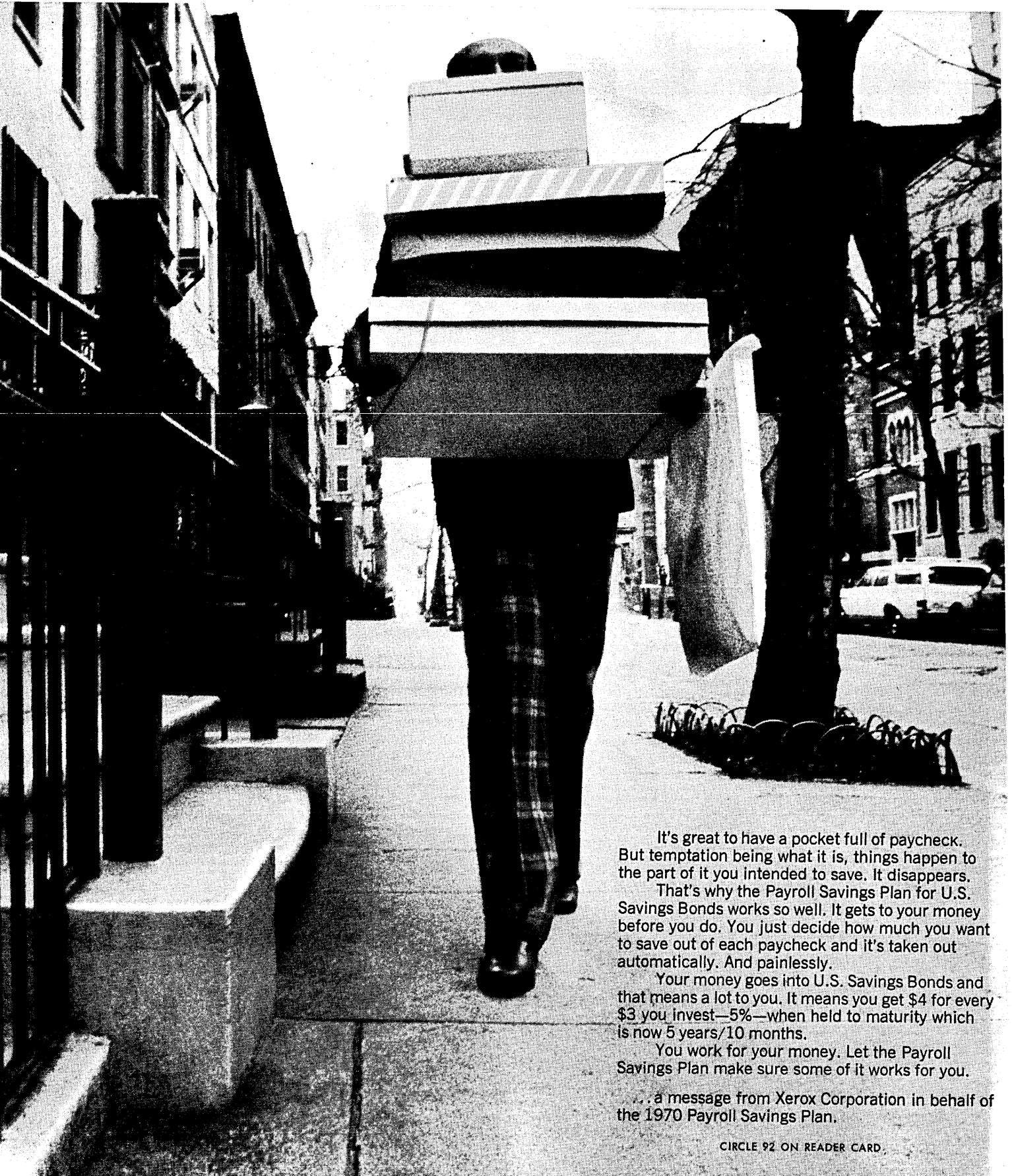
For the most complete under \$10,000 computer, call or write and ask for Data File C-187.

Raytheon Computer, 2700 South Fairview, Santa Ana, California 92704, Telephone (714) 546-7160.



The only thing Raytheon Computer does is your job. Faster.

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It's great to have a pocket full of paycheck. But temptation being what it is, things happen to the part of it you intended to save. It disappears.

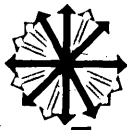
That's why the Payroll Savings Plan for U.S. Savings Bonds works so well. It gets to your money before you do. You just decide how much you want to save out of each paycheck and it's taken out automatically. And painlessly.

Your money goes into U.S. Savings Bonds and that means a lot to you. It means you get \$4 for every \$3 you invest—5%—when held to maturity which is now 5 years/10 months.

You work for your money. Let the Payroll Savings Plan make sure some of it works for you.

... a message from Xerox Corporation in behalf of the 1970 Payroll Savings Plan.

CIRCLE 92 ON READER CARD.

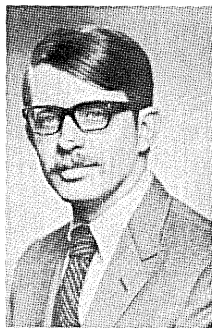


people

The season of primaries and politicking is taking some stalwarts away from the computer industry. **Rep. Emilio Q. Daddario**, indefatigable chairman of the House Subcommittee on Science, Research and Development who was recently cited by the Information Industry Association for his "recognition of information as the primary national resource for furthering the growth of the American economy . . . with greater utilization of . . . information processing and communication" is bidding to become governor of Connecticut via the Democratic nomination. **Peter James**, founder of Photo Magnetic Systems, Inc., Maryland time-sharing firm, resigned the presidency of his company to run for governor of his state in the Republican primary. **William H. Rentschler** has been elected to take his place, and is moving corporate hq to Chicago. Rentschler is a Nixon politico, recently was in Washington for a six-month stint as Presidential advisor, and made an unsuccessful run for Everett Dirksen's Illinois Senate seat last March. Otherwise, he has been a business developer, banker, and used to be a newspaper man himself (reporter for the Minneapolis Star & Trib, after graduation from Princeton). He thinks PMS is "one of the most exciting small companies in America," mainly because of its Comput-A-Phone patent. . . . IBM has done the expected to fill the shoes of **Arthur K. Watson**, who resigned chairmanship of its World Trade Corp. to become ambassador to France, and has appointed **Gilbert E. Jones** to that post. President of the subsidiary since 1963, he has been a No.-One company man for 32 years, with time out only for Navy service in World War II. He started as a sales rep in N.Y.C. **Thomas P. F. Hoving**, better known as the swinging director of N.Y.C.'s Metropolitan Museum of Art, also was elected to grace wrc's board of directors. . . . After 35 years in government service **Robert L. Jack**, now ex-head of the IRS computer system, is not planning to run for anything. He retired on April 18 to Pompano Beach, Fla. He it was who had main responsibility for developing automation at IRS, since being named director of the collection division in 1955. The Treasury Dept.

gave him its Exceptional Service award last year (1969 tax revenues amounted to \$187.9 billion). . . . The increasing importance of in-house dp to many big companies was reflected in the election of **Thomas Danbury** to be a vice president at Foote, Cone & Belding Advertising, Inc. He directs its National Information Systems, servicing clients nationwide, and is presently working on a computerized media planning system as well as building up marketing data banks. He was instrumental in organizing the NIS unit after joining the agency in 1966. . . . Two diversified companies that nevertheless are concentrating on dp products have transposed a key man. **Milton Sanders** resigned as business plan-

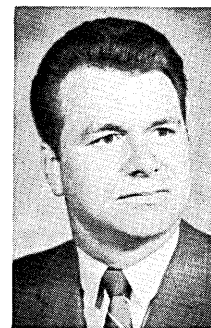
ning manager for the recently announced data systems subsidiary of Sanders Associates (no relation), Nashua, N.H., to take the newly created post of corporate director of dp programs for all of Conrac Corp.'s computer-related lines, i.e., data terminals and display equipment, produced at four of the company's 10 divisions. Sanders (the man) was previously N.Y.C. manager for Auerbach, and helped develop the Telefile system for Dow-Jones while working as vp/gm for Bunker-Ramo Corp. Conrac Division, Covina, Calif., the largest in the corporation and major maker of its data products, also has a new general manager, **Lawrence M. Ryan**, who was previously gm in Instrument/Con-



T. Danbury



R. Jack



J. Neal



G. Jones

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NEW ISSUE

April 9, 1970

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We have the most effective small scientific computers you can buy for the price.

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They come with an efficient disk-resident operating system (OS/15), an unbeatable Fortran IV compiler, a library of scientific and commercial subroutines, and a Report Program Generator.

It used to be that picking a small scientific computer was a problem.

But then, as we said, Honeywell's Series 15 computers have a way of making problems disappear.

For a copy of our "Problem Solver" brochure, write: Small Systems Marketing Manager (MS 025), Honeywell Electronic Data Processing Division, Wellesley Hills, Mass. 02181.

The Other Computer Company:

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CIRCLE 17 ON READER CARD

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Germany, Japan, Mexico,
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people . . .

trols and has been with the company for 19 years. . . . **E. W. Housh**, who directed overseas operations for Cybernetics International Corp. for the past year, has been elected its president, succeeding **Lewis W. Kresch**, founder of the four-year-old peripherals and software firm, who becomes chairman of the exec committee. CI recently initiated a back office service for U.S. film companies operating in Europe (May, p. 193) and plans to develop more new markets there. Housh was formerly a 15-year man with IBM, where his last assignment was as dp systems and info director of World Trade Corp. activities in 108 foreign countries. . . . **John A. Neal**, founder of Automated Systems Corp., will be in charge of it as a Washington, D.C., subsidiary of Auerbach Associates. His official titles are vp of the parent company, as well as vp/gm of asc, which has the avowed purpose of extending the parent's capability in "systems consulting, edp systems design and analysis, and facilities management." Neal was previously with vrs Systems and North American Rockwell. . . . And at vrs Systems, **Arthur H. Stromberg**, a corporate director and former vp of an investment management firm, has taken over as vp and chief operating officer so **Charles G. Calderaro**, formerly in that position, can concentrate on his other job as president of vrs Data Sciences, an affiliate that has admittedly run "a little too hard too fast". . . . Xerox Corp. has moved to strengthen its administration by giving added responsibility to **Joseph B. Flavin**, who henceforth will be exec vp in charge of computer and communications operations, including Xerox Data Systems, as well as of Rank Xerox Ltd., an overseas arm; xds itself has acquired a rhyming cohort, **William F. Glavin**, fresh from 15 years at IBM, who will be



W. Glavin



J. Flavin

exec vp responsible for all company line operations. He was latterly vp of IBM's Service Bureau Corp. . . . **John Swearingen** (swear-injun), longtime computer man who was in on the first commercial installation at GE in Louisville, Ky., and is a past president of DPMA, has taken a new course in his professional journeys (via Computer Technology, Inc.) to become vp/gm of Environmental Research Corp., a subsidiary of Computer Sciences Corp. that specializes in seismic investigations. . . . Another industry pioneer, **B. Keith Betz**, has become vp for R&D at a firm he helped found, Devonshire Computer Corp., in Newton, Mass. He worked at Aberdeen Proving Grounds on the ORDVAC and EDVAC historic computers, and later at Honeywell's research center. Devonshire also has named **Edgar L. Van Cott** vp for engineering and manufacturing, responsible for design and production of the company's special-purpose communications computers. . . . **Ronald S. Freeman**, who organized Data Station Corp. in L.A. and was its president for 2½ years, has been appointed president of Informatics Inc.'s new subsidiary, Informatics/Management Computer Services, which will operate Informatics' remaining data center in L.A. and one in Oakland, Calif., emphasizing facilities management. Freeman is an IBM veteran who parlayed DSC to \$3 million in revenues before it was privately sold last March; new president of DSC (now to be writ "Data-Station") is **Thomas L. Schoen**, formerly senior vp at DPF&G Corp.'s data centers division. Exec vp **John L. Cudworth** and secretary-treasurer **C. H. Tseronis** also were formerly with that organization. . . . Another brief DSC'er, **Herb Rosenheck**, who was corporate vp there, has gone back to TRW Inc., where he is now vp/gm of the computing services division. He has 20 years of dp experience, previously worked for TRW Systems, where he was manager of computer technology. . . . Back at Informatics, **Carl D. Long**, an Illinois CPA who has had 14 years experience in corporate finance, has been elected financial vp and treasurer. And IFIPS treasurer **Dr. Robert W. Rector** has left his Informatics post as vp of corporate relations to go with Cognitive Systems, Inc., Beverly Hills firm applying its technology in education and urban problems, where he will serve as vp of corporate operations. . . . After 21 years with GE, **Raymond J. Noorda** has moved to General Automation, Inc., Santa Ana, Calif., as vp and director of planning. He will determine and fill needs for computer-based systems in manufacturing and industrial applications, as he once developed similar systems for

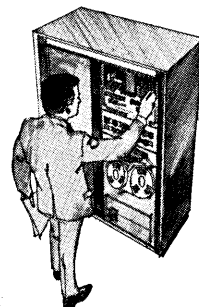
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IODISC 2011: 24-megabit capacity on one removable disc cartridge.

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The versatility of removable media offers virtually unlimited off-line storage.

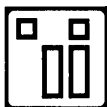
All IODISC 2000 disc drive systems are available in the user's choice of style and color, complete with interface controller/adaptor and integral power supply.

And IODISC series 2000 systems have all the same high performance features found in the popular IODISC 1000 data storage systems.

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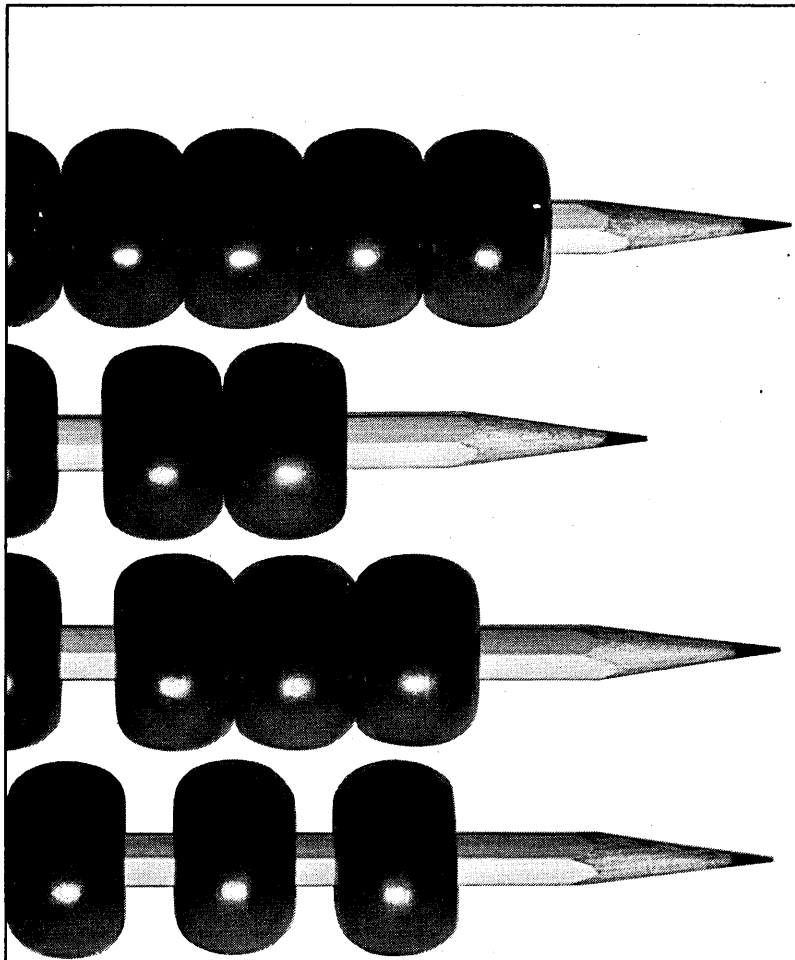


people . . .

GE, using some of the first mathematical models in automating the manufacture of steel and cement. . . . A well-known speaker and expert in diverse computer circles, **Irving I. Solomon**, has been named vp/manager of NRMA's Information Systems Division to cope with "a new surge of growth" predicted for this aspect of the retail industry. Besides his consultant and conference work, he is an associate professor of computer technology at New York Univ., active in the Association for Systems Management and the American Management Association. He is the author of "Management and Uses of the Computer." . . . **Stanley A. Rosenthal** has left the presidency and board chairmanship of Ramcor, Inc., Huntington, N.Y., to be president and chief exec officer of Decitron Electronics Corp., Brooklyn-based maker of peripherals and communications devices. He succeeds **Henry T. Starkand**, who continues as board chairman. . . . Honeywellians are still being shifted



around. In the edp division at Wellesley Hills, Mass., **Robert F. Anderson** has become vp of planning and administration, in charge of a new "planning and program management" division, and **Robert W. Rose** has been appointed manager of computer systems ops, both promotions of old hands. At the computer control division in Framingham, **James K. Frakes Jr.**, transferred from an ordnance division plant in Minnesota, will direct manufacturing of computers and other digital product lines, and **Robert C. Baron** will be responsible for R&D as head of engineering. In Waltham, **John L. Sullivan Jr.** no sooner became marketing vp of the entire Honeywell computer and communications group than he decided to shift for himself and went to Washington, D.C., to work for Memorex Corp. ■



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AIRLINE EDP MANAGER SHORT CIRCUITS UTILITY COMPANY INPUT PROBLEM.

THE INPUT UNDERGROUND IS WORKING.

Mr. A., EDP manager for one of the major airlines, has applied his company's remedy to another company's headache.

"I joined the Underground because I believe the success my company has had with optical readers should be shared with companies still living in the data processing dark ages," Mr. A. told IU Headquarters. "I immediately began looking for someone to help. Preferably someone who was still keypunching."

Mr. A. didn't have to look farther than his mailbox. There, in living holes, was a utility company bill.

"I couldn't understand how utility companies, with all their volume, could keep plugging along with outmoded input methods."

According to reliable sources, most utility companies use a combination mark sense/keypunch billing system. Meter readers fill out mark sense forms in the field. The forms are fed to optical scanners which drive automatic keypunch machines. The resulting cards go to the computer to update billing records. Computer-operated line printers prepare statements. Before they're mailed, statements are keypunched with account numbers.

* **I. U. FLASH BULLETIN:** *
* Just in from Recognition *
* Equipment: Major new *
* input products to support *
* underground movement *
* now under development. *
* Watch this page *
* for announcements. *

When statement stubs are returned with payment, clerks have to open each envelope to make sure the payment equals the amount due. Any partial payment has to be keypunched into the stub before it goes to the computer for processing.

"That's a lot of keypunching and a lot of room for errors," Mr. A. stated. "I was determined to find a better way. I started with the people my company got its reading system from. Recognition Equipment Incorporated. I figured that any company that could build a system to read and sort flimsy airline tickets should be able to handle anything.

"I was right. Recognition Equipment has a system called INPUT 2. It's just what the utility companies need. Reads hand-printing and machine printing. Records the data on magnetic tape in computer language so it can be fed directly into the computer.

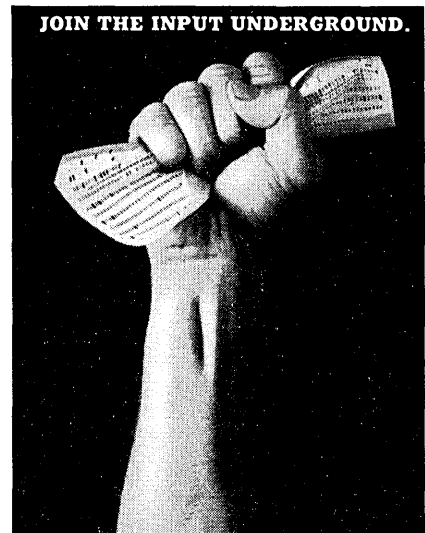
"I figure the utility companies can use it something like this:

Information handprinted by meter readers can be read by INPUT 2 and fed directly into the computer. Statements don't have to be keypunched because INPUT 2 will read information printed by the line printer. And, since there's no need for keypunching, there's no need for card stock. Statements can go out on plain paper.

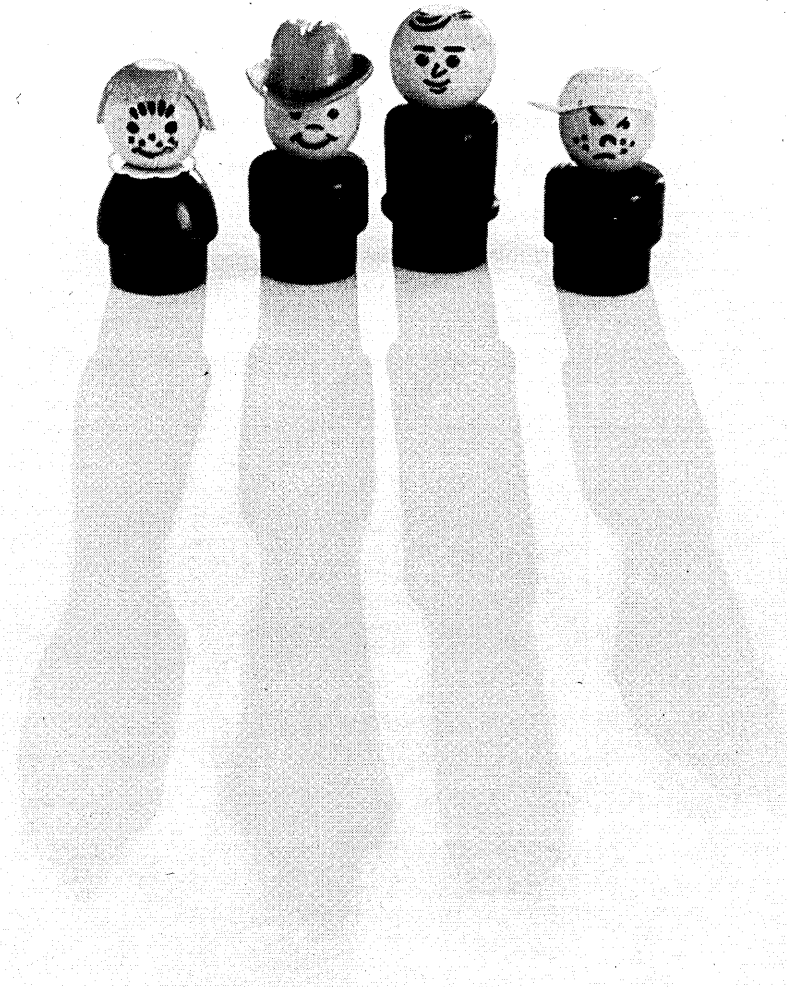
"Partial payment information can be handprinted by clerks and sent directly to the reader for processing. And I'll bet the utilities have a lot of other forms they can read with INPUT 2."

Thanks to the joint efforts of Mr. A. and Recognition Equipment, IU Headquarters can supply detailed information to any utility company seeking a solution to input fatigue. Send all requests to Input Underground, P.O. Box 5274, Dallas, Texas 75222.

JOIN THE INPUT UNDERGROUND.



Eliminate your key people.



And cut your data handling costs up to 90%.

No more keypunch, key-to-tape, key-to-disc, key-to-CRT. And none of their operators. DATAPLEX™ replaces all those repetitive, wasteful, "people" operations in a single stroke.

DATAPLEX systemizes data preparation. Absolutely automatically. For any computer. The only "people" help it needs is the typist of your original business document.

Whether you use a computer or not, your bookkeeper, purchaser, secretary or whatever, still has to type up the business form first. With DATAPLEX, that's all there is to it. With conventional EDP systems, it's here that the data organizers take over . . . batching, coding, keying, verifying, pooling. The data takes a costly manhandling along the way.

DATAPLEX lets you save in the process. Your present

office typists fill out your standard business forms using DATAPLEX Recording Typewriters. Without changing usual office procedures in the slightest. Then the DATAPLEX Processor reads the facts and figures for your computer use, untouched by human hands. No cards, no punch, no kidding.

By eliminating the need for data handling personnel, your expense per unit record zooms down from the normal 2-to-5¢-level. To 0.2¢ . . . a 90% reduction at least.

Give your key personnel the slip. And watch your profits climb.

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Data Instruments



CIRCLE 164 ON READER CARD

When is a desk not a desk?



When it's the new WILSON JONES "DATA-STATION"

"Data-Station" is a combination of a work area "Top" and two Wilson Jones DeLuxe "Data-Racks" locked together.

"Data-Stations" provide a convenient, flat, desk-high surface for accounting, credit, data processing, sales and other departments where constant analysis, reference to, and up-dating of EDP records is made. "Data-Stations" eliminate the clutter and inefficiency of unhoued printouts.

"Data-Stations" hold up to 12,000 printout sheets in 12 or more nylon post binders, or an equal volume of unbound records in "Data-Slings" or other hanging folders.

This latest Wilson Jones data processing accessory is styled to harmonize with modern office furnishings. Rich teak-grain "Data-Station Top" matches the tops of DeLuxe "Data-Racks." Ball bearing casters provide easy relocation, when required. "Data-Stations" can be locked, keeping contents safe from unauthorized reference or removal.

If you are now using Wilson Jones DeLuxe "Data-Racks," "Data-Station Tops" add a new dimension to your reference and retrieval activities.

"Data-Station Top" only
(No. 2-16), \$37.00

Complete unit ("Top"
and 2 DeLuxe
"Data-Racks,"
No. 028-16), \$234.90



"Data-Stations" can be
extended with additional
"Tops" and "Racks"

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look ahead

No matter what the SE figures, user and competitor reports IBM is having trouble peddling its manpower. One user is getting heavy pressure to sign his SE contract, whose confidentiality and other clauses are not acceptable to him. How? Sales won't give him the needed SE help in the meantime, even though IBM has stated such help would be available if the contract were in negotiation.

IBM is also battering the small education firms by coming in low bidder for on-site education contracts. Remember, the SE is used as an instructor. Example: on a 10-day PL/I course that was RPQ'd, IBM bid about \$4500, less than half bid by competitor NGP Assoc. NGP says the independent can't afford to compete with that. Oyer Professional Computer Services says it ran against IBM for a six-week Cobol course, bidding \$30K, IBM coming in \$20K. One firm came up against the boys in gray in the "last place we expected": a state contract for a Cobol course for Univac computers. Guess who won! If this is a trend, IBM competitors may end up splitting a far thinner slice of the service pie than expected, at least until Nixon's bottomless economy has bottomed out or is over, or becomes a painful memory.

GE DENIES TROUBLES WITH TOSHIBA

GE denies troubles with Toshiba (May, p. 49) over a cooperative venture to build a machine called Pi. "There are no troubles between GE and Toshiba," the firm says. "Both firms have been engaged in design, production and distribution studies of Project Pi, but the project has been dropped independently by both firms." Each was to have made and marketed the machine in its own area, so Toshiba, as we said, was not going to make the equipment for GE. "A number of beneficial aspects rising from the project are still being examined," GE continues. It confirms that the Pi could've been three times faster than the 435.

VENDORS DISCUSSING STATES RIGHTS

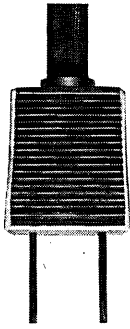
Credit the Council on State Governments and its affiliate NASIS for trying to make all states equal in the "I's" and "T's" of computer contracts. The NASIS standards committee draft of standard modules or paragraphs for both hardware and technical services contracts will go to the Council membership during its September meeting. Two problems are penalty clauses and performance measures, which NASIS is discussing with vendors. It's an uphill battle, since penalty payments have come in the past only to those with muscle, like California, and the vendors fear that whatever they allow in all state contracts will be demanded by private industry. Software packages will be the next project.

SLIPPING DISCS: GAME ANYONE CAN PLAY

Cutthroat competition in the memory biz will get even tougher with the introduction of new units from Standard Memories, Technology Marketing, and Hughes Aircraft. Hughes Aircraft? All three firms will hit the market with products unlike those now being peddled.

Hughes, long a military computer builder, has signed an exclusive manufacturing/marketing pact with Digital Development Corp., San Diego fixed-head disc maker, for the Dynabit domain wall memory. DDC pays royalties and HAC gives DDC the memory and facilities to build it. A cross between core and disc in size and speed, Dynabit is made from a wire wrapped around a cylinder, will store about 2K bits

(Continued on page 267)

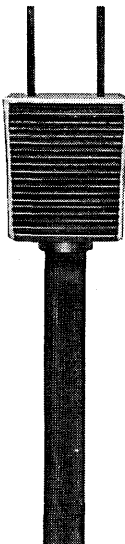


We're More Than Just Plug-to-Plug Compatible ...we're Communications Compatible too!



Sometimes talking to your computer can be a waste of time and money... and it's not always your computer's fault.

Speed, accuracy and optimum computer usage time call for a terminal that is *communications oriented*. This means more than just "plug-to-plug" compatibility. More than Teletype and IBM compatibility. More than even Courier's ease of operation, modular construction and advanced styling. It means more than the Executerm's exclusive integral data set. It means that *Courier* has the engineering know-how, and personnel with the training and experience in data communications to ensure proper utilization of your equipment, communications facilities and personnel.



Courier Terminals have been designed for use in remote systems of any size, or for use as a single station. Executerm I is Teletype compatible. Executerm 60 and 65 are IBM 360 software compatible. Printer options are available.

Before you consider any terminal, look beyond the plug, and write for our latest literature.

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look ahead

per element. Access times will be some 5 msec, prices between 0.1 and 1¢/bit, and the removable wire-wrapped element is nonvolatile, like a disc pack.

Technology Marketing Inc. is a nonmanufacturer too, a memory design group that has done work for Rolm, Raytheon, and Omnicomp's new minicomputer, Omnus I. The firm's newest plans are for a 32K by 16 or 18-bit core memory with a cycle time under 1.5 msec and a selling price of about \$3K.

Standard Memories is also shooting at the more-reliable-than-disc expanded core market, but will offer much higher speeds. Access times for its new Mini-Mass 64K x 18 core will be in the 250-300 nsec range. Its 1.9¢/bit price (under \$25K with power, cooling, memory protect) puts it well over the 0.6¢ projected for TMI's and the 1¢ high for Dynabit. But in addition to speed, Mini-Mass offers even higher reliability: it gracefully degrades 4K at a time rather than all at once. The full-blown system takes up only 12 inches of rack space.

A MICROCOSM OF THE WORLD GOES BY

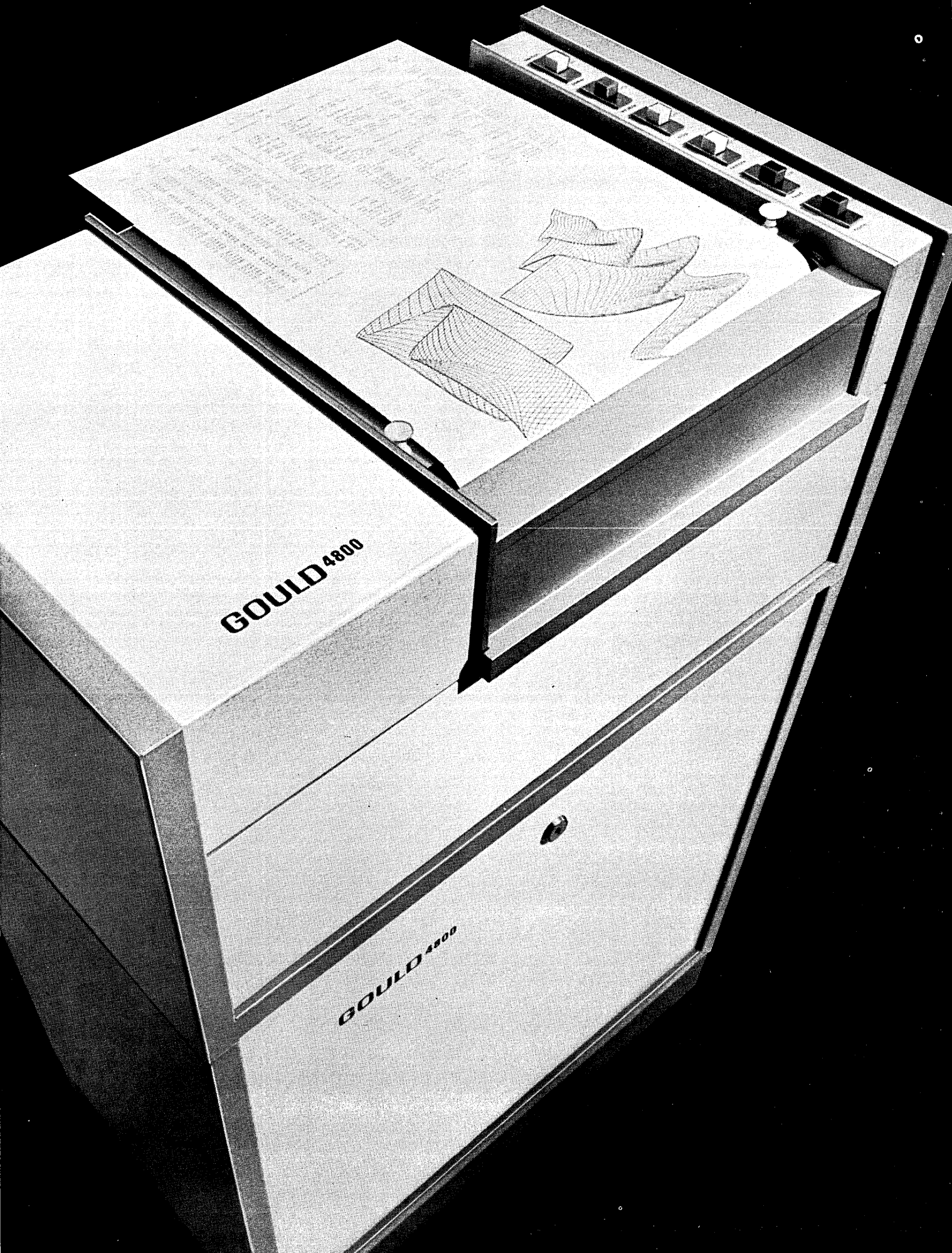
With professional ethics standards becoming a strong ACM and AFIPS concern, the issue was raised in ACM's back yard last month via the election of the ACM Greater NY Region rep. After considerable wrist-slapping, the first ballots were chucked in the basket, and a rerun is now being held, all votes due in by month end.

One problem was a three-page newsletter mailed by candidate Paul Oyer, now NY Chapter chairman, to 3,000 regional members. Oyer urged the vote, among other items, but mentioned only himself and not opponents Jim Adams and Ken King as a candidate. Some members complained, feeling the letter generally too self-serving, especially as it went out over ACM-NY and ACM-70 letterheads, and at chapter expense (since agreed to by the NY council). Oyer admits to poor judgment, but not wrong intent, nor did he violate ACM bylaws. On the other hand, Oyer also felt poorly treated in the regional publication, Four-Cast, which he says edited out some of his platform and background in the election issue.

This affair is just so many soiled handkerchiefs, but it does raise a question for ACM: Should the simple standards of professional conduct become bylaws in its constitution?

RUMORS AND RAW RANDOM DATA

An embryo minicomputer maker got unfavorable feedback from investors when his first prototype didn't look enough like a minicomputer. A second model, outfitted with a console strongly resembling the PDP-8, met the financial criterion...Applied Data Research is coming out with a Generalized Cobol Preprocessor that provides "a true macro facility within Cobol." It operates under 360 OS and DOS, requires 44K, and will be available in the third quarter...Viatron began deliveries of the cassette tape to standard mag tap converter and the communications interface for System 21 last month. Now users will be able to conduct meaningful tests...Since Viatron has also raised prices and stopped renting, we wonder how users with grandiose plans for System 21 will adjust. Data Power Inc., service bureau franchiser that intends to use 34K units in four years, feels that Viatron will revert to rental by then, or that DPI will be able to get lease financing. But what of those with more immediate plans?...Born too late for the hardware survey in this issue is the Datapoint 2200 from Computer Terminal Corp.



GOULD 4800

GOULD 4800

This is the fastest printer around.

It also produces both alphanumerics and graphics.

**And printout is 132 columns
wide on an 11 x 8-1/2 format!**

The practical continuous speed of the standard line printer is 600 lines per minute. But the new Gould 4800-II will deliver 4800 lines per minute. And it'll produce both alphanumerics and graphics — simultaneously — directly from any source of digital input as data transmission by telemetry, radio microwave, and/or land line.

There's a new character generator, too. With an ultimate capability of three 128 character fonts with dot matrices up to 15 x 15.* And because it has a 132 character buffer, you don't have to burden your computer's memory banks. The input control lines are built-in, too. Which makes it comparatively simple to interface the 4800 with almost any computer you have in mind.

The 4800 provides programmed control for a

variety of output forms . . . line and letter spacing, paragraphing, columns and so forth. Plus a convenient capability to translate bit mode input into generalized graphics. But speed and versatility are just part of our story. Because it's electrostatic, the 4800 is infinitely quieter than line printers. Because it has fewer moving parts, it's more reliable. And because it's a lot simpler, it's priced well below printers that can't come close to the performance.

So there you have it: the Gould 4800 electrostatic hardcopy printer. Isn't it time we talked? Graphics Division, Gould Inc., 3631 Perkins Avenue, Cleveland, Ohio 44114.

*Supplied standard with unit:
One 64 character font with
5 x 7 dot matrix.

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The Gould 4800. The next generation of high-speed printers.



A Unique Optical Mark Card Reader

Soiled cards. Smudged cards.
Just plain dirty cards.
Crumpled cards.
Bent cards. Damaged cards.

Problems for your card reader?

Maybe *yours*. But not *ours*.

Special pencils. Special marks.
Completely filled in blocks.

Required by your card reader?

Maybe *yours*. But not *ours*.

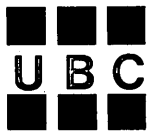
That's right. Our unique Model 100-M Optical Mark Card Reader has no trouble processing 300 soiled, smudged, dirty, crumpled, bent, and damaged cards per minute. Data is entered by a single stroke of a common lead pencil.

Compactness is another thing you'll like about the 100-M. Not to mention its ruggedness, economy, and proven design.

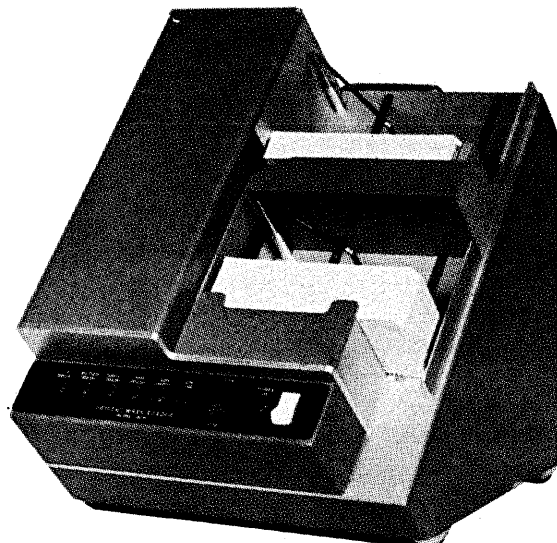
The versatile interface makes it ideal for use with small computers, data communications terminals, and off-line devices.

Write or call for complete information on the 100-M, the card reader designed for ordinary human beings who want extraordinary results.

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world roundup

POLITICS CUT IMPACT OF BRITISH COMPUTER PROBE

The usefulness of the British Government committee inquiry into the state of health of the local computer industry gradually receded into the distance during the month as the country's politicians started to warm up for the election. The present Labour Government had up to next March at the latest before closing shop and going to the polls. At time of writing the party's reputation was riding high, and it looked certain that Prime Minister Wilson would exercise his option to choose the date of the election before this year was out. And what looked like a certain October election was beginning to take on overtones of an event to be staged some three months earlier. (Editor's note: The Prime Minister did indeed set the date for June 18.)

Choice of an early polling day could overtake the July date fixed by the Select Committee on Science and Technology for completing their report after three months of hearings from industry, Government and independents on the current outlook for the future on the dp scene. Whatever the outcome, it doesn't look as if the practices prevailing at this time will alter too much in the near future—at any rate not because of some brilliant insight produced from a political inquiry. In fact, the closing session for evidence ended where it had just about started. International Computers chairman Sir John Wall returned to the witness stand and declared with shocked surprise that there was no favouritism shown his company by the Government methods of procurement. He was followed by some senior civil servants who maintained that demureness fitting of bureaucrats, while shaking their heads in sadness that any such allegation could ever have been made. The British taxpayer pays his money—a large slice of which goes directly into ICL—and takes his choice. Either he believes that ICL computers outrank all others in performance, hence the greater use of them by Government-influenced departments, or he doesn't believe it.

\$30 MILLION WORTH OF SHADOW BOXING

Perhaps more interesting to the initiates was the shadow boxing between the committee and Sir John about questions over a new range of machinery from the State funded company. Was it to be the development of that once much talked of Basic Language Machine or code word computer which could bridge the gap between the incompatibility of ICL's own existing machinery and other makes, or would it be a really different design awaiting more progress in large scale integration before going into production—but based on sponsored research now pushing ahead apace at Manchester University?

There was another little conundrum that could have been added to the intrigue because it turns out that ICL's managing director Arthur Humphreys was in

A COMMUNICATIONS LINE PRINTER... A HIGH SPEED TERMINAL



The **SCANTLIN 150** printer is a local or remote terminal that is more economical than a cluster of teletypewriters. The SCANTLIN 150 is an impact printer, handles multi-part forms, and has a built-in modem; as a communications terminal it is **20 times faster** than a teletypewriter.

Look at these features!

- Fully buffered, 1200 baud, 202 compatible • 150 lines per minute, 64 character set • Impact print; high readability through 6 part forms
- Plug-in modular circuits • Plug-to-plug compatibility with 360's • Back-up service from over 60 nationwide field engineering offices.

Scantlin Electronics, Inc. develops and manufactures advanced equipment used in on-line real-time dataprocessing systems. Scantlin operates the QUOTRON Financial Information Service that distributes stock market information throughout the United States.

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325 HUDSON STREET, NEW YORK, NEW YORK 10013 • (212) 344-0400

the States at the time, and those who mark him down as the shrewdest of the European executives in manufacturing wouldn't expect him to return empty handed.

The furthest Sir John was prepared to go was to suggest that the \$30 million-odd advanced from the Government for research and development wasn't quite enough really to get the wheels humming quickly. Even though the company matched it by more than dollar for dollar, there was going to be a lot more cash needed for the "bridgework" to prevent them falling into that gap which could exist from incompatibility between the top end of present range of machines and the new series.

AS ICL, BARCLAYS MOVE ON SERVICE BUREAU MKT.

While the select committee was hearing all this, other executives in International Computers were tying up details of the service bureau scheme that could help the cash roll in. A joint enterprise between International Computer Services Ltd. and Barclays Banks (with 3,300 branches in the country) was formally christened "Baric."

The purpose of the new company is to sell the service bureau services to customers of the Bank through a group of consultants who will act as go-between. Having established the principle, the bureau can raise its slice of the services market estimated to be about \$4 million of the \$45 million annual business believed to be increasing in the UK at 30% a year. International Computer Service chiefs also have been wasting no time trying to seek how the service can be extended in the rest of Europe, and they already have made preliminary forays with a meeting of subsidiaries in Paris to plan extension onto the Continent.

AN ATTEMPT TO FORESTALL IBM UNBUNDLING MOVES

The dominant British manufacturer brought yet another string to its bow in May by forming a software house called Dataskill. Though allegedly other motives are behind its formation, it looks remarkably like an attempt to forestall IBM's unbundling manoeuvres that will not be felt fully in Europe for another two years. A gamut of software services are to be offered though Dataskill, from a prop to customers with staff shortages for straightforward applications packages, to taking on complete turnkey contracts in more esoteric fields.

One line of gossip in the industry surrounding speculation about the expected new series from ICL has it that most internal debate within the company hinges on price structures. One disagreement is over the pattern that ICL's own unbundling policy should follow to cater to the market into the late seventies.

BITS AND PIECES

CII, French computer maker, is evidently having big troubles. Rumors are they've lopped 900 off payroll at year-end.

washington report

GROSCH OFFERED OTHER NBS POST, BUT WILL LOOK

Herb Grosch was fired as Director of the Center for Computer Sciences and Technology at NBS. He's been asked to stay on as a senior research fellow, but reportedly would like another post in the federal government, or with a large edp-using company.

"Grosch felt the Center had inadequate power and resources to discharge its mission under the Brooks bill," says a knowledgeable source. "(NBS Director Lew) Branscomb thought Grosch wasn't trying hard enough."

Grosch's outspoken views further irritated Branscomb, and rekindled the enmity of Branscomb's boss, Assistant Secretary of Commerce Myron Tribus, who knew Grosch at GE. Also, a cadre within the Bureau thought the Center was neglecting their need for edp support.

Among the replacements reportedly under consideration are John Lubin, of the University of Pennsylvania; Stanley Winkler, of the Office of Emergency Preparedness; and Wayne Swift, of CSC.

A source within the Brooks committee commented that if the Center's new director "subordinates the dp standards effort to operation of a routine computer service facility, it would obviously concern us."

FCC LOOKS INTO AT&T EXCHANGE SERVICE

FCC asked AT&T why it is offering foreign exchange service, end-to-end, under an interstate tariff that excludes the local exchange line (connecting the end of the f-x line with the user's terminal). AT&T asst. vp T. W. Scandlyn answered that under the Communications Act of 1934 (Section 221b), "telephone exchange service is exempt from (FCC) jurisdiction even though a portion of such service constitutes interstate communication." But Scandlyn ignored the fact that local exchange lines used in f-x service are dedicated solely to interstate traffic.

If FCC takes jurisdiction over these links, it would: a) put many information system access lines under federal control, and help on-line dp users stave off carrier attempts to raise ISAL rates (see April '70, p. 195); and b) make it possible to standardize a bewildering variety of terminal attachment, line quality, and maintenance specs now imposed by the states on operators of t/s service bureaus and dedicated private networks.

Related developments: BEMA's dp/telecommunications committee, which has been considering petitions asking FCC to declare that ISAL's are interstate, started last month to redraft the document so that it encompasses automatic call distributor lines as well. Univac reportedly opposes the petition, but probably will go along with the final draft. IBM apparently will do likewise, after fighting the petition idea earlier.

GSA ENCOURAGES INDEPENDENTS

GSA released a dp system RFP that, for the first time, encourages bids from independent peripheral makers and software suppliers. Inspired by persistent

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The new, no parallax crosshair cursor is positioned with the desk-top Joystick.



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nagging from Bryant Computer Products' Dick Caveney, the procurement hopefully will enable GSA, late next year, to determine whether a system acquired from multiple sources can be more cost-effective than one obtained from a single source.

Last month's RFP is aimed at producing a system for the Commerce Dept. which will be evaluated against an existing 360/30. A bidder can offer a complete configuration composed of his own components, a complete configuration containing items obtained from other firms, or individual components. Option II bidders assume system responsibility. Under Option III, GSA "may" assume the responsibility of prime contractor.

AGENCIES GET COBOL STANDARD

A proposed federal Cobol standard began circulating among the agencies last month—hopefully the last major step before publication in the Federal Register and formal adoption. It provides for 3 compiler levels—the highest one is virtually identical with Level 4 of the ANSI standard. Level 2 of ANSI is split between the two lower levels of the federal version, and much of ANSI's Level 3 is eliminated. A knowledgeable source expects the report writer module, now in level 3 of the federal version, to be excised as a result of agency opposition.

HOUSE ACTS ON EDP BILL

A legislative reorganization bill, providing for a joint congressional committee on data processing, was finally reported out by the House Rules Committee last month. Staffers say there is "a good chance" the measure will be passed by the House, then the Senate, and enacted by the end of this session. Meanwhile, the Senate Rules Committee, which will help decide what happens to the reorganization bill if and when it reaches the upper chamber, has launched a study of Senatorial needs for computerized information. A House group, formed a few months ago to make a similar study, was, at press time, said to be on the verge of awarding system study contracts worth up to \$500K.

SANDERS STUDIES AIR TRAFFIC CONTROL

Sanders has won a \$2.7 million contract to develop a complex crt display capable of being used at air traffic control centers. It will be a modified version of the ADDS/900 system. Sideline observers think Sanders may displace Raytheon, FAA's main crt contractor, which is in deep trouble (see March, '70, p. 233). But agency officials deny this. They insist Sanders is doing a human factors engineering study.

Although the Raytheon crt is long overdue, and its original cost has escalated, FAA has consistently refused to consider another source. Reportedly, it was only after Sen. Norris Cotton of New Hampshire (Sanders' home state) intervened that the agency finally awarded the "human factors engineering" contract.

FAA needs several hundred crt's to implement its multi-billion dollar plan for modernizing the national air traffic control system.

CAPITOL BRIEFS

AT&T private line users who want to direct-connect their own terminals won't have to obtain Bell-supplied connecting arrangements next month, as originally specified by the phone company. The new deadline is July 1, '71.

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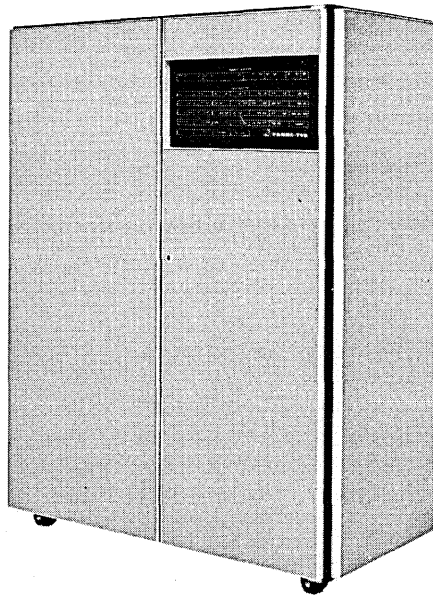
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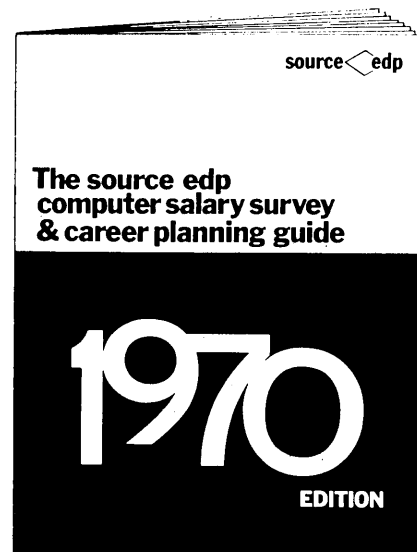
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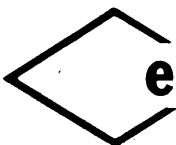
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recruitment advertisers' index

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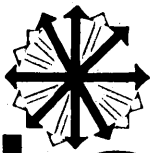
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books

***The Real Computer: Its Influence, Uses, and Effects*, by Frederic G. Withington. Addison-Wesley Publishing Co., Reading, Mass., 1969. 359 pp.**

A central fact of our world today is change. The current generation, in fact, might be said to be the first to recognize that their lives are based on change. Prior to the Industrial Revolution, change was a minimal force in everyday life. Even subsequently, despite such radicalizing forces as the automobile and the telephone, the general tenor of life was adapted to the idea that soon things will settle down and there will be no more significant changes. Now the fact of change itself seems accepted, at least in the U.S. and even violently urged by certain segments of society.

The computer is an instrument that has wrought the means of change, and hence can be considered, like the automobile and the telephone, to be a prime radicalizing force, causing changes in organizations and the lives of individuals. Mr. Withington's book, in his words, "is intended to help concerned managers control these changes and adapt to them intelligently." It should "improve his ability to make intelligent decisions about the use of computers, and to live in a world that is becoming increasingly dependent on computer systems."

The method he has chosen to ac-

complish his purpose is to illustrate the various facets of change caused by computers with a copious dose of case histories, more than 100 of them. In general, the method works; the conscientious reader will emerge from the book with a better understanding of the capabilities and limitations of computer-based systems, and with an appreciation for some of the basic considerations involved in large-scale system analysis and design. An admirable feature of the book is that any intelligent reader can achieve this understanding. Mr. Withington has managed successfully to avoid all technical jargon, and even more admirably has steered clear of what this reviewer had come to regard in such volumes as the inevitable and usually unnecessary description of How a Computer Really Works Inside. His true focus is systems, not the machines, but the book is written from the viewpoint that it is the computer that has made large, complex systems not only possible but unavoidable.

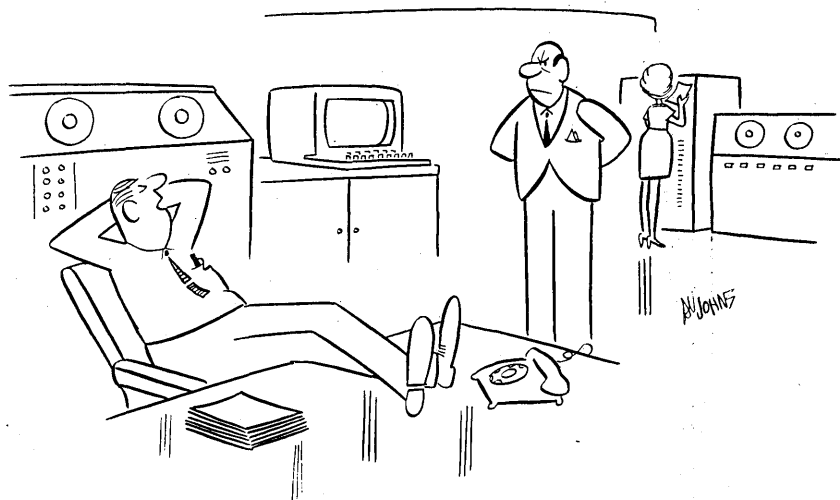
The book pretends to objectivity, because of which, the preface states, the "tone is unemotional." Personally, I like a bit more emotion in my reading, but 'tis a mean thing to quibble over style. The claim to objectivity does not really hold up, however, as Mr. Withington passes through factual descriptions of effects of computer systems in objective terms and then begins to evaluate them on subjective bases: e.g., chapter 9 "Those Who Benefit," and chapter 10 "Those Who Suffer." It is impossible to generalize on these themes without setting a frame of reference for judging what constitutes benefits and pains. Mr. Withington's value systems are (by inference) pragmatically oriented, as befits someone

addressing an audience of managers.

On the whole I don't quarrel with Mr. Withington's final judgment that the changes and human concessions required by computer systems are relatively trivial in comparison with the potential benefits occasioned by their use. He sees, rather, the probability that instead of becoming forces of mechanization, regimentation, and dehumanization, computer systems will be adapted to human needs and wants in increasingly flexible and responsive terms. He uses the familiar example of how the public resisted direct-distance dialing because of the resistance to all-digit telephone codes; now acceptance is practically unanimous and nearly everyone appreciates the convenience of not having to depend upon a dialog with an operator to reach anywhere in the country. He could equally have pointed out that when automatic dialing was introduced there were many who predicted dire consequences due to "dehumanization" because one no longer enjoyed the human contact of asking the operator to place your call. Further, he seems to feel that these effects will occur without the need for specific governmental regulation or demand.

Certainly in the face of such potentially dehumanizing influences as excess global population, nuclear war, near-universal starvation, and ecological disaster, our fears of depersonalization by computer ought to be relatively minimal. It is nonetheless encouraging to read that an expert who has made a genuine effort at dispassionate analysis finds that computer systems are not about to crush the individual. There are many who will not agree; let them read the book and then argue.

—RICHARD H. HILL



"Machines should work; men should think"

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book briefs

(For further information on the books listed here, please write directly to the publisher mentioned.)

Computer Output Microfilm, by Don M. Avedon. NMA Monograph no. 4. National Microfilm Assoc., 250 Prince George St., Annapolis, Md. 21404. 99 pp. \$10.00 (\$7.50 for NMA members).

This monograph provides an overview of the computer output microfilm (COM) field. It contains a section on COM technology, covering such topics as crt systems, ebr systems, character generation and set, tape format and programming, transfer rate, thruput, forms overlay, retrieval coding, films, and image quality.

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June 1970

Several users are described, such as J. C. Penney, Collins Radio, and AT&T, and other scientific and business applications are discussed.

A systems service company directory is provided; one alphabetically, and one geographically.

The book also contains a state-of-the-art summary, an equipment guide, the results of an NMA survey of the COM field, a glossary of terms, and a bibliography.

Computer Science: A First Course, by Alexandra I. Forsythe, Thomas A. Keenan, Elliott I. Organick, and Warren Stenberg. John Wiley & Sons, Inc. New York, 1969. 567 pp. \$9.95.

This book is intended as a first course in computer science for students with good high school-level preparation in mathematics.

The material is divided into three sections: (1) Basic concepts—algorithms, flow-chart language, looping, and approximations; (2) Numerical applications—functions and procedures, and mathematical applications; (3) Nonnumerical applications—tree structures; compiling, lists and strings.

The SAMOS appendix amounts to an elementary programmer's reference manual for a hypothetical computer called SAMOS which is introduced in the first chapter. SAMOS has been simulated on actual computers, making it possible for students to gain an initial exposure to machine-language programming through laboratory practice.

Corporate Simulation Models, edited by Albert N. Schrieber. Office of Publications, Graduate School of Business Administration, University of Washington, Seattle 98105, 1970. 614 pp.

This volume contains 25 papers presented at a symposium held at the University of Washington on March 23-25, 1970. Papers cover such topics as: an overview of current practices (2 surveys); models of a total corporate system (large, well-known companies); functional operation systems within a corporation; training uses; and the philosophy of using these models and the administrative problems that are involved.

A report on this symposium appears on p. 167 of this issue.

Computer-Aided Design of Magnetic Circuits, by Alexander Kusko and Theodore Wroblewski. The M.I.T. Press, Cambridge, Mass., Research Monograph No. 55, 1969. 126 pp. \$6.95.

The purpose of this book is to present the authors' approach to modeling magnetic circuits; to handling the in-

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books...

terface with the electric circuit; and to preparing the sequence of steps for computer-aided design. The book is an account of the application of computers to the design of a class of equipment—starting with the problem; discussing the assumptions, equations, and models; and finally showing the flow diagrams and typical input and output forms in use.

The chapters are arranged with the reactor considered first, followed by leakage-reactance transformers and

regulating transformers, and finishing with conventional multiwinding transformers. For each class of device, the theory and modeling are treated, followed by numerical examples and the authors' approach to computer-aided design.

A Collection of Matrices for Testing Computational Algorithms, by Robert T. Gregory and David L. Karney. John Wiley & Sons, Inc., New York, 1969. 163 pp. \$9.95.

This monograph is intended as a reference book for numerical analysts and others interested in computational

methods for solving problems in matrix algebra. It provides a collection of numerical examples with which to test each algorithm as soon as it is proposed.

The matrices, for the most part, were obtained from the current literature, but they also include four private collections.

The chapters cover: inverses, systems of linear equations, and determinants; eigenvalues and eigenvectors of real symmetric matrices, real non-symmetric matrices, complex matrices, and tridiagonal matrices. A list of references, a symbol table, and an index are provided.

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Computer Mathematics, Series II, edited by Geoffrey Knight, Jr. Cambridge Communication Corp., 1612 K Street, N.W., Washington, D.C. 20006, 1969. \$14.95.

This volume is a collection of over 5,000 abstracts compiled from *Computer & Information Systems* on mathematics and arithmetic techniques related to computers and information processing. It is part of a series of abstract collections, the others being *Computer Software*, *Computer Applications*, and *Computer Electronics*.

The abstracts have been arranged in the following categories: general—numerical and symbolic analysis; elementary algebra; calculus; difference, differential, and integral equations; abstract mathematics; probability and statistics; optimization, mathematical programming, operations research; mathematical communication theory, information theory; mathematical systems and control theory; and mathematical logic and switching theory, automata.

Each book contains internal cross-references related to allied topics within the book, as well as external cross-references relating to secondary topics found in other books of the series.

How to Use the Computer in Business Planning, by Henry F. Lande. Prentice-Hall, Inc., Englewood Cliffs, N.J., 1969. 178 pp. \$19.95.

This book is intended to help bridge the gap between the many general prescriptions for business planning and a specific, practical planning system, tailored to the needs of the particular business in question. Making use of today's information technology, the book deals mainly with an approach, with the architecture of the system.

Rather than being a survey of the subject, this book is based on the specific approach the author has taken in developing systems for comprehensive business planning at IBM at the divi-

sional and corporate staff levels. He cites the methods of other organizations for purposes of example and comparison.

Introduction to Analog Computer Programming, by Dale I. Rummer. Holt, Rinehart and Winston, Inc., New York. 1969. 198 pp. \$8.95.

This book is intended as an introductory text for college freshmen and sophomores who have not yet studied differential equations. After an introduction to computers, analog and digital, some arithmetic operations using potentiometers and amplifiers are presented. These techniques are then applied to the solution of algebraic equations. Methods for integration and differentiation are introduced and applied to the generation of ramp, polynomial, and sinusoidal functions. First and second order systems and non-linear operations are described.

The International Directory of Computer and Information System Services—1969, published for the Intergovernmental Bureau for Information Technology, Rome, Italy by Europa Publications Ltd., London. 1969. 348 pp. \$15.00.

In alphabetical order by country, this directory lists the institutions and companies providing computer ser-

vices, together with such data as the type of computer installations, fields of experience and educational and training facilities, operating conditions, and the type of services provided. Alphabetical indexes of company installations and of institutions are also provided.

Numerical Control, by Glenn G. Ertell. John Wiley & Sons, Inc., New York, 1969. 158 pp. \$9.50.

Numerical control is defined in this book as "that part of an electromechanical system that uses digital logic circuits to cause the system to respond to instructions received from digitally coded tapes." Systems using general-purpose computers are not considered. The book is intended for engineers and technicians, and, although knowledge of the use of particular circuit components is not needed, a knowledge of the binary number system and the logic functions performed by digital circuits is required. Techniques have been developed that are common to all numerical controls, with emphasis on logic functions.

Subjects covered are: binary numbers and arithmetic, basic digital circuits; binary counters; the selection and collection numerical control; numerical positioning using a stepping

motor; the power servo; numerical positioning using a servo; the single-axis continuous-positioning numerical control; the two axes continuous-positioning numerical control; punched tape readers; and the technique of troubleshooting.

The author wrote this book because he felt that a single text, suitable for a course in numerical control, did not exist.

Programming with USA Standard FORTRAN and FORTRAN IV, by Donald D. Spencer. Blaisdell Publishing Co., 275 Wyman St., Waltham, Mass. 02154, 1969. 243 pp. \$4.75.

This book attempts to familiarize the reader with the most important areas of FORTRAN IV and USA Standard FORTRAN. No attempt has been made to include all of their features, but this book should be applicable to all FORTRAN IV and USA Standard FORTRAN systems.

The book can be used whether or not a computer is available, and problems and worksheets are included. The appendices contain a summary of FORTRAN statements, the IBM punched-card code, a list of computers that use the FORTRAN IV and USA Standard FORTRAN systems, a short glossary, and a list of references. ■

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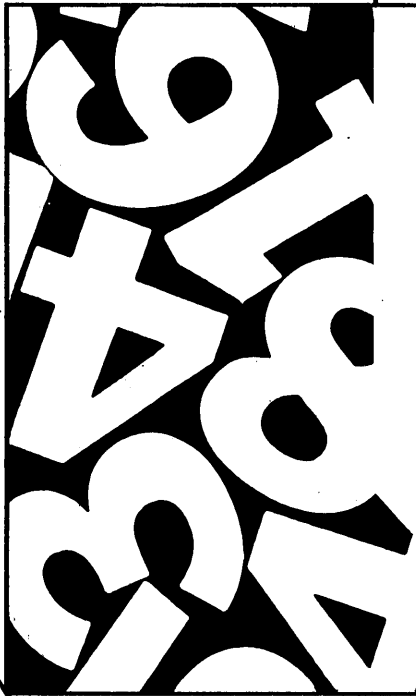
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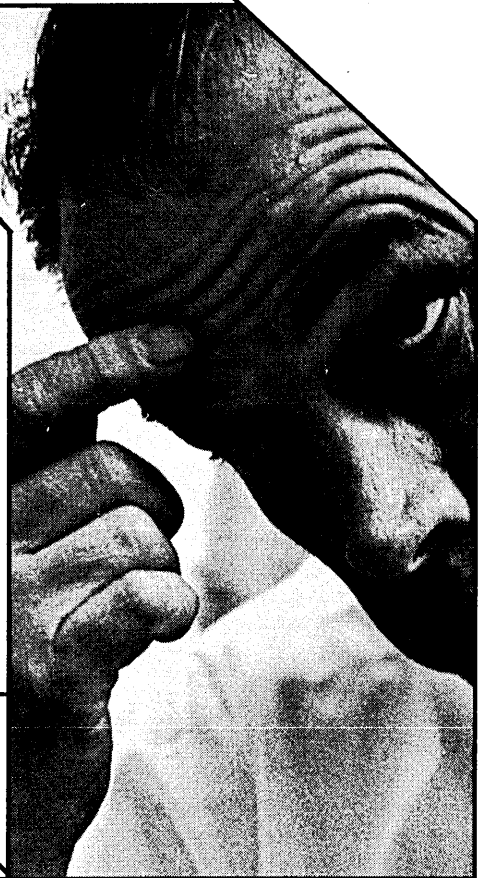
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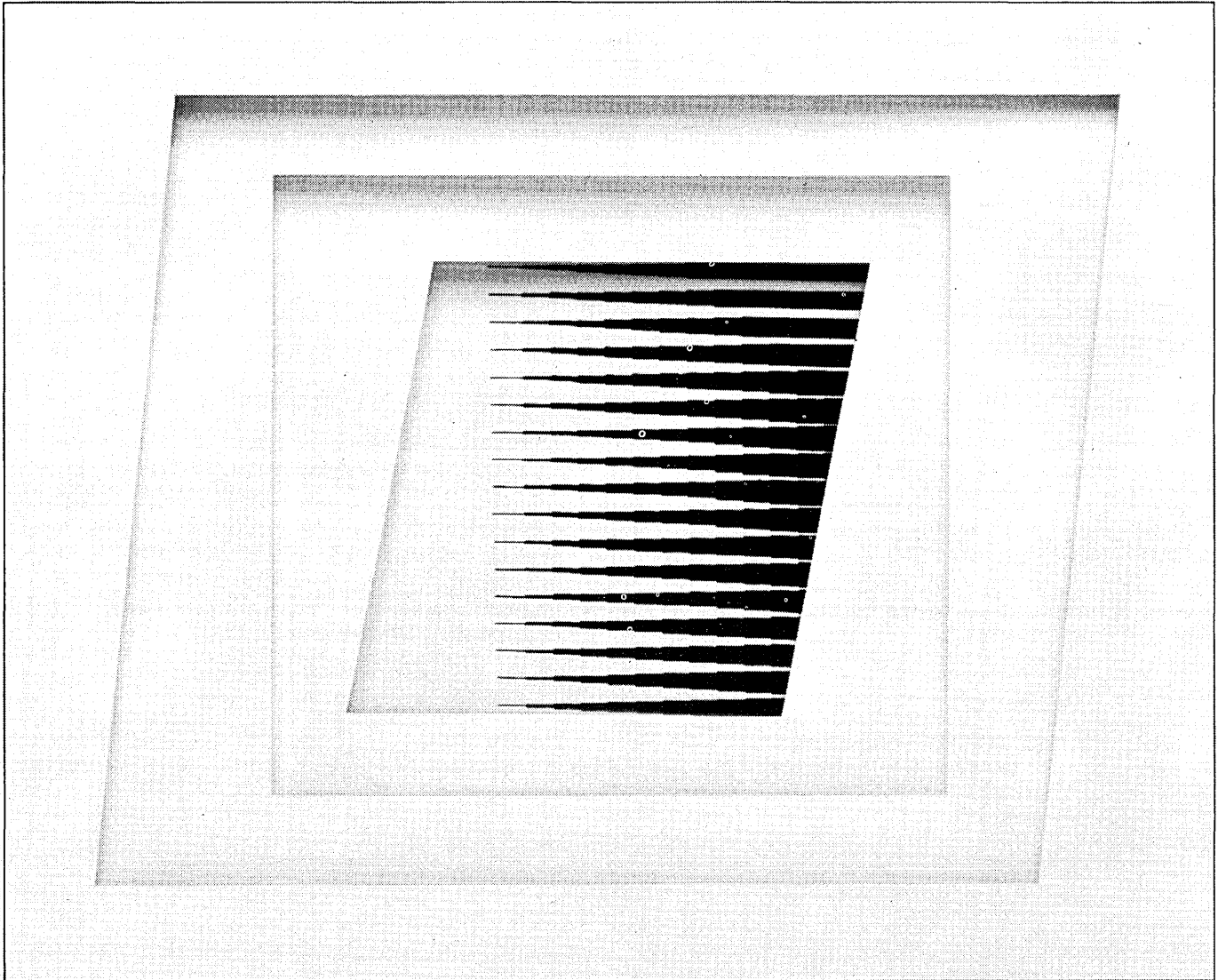
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ECONOMIES OF SCALE DEFENDED

The data processing industry has become very large, important, and expensive. Data processing management can no longer afford to have what it "wants," but rather must opt for those policies which make economic sense. We have not supported suppositions with facts and we have been able to remain extremely inefficient and blame it on "them."

This year will surely mark the beginning of a new era when data processing management begins to take on a new level of sophistication. Consequently, vague and nebulous policy recommendations which increase costs will be set aside. With this in mind I will turn to the recent criticism by Peter Berman (*Datamation*, May, 1970, Forum) of my article on Economies of Scale and Computing Personnel (*Datamation*, March, 1970).

Mr. Berman's criticisms are largely centered around a misunderstanding of centralization. Centralization is an organizational concept and holds no necessary implications for physical, geographic or managerial restrictions: it potentially allows the greatest managerial flexibility. It is beating a straw man to assume that centralization implies a giant monolithic structure, remoteness or anything of the sort. The real disagreement between Mr. Berman and myself is how a centrally administered organization can be managed. A small decentralized data processing organization might appear desirable but it cannot provide high quality or well-rounded service. Let us inspect each of Mr. Berman's complaints briefly. (His complaints are in italics.)

1. *Centralized data processing is a giant monolithic structure.* There is no reason why, through reasonable organizational structures, a centrally administered organization need appear either gigantic or monolithic.

2. *Centralization ignores the needs*

of users. Quite to the contrary, if a larger, more highly specialized staff is available, the user can receive precisely the kind and levels of talent required for solution of his problems.

3. *With centralization, the user has a weak voice.* If this means that the user cannot automate applications without justification under centralization, then hurrah for centralization. One of the major problems in the industry today stems from automating too many of the wrong kinds of applications, thus usurping large amounts of manpower and computer time in development, maintenance and conversion. Good man-



agement will dictate careful evaluation of project proposals.

4. *Under centralization the user will not have available analysts who are intimately familiar with his applications.* Line managers must be capable of articulating their problems and reviewing proposed solutions. Too long now the analysts and programmers have "run" departments, defining the problems and making the critical policy decisions. Analysts should be staff resources and, as such, should aid, not take the place of, line management. But more directly, there is nothing about centralization which precludes the concept of teams on location or resident analysts. In the case of large user groups the resident

concept can be powerful if combined with rotation and the interjection of highly specialized staffing when required. But the advantage of central administration here is that when company or institutional priorities shift, this staff can be relocated and used for other departments or units. The permanent department analyst implies that any task required in the department is of high priority. Of course this cannot make sense. Intimate familiarity with an area seems to reduce the probability of documentation being performed.

5. *Decentralization provides better service, involvement, responsiveness and sensitivity to the user's needs in a geographically distant location.* The resident analyst or team solves the distance problem. Quality service has not generally been provided uniformly by decentralized units and therefore this argument holds no water.

6. *With decentralization, systems development is often less massive and less prone to serious problems if broken down into manageable chunks.* Top-notch management solves these kinds of problems. It is my contention that, through central administration, a company can develop more desirable career paths, stratified supervisory levels, and management training programs. And it should be better equipped to solve project management problems. Nothing about centralized staff administration implies massive numbers of people working on a project. IBM taught us that this approach has little chance of success. In a decentralized data processing group there is less opportunity to train, develop, and retain people with high management potentials. A major problem today in the industry centers around management by technically competent but managerially unequipped personnel. In a centrally administered unit, effective project management is more easily established because specialized efforts can be applied.

7. *In decentralization, travel expenses of a central staff offset much of the apparent cost savings.* See 4 above.

8. *If salary levels are competitive and hiring standards are high, there is much greater job satisfaction for the computer professional with a small or medium size system staff.* Nonsense! I submit that a significant factor in the unusually high turnover rate in our industry stems from the fact that in small groups no career paths exist, no spe-

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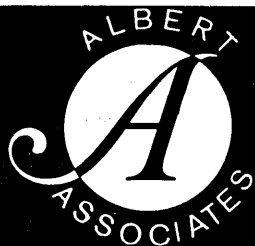
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the forum...

cialties can exist, and training or project rotation is less feasible.

9. *Involvement of the user is difficult for the corporate central staff to achieve.* Not for a well trained, well managed, and motivated staff. Remember, through central staff administration, more highly skilled and better trained people can work on projects because central management can select from a wider specialization spectrum and fit a man to a job. The day of the computer generalist or jack-of-all-trades is over! Any user appreciates talent and, at the same time, the user can influence staff selection when dissatisfied with the performance.

10. *If standards are not maintained and duplication exists with decentralized staffs, this is a weakness of corporate edp, not of the concept of decentralized staffing.* Come on now, Peter, you can't really believe that! First of all, with decentralized staffing, standards do not generally exist so there is no sense in worrying about enforcement. But even if they do exist, it becomes devilishly difficult to enforce standards when the staff reports to other organizations. Successful enforcement of standards implies (a) useful standards, preferably co-developed by the types of people who will use them; (b) maintenance of standards so that new ideas, complaints, etc. can be included on a timely basis—standards are analogous to natural languages and note that Latin is almost dead—and (c) auditing of completed and on-going work. Too many times data processors believe that standards are for the other guy. Small groups cannot perform these tasks. Finally, of what value are 20 sets of standards?

11. *Poor performance does not go unnoticed as easily in a small group. Evaluation of performance is more accurate in a small group.* Poor performance has been going unnoticed in small groups for more than 10 years. Accurate performance evaluation requires performance standards and they do not exist for our industry. Through well designed methods standards, performance standards can evolve (à la Dick Brandon). We already see why methods standards will not be developed under decentralization and, therefore, neither will performance standards be developed. With a good set of performance standards an "accurate"

evaluation of 100 professionals is possible. The present subjective evaluation procedures make it unlikely that even three evaluations are useful.

12. *Turnover in the small group is less.* Even if this is true, which I doubt (except where industry behavior dictates as in aerospace), when turnover does occur in the small group, continuity becomes more difficult.

13. *If there is a scarcity of computer professionals in the area of the corporate office, then these problems are more serious if you are centralized.* Quite the contrary! A larger staff can develop junior-senior relationships, training programs, project rotation, standards and documentation compliance. These are the things that minimize the damage of turnover or staff shortages. The large group can afford training programs and does not necessarily rely upon obtaining a "fully-trained" programmer (whatever that means). The "blackmail" which is so prevalent in our industry can be controlled with central administration through continual availability of quality personnel from good training programs.

14. *Decentralized staff in no way invalidates the concept of central control.* Yes, in the same way that you can control someone else's employee.

Mr. Berman complains that my article is one-sided. It is! But if he insists I will list some of the advantages of decentralized computing organizations:

a. Project control techniques will probably not be employed and, in the absence of standards, programmers and analysts can decide upon the duration of projects. (What a glorious life!)

b. In many decentralized groups, a non-data processing manager is employed. He can be easily "snowed" with our technical jargon. (How sweet it is!)

c. We can more easily overpower poor design and programming with faster hardware. (Here we go 'round the mulberry bush!)

d. No justification is required for project approval so we can have lots of fun coding irrelevant applications. (Hey, Charlie, I got it down to 125 lines of code in only 50 runs!)

e. No one will force us to document our work. Therein lies job security. (Get my rockin' chair ready!)

A larger group of programmers and analysts presents new challenges and management difficulties for the dp manager. On the other hand, that's what he gets paid for.

—MARTIN B. SOLOMON

FOR VIATRON CIRCLE 53 ON READER CARD →
DATAMATION

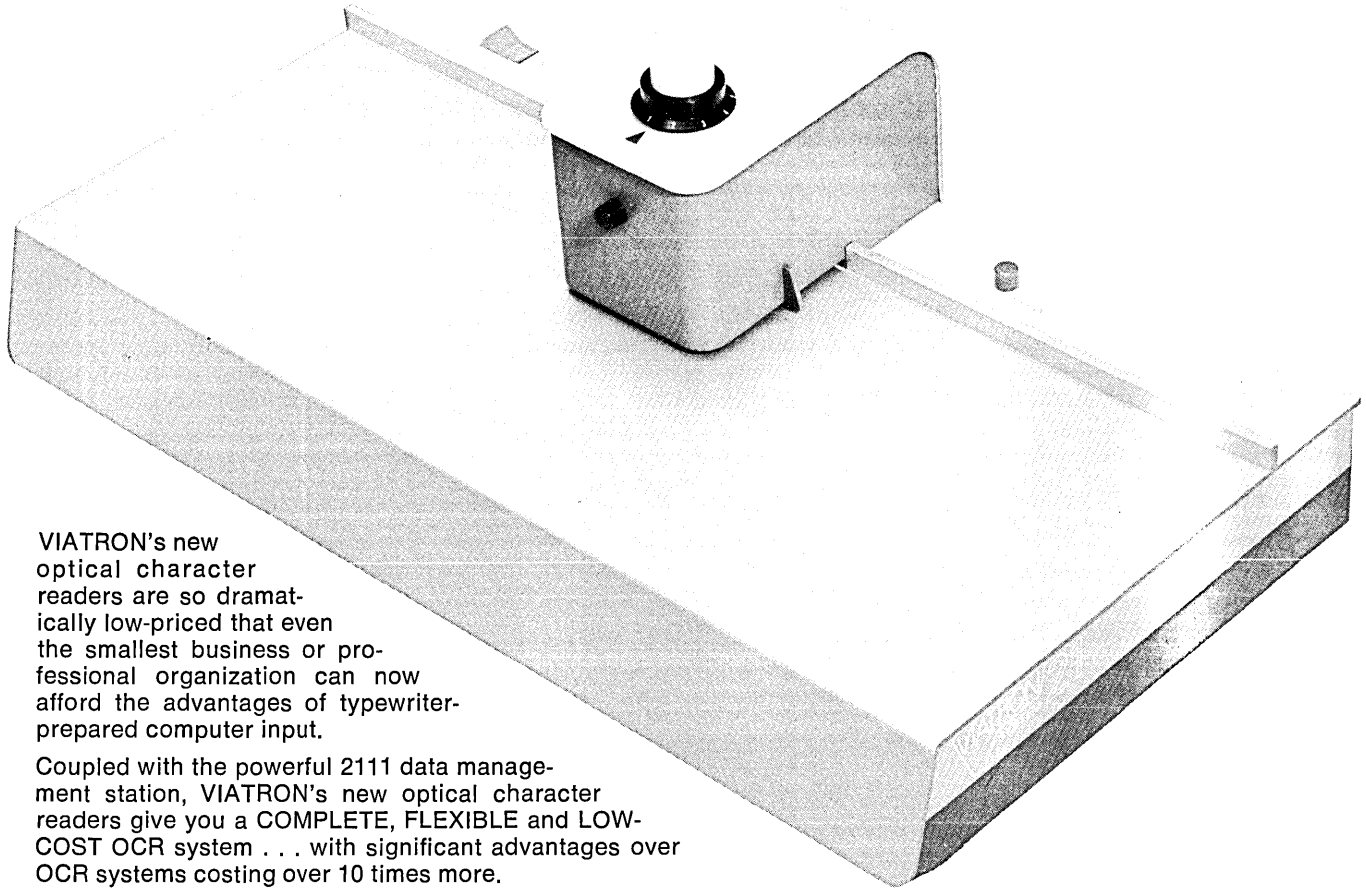
VIA TRON



THE VIA TRON OCR STORY

VIA TRON 21
VIA TRON 21

THE EYES OF



VIATRON's new optical character readers are so dramatically low-priced that even the smallest business or professional organization can now afford the advantages of typewriter-prepared computer input.

Coupled with the powerful 2111 data management station, VIATRON's new optical character readers give you a COMPLETE, FLEXIBLE and LOW-COST OCR system . . . with significant advantages over OCR systems costing over 10 times more.

VIATRON On-Site Processing . . . After a line of data has been read, and before it's been recorded or transmitted, the System 21 terminal will process it. Automatically, the data may be reformatted, constant information inserted, selected information deleted and communication or printing control characters added.

VIATRON Operator Control . . . Data read by the OCR is automatically available on the terminal's video display for visual verification. The operator may then manually verify the data, correct errors and add or delete selected information through the System 21 keyboard.

VIATRON Error Detect Logic . . . No bad characters get to your computer. Automatic error detect logic will step in and stop the microprocessor, allowing the operator to correct the error BEFORE the data has been recorded or transmitted.

VIATRON LSI/MOS Reliability . . . Recognition is strictly digital — allowing VIATRON to apply its expertise in LSI/MOS technology to OCR — a major factor in the dramatic price breakthrough.

VIATRON Low, Low System Cost . . . Allowing literally everyone the advantages of OCR data input at a price he can afford. So inexpensive that the system can be put where the action is . . . and save time and money. No more errors or delays created by "the paperwork cycle" or by keypunch and key verification at the computer center.

And there's still more! Built into the OCR logic are special control characters to give maximum control and flexibility to systems people and forms designers and still let your typist or secretary prepare computer input on a standard office typewriter.

VIATRON Brackets . . . Let you bracket any information that you want the reader to ignore . . . give you control over information that you need on paper but not in the computer.

VIATRON Short Record . . . Lets you have variable length records up to 80 characters and saves you time and money on data transmission.

VIATRON Space Suppression . . . Automatically prevents blank spaces from entering the data record. Lets you use forms that are easy to read, easy to prepare.

VIATRON Space Insertion . . . Maintains maximum flexibility by letting the operator enter spaces in the data record when they are needed.

VIATRON Error Correction . . . Saves time and makes the typist's job easier. No erasing . . . no correction fluid . . . when she makes an error she uses a special "correct key" and keeps on going.

SYSTEM 21

VIATRON'S NEW OPTICAL CHARACTER READERS
SO LOW IN PRICE YOU CAN AFFORD TO PUT THEM WHERE THE DATA IS

MODEL 6101

Optical Character Reader provides automatic feeding of up to 200-foot rolls of standard 1-inch paper tape. From the paper tape, the Model 6101 will read variable length records, each containing up to 80 characters. Over 20,000 characters may be stored on a single reel of tape.

SPECIFICATIONS

Record Length:	Variable, up to 80 characters
Maximum Line Length:	Unlimited
Reading Speed:	80 character positions per second
Document Size:	Standard 1-inch paper tape rolls up to 200 feet
No. of Line Positions:	1

\$2400

Feed Method:	Automatic
Forms Handling:	Manual (Automatic-optional)
Power Requirements:	110 VAC, 60 Hz, 2 amps
Ambient Temperature Range:	32°F to 96°F
Maximum Relative Humidity:	98%

MODEL 6102

Optical Character Reader provides maximum flexibility for reading variable sized documents. The document size may vary in length from 3 inches to 11 inches, and in height from 2.125 inches to 11 inches — encompassing virtually all standard business documents, including credit cards. An optional feature allows this Model to read standard paper tape and other documents as narrow as 1 inch. The Model 6102 is a simple, reliable, hand-fed Reader which will read a single line of information containing up to 80 characters.

SPECIFICATIONS

Record Length:	Variable, up to 80 characters									
Maximum Line Length:	11 inches (100 character positions)									
Reading Speed:	80 character positions per second									
Document Size:	<table><thead><tr><th></th><th>Length</th><th>Height</th></tr></thead><tbody><tr><td>Min.</td><td>3 inches</td><td>2.125 inches</td></tr><tr><td>Max.</td><td>11 inches</td><td>11 inches</td></tr></tbody></table> (One inch paper tape optional)		Length	Height	Min.	3 inches	2.125 inches	Max.	11 inches	11 inches
	Length	Height								
Min.	3 inches	2.125 inches								
Max.	11 inches	11 inches								
Read Area:	2 inch band starting .5 inches from the aligning edge of the document									

\$4800

Data Position:	.25 inch data path located anywhere within the read area
Feed Method:	Automatic
Forms Handling:	Manual
Paper Stock:	10# to 125#
Power Requirements:	110 VAC, 60 Hz, 2 amps
Ambient Temperature Range:	32°F to 96°F
Maximum Relative Humidity:	98%

MODEL 6103

Optical Character Reader provides automatic loading, feeding and stacking for up to 250 documents. From the document, the Model 6103 will read a single line of information containing up to 80 characters. The document may vary in length from 2.329 inches to 9.625 inches, with a fixed height of 3.250 inches, assuring compatibility with Hollerith cards and standard forms sizes.

SPECIFICATIONS

Record Length:	Variable, up to 80 characters									
Maximum Line Length:	9.625 inches (90 character positions)									
Reading Speed:	80 character positions per second									
Document Size:	<table><thead><tr><th></th><th>Length</th><th>Height</th></tr></thead><tbody><tr><td>Min.</td><td>2.329 inches</td><td>3.250 inches</td></tr><tr><td>Max.</td><td>9.625 inches</td><td>3.250 inches</td></tr></tbody></table>		Length	Height	Min.	2.329 inches	3.250 inches	Max.	9.625 inches	3.250 inches
	Length	Height								
Min.	2.329 inches	3.250 inches								
Max.	9.625 inches	3.250 inches								
Read Area:	2 inch band starting .5 inches from the aligning edge of the document									
Data Position:	.25 inches data path located anywhere within the read area									

\$7200

Feed Hopper Capacity:	250 documents
Stacker Capacity:	250 documents
Feed Method:	Automatic
Forms Handling:	Automatic
Paper Stock:	80# to 125#
Power Requirements:	110 VAC, 60 Hz, 2 amps
Ambient Temperature Range:	32°F to 96°F
Maximum Relative Humidity:	90%

THIS IS VIAFONT™ X

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

_ 1 2 3 4 5 6 7 8 9 0 \$ @ _ ' " { } ~ < > ^ &

VIAFONT™ X

VIAFONT-X is the first graphic form of VIATRON's radically low-cost, proprietary optical character detection scheme. VIAFONT is a unique, man/machine readable code which includes all the standard alphanumeric and punctuation characters. It also provides special characters, featuring an over-print character for correcting typing errors and

a character which allows a typist to bracket any data that is not to be read as input.

VIAFONT and VIAFONT optical codes will be made available — royalty-free — to the industry. Currently, VIAFONT is available on Compugraphic film for photo-composition and will be available soon from IBM on a Selectric® typing element.

THE NEW OCR STANDARD

VIATRON's proprietary optical coding scheme is the secret to producing VIAFONT characters that are easier and cheaper to read than any existing OCR font. This coding scheme is another factor in making possible massive reductions in OCR system costs, assuring that VIAFONT will be the OCR standard of the 70's.

COMING IN THE FALL

Starting in the Fall of 1970, VIATRON will begin delivering the most impressive and least expensive line of Optical Character Readers in the business.

SO WHY WAIT?

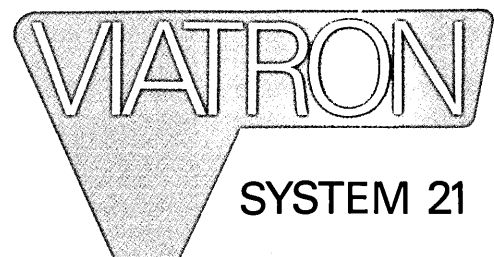
There's no longer any reason to wait until the volume of data preparation becomes so overwhelming that you can justify the high cost of other optical character readers. There's no longer any need for special training or special operators. Your typist or secretary — using an ordinary office typewriter — can now prepare computer input.

If you're ready to start exchanging pleasantries with your computer in a language you both can read, contact your nearest VIATRON dealer.

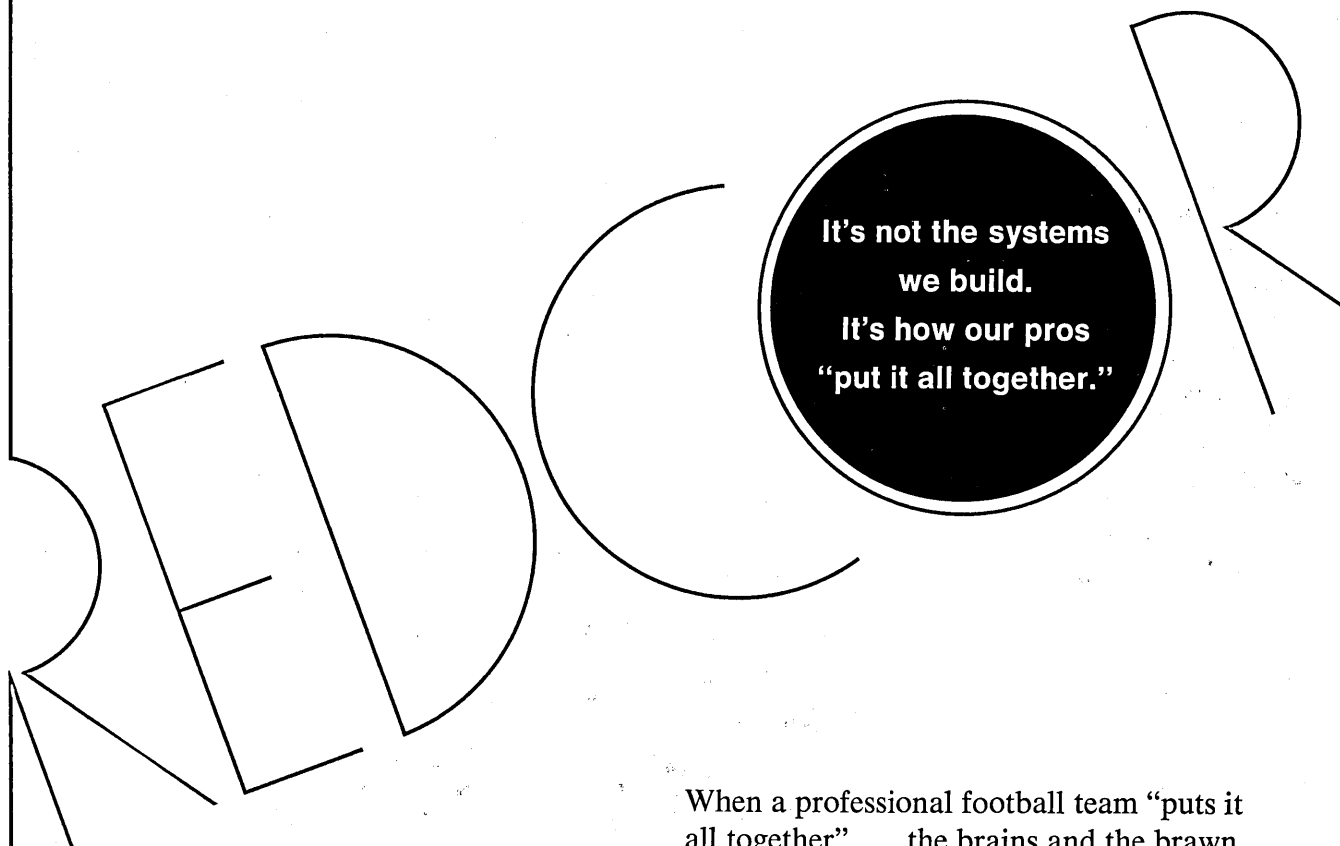
He'll show you how to put eyes in System 21.

FOR MORE INFORMATION

Your local VIATRON dealer can give you the complete OCR story. For the name of the dealer nearest you, write VIATRON Computer Systems Corporation, Dept. D-15, Crosby Drive, Bedford, Massachusetts 01730. Telephone (617) 275-6100.



The standard of the 70's



**It's not the systems
we build.
It's how our pros
"put it all together."**

**It's not the computers
we build.
It's the problems
we solve.**

When a professional football team "puts it all together" . . . the brains and the brawn of more than 22 men are working as one . . . a coordinated effort that makes a winning unit out of a group of individuals. That is REDCOR. In a field crawling with love'em and leave'em hardware hustlers, we're All-Pros in management, marketing, systems design, software and service. We make on-line, real-time systems, and we make all the systems components . . . including the computers. We'll design your one-of-a-kind system from our standard components, and we'll provide the all-important software and field service. Only REDCOR offers the "one source, one responsibility" commitment that's the most efficient, economical solution to your systems problem. Let one of our Systems Pros "put it all together" for you.

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VIATRON



THE VIATRON OCR STORY
SEE LAST FOUR PAGES

VIATRON 21
SYSTEM

CIRCLE 3 ON READER CARD